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Intermittent Filaments

By DAVE GNESSIN

THE elusive intermittent is the bane of the serviceman's life. It follows no rules and keeps no hours. The raucous noise that emanates from the rear of most service shops is due largely to receivers operating open, full-blast (just as in normal operation in the home!) in the hope that the intermittent may be at least located, if not repaired. Many's the kilowatt consumed by electric radiant heaters operating on radio equipment on the service bench, in the hope that applying excess heat will open up the intermittent.

Like the poor, the intermittent will probably always be with us. But the malady will prove less virulent if we attack the disease with all the weapons at hand.

One such weapon is described here. Its purpose is to indicate immediately when a tube filament is open, be it even for a period hardly long enough for the receiver to go dead, cool off, and then let the filament wires fall together again. This condition accounts for a fair proportion—though by no means a majority—of intermittents, and represents a type very hard to find.

Other uses will be found for the device, such as indicating which tube in a series filament string is open. This quick technique might be applied as standard practice to all transformerless receivers arriving at the shop with filaments out.

An octal (or loctal or miniature) adapter, with prongs on the bottom and an octal (or loctal or miniature) socket on top is opened to admit the pair of wires from a miniature neon test light. This pair is connected to the filament prongs. (Different tubes have different filament terminals. Adapters should be prepared and marked on the base for ready identification). A whole set, certainly no less than six, should be made up.

In using the device, the tube is removed from its socket and the correct neon adapter is plugged in. The tube is then inserted into the adapter, with the neon indicator hanging out. See Fig. 1 for the setup. This is done for all the tubes in the receiver. Fig. 2 shows the application to three tubes; it holds for as many tubes as are in the receiver being tested.

How does it work? The neon indicators fire at about 90 volts. Since tube filaments don't rate that high, the indicators normally will not ignite. When they don't light up, they don't draw current. Hence, they will not affect normal operation. If one tube is open, as in Fig. 3, the filament string is broken. The series filaments will not light.

With no current flowing through the series filaments, both terminals of the neon bulb across the open filament are at full line potential (117 volts). The neon tube immediately ignites and stays lit as long as the filament of its associated tube is open.

Note that only the neon lamp across the *open* filament lights. The other indicators still have low-resistance filaments across them, shorting them out of the circuit. Thus the open circuit, whether intermittent or permanent, is immediately marked. Remove the lit neon adapter and faulty tube. Replace the faulty tube. Now watch the circuit for a while to see if any other neon indicator flashes. If all is quiet, the trouble has been spotted and repaired.

Fig. 1—A tube in the adapter assembly.

Two-way octal and other adaptors are available. They come apart for wiring. It may be necessary to drill a hole in the cover of the assembly to accommodate the neon-indicator wiring. If no adapters are available, they can be home-made, using old tube bases and sockets. Make them sturdy; they will undoubtedly be plugged in and out very frequently.

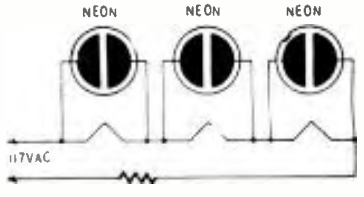

Fig. 2—Lamp shows up the bad filament.

This information is made available with the permission of Fred Colton, who has used the procedure for some time in his Columbus, Ohio, service shop.

(Another quick way of checking a suspected filament string is to measure all filament voltages with an a.c. voltmeter. An abnormal tube will often show surprisingly (to the uninitiated) high or low voltage across the filament. —*Editor.*)

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The Intermittent Headache

By MAX ALTH

NOTHING on a service bench will turn a man's liver a brighter shade of green than will an intermittent receiver. Other problems can be solved with time, special equipment, money, and even with sweat—but the only things to which an intermittent radio respond are hair tearing, nail biting, and tears.

This is the case inevitably whenever the service technician uses the wrong approach. But there is a right one.

The very first thing to do when a customer says, "My radio set fades," is to rush out of his house and get yourself a Sherlock Holmes hat—that's the double-ended job in green plaid—and a meerschaum pipe. The second thing to do is to return to the scene of the crime, slip your feet under the Morris chair, and prod the victim into talking.

Let him talk all he wants, but don't believe a word he says. Then tell him, "Show me." Get him to turn the set on . . . tune in the disappearing radio program. Then wait for it to fade.

All this may seem a silly waste of time, but believe me it is not. The problem of locating the causes of fading and intermittency is one of detection; and, if a Sherlock Holmes hat and pipe will help you think and act like a detective—go get them!

Make certain that the set actually fades, and that it is not tuned to a weak dx station which carries a program similar to the local one, and whose fading is caused by normal conditions outside the set.

If the set doesn't fade in your presence, you can suggest to the customer that he wait until the fading becomes more pronounced, in which case your job will be much easier and you will be able to charge much less for the repair.

Assuming that the customer's set really does fade, you may have a suspicion as to what is causing it. Keep your suspicions to yourself! This is where many a good radio technician goes wrong. Your guess may be very good—but *don't* yank the set until you are certain the trouble is not due to the installation.

Maybe it's not the set

The fade may be caused by a defective antenna, a loose ground connection, or even a low and changing line voltage. Make certain of it by disconnecting the antenna and using a length of bell wire as a temporary antenna, for example. Disconnect the ground completely, and put a voltmeter across the line when the set is at its nadir. A radio will play very nicely when the line voltage is high. But, when the line voltage is low, there is a critical point at which a slight variation will make a great change in the set's output, or may even cut the oscillator off completely.

When you have cleared the installation of suspicion, then everything else is suspect, including the extension speakers, record player attachments, telephone cutoffs, etc. First consider the chassis in relation to its cabinet. Someone may have stuffed papers inside, causing the temperature to go too high. Anything can have happened, including a visit from a family of mice. It is very possible that the set will play well on your bench where, well ventilated, it operates relatively cool. Won't you be the embarrassed one when you return the set, and it still fades, running hot in its cabinet? If possible, take the cabinet to the shop with you. If not, run the set, out of its cabinet and sitting on the floor, and see what happens.

Bear in mind during all these shenanigans that you are not trying to be the fair-haired boy of the radio service world, but that you are trying to simplify and localize your trouble by eliminating one possible source of fading after another.

Up to this point:

You have established by personal observation that an actual defect exists.

You have cleared the installation.

You have cleared the line voltage.

You have cleared the chassis-cabinet combination.

You know that a defect exists in the set proper—the chassis.

Do not yank the set until you have made all the foregoing checks.

When you do take the set to the shop, do so very carefully as not to jar it into normal operation accidentally. If you do jar the set, you won't know what's up when you get it on the bench; and what's worse, you may jar the set again on returning it—and start it fading again! (*Continued on page* 62)

Suggested by Arthur A. Henrikson, Chicago, Ill.

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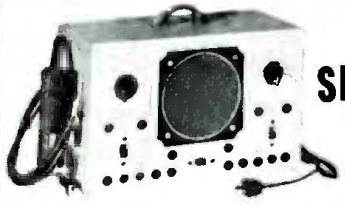

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(*Continued from page 60*)

A number of tools on the market are designed to aid in the servicing of fading radios. The best of them is perhaps the Chanalyst, or channel analyzer. This five-eyed monster that never sleeps can watch five sections of your radio for you. In effect, it is five vacuum-tube voltmeters. You hook one section of it to each section of your set, and let her rip. When the set cuts out, you look into the electric eyes, and learn immediately whether it's the r.f., mixer, i.f., output, or power supply that has lain down on the job.

While this instrument is very good, a better instrument is still that brain supposedly lodged beneath that detective cap. Even after the Chanalyst has put the finger on the fading stage, or group of stages, *you* still have to locate the offending capacitor, coil, solder joint, wire, rosin drop, or whatever is causing the trouble. That component may well be in another portion of the circuit. And very often, the set will leap back into action when you try to clip the test lead on the first suspected component and not fade again for several minutes, or in some horror cases, several hours.

A few possible clues

The experienced technician can sometimes guess the trouble by listening to the set cut in and out. Here are some characteristic sounds, and their causes:

Breaks in the front end of the set, antenna, and r.f. stages cut in and out with a cleanness, or lack of thump, which is very distinctive as compared to rear-end breaks. Breaks in the audio usually have a heavy-footed thumping accompanying them.

An oscillator cutting in and out can be spotted by the signal's disappearing, an increase of rush, and a seeping in of all stations, especially if the set is tuned toward the high-frequency end of the broadcast band.

When an r.f. stage cuts out on sets having a.v.c., the signal may or may not hold its level, but the background noise may increase as the a.v.c. turns up the gain. The same thing happens when an i.f. stage cuts out.

When one of several audio stages cuts out, the set performs normally with the exception of a great loss of volume. But the signal is clear and undistorted. Interstage coupling due to the existing wiring feeds some of the energy around the dead stage, making it harder to locate the trouble.

If the set cuts out when the volume is turned way up, very possibly the speaker voice-coil leads are making poor contact. If there is no hum whatever in the speaker, you can be certain the break is there.

When one or more of the filter capacitors opens up, there will be—in addition to an increase in hum—the possibility of decrease in volume (due to a lowering of plate voltage) of audio oscillation, motorboating, r.f. and i.f. oscillation, because of lack of the filter

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capacitor's bypass effect on a.f. and r.f. currents.

When one of the cathode bypass capacitors in an audio circuit opens, there will be an apparent loss of bass and possibly a great loss of volume in the loudspeaker.

Intermittent capacitors often react to line-voltage fluctuations. Switching on lights in the same room makes them cut in or out. Cold-soldered joints, on the other hand, are very susceptible to vibrations.

The cycle of fading should be carefully noted. A short cycle is more often due to a tube. A long cycle is possibly due to some heating or thermostatic effect.

Systematic procedure

These are but some of the many ways fades give themselves away. However, before you touch any of the set's components—unless the trouble is staring you plumb in the face—clear the tubes first. Replace them with another set known to be good. Do not depend upon a tube tester to check tubes suspected of fading. Most testers merely check the emission of the tube, and none of them duplicate the exact conditions it encounters in actual operation in a receiver.

Check the tubes by substitution because a tube can, and often does, react exactly like a cold-soldered joint or intermittent capacitor.

Your next step is to check the soldered joints. This is very important in new sets where a cold-soldered joint is much more common than in an old one. (Obviously, if the old set had a bad joint, it would have caused trouble before.)

Go over the joints with a hot iron. This seems to be a lengthy method, but is a wise one. For one thing, the hot iron marks the joints you have inspected. For another, it is slightly impossible to spot a bad joint by eye—or any other way!

With the accessible joints cleared, next have a go at the wires. Tug and pull on them, keeping in mind the fact that a wire has two (or more) ends, and that pulling on one end also moves the others.

Next in line come the capacitors. If you have more or less located the defective capacitor (or capacitors) with instruments, replace it (them) and check by listening. However, replacement of capacitors is not a simple problem, with one exception. If the set is fairly new, you can safely assume that the defective capacitor is an accident, and that the rest of them are up to snuff.

If the set is an old one—and a midget—your best bet is to *rip them all out*, excepting micas (they seem to last forever) and not waste time testing each one. **If the set is old, but huge, you are definitely faced with the cost of a complete capacitor replacement. Your best and safest bet is to sell your customer on the idea.**

Your next best bet is to replace all the capacitors on or in the defective circuit. That is, if the intermittent capacitor seems to be one of the filters—out with all the filters! If it is one of the bypasses in a tone network—out with all of them; and so on down the line.

Your next move, if none of the foregoing approaches are practical in the given case, and you believe the fault to lie in one of the capacitors, is to try and find the faulty one. The problem is that the capacitor at fault won't lie down and stay dead, but gets up and works when you approach with your test leads. Therefore, you have either to locate it by way of its associate circuits or by forcing it to lie down and stay down. A good stunt (if you *can't* replace all the capacitors) is to unsolder the hot end of each suspected one. When disengaging a capacitor duplicates the fade exactly, you may be a little nearer the solution of your mystery.

Some technicians test pigtail capacitors by wriggling them while the set is in operation. Other equally competent men will tell you that wriggling will send them on their way to intermittency.

Some bring a hot soldering iron near the suspected capacitor, and hope the additional heat will cause it to act up. Some use a loop coupled to a high-power, high-frequency generator in the belief that the induced current will cause the intermittent to become permanent.

Others drop one corner of the set a few inches to jar the components, and still others warp the chassis with their hands, to put mechanical strain on the set.

The most successful are those who toss the set out a ten-story window and quit the business. For the replacement of less than all the capacitors on an old set is a compromise—and just when to compromise depends upon the serviceman's judgment. No hard and fast rule can be laid down here or anywhere else.

Other components

With the tubes, joints, wires, and capacitors cleared we can go on to testing the remaining components in the receiver.

Coils can be checked by momentarily flashing a high voltage through them. The theory is that the overload will either make them or break them (either weld the break permanently together or melt the ends further apart.) Other components will have to be tested individually in fashions depending upon their nature.

Continue in this way, clearing part after part; follow a definite, systematic plan until you locate and arrest the offending part.

If you follow this Sherlock Holmes system, you will eventually locate the trouble. But if you cross your fingers, trust to luck and your technical skill, and jump around in the set, you may never, never find it!