HAM RADIO

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Slaying Some SLJ's

Do you know what an "SLJ" (pronounced "Slidge") is? Everyone has them, and everyone dreads them. Some people call them "chores," while others call them "honeydos" (honey do this, honey, do that). "SLJ" stands for "Silly Little Job" (it has other names, but you get the point). SLJ's

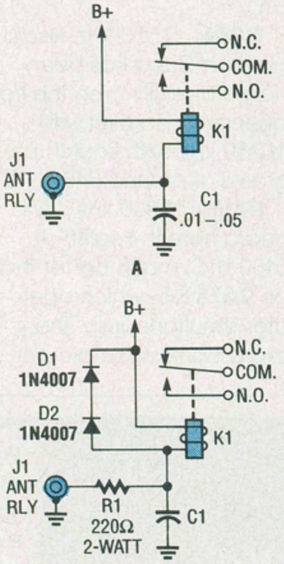

Fig. 1. Many transmit relays in HF linear amplifiers connect one end of the relay coil to the B+ source, and the other end to the ANT RLY jack (as shown in A). A popular cure for relay disorder is illustrated in B; simply break the line and insert a 220-ohm, 2-watt resistor in the line ahead of the capacitor. Also shown is a little "fix" (two series connected diodes wired in parallel with the relay coil) that's used for transceivers that have a transistor instead of a relay.

are some of those little repairs, enhancements, and improvements that we all need to make to our equipment from time to time.

This month in Ham Radio, we will look at some of the more common problems associated with amateur-radio equipment (by no means all of them, but a couple)—especially those that translate into a Saturday morning or one-evening SLJ.

INTERMITTANT TRANSCEIVER PUSH-TO-TALK

Most hams that operate in the high-frequency (HF) portion of the spectrum use a transceiver (transmitter and receiver in one package) that covers all bands from 160 meters up to 10 meters (with a few also giving us 6 meters). In most cases, the transceiver's transmitter section has a 100- to 250-watt PEP output (SSB), with 100 watts being very common.

One of the most common complaints about such rigs is intermittent transmit or receive. If the complaint is intermittent transmit, find out (by using the rig) whether or not the intermittent operation is common to both CW and SSB. If it is *not* common, then it's possible that the trouble is a broken wire inside the microphone, microphone cable, or microphone connector (the last being most likely).

I keep two microphones handy: One is the mobile-style mike that came with the rig, while the other is a super desk microphone that I bought at a high premium (it's got designer styling, but it somehow lacks the aesthetic design integrity of my old "Chrome Lollipop" D-104).

If the trouble is common to CW and SSB, however, then the problem is most likely inside the rig. In most transceivers, the job of toggling back and forth between transmit and receive functions is handled by an old-fashioned electromechanical relay. In such units, a set of switch contacts are mounted on a movable mechanical armature that is operated by an electromagnet.

If the rig is intermittent on transmit, or if the power jumps up and down (use an RF wattmeter to monitor output while "transmitting" into a dummy load) on successive keyings of the push-to-talk or transmit button, then suspect the relay. Alternatively, if the receiver sensitivity sometimes drops one *heckuva* lot on returning from transmitting, then also suspect the relay.

WHY HARP ON THE RELAY?

One service manager at a major mail-order retailer of ham gear told me that relay problems account for somewhere around 25 percent of all conditions found by his technicians, and that relays pose the second most frequent problem. (At the end of this article, I'll tell you what the number one condition found was.)

The relay is, quite frankly, a high failure rate item. It is designed to last for so many operations, and will inevitably fail someday. In some rigs, the relay is easily removed from a socket, but in others, it must be unsoldered. If you're unhappy at the prospect of desoldering a zillion-pin relay from a printed-circuit board, then let a pro do it.

Look in your repair manual to find out where the relay is located and how it is configured. Sometimes it's possible to extend the life of relays by cleaning them with switch/contact and tuner cleaner. Your manual should give information on that operation.

If you use a high-power linear amplifier, it's possible that you'll shorten the life of the transceiver's relay by a considerable factor. Figure 1 can be used to illustrate how that might happen. Figure 1A shows the circuit used for many transmit relays in HF linear amplifiers. The relay coil is connected to a B+ source—which could be as little as 12 volts or as much as 250 volts. In many cases, B+ is about 120 volts DC. (Only occasionally have I seen an AC relay, and those were on older rigs.)

Look in the amplifier service manual or schematic to find out which is the case. The "cold" end of the relay's (K1) coil is connected to an ANT RLY jack (J1, usually an RCA phono jack) at the rear of the amplifier. The relay contacts inside of the transceiver short the center of the ANT RLY jack in order to turn on the amplifier.

The problem is the RF bypass capacitor connected between the center pin of J1 and ground. It is charged by the B+ voltage when not in use. When the relay contacts inside the transceiver short together in order to actuate the amplifier, the current stored in C1 is dumped through those contacts—pitting them and forcing an early death.

THE CURE

The circuit in Fig. 1B illustrates a popular cure for that relay disorder. All you need do is break the line between the bypass capacitor (C1) and insert a 220-ohm, 2-watt, carbon-composition or metallic-film resistor between the center pin of J1 and the capacitor. When the transceiver relay terminals short together, the

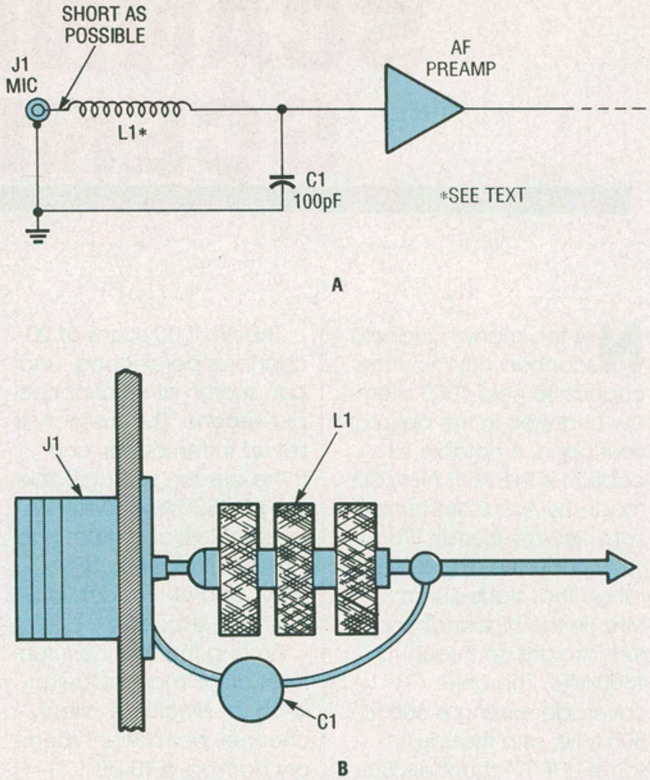

Fig. 2. A lowpass filter—consisting of L1 and C1—can be added to the microphone-input circuit to pass audio signals, while severely attenuating RF signals. Shown in B is the typical mechanical configuration of the lowpass filter; the coil should be mounted as close as physically possible to the microphone jack.

resistor acts to limit the current. Don't use a higher value resistor, or the time constant (set up by the resistor and capacitor) may interfere with the operation of the linear amplifier.

Figure 1B also shows a little "fix" that's used if your transceiver has a transistor instead of a relay. Some older linear amplifiers (and, I suspect, some newly produced older designs) use an internal relay that has no spike protection across the coil. Any inductor will produce a counter-electromotive force (CEMF) when the current in the inductor is interrupted. In other words, a high-voltage spike of opposite polarity to the supply voltage is generated when the coil is de-energized.

That inductive kickback can damage the control transistor in the transceiver that energizes the linear amplifier's relay. Connect one or two diodes in parallel (with a reverse-bias orientation) with the relay coil. Figure 1B shows the orientation of the diodes used when the source voltage is positive (B+). If, on the other hand, the DC voltage to the relay is negative (B−), then the diodes should be reversed.

The diodes are reverse biased under normal conditions, but are forward biased for CEMF spikes; that results in the spikes being clipped to a safe level.

RF-TO-AUDIO FEEDBACK

You start getting complaints that your signal is very broad, and a bit distorted; in fact, it's downright sinful to stay on the air, you are told. Funny, the problem didn't exist until I bought that linear amplifier. The problem might be RF electromagnetic interference (EMI) getting into the rig, causing feedback and biasing (through auto-rectification) of the audio preamplifier stages.

Fortunately, that problem is less likely today because microphone impedances are lower than in the past. However, the problem is not altogether gone. First, check the microphone's shielded cable. A gap of an inch or two between the end of the shield and the connector pin may suppress 60 Hz hum, but still allow a *heckuva* RF path into the rig!

If the microphone's shielded cable is OK, then you might want to experiment with the low-pass filter shown in Fig. 2A. By adding the filter to the microphone-input circuit, audio signals are allowed to pass, while RF signals are severely attenuated. The lowpass filter consists of a radio-frequency choke (L1) connected in series with the signal line and a bypass capacitor connected across the signal line.

The capacitor value can range from 100 pF to 0.001 µF, but I prefer to use the smallest value that does the job (there's less chance of attenuating high, audio frequencies that way). Capacitor C1 should be a ceramic-disc or a mica capacitor, with the former being preferred. The value of L1 should range from 1 to 2.5 mH in HF rigs, and be about 100 µH in VHF/UHF rigs. Figure 2B shows the typical mechanical configuration; note that the coil is mounted as close as physically possible to the microphone jack. That is to prevent RF from "spraying" into the rig's circuitry.

Now, about that "number one fault." Believe it or not, it is "no trouble found!" Many of those rigs were just packed and shipped off without even a basic attempt at troubleshooting. It really makes you wonder! ■