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CRYSTAL RADIO TO THE RESCUE

There was a time when crystal radios played a role in national defense. That time was the mid-1950s, when the United States was newly finding itself under the shadow of a Soviet H-bomb threat.

On 1 November 1952, the U. S. had detonated the first full-scale hydrogen bomb. The Soviet Union quickly followed with its first H-bomb test in 1953. These fusion bombs drastically raised the stakes in the nuclear arms race. The 1952 U. S. test, for instance, released over 450 times the energy of the puny, by comparison, fission bomb that was dropped on Nagasaki, Japan.

That bomb hastened the end of World War II, but the advent of the H-bomb raised the specter of a truly civilization-ending conflict. The end of civilization means the end of commercial electrical power. So what technology remains once the commercial mains are dead and all batteries exhausted?

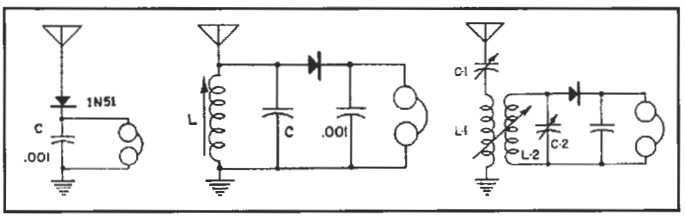

Fig. 1. G.E.'s sample crystal set circuits.

I've always been fascinated by the crystal radio, that most elemental radio circuit, requiring no source of power other than that which it teases from the ether. With a crystal set on the receiving end, the broadcast stations themselves supply the power. There is no need for commercial power or even batteries. Thus, the good folks at General Electric, in their bi-monthly *G-E Ham News,* publicized "Operation Crystal" to encourage the development of crystal radio receivers for use in times of national crisis.

Operation Crystal was the cover story for the January-February 1955 issue of *G-E Ham News.* The project challenged "old-timer and novice alike" to "make a valuable contribution to the public welfare." The story inside fleshed out the scenario: "Disaster. . .no radio, no newspaper, no telephone. . .hurricane? Explosion? A-bomb? H-bomb? How many bombs? What should you do to save yourself and your family?"

The writer sketches a situation that day-by-day becomes more desperate. "Is help on the way? Or are worse disaster areas taking up all the relief? Should you start hiking? Which way? North? South? East? West? Will there be more bombs?"

Finally, of course, our hero the crystal set rides to the rescue: "Superhuman effort has kept one broadcasting station on the air, perhaps on the Conelrad frequency. But you can't hear the official reports and advice without power or batteries." CONELRAD (Control of Electromagnetic Radiation) was the predecessor to the Emergency Broadcast System. Developed in 1951, CONELRAD was an elaborate system to alert and inform the public during disaster situations (originally anticipated to be atomic bomb attacks from fleets of Soviet bombers) using a network of radio stations.

Upon notification, all commercial broadcast stations would leave the air except for select AM stations on 640 kHz and 1240 kHz. These stations were to broadcast the Civil Defense announcements and cycle on and off the air. Having all active stations on just two frequencies, it was hoped, would prevent Soviet bombers from using radio direction finding to deliver nuclear death and destruction. Remember, this was *way* before GPS.

Since, in this picture, the commercial mains are down, and batteries are dead, ordinary radios are useless, the *Ham News* article continued with "What is the answer? You, the radio amateur have the answer—right in your junk box. You guessed it. A crystal diode detector."

Thence followed a selection of really simple crystal radio circuits (Figure 1) along with a challenge to the readers: "*G-E Ham News* will award $10 tube certificates for the three most

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outstanding emergency crystal diode designs submitted for publication for each issue during 1955." And readers responded to such an extent that "Larry Lighthouse," the principal editor of *Ham News* had to enlist an editorial assistant, "Danny Diode" to handle the operation.

The March-April 1955 issue featured the first three winners. These little rigs carried imaginative names, "Knob Twister's Special," "Furschlugginer Model," and "Drinking Glass Receiver." The "Knob Twister's Special" (Figure 2) came from William Patzer, W8RWX, and featured five variable adjustments (although two were ganged). A 1N48 or 1N52 diode was specified for rectification and two vari-loopstick coils (L2 and L3) were coupled with L1 and L4 via 30 turns of No. 36 wire wound over the primaries. C1 and C3 were ganged 365 pF variables. C2 was a 3-30 pF compression trimmer.

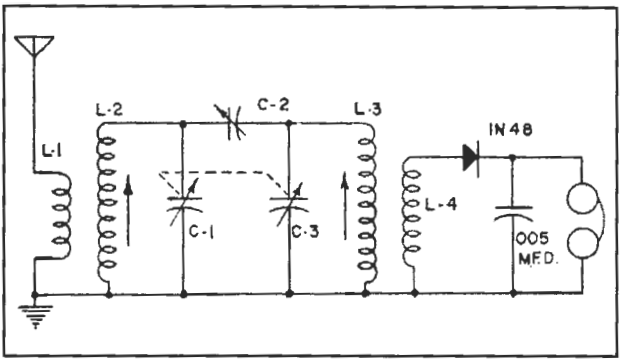

Fig. 2. The knob twister's special.

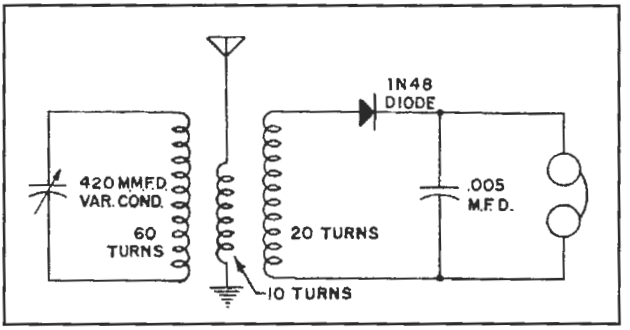

Fig. 3. Drinking glass receiver.

The Drinking Glass Receiver demonstrated the ingenuity of eighth-grade student, Jack Lambuth. As described by Danny Diode, "the 10-turn antenna and the 20-turn detector coils are wound over the 60-turn coil with a layer of plastic electrician's or scotch tape" on a 2-inch water glass form using No. 26 wire (Figure 3).

The third installment of Operation Crystal shifted back to simple circuits, one of which required no ground connection (Figure 4) and another that was the essence of simplicity (Figure 5), obviously from someone who had only a meager junk box. As Danny Diode commented, the simple set "makes up in volume and simplicity what it lacks in selectivity." It took advantage of the fact that CONELRAD stations broadcast on only two frequencies. Thus, In an actual emergency, interference probably wouldn't occur.

The simple circuits of the third round must have inspired the *Ham News* readers to new heights of creativity, because the September-October issue carried a dual-antenna monster with a triple-ganged variable capacitor (Figure 6). Note how this circuit uses a tuned ground

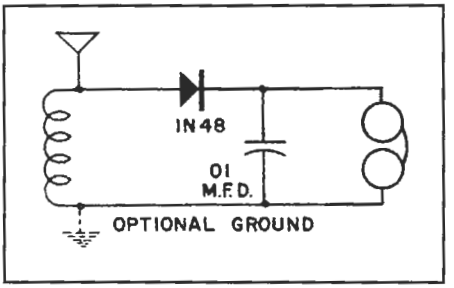

Fig. 4. No ground required!

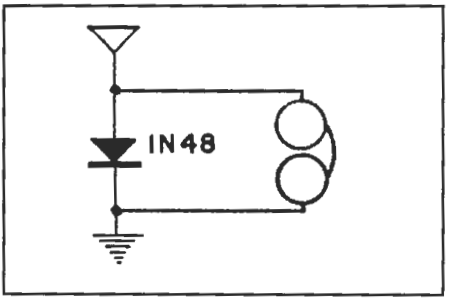

Fig. 5. For those with a meager junk box.

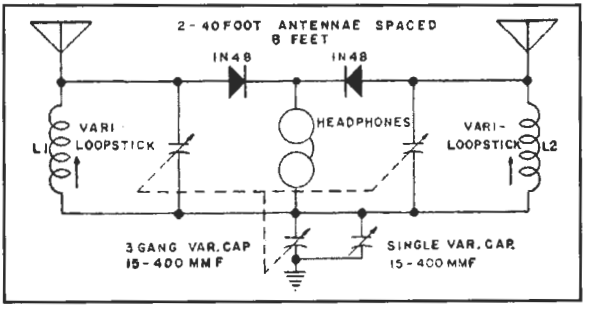

Fig. 6. Dual antenna monster.

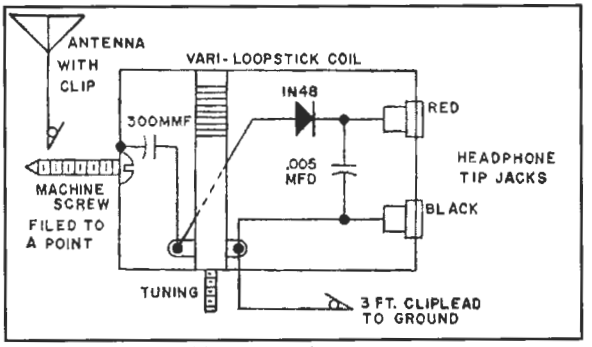

Fig. 7. Receiver doubles as signal tracer.

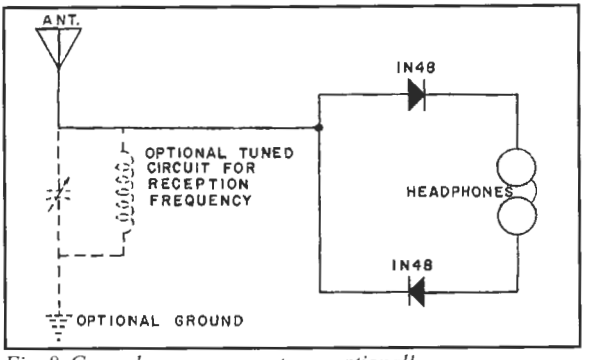

Fig. 8. Ground unnecessary—tuner optional!

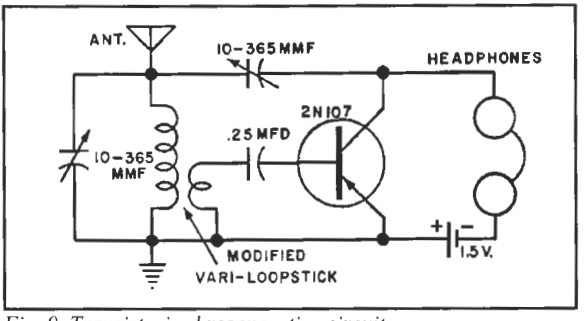

Fig. 9. Transistorized regenerative circuit.

connection. And for his entry, L. Walty of Walla Walla, Washington created a crystal set that could do double duty. First, of course, it was a crystal set; but while waiting for a national disaster, Walty's rig could be used as a signal tracer (Figure 7). You gotta give these guys credit for ingenuity.

The dual antennas model, in turn, must have inspired other dual approaches because the following issue contained sets with dual detectors. Two were fairly standard full-wave rectification circuits. The third was an inventive circuit by R. J. Baker, W8JIA, which contained no ground connection and only an optional tuner (Figure 8). The caption includes the comment, "Several of the local hams glanced at the circuit and told me, 'Impossible!!, There's no ground return path'." Had Danny Diode not vouched for the efficacy of this circuit, I'm afraid I'd side with the local hams who expressed their skepticism.

The final sets of Operation Crystal appeared in the March-April 1956 issue of *G-E Ham News* and these three really broke new ground. Technically, the rigs violated a basic rule of the contest because each used battery power. Quite significantly, the *Ham News* publishers in GE's Electronic Tube Department had then introduced the brand new GE 2N107 hobbyist transistor. One circuit used a conventional detector circuit and added a one-transistor amplifier driven with 3 volts of battery power. A variation replaced the diode detector with a second 2N107 to fashion a two-transistor "crystal" set.

The third transistor set incorporated a simple and elegant regenerative circuit (Figure 9). Powered by a 1.5 volt battery and using two 365 pF variable capacitors for tuning along with high-impedance headphones, the little rig added eight turns of wire around a standard loop stick inductor to feed the

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base of the 2N107.

Fortunately, the national disasters envisioned by Larry Lighthouse never came to pass. But the contest for no-power receivers stimulated the creativity of many hams who developed interesting twists on a fundamental circuit that had been in use since the dawn of radio communications.

This story of Operation Crystal contains an interesting postscript. Several times I alluded to the principal writer of *G-E Ham News*, an individual using the pen name of Larry Lighthouse (and probably Danny Diode, too). Old Timers *might* remember Larry Lighthouse, but they *must* certainly remember "Hashafisti Scratchi" the *CQ* magazine columnist famous for his humor and tall tales.

Hashafisti and Larry Lighthouse were one and the same, both creations of George Henry Floyd, Jr., WA4DGA (ex-W2RYT). Floyd was an engineer and executive at General Electric. He was born in 1917 and just recently passed away on 22 November 2008. Floyd was 91.

The complete *G-E Ham News* issues featured in this article may be found on the writer's web site at: http://n4trb.com/AmateurRadio/GE_HamNews/ge_ham_news.htm.