Gnat-Size Crystal Checke

By GARY McCLELLAN

YOU hit the push-to-talk switch, call your mobile and then wait for a reply. No dice. You try again and again but to no avail. When the car gets home you try again at close range and discover your signal wasn't even getting out of the shack.

So you check the antenna, transmission line and tubes. Still no luck. The thing you forgot was the crystal. It could be ready for the trash can, because when crystal activity falls, so does your transmitter's output power. And insufficient drive to a final due to a weak crystal can adversely affect modulation. A bad crystal in a receiver will mean you won't be able to hear a call from a station three blocks away.

Then there's the reverse situation. In this scene the operator first considers the crystal the source of poor reception or transmission. First thing he does is pull the rock, toss it out and put in a new one. Two minutes and $3 later he finds it wasn't the crystal after all.

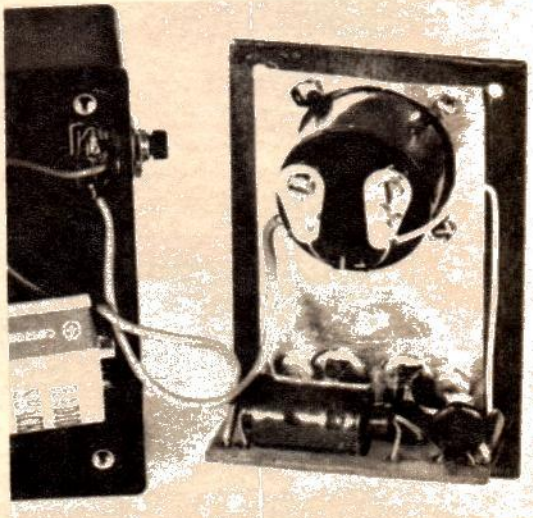
What one thing will prevent all these things from happening again? Our Gnat-Size Crystal Checker. Not much larger than a pack of cigarettes, the checker will spot a bad crystal in seconds. It will test almost any crystal at its fundamental frequency. Unlike some checkers, there are no controls to set. The only control you have to contend with is the push-button power switch. As a special bonus, the checker will, with an appropriate crystal, serve as a signal generator or a band-edge marker. And, if you replace the meter circuit (D1 and M1) with an antenna, you have a low-power CW transmitter.

The parts will cost about $10. However, they are all common and you should be able to save money by digging into your trusty old junk box. Construction is easy and you can build it in an evening.

Construction

Our checker was built in a miniature plastic case sold by the Radio Shack. However the size or type of box you use is unimportant. The main thing that will determine the box to be used is the size of the meter you can obtain. Our model uses a 1¼-in. square imported job that is stocked by many stores. If you can't find anything like it, try one of those miniature tuning meters. But if it doesn't have a 1-ma movement you will have to shunt it.

Once you have the parts you can start working on the box. The meter and crystal socket go on the front panel. Position the meter as far to the top of the box as possible



Inside of author's model. Note closeness of circuit board to crystal-socket lugs at bottom. Aluminum panel is covered with decorative paper.

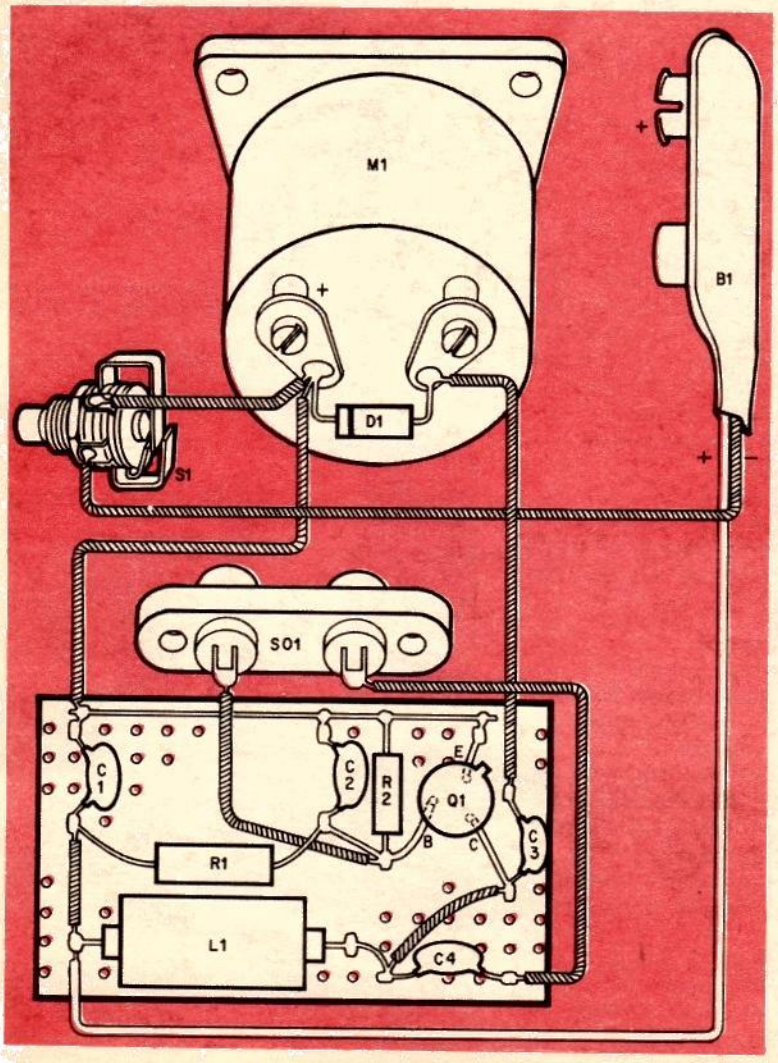
Gnat-Size Crystal Checker

and the crystal socket about ¾-in. from the bottom. This dimension applies mainly to the Radio Shack box; you are free to use some other layout with a different box.

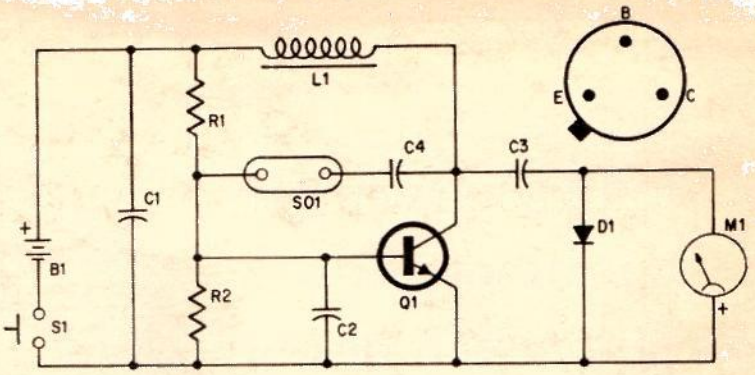
The oscillator circuit was built on a 1 x 1⅞-in. circuit board. (The author made his own printed-circuit board. However the oscillator can be built on perforated board as we show in the pictorial.) Start construction by laying out the parts following the schematic and pictorial. Solder them to push-in terminals and clip off the excess leads. Make a small L-bracket out of scrap metal and attach it to the board as shown in the photo. Mount the board on the front panel with the components facing the crystal-socket terminals. Connect the wires. The power leads must be soldered directly to the battery if you used the box we specify because there isn't room for a connector. Connect diode D1 across the meter and ground the positive side of each. Check the wiring, and if all's well, button up the box.

Checkout and Operation

Checking crystals couldn't be easier. Plug a good crystal into SO1 and press S1. The meter, which shows relative crystal activity, should show a steady indication. If it doesn't, check the circuit. Once you are sure the



In the photo at the left you can see that the author built his model on home-brew printed-circuit board. We show parts mounted on a 1 x 1⅞-in. piece of perforated circuit board on which push-in terminals were used for tie points. Use a small bracket to attach the board to the case's metal panel. Connect ground bus (top of board) to bracket.



Checker is a crystal-controlled oscillator circuit in which crystal to be tested is inserted in socket SO1. If crystal is good, oscillator starts and RF at Q1's collector is rectified by D1 and applied to the meter, M1.

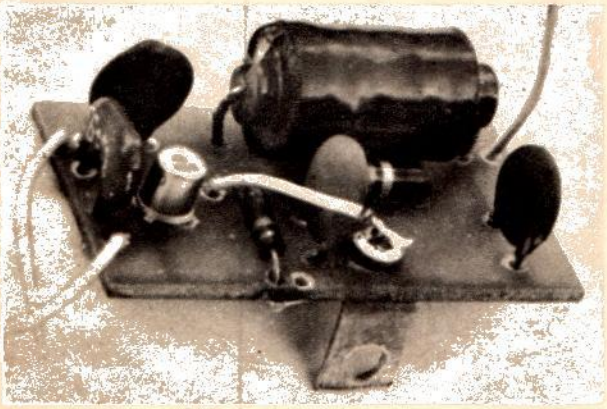
PARTS LIST

B1—9 V battery (Burgess 2U6 or equiv.)
C1,C4—.001 μf, 30 V or higher disc capacitor
C2—47 μμf, 30 V or higher disc capacitor
C3—33 μμf, 30 V or higher disc capacitor
D1—1N34A diode
L1—2.5 mh RF choke (J. W. Miller No. 6302, Lafayette 34 T 8792 or equiv.)
M1—0-1 ma miniature DC milliammeter
Q1—2N706 transistor
R1—100,000 ohm, ¼ watt, 10% resistor
R2—10,000 ohm, ¼ watt, 10% resistor
S1—SPST normally-open push-button switch
SO1—Socket for FT-243-type crystal (Millen Type 33102, Newark stock No. 38 38F656. Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60524. 43¢ plus postage. $2.50 minimum order)
Misc.—3¼ x 2⅛ x 1⅛-in. utility case (Radio Shack 270-230 or equiv.)

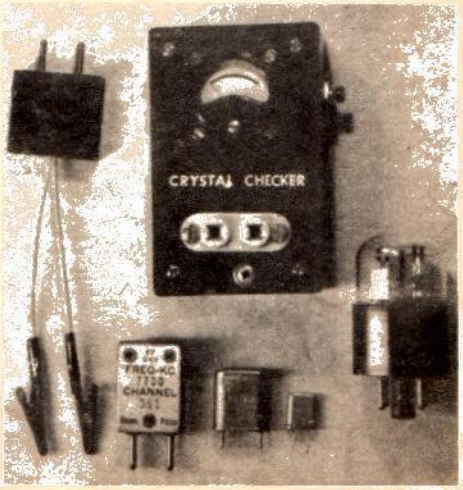
checker is working try several good crystals to get an idea of what indications to expect. When checking other crystals, reject those that produce fluctuating, weak or no indication.

You might want to build an adaptor for checking crystals that won't plug into SO1. Simply disassemble an old FT-243 crystal and discard the element. In it's place solder a short piece of hookup wire to each pin. Drill a hole in the top of the holder for the wires to pass through. Reassemble the holder and solder an alligator clip to each lead. Plug the adaptor into the checker and the clip leads to the crystal to be tested.

To keep track of how a crystal should perform, paste a chart on the back of the cabinet showing the indication you get when you check a new crystal. (The indications will simply be the numbers printed on your meter's scale.) Such a scale will let you compare questionable crystals against the reference values.



Author's circuit is built on an etched circuit board. Layout is as ours, shown in pictorial. Bracket mounts and grounds the board to box's panel.



Adaptor, at left, is made from discarded crystal. It is used to check three crystals at right that can't be plugged in socket used to check FT-243-type crystals.