A CRYSTAL CONTROLLED V.F.O.

The recent introduction of wider-range variable crystals has made a direct crystal-controlled v.f.o. unit capable of covering a wide frequency range an economical possibility. These new crystals are 80-meter units having a fundamental frequency variation of approximately 12 kc. with ranges of two, four and eight times this amount when their frequency is multiplied into the 40-, 20- and 10-meter bands, respectively.

Since these new crystals have the relatively high temperature coefficient of 50 cycles/°C./Mc. it is imperative that the crystal oscillator stage be designed to have an absolute minimum of crystal current. The use of one of the wide-range crystals in a relatively high-power crystal stage such as is commonly used with low-drift crystals will almost certainly result in a great deal of frequency drift. As the crystals require a low-power oscillator, and since their wider range makes them suitable for crystal-controlled v.f.o. use, their logical application is in an operating-desk exciter feeding the transmitter through a link.

The Circuit

The diagram of the crystal-controlled v.f.o. is given in figure 1. From this diagram it may be seen that a "hot cathode" type of oscillator is used, the screen acting as the anode for the oscillating portion of the tube. Electron-stream coupling to the plate of the 1852 provides either fundamental or harmonic output in the plate tank L_1-C_1 which covers the 80- and 40-meter bands. The circuit constants are so proportioned that the excitation to the crystal is the minimum required for reliable operation, thus keeping the crystal current to a minimum. The use of an 1852 as the oscillator tube is another feature which helps to stabilize the oscillator, since this type of tube has such high transconductance that a very minimum of excitation is required for full output.

Two crystal sockets on the sloping panel allow the use of two variable crystals for covering a wider range of frequencies. Alternatively a single variable crystal may be used in one of the sockets and a fixed crystal in the other. The latter crystal may have a fundamental frequency in the 160,- 80- or 40-meter bands. With either 80- or 160-meter crystals, the output circuit may be tuned to 80 or 40 meters. When a 40-meter crystal is used the output frequency is limited to 40 meters since the output tank circuit covers only the 80- and 40-meter bands.

Switching

The v.f. crystal oscillator is provided with two sets of terminals at the rear of the cabinet for keying the relay-control purposes. Keying is accomplished directly in the cathode of the 1852. The terminals for the relay allow the transmitter to be controlled by switch S_2, which is on the panel of the exciter. This switch is a double-pole single-throw type which shorts the keying contacts and closes the transmitter relay circuit when it is thrown to the "on" position. The crystal switch, S_1, may also be used to control the transmitter by switching it to the center open position. This requires that the stages following the exciter be biased so that their plate current does not rise unduly when excitation is removed.

Output Indicator

A novel feature of the v.f. crystal oscillator is the use of a 6U5 tuning "eye" tube as a direct output indicator in place of the usual meter. The triode section of the 6U5 is coupled to the output tank through a small coil and the rectified r.f. is made to open the eye. Tuning the output tank to resonance in-

This small cabinet houses the oscillator and its power supply. The large knob at the center of the panel tunes the output circuit to either 80 or 40 meters. Crystals are plugged into the panel, where they are available for quick change or frequency shift.

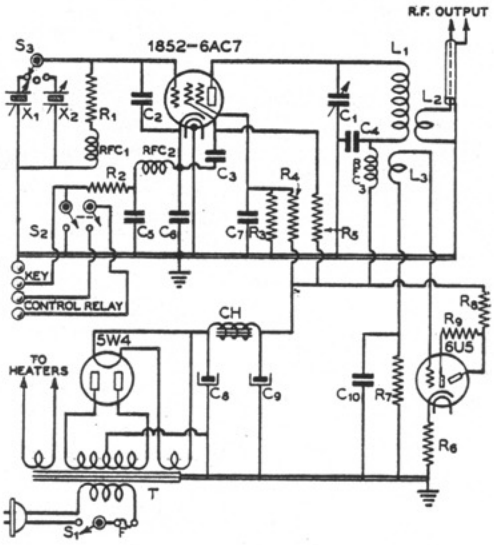

Figure 1. Diagram of the V.F. Crystal Exciter.

C_1—140-μμfd. midget variable
C_2—.000015-μfd. mica
C_3—.01-μfd. 400-volt tubular
C_4—.01-μfd. mica
C_5—0.1-μfd. 400-volt tubular
C_6—.00015-μfd. mica
C_7—.01-μfd. 400-volt tubular
C_8, C_9—4-μfd. 450-volt electrolytic
C_{10}—0.1-μfd. 400-volt tubular
R_1—20,000 ohms, ½ watt
R_2—150 ohms, 1 watt
R_3—20,000 ohms, 1 watt
R_4—100,000 ohms, 1 watt
R_5—30,000 ohms, 2 watts
R_6—10,000 ohms, 1 watt
R_7—100,000 ohms, 1 watt
R_8—200,000 ohms, 1 watt
R_9—1 megohm, ½ watt
RFC_1, RFC_2, RFC_3—2½ mh. r.f. choke
S_1—S.p.s.t. toggle switch
S_2—D.p.s.t. toggle switch
S_3—Three-position tap switch
L_1—30 turns no. 22 d.c.c. closewound on 1" dia. form
L_2—3 turns no. 22 d.c.c. at cold end of L_1
L_3—3 turns no. 22 d.c.c. below L_2
T—500 v. c.t., 50 ma.; 5 v., 2 a.; 6.3 v., 1 a.
CH—10 hy., 50 ma.
F—2-amp. fuse
X_1, X_2 — Variable or fixed crystals

volves merely tuning for greatest opening of the shadow on the tube target.

The self-contained power supply is of the simple brute-force filtered type employing a single choke and two 4-μfd. electrolytic condensers. The transformer may be of the midget broadcast variety.

Transmitter Coupling

The output available at the transmitter end of the link is slightly under 3 watts on both 80 and 40 meters with 80-meter crystals. This same amount of output is also obtainable on 40 meters when crystals having a fundamental frequency in that band are used. The 80-meter output when using 160-meter crystals is again around 3 watts, but the 40-meter output from a 160-meter crystal will be somewhat reduced. When using a 160-meter crystal care must be taken to be sure that the output circuit is not tuned to the third instead of the second or fourth harmonic of the crystal.

The 3 watts of output from the exciter is sufficient to excite practically any present crystal stage in the transmitter, and in many cases will be found to be great enough so that the v.f. exciter can replace the present crystal stage. Normally the transmitter's present crystal stage will be operated as a doubler with link coupling from the exciter. The socket formerly used to hold the crystal can then well be used to mount a tube-base type coil acting as a grid tank. The grid tank may be made quite low C and consequently have a broad resonance characteristic to allow a large amount of frequency shift without retuning.

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Radioddities

The 160-meter band is the only one which is an odd number of kilocycles wide.

U. S. hams occupy a total of 18,485 kc. of radio spectrum. Approximately one-third of this territory is taken by the 1¼-meter band alone.

Phone operation is permitted in over three-quarters of the total ham spectrum.

Switching from the lowest to the highest amateur frequency represents a frequency change of over 230 to 1.

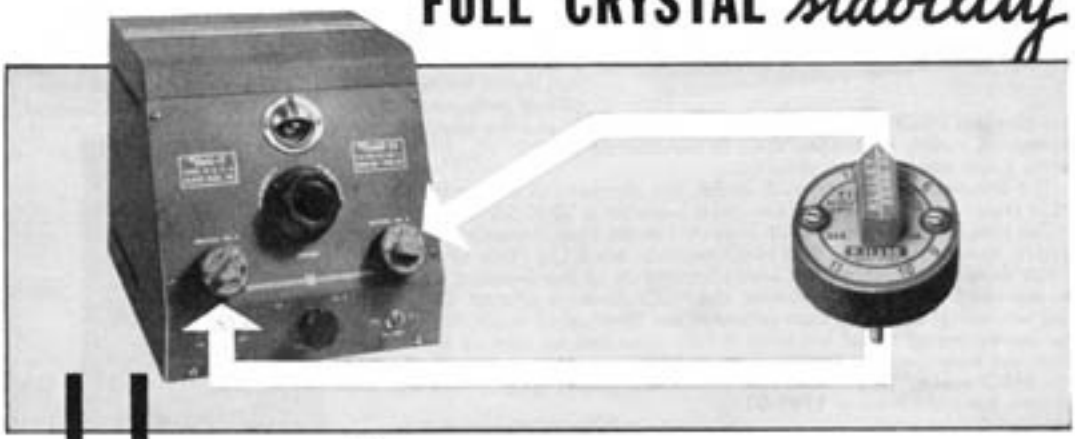
Radio shield "experts" will be interested to know that at the other ends of the tremendous band of vibrational phenomena, shield materials take odd forms. Lead is used against radium rays, while glass will shield the ultra violet.

If human eyes responded to radio waves and ordinary light did not exist, eyeglasses would be made of paraffin.

Lately it has been the practice of the F. C. C. not to assign three-letter broadcast calls "except in cases where 'good will' has attached to the use of such existing call letters."

2000 and 4000 kc. are the only top-edge ham frequencies whose harmonics also mark the lower edges of higher-frequency bands.

Now! FREQUENCY flexibility with FULL CRYSTAL stability



Bliley Vari-X

VARIABLE CRYSTAL OSCILLATOR

The Bliley Vari-X, with VF2 Crystal Unit, combines full quartz crystal stability with the frequency flexibility of a self-excited variable oscillator. Engineered for operating convenience, this crystal controlled variable frequency exciter is easily placed in service. Set the Vari-X beside your receiver, couple it to your present oscillator stage by means of the concentric cable supplied, plug in the a. c. power cord, insert two crystal units and you're all set for action.

Output is obtained on 40 or 80 meters simply by rotating the tuning knob and watching the electric eye for resonance. Either crystal is instantly chosen by a convenient selector switch. To vary the transmitter frequency, simply rotate the knob on the VF2 Crystal Unit in use. If you now have 40 or 80-meter crystal units, of any type, so much the better—they'll work in the Vari-X.

See your Bliley Distributor at once for full details—ask for Circular D-2.

with VF-2 CRYSTAL UNIT

Developed especially for the Vari-X, the VF2 80-meter Variable Frequency Crystal Unit is another outstanding development by Bliley engineers. Mechanically, the VF2 Unit is the same as the well-known VF1 Variable Crystal Unit but, through the application of a special crystal cut, the frequency variation is doubled to approximately 12kc. When frequency multiplying, the variation approaches 24kc. at 40 meters and 48kc. at 20 meters.

The VF2 Crystal Unit is intended for use *only* in low-power oscillators, such as the Vari-X, where crystal heating is negligible. Properly excited, the VF2 Unit provides new wide-range variable frequency crystal control.

BLILEY Vari-X

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