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SOLID HIGH-C VFO

page 3

Here's a double feature issue—with Part II of our 200-watt DOUBLE SIDEANDER, and—in response to many requests—details on constructing a solid high-C VFO for the popular amateur frequency ranges.

—Lighthouse Larry

Also—

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MEET THE DESIGNER . . .

W2FBS—Sam Johnson, needed a stable, tunable oscillator covering a single frequency range for the new heterodyne exciter he was building for his station. Having seen first hand the fine results obtained by ex-W2FZ (now K7BLOG) with his high-C oscillator circuits for our 150-watt single band transmitters, Sam packaged his high-C circuit like the proverbial battleship. (See the cover photos and description starting on page 3.)

A long-time DX chaser with 230-odd countries confirmed, Sam can be heard almost daily on the CW DX bands, seeking new rare countries. W2FBS, incidentally, provided the technical guidance for our SPECIAL DX LOG ISSUE last year; also the 1959 supplement in this issue.

Vocationally, Sam is a mechanical engineer with General Electric’s Gas Turbine Department at our big-sized manufacturing plant in Schenectady, N. Y.

After Sam’s heterodyne exciter has a bit more mileage on it—and countries too—we’ll bring you the details in a future issue. 1

See G.E.HANDEL WE, Microwave Electronics, 1957 (Vol. 12, No. 6) for details on his oscillator and transmitter.

COMING NEXT ISSUE . . .

The photo below is an operator’s eye view of K1OYW’s Compact Triode Kilowatt featured in a special 12-page September-October, 1959 issue. We promised you this fine article in the March-April issue in which Bob’s bandswitching VFO appeared.

Amateur radio gear may be literally red hot in the future if TIMMS, as pictured above, are employed in its construction.

TIMMS circuits are a new concept of self-heating combination of heaterless electronic tubes, resistors, capacitors and other parts fabricated into stacks, shown above.

A complete circuit, such as the multivibrator in the sketch, occupies a space no larger than a pencil eraser. Once heated initially, the circuit generates its own operating temperature of 500 degrees C.

TIMMS are not yet commercially available, but if you’d like more information, we’ll send you a bulletin describing them.

—Lighthoize Luray
TABLE I: PARTS LIST

| C1 | air variable with front and rear rotor bearings; see Table II for capacitance values (But or Mastercraft "IC" or Johnson "I" series). |
| C2 | aluminized film or electrolytic; see Table II, for impedance values. |
| C3 | .01-.005 mfd, 100 volt above 5 megacycles in grid circuit, 200 volt below 5 megacycles. |
| C4 | .02-._.04 mfd, aluminized mica only for capacitive coupling output circuit. |
| C6 | aluminized mica; see Table II for values. |
| L1 | choke-type coaxial cable connector. |
| L2 | coils 1 inch long, wound on 15-inch diameter ceramic cone slug tuned coil forms 2-1/2 inches long, CTC 15-15, or PL37-35CCL), see Table II for inductance values and turns. |
| L3 | CTC LS-5 ready-wound coils, or wound on same forms as L2, see Table II, Wind 2 turns coil over L2 for link. |
| RFC | pi-wound r.f. choke, 2.5 mh below 5 megacycles, 1 mh above 5 megacycles (National R-32, or equivalent). |

TABLE II—TUNED CIRCUIT COMPONENT VALUES

<table>
<thead>
<tr>
<th>FREQUENCY RANGE</th>
<th>CAPACITORS</th>
<th>COILS—WINDING LENGTH = 1 INCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;A&quot; (MHz)</td>
<td>&quot;B&quot; (MHz)</td>
<td>C1, mfd</td>
</tr>
<tr>
<td>1.75—1.88</td>
<td>3.5—3.75</td>
<td>0.004</td>
</tr>
<tr>
<td>3.5—4.0</td>
<td>7.0—7.5</td>
<td>0.003</td>
</tr>
<tr>
<td>5.0—5.5</td>
<td>10—10.5</td>
<td>0.002</td>
</tr>
<tr>
<td>5.5—6.0</td>
<td>12.0—12.5</td>
<td>0.002</td>
</tr>
<tr>
<td>6.0—6.5</td>
<td>14.0—14.5</td>
<td>0.002</td>
</tr>
<tr>
<td>7.0—7.2</td>
<td>24.0—24.6</td>
<td>0.002</td>
</tr>
<tr>
<td>8.0—8.22</td>
<td>25.0—26.0</td>
<td>0.002</td>
</tr>
</tbody>
</table>

FIG. 1. SCHEMATIC DIAGRAM of the high-C variable-frequency oscillator. Components required to cover a given frequency range are listed in TABLE II. All capacitances are in mfd, unless otherwise specified. All resistances are in ohms, 1/2 watt (1000). Use either line coupling C1 and C2 for the output, or capacitive coupling with C3, depending on the driving requirements of succeeding stage.
TOP VIEW of the oscillator with shield box over the tuning capacitor removed. Note how gear box on NWP dial fits into step-down shelf on chassis plate, permitting the dial to swing up with indicator shaft. No spacers are used under fasten on capacitor.

SOLID HI-MAG VFO

(Continued from page 2)

original high-C circuit (see "Technical Talk," High-C Oscillators," G-E HAM NEWS, November-December, 1957 Vol. 12, No. 6). Capacitors C1 and C2 form an r.f. voltage divider for feedback and also are in series across L3 for determining the frequency of oscillation. The capacitance range of C1 determines the frequency coverage.

A 6AK6 miniature pentode was chosen as the oscillator tube because of its high transconductance. The plate circuit (C3 - L5) is usually tuned to the second harmonic of the grid circuit to lessen interaction caused by changes in load on the oscillator output. Details on the critical components are given in TABLE I. A choice of component values for suggested tuning ranges is listed in TABLE II.

This particular oscillator was designed to cover an output tuning range of from 12.5 to 12.5 megacycles, a range of 500 kilocycles. With the National type NWP dial calibrated from 0 to 500, a tuning rate of about 1 kilocycle per dial division was achieved. However, the tuning rate was not precisely linear. A well-calibrated, smooth running tuning dial should be used on this— or any — VFO.

HIGH QUALITY insulation—stellite or ceramic—should be on the components selected for the oscillator wherever possible. This helps reduce frequency drift. The oscillator grid coil (L6) had a measured "Q" of over 200 on the coil form specified, in spite of the small diameter.

CONSTRUCTONAL DETUNES are covered in the photos and the drilling diagram for the chassis plate and shelf. FIG. 3. The shield box for C1 is a 3 x 4 x 3-inch Minidex (Bud CU-30). The shield under the chassis plate was made from See-Zot aluminum expandable chassis parts. The front and rear side rails are See-Zot R-34 (3 inches high, 6 inches long). A See-Zot P-44 chassis plate forms the bottom cover. Hole locations in the chassis plate for this shield should be marked from the shield parts.

A special mounting, as shown in the detail drawing, FIG. 3, was made for C1 and C2. This assembly is located next to L6, as shown in the bottom view. The three 0.001-mfd feedthrough capacitors for the power leads, and the r.f. output connector, (J1), mount on the rear side rail. The power leads and link on L6 were made with insulated hookup wire; tinned No. 13 bus wire was used for r.f. leads.

TUNEUP consists simply of adjusting the tuning slug in L6 so that the desired tuning range is covered. A specific frequency at either the lower or upper end of the tuning range may be covered.

FIG. 2. DRILLING DIAGRAM for the chassis plate, and dial shelf plates. Holes marked "X" were made with No. 32 drill; "B" with No. 27 drill; "C" with 3/32-inch diameter drill; and "D" with a 3/16-inch diameter socket punch.

(Continued on page 7)
CONSTRUCTION DETAILS of the main chassis, and more operational data, are contained in the conclusion of this article on the latest in communication media.

The audio amplifier-modulator, control circuitry and power supplies for the 200-watt double sideband transmitter were constructed on a single 12 x 17 x 3-inch deep chassis (Bud AC-4, or equivalent). If the constructor desires, the power supplies could be built on a separate chassis—say 6 x 17 x 3 inches in size and attached in back of a 7 x 17 x 3-inch chassis for the audio section, and base for the r.f. unit.

Or, some constructor’s may prefer to utilize separate power supply already available. If so the standard 7 x 17 x 3 or 8 x 17 x 3-inch chassis sizes will suffice. Tubers V1 and V3 can then be moved over in line with the audio tubes, and the whole line of tubes extended into the area occupied by L4.

Placement of audio components on this main chassis is shown in the top and bottom views. No dimensions have been given, since the exact locations will depend on the sizes of the parts actually to be used in duplicating the transmitter. The same general configuration should be followed, since it has been found trouble-free.

Both control relays (K1 and R1) were located at the right side under the chassis, near the main power switch (S1), fusible fuses (F1 and F2), and the AC power input connector (J1), but some distance from the time-delay—grid current interlock tube (V6).

The panel controls and indicator lamps line up vertically with the control shafts on the r.f. unit—spaced 2 inches—as shown in the front view on page 3 of the May-June, 1959 issue.

Grid and plate leads in the first few stages in the audio amplifier (V4, V5, V6, V7 and V8) should be kept as short as possible to minimize hum pickup and the possibility of feed-back troubles. Medium voltage power and control circuits were wired with regular hookup wire; high voltage leads should be wire tested for several thousand volts. Pairs of wires carrying an alternating current should be twisted wherever possible.

1. Top View of the main chassis with locations of the major parts indicated. The black clip near the front of the chassis is for high voltage to the r.f. unit. Three other clips at the front of the audio tubes are for connecting circuit connections in positions 9 (X, output voltage), 10 (400-mil-ranged and 11 (2500-mil-ranged) of the meter selector switch.
PARASITICS
Several changes should be made in the diagram of Fig. 1, as it was printed in the May issue, 1959. They are:
1) Conect the cathode of V4 to the grid of V18 (pin 3)
2) Resistor 500,000 ohm between the grid circuit of V18 and 0.001 mfd.

INITIAL ADJUSTMENT and tuneup, as outlined on pages 6 and 7 of the May-June, 1959 issue, should first be completed. Normal tuneup when operating the transmitter into a dummy, or "live" antenna, is quite simple.

1. Set the V12 diode position and adjust C2 and C3 for maximum grid current in the 6146 stage, with the meter switch (S) in position 4 or 5. Then, tune S to the TRANSMIT position, C4 to the grid position and S5 to position 4. Adjust the 500,000 ohm potentiometer in the grid of V18 so that the meter (M) reaches about half scale when C4, C5 and S4 are adjusted for maximum meter reading.

Check the signal frequently, both with tone modulation, and with voice modulation, to ensure that the 6146 balanced modulator is operating properly without "flat-topping." For a discussion of the correct and incorrect scope patterns produced by a DDS transmit, refer to "DDS Considerations and Data," CQ magazine, October, 1957, page 64. This article was written by Dale S. Harris, K7CBQ, of G-E's Heavy Military Electronics Department.
reached by setting C1 at maximum, or mini-
mum, capacity respectively, and adjusting L1.

Warmup frequency drift of the 12-megacycle
model oscillator was about 1 kilocycle in ten
minutes, after which the oscillator remained
within 100 cycles of the nominal frequency.
This was without temperature compensating resis-
tors and thus could have been reduced ap-
preciably.

A bulletin is available with a full size chassis
layout drawing, also, a schematic diagram of a
mixer, crystal oscillator and amplifier unit
which, when used with this oscillator, forms a
heterodyne type circuit.

NOTE: The disclosure of any information or arrangement herein
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or others, to the degree of its development written agreement by the
company, the General Electric Company reserves no liability for
intellectual infringement (for use other than for) arising from the use
of such information by others.

FIG. 3. ASSEMBLY DETAIL OF THE mounting for C1 and
C6, lands were chased short and bent at right angles
closer to properly body for rigidity. Threaded nut
between pillar was made from 0.12 x 1/8-inch machine
screw with head removed.

1959 Supplement to SPECIAL DX LOG ISSUE

[Cut out this log and paste it in the address space at the bottom of page 12 in the July-August, 1958 SPECIAL DX LOG ISSUE of G-E MAIN NEWS, Vol. 13 No. 4.]

OFFICIAL COUNTRIES

Prefix | Country
-------|---------
C61 | Juan Fernandez Archipelago. S. America.
K61 | Round Island/Revillagigedo Is. N. America.
K01 | Marquesas Islands Cook Is. Oceania.
PQ1 | Republic of Guinea (French West African) Africa.

FOOTNOTES

1 New additions to ARRL Official Countries List since July 13, 1958, for credible confirmations dated on or after November 13, 1948.
2 Masaki Island covered as part of Cook Islands prior to March 1, 1959.
3 Republic of Guinea covered as part of French West African prior to October 1, 1958.

OTHER CHANGES IN DX LOG OF JULY-AUGUST, 1958

Listing on page 4 for MGL, Arapaho of San Andreas and Providence, shown in the Continent column as "S. America," should be changed to "8. America."

Listing on page 5 for FS1, shown in the Country column as "Thiretoke," should read "Thiretoke and Yat Island."

Listing on page 6 for K06, Apalae, Japan; UPJ, Georgia; and UG9, Anemia, shown in the Continent column as "Asia," should be changed to "Europe," for the L.A.R.L.'s "Wooded AJ Contests (VAC)" award. However, for the "Washed All Europe" (WAE) and similar awards in which European countries are involved, these three countries are considered as "Africa."

Listing on page 7 for V52, Malaya, should be changed in the Prefix column to read "9M2." Prefix for Malaya was changed to 9M2, effective January 1, 1959.

Listing on page 8 for ZK3, Christmas Island, should be changed in the Prefix column to read "VX2."

Listing on page 9 for Nepal, shown in the Prefix column with no regular assigned prefix, should be changed to read "9N."

7
TECHNICAL INFORMATION—6EZ8

Triode, high-mu miniature triode

The industry’s first triode receiving tube—the 6EZ8—is capable of serving as a one-tube tuner at frequencies as high as the FM band. This 9-pin miniature packs three complete triodes in one envelope, saving designers the cost of extra tubes in many applications. Two sections have a common grid connection, while the third section’s cathode is brought out to a separate pin.

ELECTRICAL DATA

Cathode—Coated Unipotential
Heater Voltage .................................................. 6.3 ±10% Volts
Heater Current .................................................. 0.45 Amperes

DESIGN-MAXIMUM VALUES, EACH SECTION

Plate Voltage .................................................. 330 Volts
Positive DC Grid Voltage .................................. 0 Volts
Negative DC Grid Voltage .................................. 50 Volts
Plate Dissipation, Each Plate ................................ 1.0 Watts
Total Plate Dissipation, All Plates ......................... 5.2 Watts
Heater-Cathode Voltage (Section 3) ......................... Plus or Minus ............................................. 100 Volts

AVERAGE CHARACTERISTICS, EACH SECTION

Plate Voltage .................................................. 125 Volts
Grid Voltage .................................................. 1.0 Volts
Amplification Factor ......................................... 57
Plate Resistance, approximate ................................ 13600 Ohms
Transconductance ............................................ 4200 Microamperes
Plate Current .................................................. 4.2 Milliamperes
Grid Voltage, approximate Ig = 20 Microamperes ......... 4 Volts

TERMINAL CONNECTIONS

Pin 1 .......... Cathode (Section 3)
Pin 2 .......... Grid (Section 3)
Pin 3 .......... Plate (Section 3)
Pin 4 .......... Cathode (Section 3), Cathode (Section 1), and Heater
Pin 5 .......... Heater
Pin 6 .......... Plate (Section 2)
Pin 7 .......... Grid (Section 2)
Pin 8 .......... Plate (Section 1)
Pin 9 .......... Grid (Section 1)

BUILD-IT-YOURSELF IDEAS

from the 999 radio amateurs of

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