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

—Lighthouse Larry

Also—
Scanning the Spectrum ............... page 2
200-watt DOUBLE SIDEBANDER (Part II) .................... page 5
1959 Supplement to DX LOG ISSUE. page 7
TECHNICAL INFORMATION—6EZ8... page 8

Copyright 1959, General Electric Co.
A new concept in electronic tubes and circuits

TIMMS
(Thermionic Integrated Micro Modules)

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-W2FZW (now K7BGI) with his high-C oscillator circuits for our 150-watt single band transmitter, Sam packaged his high-C circuit like the proverbial battleship. (See the cover photo 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 king-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.

See G-E HAM NEWS, November-December, 1957 (Vol. 12, No. 6) for details on the multi-vibrator and components.

COMING NEXT ISSUE . . .

The photo below is an operator’s eye view of K2IOW’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 580 degrees C. TIMMS are not yet commercially available, but if you’d like more information, we’ll send you a bulletin describing them.

—Lighthouse Larry
SOLID HIGH-C VFO

CHOOSO YOUR TUNING RANGE and build this completely shielded, stable oscillator for your new multiplying type, or heterodyne type, exciter.

There's a great many possible combinations of frequency-determining components for the high-C oscillator circuit. Several ranges for the popular amateur frequencies are covered here, along with constructional details for variable frequency oscillators with excellent mechanical rigidity. The oscillator shown was designed to be mounted in a hole cut in a larger chassis, with a rubber bushing under each corner.

The basic circuit shown, in the schematic diagram, FIG. 1, is essentially similar to our constructional details (Continued on page 4).

TABLE I: PARTS LIST

<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; (MC)</td>
<td>&quot;B&quot; (MC)</td>
<td></td>
</tr>
<tr>
<td>1.75-1.88</td>
<td>3.5-3.76</td>
<td>0.004 30 18 30-70</td>
</tr>
<tr>
<td>3.5-4.0</td>
<td>3.5-4.0</td>
<td>0.002 30 16 30-70</td>
</tr>
<tr>
<td>5.0-5.5</td>
<td>5.0-5.5</td>
<td>0.003 20 0.9 30-70</td>
</tr>
<tr>
<td>7.5-7.75</td>
<td>7.0-7.3</td>
<td>0.0025 30 1.3 6-13</td>
</tr>
<tr>
<td>10-10.5</td>
<td>10-10.5</td>
<td>0.005 20 0.9 6-18</td>
</tr>
<tr>
<td>6.0-6.5</td>
<td>6.0-6.5</td>
<td>0.002 30 0.8 6-14</td>
</tr>
<tr>
<td>6.0-6.25</td>
<td>12.0-12.5</td>
<td>0.003 30 0.2 5-9</td>
</tr>
<tr>
<td>7.0-7.2</td>
<td>14.0-14.4</td>
<td>0.004 30 0.6 6-8</td>
</tr>
<tr>
<td>8.0-8.22</td>
<td>24.0-24.86</td>
<td>0.006 20 0.3 5-12</td>
</tr>
<tr>
<td>8.33-8.66</td>
<td>25.0-26.0</td>
<td>0.002 30 0.3 5-10</td>
</tr>
</tbody>
</table>

There's air variable with front and rear rotor bearings; see TABLE II for capacitance values (But or Hammond "MC" or Johnson "E" series."

C, C2, aluminum or mica; see TABLE II, for capacitance values.

C3...silvered mica; 100 md above 3 megacycles in grid circuit, 200 md above 5 megacycles.

C4...aluminum or mica; see TABLE II for values.

C5...chassis type coaxial cable connector.

L1...coils 1 inch long, wound on 5/6-inch diameter ceramic iron-plug tuned coil form 2½ inches long (CTC LS-7, or PLFJ-3PCLI), see TABLE II for inductance values and turns.

L2...CTC LS-3 ready-wound coils, or, wound on some form as L3, see TABLE II. Wind 2-turn coil over L3 for link.

RFC...p-wound t.t. chokes, 2.5 mh below 2 megacycles, 1 mh above 5 megacycles (National R-50, or equivalent).

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 mmF, unless otherwise specified. All resistances are in ohms, ½ watt (K=1000). Use either t.t. coupling L2 and L3 for the output, or capacitive coupling with C4, depending on the driving requirements of succeeding stage.

TABLE II: TUNED CIRCUIT COMPONENT VALUES

FREQUENCY RANGE | CAPACITORS | COILS—WINDING LENGTH = 1 Inch |
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<td>0.002 30 0.3 5-10</td>
</tr>
</tbody>
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FIG. 2. 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 mmF, unless otherwise specified. All resistances are in ohms, ½ watt (K=1000). Use either t.t. coupling L2 and L3 for the output, or capacitive coupling with C4, depending on the driving requirements of succeeding stage.
SOLID HIGH-C VFO

(Continued from page 3)

original high-C circuit (See "Technical Tidbits, High-C Oscillators," G-E HAM NEWS, November-December, 1957 Vol. 12, No. 4). Capacitors C3 and C4 form an r.f. voltage divider for feedback and also are in series across L2 for determining the frequency of oscillation. The capacitance range of C4 determines the frequency coverage.

A 6AK6 miniature pentode was chosen as the oscillator tube because of its high transconductance. The plate circuit (C6-L2) 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 12.0 to 13.5 megacycles, a range of 500 kilocycles. With the National type NW 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 (L4) had a measured "Q" of over 200 on the coil form specified, in spite of the small diameter.

CONSTRUCTIONAL DETAILS are covered in the photos and the drilling diagram for the chassis plate and shelf, FIG. 3. The shield box for C4 is a 3 x 4 x 5-inch Minibox (Radio CU-30). The shield under the chassis plate was made from See-Zeh aluminum expandable chassis parts. The front and rear side rails are See-Zeh R-34 (3 inches high, 4 inches long). A See-Zeh 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 C4 and C5. This assembly is located next to L2, as shown in the bottom view. The three 0.001-mfd feedthrough capacitors for the power leads, and the r.f. output connector, (J3), mount on the rear side rail. The power leads and line on L4 were made with insulated hookup wire; tinned No. 16 bus wire was used for r.f. leads.

TUNEUP consists simply of adjusting the tuning dial in L4 so that the desired tuning range is covered. A specific frequency at either the lower or upper end of the tuning range may be

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TOP VIEW of the oscillator with shield box over the tuning capacitor removed. Note how gear box on NW dial fits into step-down shelf on chassis plate, permitting the dial shaft to line up with capacitor shaft. No spacers are used under feet on capacitor.

BOTTOM VIEW of the oscillator with bottom plate and side plates removed. The ceramic pillars for mounting C3 and C4 (see detail, FIG. 3) are just behind L2. The 0.001-mfd feedthrough capacitors for power connections are on the rear wall plate.

---

FIG. 2. DRILLING DIAGRAM for the chassis plate, and dial shelf plates. Holes marked "A" were made with No. 32 drill; "B" with No. 27 drill; "C" with 9/32-inch diameter drill; and "D" with a 3/16-inch diameter socket punch.
DOUBLE SIDEBANDER

CONSTRUCTIONAL 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 sidetone transmitter were constructed on a single 13 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 constructors may prefer to utilize separate power supplies already available. If so the standard 7 x 17 x 3 or 8 x 17 x 3-inch chassis sizes will suffice. Tubes V1 and V2 can then be moved over in line with the audio tubes, and the whole line of tubes extended into the area occupied by L2.

Placement of major components on the 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 K2) were located at the right side under the chassis, near the main power switch (S1), fuses (F1 and F2), and the AC power input connector (J1), but some distance from the time delay—grid current interlock tube (V10). 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 (V1, V2, V3, and V4) 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.

TOP VIEW of the main chassis with locations of the major parts indicated. The black jack near the front of the chassis is for high voltage to the r.f. unit. Three other jacks in front of the audio tubes are for metering connections to positions 9 (r.f. output voltage), 10 (600-volt range) and 11 (2000-volt range) of the meter selector switch.

WELL-PACKED main chassis of the double sidetone transmitter. Most small parts in the audio section were mounted on the rear face of the chassis, as shown in the top view. The power input connector (J1) and the fuse holders (F1 and F2) are on the rear apron of the chassis.
BOTTOM VIEW of the transmitter main chassis. Note the extension shafts on three of the panel controls. The doughnut-shaped cut just above the terminal boards is $L_1$, part of the audio low-pass filter. Wires carrying alternating current are twisted together wherever possible. Although the schematic diagram in the last issue showed all tube heaters operating from the 6.3-volt supply, $T_n$, this model has a separate transformer for all the heaters in the v.f. unit, located just to the left of $T_n$, and close to $F_t$ above the chassis.

**PARASITICS**

Several changes should be made in the schematic diagram, Fig. 1, on page 4 of the May-June, 1959 issue. They are:

1. Connect the cathode of $V_{1a}$ (pin 3) to the cathode of $V_{2a}$ (pin 8).
2. Capacitor between the 150,000-ohm resistors in the grid circuit of $V_{1a}$ is 0.001 mfd.
3. Resistor between 2700-ohm cathode resistor for $V_{1a}$ and the 10,000-ohm potentiometer is 43,000 ohms.
4. RFC, in cathode of $V$, is 2.5 mh.
5. Resistor in cathode of $V$, in 29,000-ohms.
6. Resistor in plate voltage lead between $L_n$ and $B_n$ is 200,000 ohms.
7. Full scale current reading of meter with $Q_2$ in position 3 should be 40 ma, not 50 ma. Or, for 50-ma full scale reading, change the 51-ohm resistor in the cathode of $V$, to 39 ohms.

A special bulletin, containing a corrected diagram, 11 x 17 inches in size, plus additional data on components, is available upon request from the G-E HAM NEWS office.

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

First, set $S_5$ in the TUNE position and adjust $C_3$ and $C_4$ for maximum grid current in the 6146 stage, with the meter switch ($S_6$) in position 4 or 5. Then, turn $S_6$ to the TRANSMIT position, $S_5$ to the SINE WAVE position, and $S_2$ to position 9. Adjust the 500,000-ohm potentiometer in the grid of $V_{1a}$ so that the meter ($M_1$) reaches about half scale when $C_3$, $C_4$ and $S_5$ are adjusted for maximum meter reading.

Check the signal frequency, 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 DSB transmitter, refer to "DSB Considerations and Data," CQ magazine, October, 1957, page 64. This article was written by Dale S. Harris, K3CBIQ, of G-E's Heavy Military Electronics Department.
SOLID HIGH-C VFO

(Continued from page 4)

reached by setting C1 at maximum, or minimum, 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 capacitors and thus could therefore be reduced appreciably.

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 easter.

NOTE: The disclosure of any information or arrangement herein contained is not intended as a license or patent grant of Genaral Electric Company or others. By the absence of an express written agreement to the contrary, the General Electric Company assumes no liability for patent infringement (or any other liability) arising from the use of such information by others.

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, 1959 SPECIAL DX LOG ISSUE of G-E R.A.M. NEWS, Vol. 13 No. 4.1

OFFICIAL COUNTRIES

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<th>Prefix</th>
<th>Country</th>
<th>Continent</th>
<th>Station Worked</th>
<th>Date</th>
<th>Band</th>
<th>Arr.</th>
<th>QSL</th>
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<td>CRU1</td>
<td>Juan Fernandez Archipelago</td>
<td>S. America</td>
<td></td>
<td></td>
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<td>Revador Cay &amp; Serrano Bank lts.</td>
<td>N. America</td>
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<td>Oceania</td>
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<td>Africa</td>
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</tr>
</tbody>
</table>

FOOTNOTES

1 New addition to ARRI Official Countries list since July 13, 1956, for creditable confirmations dated on or after November 15, 1959.

2 Manihiki Islands counted as part of Cook Islands prior to March 1, 1939.

3 Republic of Guinea counted as part of French West Africa prior to October 1, 1958.

OTHER CHANGES IN DX LOG OF JULY-AUGUST, 1958

Listing on page 4 for H42U, Anthropology of San Andres and Providencia, shown in the Continent column as "S. America," should be changed to read "N. America."

Listing on page 5 for PFG, shown in the Country column as "Trindade," should read "Trindade and Vaz Islands.

Listing on page 6 for UDP, Azerbaijan, UPA, Georgia; and UGA, Armenia, shown in the Continent column as "Asia," should be counted as "Europe" for the L.R.U.'s "Worked All Continents (WAC)" award. However, for the "Worked All Europe (WAE)" and similar awards in which European countries are involved, these three countries are considered as "Asia."

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 ZC3, Christmas Island, should be changed in the Prefix column to read "VW." Listing on page 9 for Nepal, shown in the Prefix column with no regular assigned prefix, should be changed to read "KN."

7
Triple, high-mu miniature Triode

The industry's first triple 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 cathode 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 8 Volts
Negative DC Grid Voltage 50 Volts
Plate Dissipation, Each Plate 2.0 Watts
Total Plate Dissipation, All Plates 5.0 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
Transconductance 4200 Microhms
Plate Current 4.2 Milliamperes
Grid Voltage, approximate Ie = 20 Microamperes

TERMINAL CONNECTIONS
EIA 96A
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 at GENERAL ELECTRIC