The “Barracks Bag VFO”[1]

A One-Tube Transmitter for Home or Portable Work

BY F. R. NICHOLS, W6JJI[2]

(With Notes by Robert D. Keys, NA4G)

One doesn’t see many one-tube self-controlled transmitters described in QST for a very good reason — poorly-constructed and improperly-adjusted ones will result in signals that clutter up the already-cluttered-up bands. However, the transmitter described in this story has been heard on the air by members of the QST staff, and we have no hesitancy in recommending it for 3.5- and 7-Mc. work, if reasonable care is exercised in its construction and operation.

This article is not intended to be a cure-all for you rock-bound fellows who want a simple VFO to replace your crystal oscillator, nor is it intended to be the last word in VFO construction. Someone else is certain to come along with a better and easier way to accomplish the same thing, but here it is, to be taken for what it’s worth.

The name “Barracks Bag VFO” seemed a logical one, since it is planned to toss the rig into my barracks bag when Uncle Sam sends me on temporary overseas duty for AACS.

The Circuit

The circuit, shown in Fig. 1, is a version of the Colpitts-type ECO, originally obtained from W6OD back in 1938. It has been modified for use with indirectly-heated-cathode-type tubes. The grid circuit is tuned to one-half the operating frequency, to give better plate-circuit isolation by doubling and

[1] Reprinted, courtesy QST, from the June, 1947, issue, pages 54-55. This particular electron coupled Colpitts oscillator transmitter is a classic from that era (RDK).

[2] 3431 Comer Avenue, Riverside, Calif. (.... in 1947.... (RDK)).

thus avoiding magnetic coupling back to the grid. It is imperative that the best grade of low temperature-coefficient mica condensers be used for C_1, C_2, C_4 and C_5, since ordinary mica condensers will result in frequency drift[3].

The screen voltage should be obtained from a good "stiff" source that doesn't change much under "key-up" or "key-down" conditions. A variation of not more than 20 volts seems to be satisfactory[4]. Screen voltage in excess of 150 is not recommended, because it will result in excessive drift caused by the increased screen input. A few experiments with the screen voltage will reveal the best value in relation to the plate voltage.

The plate voltage should not exceed 450. In recent overload tests, the plate was run as high as 700, but the frequency drift at 7 Mc. was 2000 cycles in 3 minutes (with and input of 20 watts), which is far too great to be tolerated.

Construction

The transmitter, as can be seen from the photographs, was built using a small shield can for the chassis. This was done primarily to reduce the over-all size and, wherever possible, space should be provided for shielding of the grid coil. A strip of plastic (Lucite or Plexiglas) was used to insulate the plate condenser, C_8, from the chassis, the shaft of the condenser passing through a clearance hole on the side of the chassis[5].

A five-prong socket mounted at one end of the chassis was used for a power connector, and a four-prong socket at the other end of the chassis furnished the connection to the output coil, L_3. Wherever possible, heavy solid wire was used to make the connection between components, in an effort to eliminate any mechanical instability of the wiring. The chassis was not

[3]The medium-sized transmitting tub mica capacitors will work well, and can be found in junk boxes and around under the tables of hamfests in the boxes that everyone seems to miss (RDK).

[4]If 150 turns out to be the best screen voltage for the oscillator, a VR-150 can be used to stabilize the screen Otherwise, a heavy-duty voltage-divider network should be used. — *Ed.*

[5]A better solution would be to firmly mount the capacitor on its insulating strip of plastic and use an insulated shaft coupling with an extra length of shaft going through a firmly mounted bushing in the chassis. The tuning condenser shaft is an exposed high voltage point, not exactly in concert with the radio transmitter sections of the National Electrical Code (RDK).

relied upon for grounding; instead a heavy ground bus connects the grounded circuits. The bus is grounded to the chassis at several points.

Tuning

The initial test for spotting the grid coil "on frequency" should be done with the aid of a well-calibrated receiver or a frequency standard *and* a calibrated wavemeter, to be certain that the grid circuit is tuning the proper range. The grid coil was adjusted so that the VFO will just hit 7000 kc. with the grid condenser fully meshed. This is done by checking the frequency of the oscillator with the condenser fully meshed and the plate circuit resonated (tuned for minimum plate current). If the frequency is found to be below 7000 kc., the top turn or two of L_1 should be spaced apart slightly, the plate circuit retuned and the frequency checked. If the frequency is found to be too high, the top turn or two should be pushed closer together, the plate circuit retuned, and the frequency checked. The process is repeated until the minimum frequency that can be reached is 7000 kc. With 7000 kc. at the maximum capacity on C_2, 7300 kc. will be hit with the condenser about 1/3 meshed[6]. A similar procedure can be followed in the adjustment of the 80-meter-band grid coil.

If the VFO is built with the grid coil shielded, all frequency checks should be made with the shield in place, since the shield raises the frequency to which the grid circuit will tune, for the same coil. In either case, the adjustment tests chould be made with the oscillator loaded to about 25 ma. A 10-watt lamp bulb makes a good load, and the loading can be adjusted by moving L_3 with respect to L_2 or by changing the number of turns in L_3.

A coating of coil dope should then be given the grid coil. Before the coat is dry, the minimum frequency should be checked again, and any necessary corrections made before the coil dope dries completely. After the first coat dries, a second coat can be applied for good measure.

You are now all set to go, with a small VFO that can be loaded up to 25 ma. at 450 volts[7]. However, do not rely on the calibration of the grid coil, regardless of how carefully you checked it, and always check the operating

[6] Since most of the activity in the C.W. portions of the bands are down in only the first half or so of the total band space, it is advantageous to use a tuning capacitor of about 1/3 to 1/2 the value of C_2 (or about 50-75pf). A 50 pf size will do nicely here (RDK).

[7] That is just a little over 11 watts plate input (RDK).

frequency — just in case! Don't crowd the band edges, by allowing at least 20 kc. for a safety factor, and you should get along fine with the monitoring stations and OOs.

The VFO has not been tried on 14 Mc., so nothing can be said about its performance on that band. However, on 7 Mc., KL7, ZL and XU have been worked, as well as many stations around the States and Canada, to prove the practicability of this low-powered device.

NOTES by NA4G

Some additional notes for modern usage of this rig are given below. These modifications have been successfully used by NA4G to size the rig up a bit so that it fits comfortably on the operating table or into a relay rack.

1. *Be Very Careful Around This Rig. The Voltages Present on the Exposed Parts of the Rig Can be Lethal!*

2. The use of a fully enclosing cabinet is recommended. Also, a good dial mechanism is a worthwhile investment, especially if one should want to crowd the band edges in the least little bit.

3. A plate voltage of 150-450 volts should work fine. Just make sure that the screen voltage is approximately 1/3 the plate voltage. If about 225 volts are used, a VR-75 might be used advantageously to stabilize the screen voltage. Similarly, a VR-90 can be used with 250-275 volts on the plate and a VR-150 with 400-450 volts on the plate.

4. Both coils may be wound with modern No. 14 sized black single strand copper household wire. They should not be wound with anything smaller than No. 22 bell wire. Any size from 12 to 22 should work satisfactorily — but in general practice, it has long been known that in oscillator coils, *the larger the wire the better*.

5. The original large plug-in coil forms are somewhat difficult to find, but good ol' black plastic plumbing pipe works just fine. Make up some small angle clips or pillars to mount the coils to the chassis.

The rig becomes a one-band affair then — so build one for each band. Alternatively, if a pair of single-pole, 2 or more position tap-switches are available, the coils could be tapped for both 80 and 40 meters. The grid coil needs to work on a fundamental of 160 or 80 meters while the plate coil needs to work on a doubled frequency of 80 or 40 meters.

6. For ease in tuning, make C_2 a 50pf variable and pad it down with fixed mica transmitting tub capacitors (approximately 100pf). These tub capacitors also work well for C_1, C_3 and C_4.
7. A Type 6L6 metal tube was originally specified, but a 6F6 or 6AG7 metal type, or an 807W or 6146 glass type will also work just fine. At 80 meters, a normal 807 or a 1625 will work, although at 40 meters these two types can become touchy and a bit difficult to keep operating without undue parasitics. A type 837 would be better on 40 meters than the 807 or 1625.
8. The use of a parasitic choke in the plate lead is highly recommended. A choke of 8-10 turns of No. 22 or 24 wire around a 50-100 ohm 1 or 2 watt carbon resistor will work fine.
9. The use of a 0.01 μf bypass condenser across the key jack would be of benefit to keep stray RF off the key leads.
10. A key click filter might be appropriate, inserted in the key lead, between the key jack and the key. A 1 henry series choke with a 1 μf condenser across the key contacts would remove any clicks.
11. The use of rubber or plastic feet on the bottom of the chassis is highly recommended to keep from scratching the table top.
12. For adventurous experimenters, it is possible to parallel additional tubes in the oscillator. Just remember to put 100 ohm half watt resistors in each grid lead, as close to the tube as possible to cut out parasitic tendencies. Insert screen resistors of the same value between each screen lead and the screen bypass condenser. Also, use the plate lead chokes in each plate lead to additionally reduce parasitics. The grid biasing resistor may need to be adjusted in value — try halving, thirding, or quartering the value if using 2, 3, or 4 tubes in parallel.

13. For the really adventurous experimenters, the link coupled tank output (which will feed coax just fine, if the turns are adjusted from about 2-5 turns until the best match is obtained) can be changed to a shunt feed capacitively coupled π-network output circuit. A plate coupling capacitor of 100 to 300pf should be used (a good place for more of those ubiquitous transmitting tub capacitors or a doorknob capacitor). The input capacitor to the π-network can be the normal plate tank capacitor. The coil will remain the same, except that no link would be used.

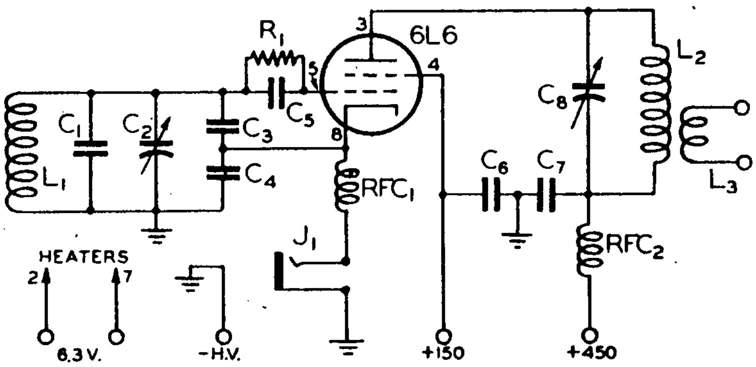
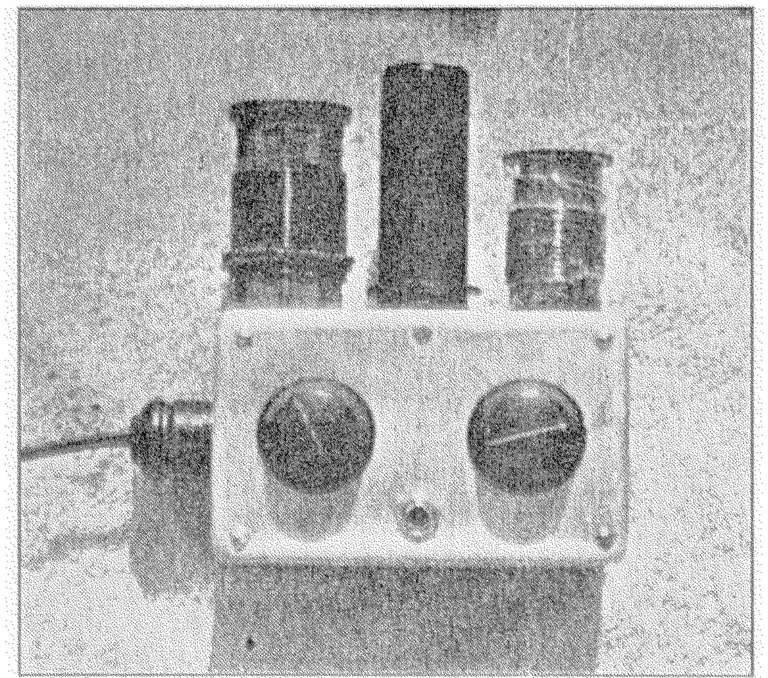
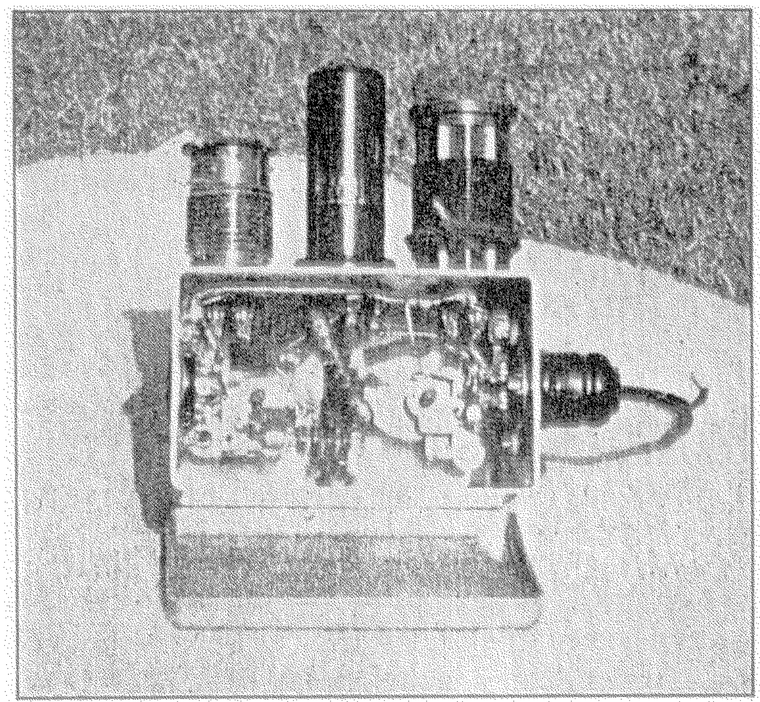


Fig. 1 — Wiring diagram of the "barracks bag VFO."

C_1, C_4 — 500-μμfd. mica, low temp. coëfficient.
C_2 — 140-μμfd. midget variable.
C_3 — 150-μμfd. mica, low temp. coëfficient.
C_5 — 250-μμfd. mica, low temp. coëfficient.
C_6 — 0.01-μfd. mica, 600 volts.
C_7 — 0.002-μfd. mica, 600 volts.
C_8 — 75-μμfd. midget variable.
R_1 — 47,000 ohms, 2 watts.
L_1 — 40-meter band — 8 to 10 turns No. 14 enam., space-wound, 1¼-inch diam. form.
80-meter band — 19 turns No. 16 enameled wire, close-wound, 1½-inch form.
L_2 — 40-meter band — 22 turns No. 14 enam., close-wound, 1½-inch diam. form.
80-meter band — 38 turns No. 16 enameled wire, close-wound, 1½-inch form.
L_3 — 2 turns No. 18 push-back, wound on "cold" end of L_2.
J_1 — Open-circuit jack for key.
RFC_1, RFC_2 — 2.5-mh. 100-ma. r.f. choke.



A front view of the "barracks bag VFO." The two knobs control grid and plate tuning, and the jack is for the key. The machine-screw heads in the corners hold the insulating panel that supports the plate condenser.



A rear view of the VFO shows the back cover removed and gives a glimpse of the component parts.