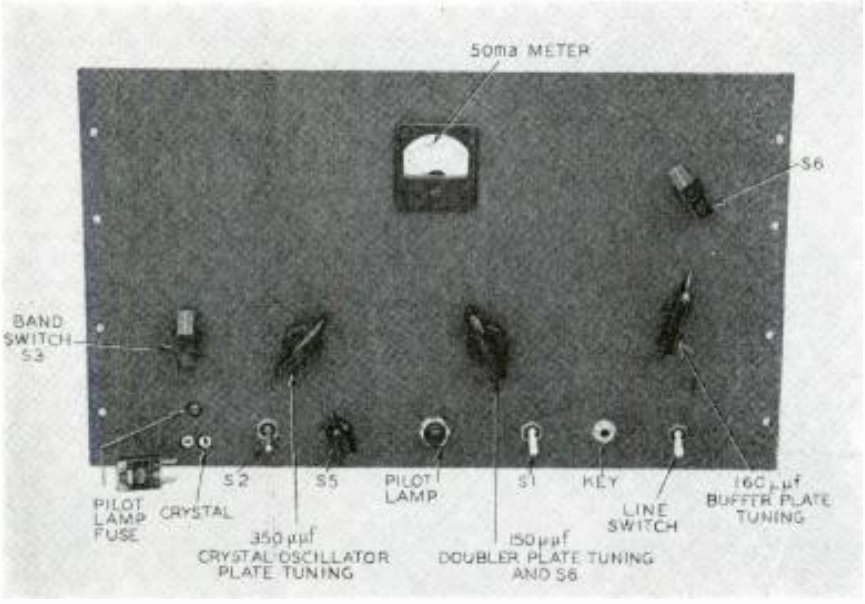
Bandswitching Exciter

By BOB WHITE



The exciter is fully described in the photographs. Here is the 7 x 13-inch front panel.

A BAND-SWITCHING exciter is a necessity in the amateur station which operates on more than one band. This exciter will operate with a crystal of any frequency from 80 to 10 meters, though only a single set of low-frequency crystals is needed for operation on 80, 40, 20, 15, and 10. It can be used with additional doubler stages for operation on v.h.f. bands which are not integral multiples of the lower amateur frequencies. There is a send-receive relay and a keying system.

The exciter has three stages: a 3.45-30-mc, bandswitching, harmonic-generating crystal oscillator; an 11-33-mc bandswitching doubler; and a 3.45-33-mc bandswitching buffer or doubler. A power supply is included.

The pictures will be of much greater assistance in constructing the exciter than any description that could be written; however, a few suggestions are included on some of the less obvious details.

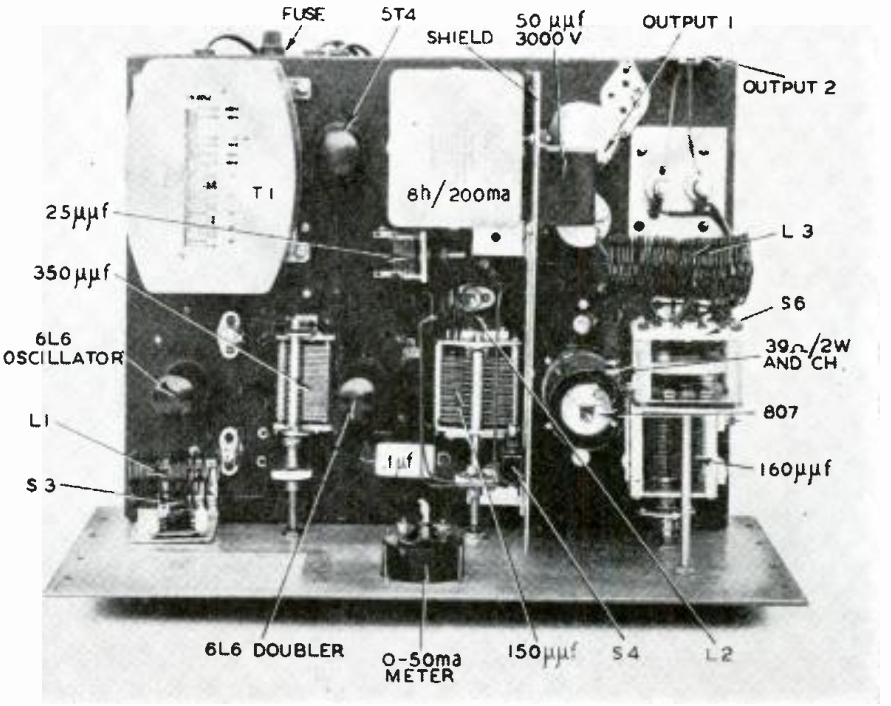
The chassis is 17 x 13 x 2 inches and the dimensions of the front panel (a standard relay-rack panel can be used) are 11 x 19 inches. The panel should be securely fastened to the chassis, and a shield panel should be erected from front to rear between the 807 plate circuit and the other plate circuits. The parts should be arranged for short, direct leads. All grounds of each stage should be made to a single point on the chassis, and each grounding point should be returned directly to the negative terminal of the power supply.

Because the rotors and frames of the oscillator and first doubler plate-tuning capacitors are connected directly to the positive side of the high-voltage supply, the capacitors must be insulated from the chassis and panel. Stand-off insulators or small insulating boards of suitable plastic are satisfactory. The shafts must be connected to the tuning controls through insulated couplings. The two variable 25-μμf coupling capacitors must also be thoroughly insulated with steatite, lucite, or a similar good high-frequency insulating material.

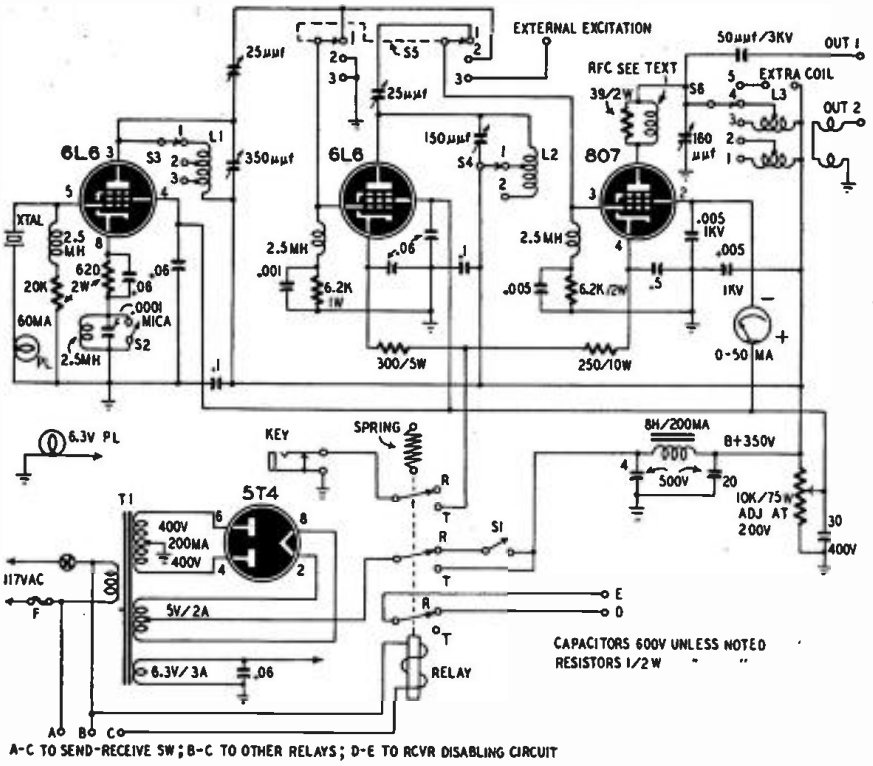
It is probably best to wire the power supply first. Of particular interest in this section is the relay system. The send-receive switch for the entire transmitter should be connected across terminals A and C to energize the 120-volt relay coil. Terminals B and C should be connected to the coils of the other transmitter relays (final amplifier relay, modulator relay, antenna relay, etc.). Terminals D and E are to be connected to the receiver's standby terminals to silence it automatically during transmission.

One set of contacts on the relay controls the high-voltage supply. When the coil is energized, high voltage is supplied to all stages. The cathodes of the 6L6 doubler and 807 are returned to the negative connection of the power supply through a set of relay contacts and the keying jack.

Switch S1 connects high voltage to all stages with the relay in receive position. Only the oscillator functions, because the cathode contacts of the relay remain open. There are many advantages in having the oscillator operative during the receiving period. The oper-



This top view shows positions of all components. Power supply is mounted on same chassis.



The schematic. Switch S5 permits bypassing the 6L6 doubler or using external excitation.

ator can check his frequency for interference. Because the oscillator frequency can be varied approximately 1 kc by the plate tuning circuit if the oscillator is operated on the fundamental frequency of the crystal it is possible to adjust the transmitting frequency exactly.

The bleeder resistor with the variable tap cannot be adjusted until all stages are completed. The tap on the resistor should be set for approximately 200 volts.

The 6L6 oscillator may be wired next. The purpose of the toggle switch S2 is to short-circuit the choke and capacitor when the oscillator plate circuit is to be tuned to the same frequency as the crystal. Closing the switch reduces the crystal current to a safe value. The pilot lamp connected in series with the crystal serves as a current indicator and provides some protection.

L1, S3, and the 350-μμf variable capacitor are the oscillator plate-tuning circuit. Position 1 of the switch covers 3.45 to 7.5 mc; position 2, 6.00 to 13.5 mc; and position 3, 13 to 30 mc. L1 was wound with No. 12 enameled wire on a 1⅜-inch cylindrical form. From tap 1 to tap 2 there are 9 close-wound turns; from tap 2 to tap 3 there are 7 close-wound turns; and from tap 3 to the B-plus end there are 2½ spaced turns.

The coil should be fastened to its switch S with the form still in place. The form can be removed after the end leads have been soldered. The tap connections should be soldered with special care to see that the adjacent turns are not short-circuited. The oscillator should be tested and the coil spacing adjusted for the correct coverage. The turns can then be held rigidly in place by cementing two narrow strips of lucite to the windings.

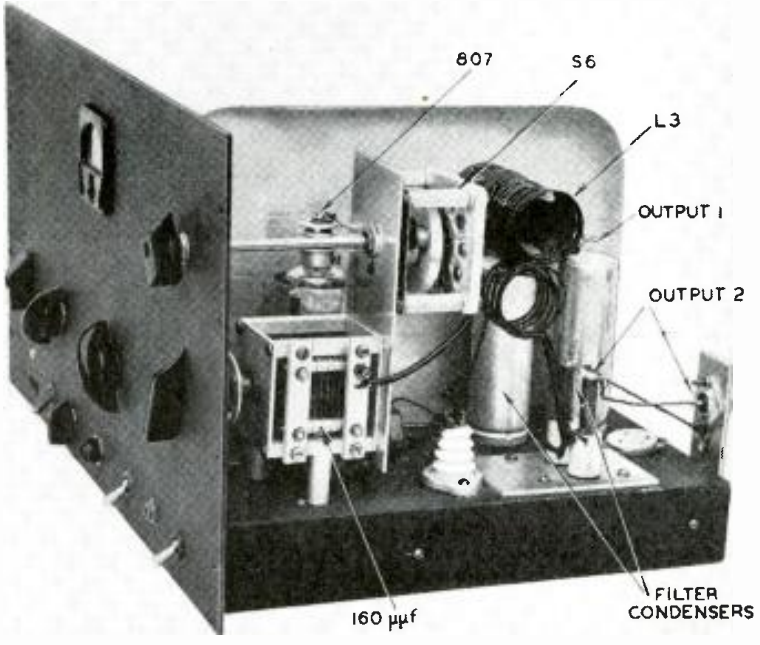
The 6L6 doubler stage is the third section to be wired. The plate of this stage should never be tuned to the frequency of the grid signal because this may result in parasitic oscillation. The circuit tunes from 11.0 to 19.5 mc with S4 in position 2 and 18.8 to 33.0 mc in position 1.

L2 is constructed with the same wire and form as L1. From the plate end of the coil to tap 1, there are 1½ spaced turns and from tap 1 to tap 2 there are 3½ turns. The length of the wire connecting switch to coil affects tuning.

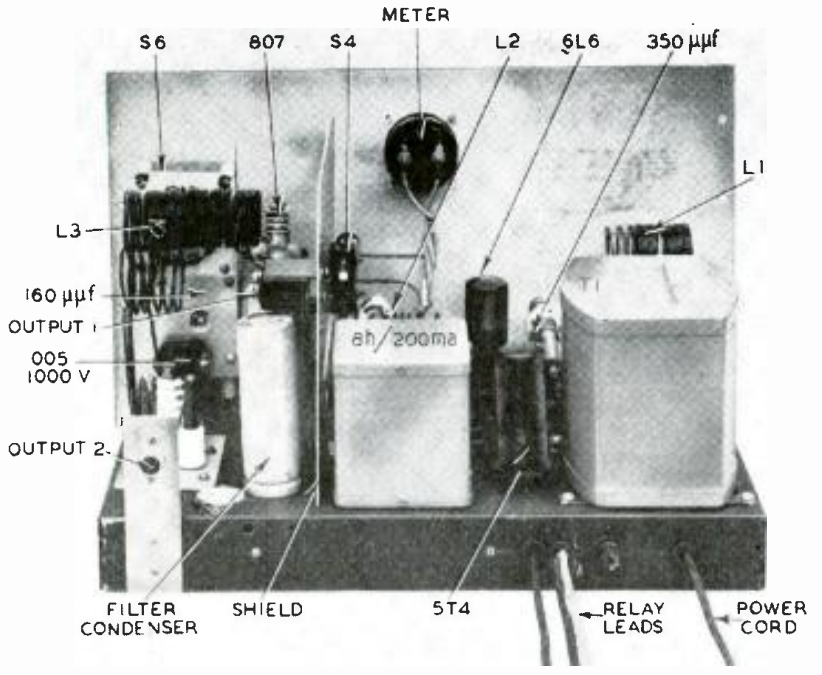
The two-position switch S4 is a small roller-leaf microswitch. The small nonmetallic roller of the switch rests against the outer rotor plate of the tuning capacitor, which can be rotated through 360 degrees. When the capacitor is rotated 180 degrees from minimum to maximum capacitance, the slight pressure exerted on the roller by the rotor plate is sufficient to hold the switch closed in position 1. When the capacitor is turned through the remaining 180 degrees, the rotor plate does not touch the roller and the switch is released to position 2. Two frequency ranges are thus covered and the entire 360 degrees of rotation are utilized.

Switch S5 in position 3 connects the 807 grid to a terminal for external excitation; in position 2 it connects the output of the 6L6 oscillator stage to the 807, bypassing the 6L6 doubler; and in position 1 it connects the output of the oscillator to the doubler and the doubler to the 807. No. 12 or 14 wire is recommended for the wiring of this switch and the other r.f. circuits. The two 25-μμf variable coupling capacitors are adjusted to give adequate excitation on all positions of S5 and at all frequencies. The best position was found to be with the plates about half meshed.

The fourth and last division of the exciter to be wired is the 807 stage. This can be operated as either a straight amplifier or a doubler because of the special precautions taken in its construction. The plate circuit is shielded



This view of the output end shows construction and layout of the 807 stage excellently.



Rear of the chassis. A small shield separates the output stage from the rest of the exciter.

from the oscillator and doubler stages by the shield placed on the chassis (see photos). The 807 is enclosed in a metal can as a further precaution. A 39-ohm, 2-watt carbon resistor with a choke in parallel is also used to suppress parasitic oscillation. The choke consists of 20 turns of No. 26 d.c.c. wire wound around the carbon resistor.

The rotor and frame of the 807 plate tuning capacitor are grounded directly to the chassis. The .005-μf plate bypass capacitor should be mounted as close to the tuning capacitor as practicable so that short, direct leads to the coil and tuning capacitor are possible. Coil L3 consists of two windings; positions 1 and 2 on the bandswitch S6 tune 3.45 to 6.30 and 6.20 to 12.0 mc, respectively. Positions 3 and 4 tune 11.9 to 20.0 and 18.0 to 33.0 mc. Position 5 is for an extra coil of any desired range.

The windings were made in much the same way as the coils previously discussed. The low-frequency coil consists of 11 close-wound turns from the B-plus end to tap 2 and 19½ turns from tap 2 to tap 1. The bottom coil, wound with the same size form and wire, consists of 2 spaced turns from B-plus to tap 4 and 3 spaced turns from tap 4 to tap 3.

Two output systems are shown. The first employs a 50-μμf coupling capacitor connected to the 807 tank circuit. This is suitable for connection directly to the grid circuit of the next transmitter stage, which must be located near the exciter.

The second output system employs a pair of series-connected coupling coils placed at the B-plus ends of the two tuning-coil windings. Each coupling coil is composed of approximately 2 turns of No. 12 enameled wire. They are alike except that they are wound in opposite directions with a continuous length of wire which forms a figure-8 because of the reverse in winding direction. The coupling link for the 11.9-33-mc plate coil must be spaced about ¼ inch from the winding. This output system is suitable for link coupling; co-axial cable between the exciter and the transmitter is recommended.

One 0-50-ma meter in the screen lead of the 807 serves for adjusting the entire exciter. With no excitation applied to the 807 grid, screen current is practically zero. It is increased when excitation is applied, and further increased when the 807 tank is tuned to resonance.

The procedure for tuning is similar for all bands. First, turn the exciter on and energize the send-receive relay. Next, plug in a crystal and turn switch S5 to position 2 so that the oscillator output excites the 807. Set the oscillator bandswitch S3 to the position that includes the fundamental, second-harmonic, or third-harmonic frequency of the crystal. Remember to close switch S2 for operation on the fundamental crystal frequency. Adjust the oscillator tuning capacitor for an increase in the 807 screen current; the oscillator stage is then approximately adjusted.

If the 6L6 doubler is to be used, S5 should next be set to position 1. Bandswitch S4 and the doubler tuning capacitor should be set for twice the output frequency of the oscillator stage. When the doubler plate circuit is tuned to resonance, the meter reading will rise.

The plate circuit of the 807 can then be resonated either to the fundamental or a harmonic by turning switch S6 to the correct position and tuning the capacitor. The screen current will increase still more when the 807 tank is adjusted. As a last step, the setting of all the tuning condensers should be touched up to produce maximum screen current.

MATERIALS FOR EXCITER

Resistors: 1—6,200 ohms, 1 watt; 1—39, 1—620, 1—6,200, 1—20,000 ohms, 2 watts; 1—300 ohms, 5 watts; 1—250 ohms, 10 watts; 1—10,000 ohms, 75 watts, adjustable.

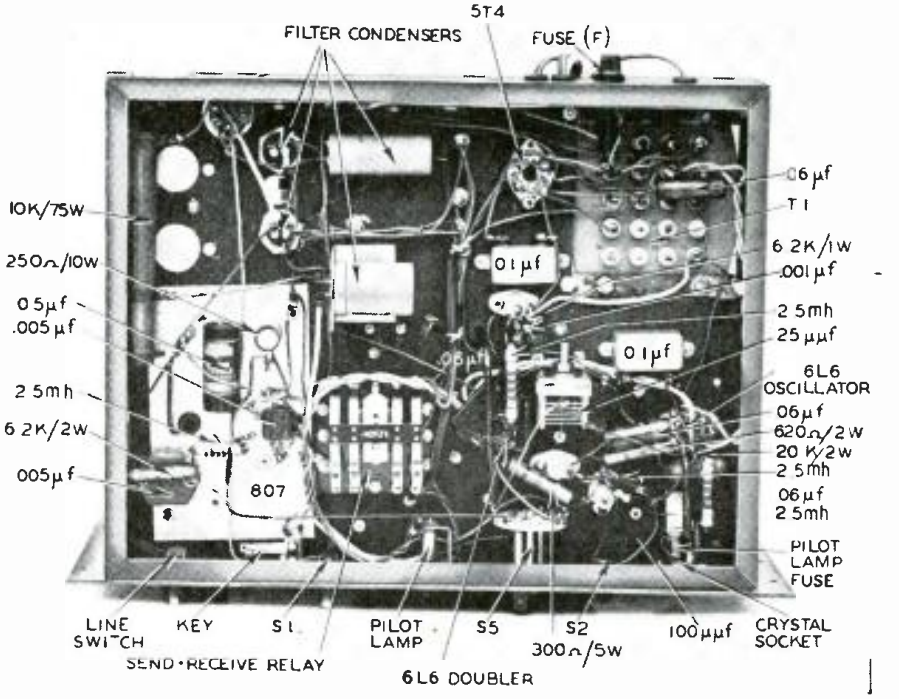
Capacitors: 1—100 μμf, 1—.001 μf, 2—.005 μf, mica; 1—50 μμf, 1—.005 μf, 3,000 volts, mica; 5—.06, 3—0.1, 1—0.5, 1—4 μf, 600 volts, paper; 1—20, 1—30 μf, 450 volts, electrolytic; 2—25, 1—150, 1—160, 1—350 μμf, variable.

Transformers and chokes: 1—power transformer, 800 volts, center-tapped, 6.3 volts, 3 amperes, 5 volts, 2 amperes; 1—8-h, 200-ma filter choke; 4—2.5-mh r.f. chokes.

Switches: 3—s.p.s.t. toggle; 1—1-circuit, 3-position, 1—1-circuit, 5-position, 1—2-circuit, 3-position rotary; 1—s.p.d.t. micro-switch with insulated roller actuating arm.

Tubes: 1—5T4, 2—6L6, 1—807.

Miscellaneous: 1—117-volt a.c. relay, 3-pole, double-throw contacts; 1—0-50-ma meter; 1—closed-circuit phone jack; 1—6.3-volt pilot assembly; 1—17 x 13 x 2-inch chassis; 1—11 x 19-inch rack panel; necessary insulators, binding posts, shield metal, insulated couplings, hardware.



The under-chassis view. Most of the important components are identified in the call-outs.