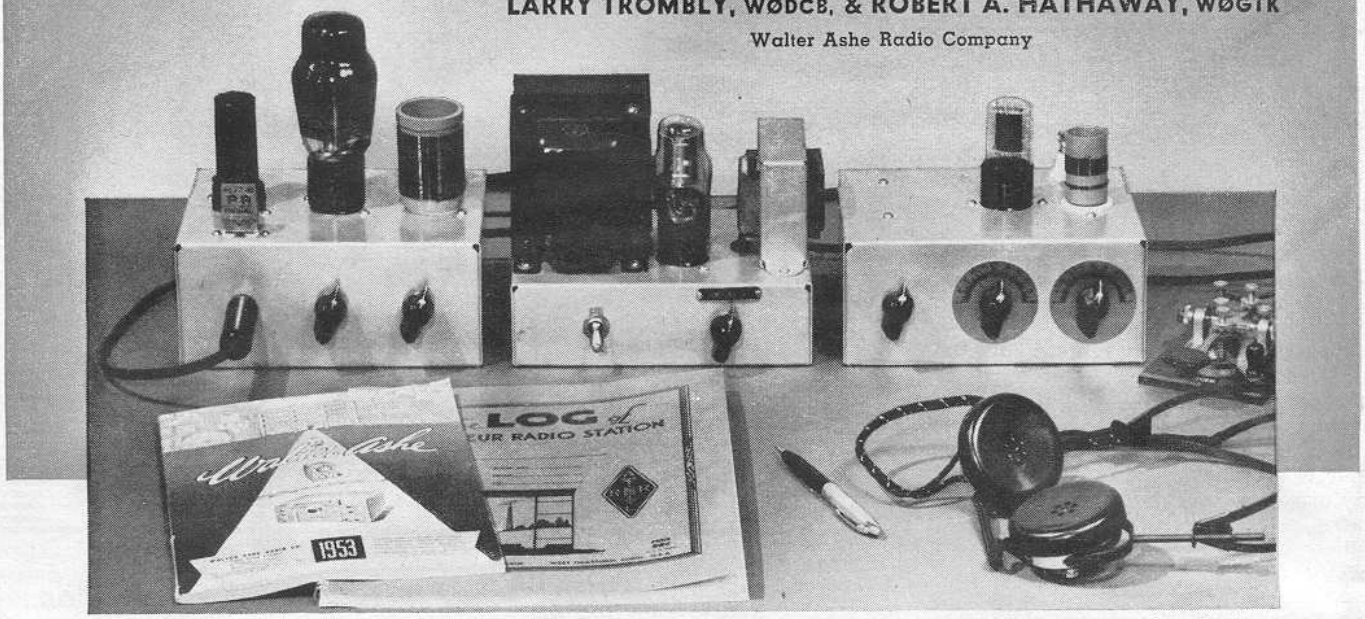
INEXPENSIVE NOVICE STATION

By

LARRY TROMBLY, WØDCB, & ROBERT A. HATHAWAY, WØGTK

Walter Ashe Radio Company



The complete Novice station: an efficient two-tube transmitter, a surprisingly effective simple receiver, and a single power supply for both. With the power supply switch in "receive" position, transmitter may be used for code practice.

Part 1. The transmitter and power supply of a complete station which can cost less than fifty dollars, including the receiver. The receiver will be described next month.

A GLANCE through radio catalogues or at the advertisements in radio periodicals may lead one to the conclusion that amateur radio is a fairly expensive hobby. In fact this belief has discouraged a number of beginners, particularly the younger ones whose supply of cash is limited. With this in mind, the writers have set out to show that it is still possible to get started in amateur radio with a very modest outlay. Twenty-two years ago, one of the writers got on the air after having spent about $22.00. Considering the rise in the cost of living since that time, the cost of the equipment to be described here is comparable and performance is better. Certainly the $22.00 outfit didn't provide you with a T9X signal.

With slight modifications of circuits found in *ARRL's* "How to Become a Radio Amateur" and "The Radio Amateur's Handbook" and using all new standard parts, a complete novice station was built at a cost of slightly less than $50.00. This equipment consists of three units; transmitter, receiver, and power supply. The receiver will be described next month.

The transmitter uses a 6AG7 modified Pierce crystal oscillator which has an untuned plate circuit using a small peaking coil whose inductance approaches self-resonance on 80 meters. The amplifier uses a 6L6 with a pi-section output circuit which permits use of random lengths of wire as antennas. Coil data for both 80 and 40 meters is given in the parts list. An 80-meter crystal can be used for both bands; however, the output is better when the 6L6 is used as a straight amplifier. Therefore a 40-meter crystal is recommended when the transmitter is used on that band.

Considerable effort was spent in an attempt to make this transmitter "foolproof" in that it will not oscillate with any setting of the controls when the crystal is removed from the socket. This insures that output will be crystal controlled and on the proper frequency, a condition which is quite often unobtainable in transmitters using high-gain tubes such as the 6AG7 and 6L6. The size of the 6AG7 plate coil, 180 microhenrys (a *Miller* #6180 peaking coil), was critical in eliminating any sign of oscillation when the crystal was removed from its socket.

EDITOR'S NOTE: *Although the equipment in this and the coming receiver article can be constructed from parts readily available from any distributor, the units are supplied in complete kit form, with the chassis already punched, by the Walter Ashe Radio Company.*

Complete TVI-proofing has not been provided in this transmitter; however, the type of construction used gives a good basis for such measures. Operated some 10 miles from a TV station on Channel 5, there was no disturbance to the picture with the transmitter and the TV receiver sitting side by side. Use of a metal 6L6, a coil shield, and a bottom plate on the chassis should eliminate TVI even in weak-signal TV areas.

The parts of the transmitter are mounted on a 5" x 7" x 3" chassis. The photographs will give an idea of the parts location which is not critical. Instead of a milliammeter, a pilot lamp PL_1 is used as a tuning indicator. It protrudes through a hole in the top of the chassis to the rear of the oscillator tube. A half-inch rubber grommet is fitted into the hole. The bulb is screwed into its socket and both the bulb and socket are held securely in place by pushing the bulb up through the grommet. Along the front edge of the chassis, from left to right, are mounted the keying jack and tuning condensers C_1 and C_2. At the center of the inside back edge, a five-terminal tie strip is used to terminate the power cable, which enters the chassis through a hole fitted with a rubber grommet. This cable is shielded and ends in a five-prong plug which plugs into the

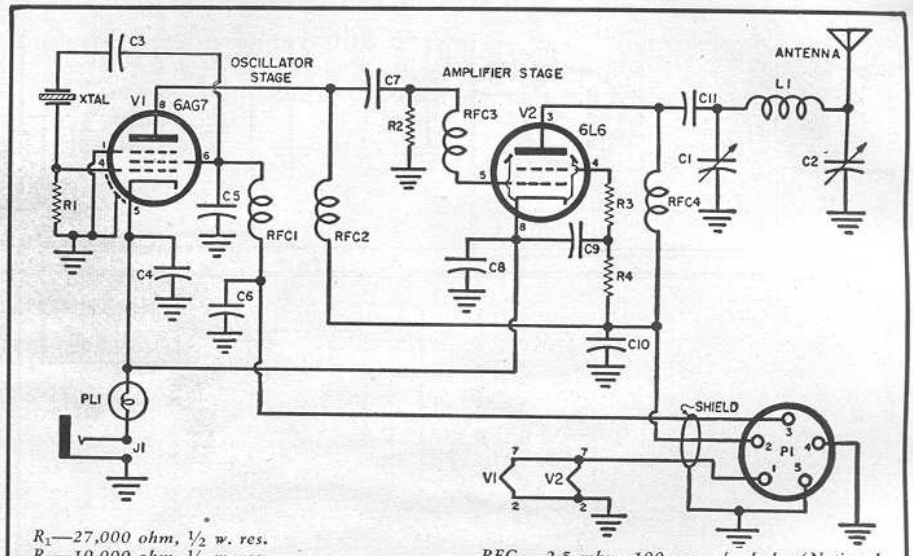
power supply. (The receiver power cable connector will be a four-prong plug. This arrangement eliminates the possibility of plugging the transmitter and receiver power cables into the wrong power supply outlets.) The heater leads should be of well-insulated hookup wire and should be kept close to the underside of the chassis. Keep all of the other leads as short as possible; in fact very little wire is required other than the leads on the components themselves and these are trimmed down in most cases.

In designing an economical novice station, the use of one power supply to furnish power for both receiver and transmitter seemed appropriate, especially since little more than a switch would have to be added to permit this operation. This supply delivers 350 volts at 100 ma. for the tube plates, and 150 volts regulated for the screen of the oscillator and for the receiver. The regulated voltage on the oscillator provides excellent keying and this 150 volts is supplied to the oscillator screen grid even when the "send-receive" switch is in the "receive" position, which permits the operator to spot his frequency on his receiver.

This arrangement is also ideal for code practice but, although very low power is used, it is advisable to disconnect the antenna from the transmitter before practicing. The previously discussed features hold true if the transmitter and power supply are used along with other makes of amateur receivers instead of the receiver to be described next month. The "send-receive" switch should be in the "receive" position for both frequency spotting and code practice, irrespective of the receiver being used.

The power supply parts are mounted on a 5" x 7" x 2" chassis as shown in the photograph. The "on-off" switch and the "send-receive" switch are mounted along the front face of the chassis and the output sockets and line cord are mounted on the back face. A hole is cut in the chassis large enough to clear all the leads from the power transformer, and the leads from the choke are likewise fed through the chassis in a rubber grommet. Care should be taken in wiring up the "send-receive" switch; close inspection of its operation will indicate the correct terminals to use. The a.c. power cord is connected through the internal jumper of the 0D3 as a safety measure (the supply is "killed" if the tube is removed); the connections to pins 3 and 7 of the 0D3 are not needed for the voltage regulating function.

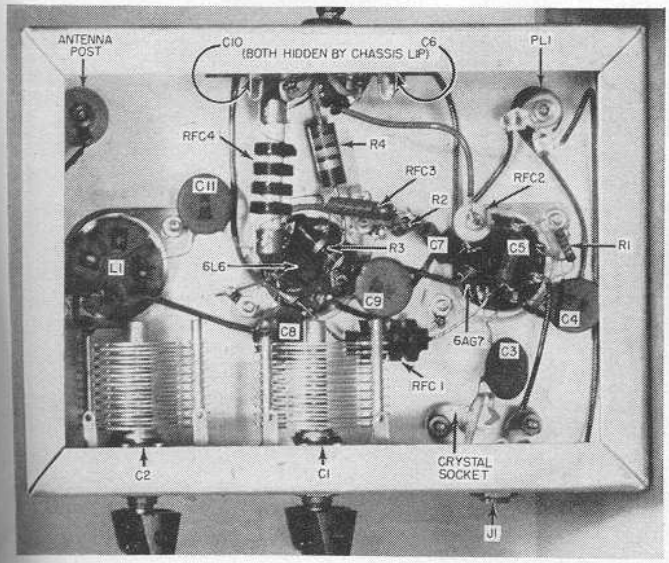
After having carefully checked the wiring of both power supply and transmitter, you are ready to test these units. With the "send-receive" switch in the "receive" position, turn on the power supply. The 0D3/VR150



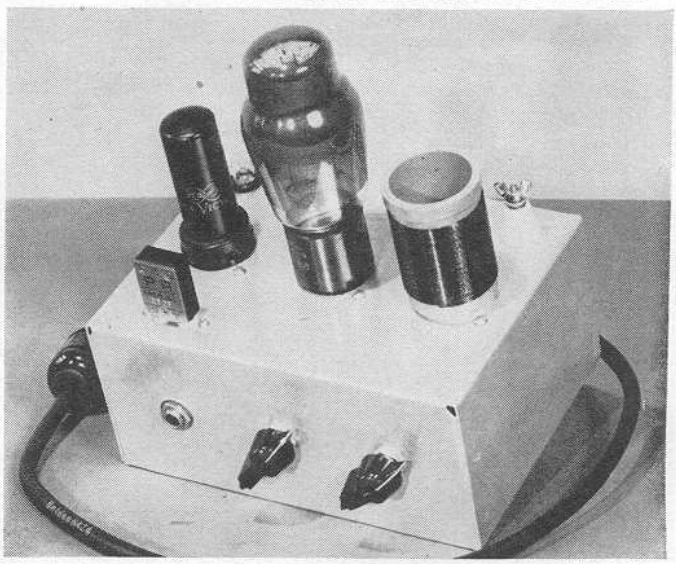
R_1—27,000 ohm, ½ w. res.
R_2—10,000 ohm, ½ w. res.
R_3—47 ohm, ½ w. res.
R_4—18,000 ohm, 2 w. res.
C_1, C_2—140 μμfd. var cond.
C_3, C_4, C_6, C_8, C_9, C_{10}, C_{11}—.01 μfd., 500 v. disc ceramic cond.
C_5—220 μμfd., 500 v. ceramic cond.
C_7—100 μμfd., 500 v. ceramic cond.
RFC_1—2.5 mhy., 50 ma. r.f. choke (National R-50)
RFC_2—180 μhy. peaking coil (J. W. Miller Co. 6180)
RFC_3—1.8 μhy. r.f. choke (Ohmite Z-144)
RFC_4—2.5 mhy., 100 ma. r.f. choke (National R-100)
L_1—80 m.—45 t., #20 en., 1½" dia.
40 m.—18 t. #20 en., 1½" dia.
Both coils closewound on 4-prong plug-in forms
J_1—Open circuit jack
P_1—5-prong cable plug
PL_1—6 v., 150 ma. pilot light
Xtal.—80 or 40 m. crystal (3700-3750 kc.; 7175-7200 kc.)
V_1—6AG7 tube
V_2—6L6 tube

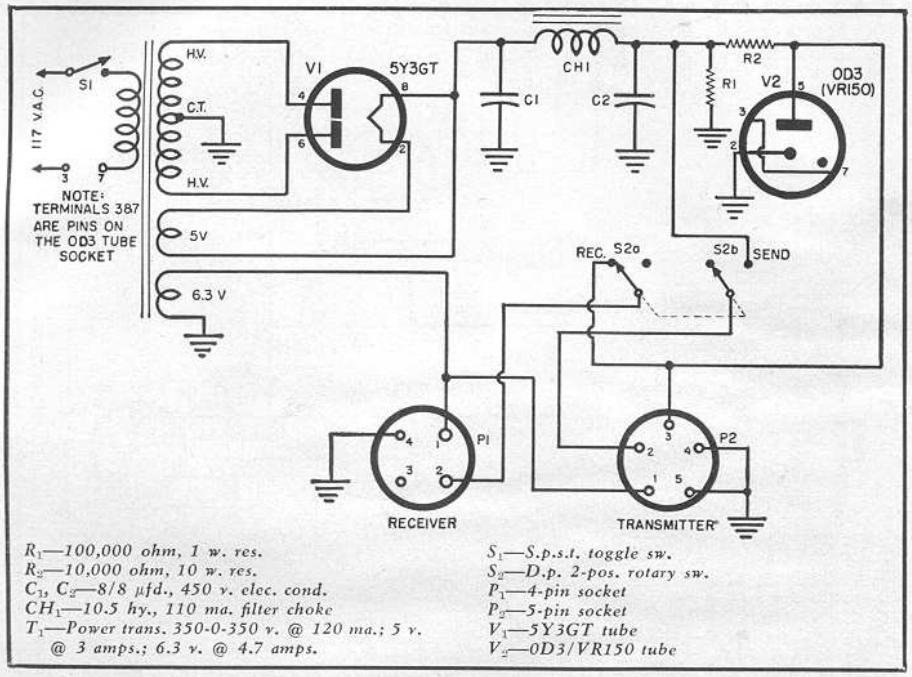
Schematic of the inexpensive transmitter. The separate power connection for the 6AG7 screen grid (P_1, pin 3) provides a regulated voltage supply for the screen, resulting in improved oscillator stability and enabling oscillator to be used with a receiver for code practice and frequency spotting without putting the whole transmitter on the air. Two-tube circuit has many advantages over simpler rigs.

Under-chassis view. Although a compact chassis is used, wiring is not crowded or difficult. Care should be taken not to overheat parts while soldering. Note that stator connections on the tuning condensers are made to ends of the stator bars rather than to the lugs (near chassis lip) to insure short leads.



The completed transmitter has a neat, businesslike appearance. Its power and performance are similar to those of "standby" rigs used by experienced amateurs. J_1 and knobs for C_1 and C_2 are along front face of chassis; the tuning indicator bulb can be seen at left rear corner, antenna stand-off at right.





R_1—100,000 ohm, 1 w. res.
R_2—10,000 ohm, 10 w. res.
C_1, C_2—8/8 μfd., 450 v. elec. cond.
CH_1—10.5 hy., 110 ma. filter choke
T_1—Power trans. 350-0-350 v. @ 120 ma.; 5 v. @ 3 amps.; 6.3 v. @ 4.7 amps.
S_1—S.p.s.t. toggle sw.
S_2—D.p. 2-pos. rotary sw.
P_1—4-pin socket
P_2—5-pin socket
V_1—5Y3GT tube
V_2—0D3/VR150 tube

Schematic of the power supply for the inexpensive Novice station. As the screen grid of the 6AG7 transmitter oscillator is connected in both positions of S_2, the tube can oscillate weakly and may be used with a receiver for code practice.

regulator tube should show a blue glow. On the receiver, tuned to the frequency of your crystal, you should hear a clean signal as you close the key. Next, with both tuning condensers set to maximum capacity, throw the "send-receive" switch to "send". The tuning lamp will glow brightly. Tune C_1 for a dip in the brilliance of the tuning lamp, PL_1. This point indicates resonance of the 6L6 plate circuit. If all has gone well so far and you are a licensed amateur, you are ready to load the transmitter with an antenna.

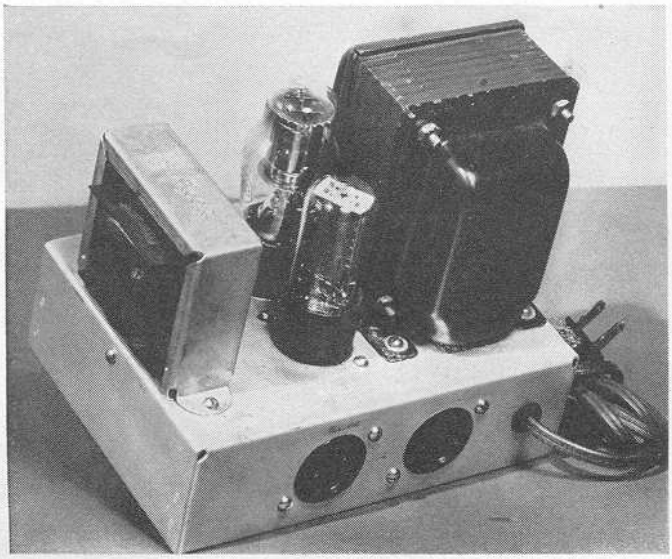
Any piece of wire 60 feet or longer can be used for both 80- and 40-meter operation. The optimum length for the 40-meter Novice band is about 65 feet and for the 80-meter Novice assignment it should be 125 feet. With the antenna connected to the transmitter, check for resonance by swinging C_1 slightly back and forth and watching PL_1. Now slowly open condenser C_2 a little bit at a time and, after each change of C_2, check for resonance with C_1. You will find that the dip in the brilliance of the tuning lamp becomes less and less as you continue to open C_2. When you have opened C_2 to a point where you can just detect a dip in the tuning lamp as you tune C_1, the transmitter is fully loaded and ready to go.

As much tuning as possible should be done with the transmitter connected to a dummy load rather than to the antenna to prevent unnecessary QRM on the heavily loaded amateur bands. A satisfactory dummy load can be made with a 25-watt light bulb and two short clip leads. The leads are soldered to each connection of the bulb and then one lead is clipped to the antenna terminal and the other one to the metal chassis of the transmitter. Tuning procedure is the same as that outlined before when feeding power to the antenna. The 25-watt light bulb will glow to nearly full brilliance if your transmitter is properly tuned. It should be noted that the setting of C_1 and C_2 quite likely will not be the same when operating the transmitter into the dummy load as when feeding the antenna. This is true unless by chance the antenna and dummy load present the same impedance to the transmitter.

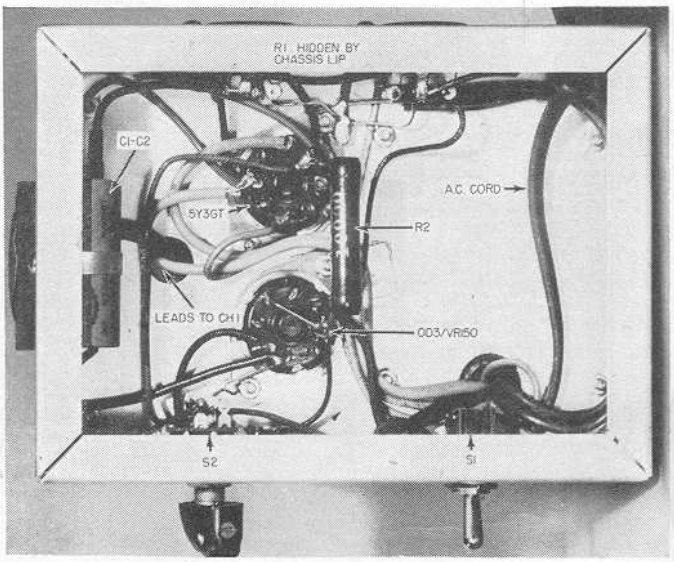
This transmitter and its companion receiver have been used successfully on the 40- and 80-meter bands, including the crowded Novice portions of these two bands. Reports on the signal from the transmitter have been excellent and both coasts were worked with no difficulty. 579X reports at distances over 1000 miles have been consistently received and it was gratifying to be able to hold our own in competition with transmitters of much higher power. Naturally the best results will be obtained when the best possible antenna is used. Running 30 watts input, and with a little patience and some late night hours on your part, this transmitter is quite capable of producing foreign contacts.

Experienced amateurs will recognize the fact that the transmitter and power supply are not only well suited for the Novice, but that they can do a fine job as the regular rig for the old-time "c.w. hound". Many of the present day hams who have been weaned and raised on higher power will be surprised to see what can be accomplished with this small compact outfit. It is ideal for the high power man as an inexpensive standby rig in the event of rebuilding or breakdown of the "big rig", too much TVI, or high electric bills. *(To be continued)*

Rear view of the power supply. Along the back edge, left to right, are the receiver and transmitter power sockets and the a.c. cord. The larger tube is the 0D3 voltage regulator.



Under-chassis view. Ground connections are made to lugs under socket mounting screws. Power transformer leads come through grommeted hole near S_1 at right. Wiring will be fairly easy.



THE NOVICE STATION RECEIVER

By

LARRY TROMBLY, WØDCB

and

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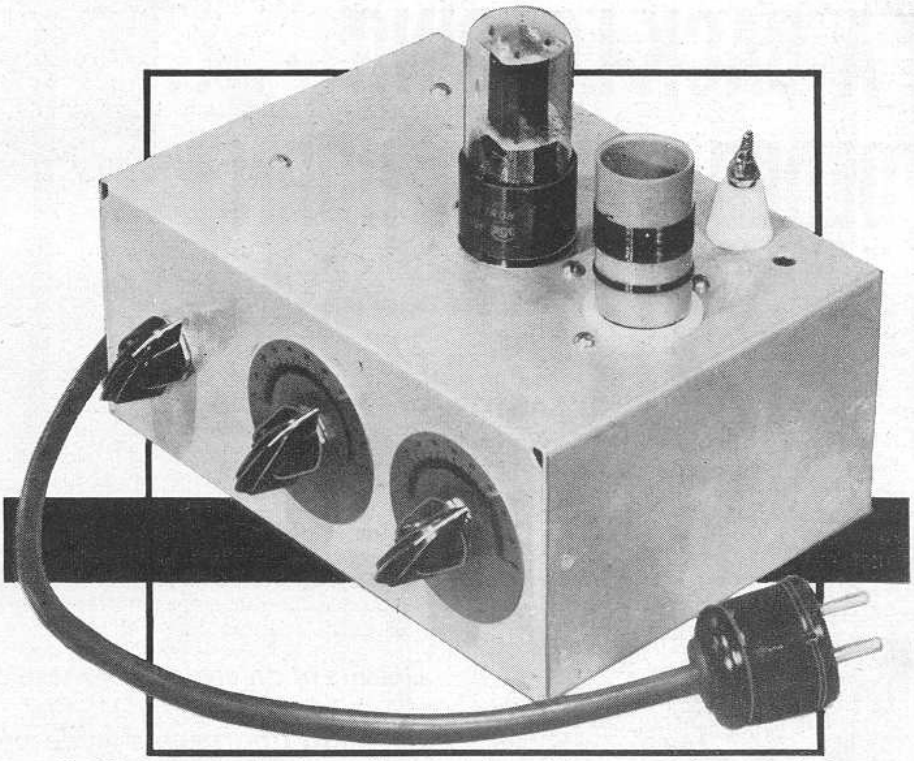


The Novice station receiver. Controls, left to right: regeneration, main tuning, bandspread. Hole near antenna insulator is for adjusting antenna trimmer. Cable plug fits socket on power supply described last month. 80-meter coil is in place.

Part 2: The receiver. The set uses one tube in a "two-tube" circuit. Performance is very high and construction simple. The transmitter and power supply were described last month.

THE first article of this series described a transmitter and power supply. Including the receiver to be described here, these three units were built for less than $50.00. This receiver, although quite simple and using circuits almost forgotten in today's amateur receivers, exceeds expectations and gives an excellent account of itself in the crowded Novice bands.

The receiver uses a 6SN7 tube, one section of which acts as a regenerative detector, and the second section as a transformer-coupled stage of audio amplification. One of the reasons for the good performance of this receiver is the use of regulated plate voltage, which is furnished by the VR tube in the power supply described in Part 1. Crystal-controlled signals sound the way they should, rather than the way they did in most regenerative receivers of twenty years ago when it was hard to tell whether you were listening to crystal control or to a self-excited oscillator.

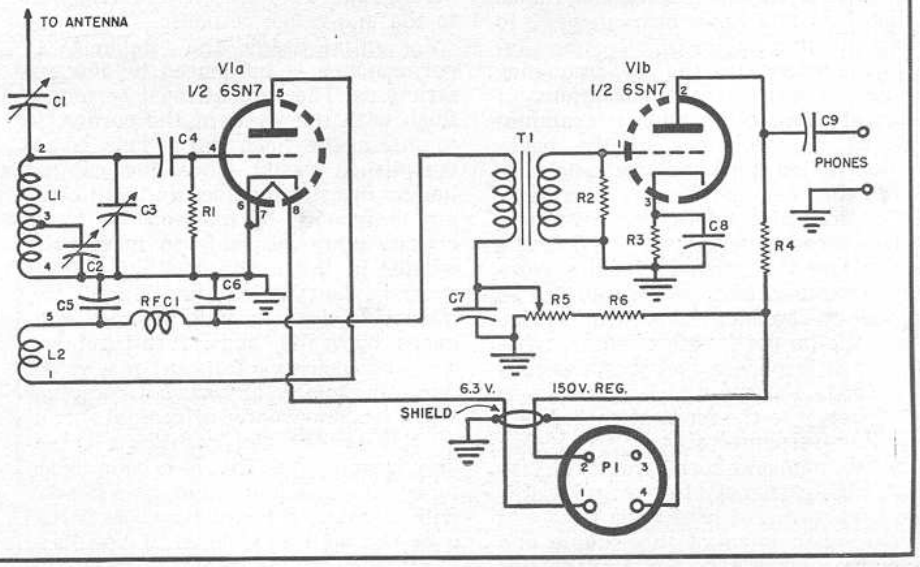
All the parts of this unit are mounted on a 5″x7″x3″ chassis. Their location can be seen from a study of the photographs and there is nothing critical about the placement of these parts. Since it was desired to keep the tuning condensers inside the chassis, it was not feasible to use a vernier dial. However, the use of a tapped coil and a low-capacity variable condenser for bandspread tuning permitted us to give almost 100 dial divisions of bandspread to the 50 kc. 80-meter Novice assignment and also to the 25 kc. 40-meter Novice band. This is more rotation of the tuning control per kilocycle covered than is offered by many vernier dial arrangements.

To some builders a tapped coil may present something of a problem but there is a way of doing it which

(*Continued on page* 122)

Schematic of the Novice station receiver. Numbers at coil connections refer to pins on coil form, looking at bottom of form. C_2 is the bandspread condenser, C_3 is for main tuning. C_1 compensates for "dead spots" due to antenna resonances.

R_1—1.5 megohm, ½ w. res.
R_2—150,000 ohm, ½ w. res.
R_3—1500 ohm, ½ w. res.
R_4—10,000 ohm, 1 w. res.
R_5—50,000 ohm pot.
R_6—33,000 ohm, 1 w. res.
C_1—3-35 μμfd. trimmer cond.
C_2—15 μμfd. var. cond.
C_3—140 μμfd. var. cond.
C_4—100 μμfd. mica cond.
C_5, C_6—500 μμfd. mica cond.
C_7—12 μfd., 150 v. elec. cond.
C_8—10 μfd., 25 v. elec. cond.
C_9—.01 μfd., 600 v. cond.
RFC_1—2.5 mhy. r.f. choke
L_1—80 m.—21½ t. tapped at 10¾ t. from bottom (ground) end. 40 m.—9½ t. tapped at 2¾ t. from bottom (ground) end
L_2—80 m.—3¾ t. ("tickler" coil)
40 m.—2¾ t. ("tickler" coil)
All coils closewound with #26 en. wire on 1" diameter, 5-prong coil forms. "Tickler" coils wound at gnd. end of L_1, ¼" below L_1. All coils wound in same direction.
P_1—4-prong cable plug
T_1—Audio interstage trans., 3:1 ratio
V_1—6SN7 tube



Novice Receiver

(*Continued from page 47*)

makes it almost as easy as a two-terminal coil. For example, taking the 80-meter coil with its 21½-turn, center-tapped coil, start with two pieces of wire about three feet long. Twist two inches or so of these wires together and put them through the proper hole in the coil form and solder them into the pin at the bottom of the form. Now wind one piece of wire towards the top end of the coil form, run it through its proper hole and solder it to its pin, then wind the other piece of wire in the opposite direction down on the coil form to its hole and solder it to its pin connection. The fractional turn counts given in the coil data are caused by the fact that the holes for the wires are drilled above the appropriate pins on the coil forms. These pin numbers are shown at the ends of the coils in the schematic diagram. The spacing between the primary and the tickler coils is about one-quarter inch in the case of both the 80- and 40-meter coils and the tickler is wound on the lower end of the coil form. Be sure to wind the primary and the tickler (the small coil) in the same direction.

Naturally the enamel insulation will have to be removed from the ends of the wires before they are soldered. It will help considerably in soldering the coil wires into their pins to "tin" them lightly before inserting them, by giving them a thin coat of solder. The builder will notice that the wire ends and terminals of the various parts, such as resistors, condensers, etc. have already been tinned by the manufacturer. The coil ends need not be scraped or tinned for much more than half an inch.

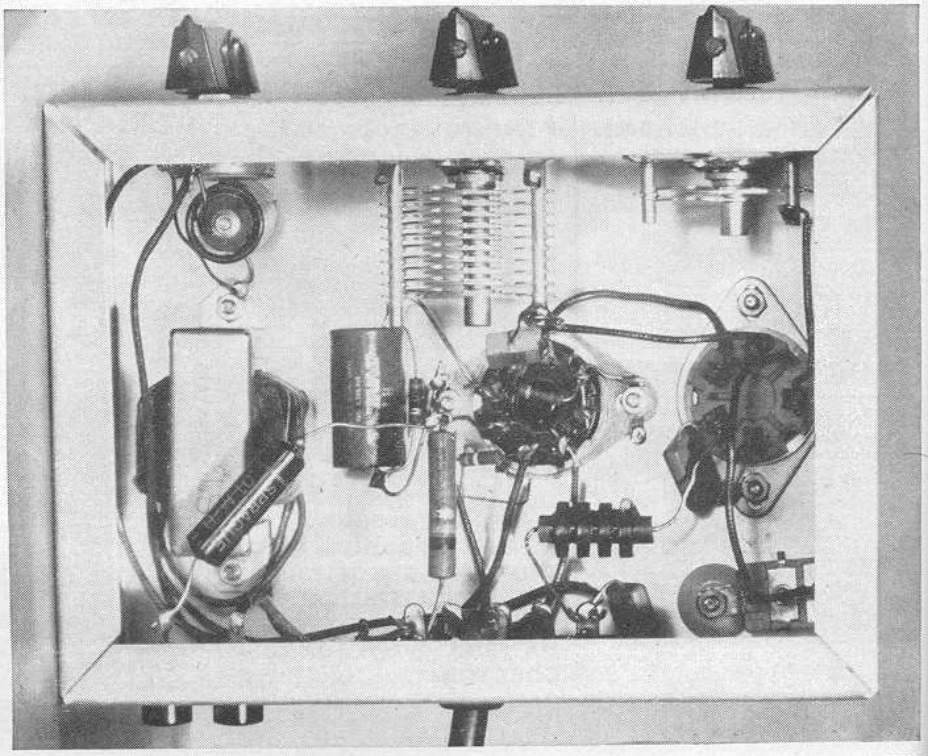
The two tuning condensers and the regeneration control are mounted on the front edge of the chassis and the phone tip jacks and power cord are brought out through the rear edge. A plate load resistor and blocking condenser are used in the output stage to keep d.c. off the headphone wires.

When the wiring is completed and checked for correctness, you are ready to try the receiver. After a moment or so of warmup, turning the regeneration control clockwise should cause a "plopping" sound in the headphones. This plopping sound occurs at the point where the detector breaks into oscillation. On the clockwise side of this point, there should be a slight rushing sound in the headset while on the counter-clockwise side there is only silence. Voice reception is achieved with the regeneration control set just short of the regeneration point while code is received with the control turned over into the regenerative state.

Almost any length of wire makes a satisfactory receiving antenna, preferably one over 30 feet long. The same wire you use for transmitting makes an excellent antenna for the receiver if you provide a single-pole, double-throw switch to change the antenna from transmitter to receiver during standby periods.

With a simple receiver of this kind and a long receiving antenna, there is a possibility of cross-modulation if you live near a strong broadcast station or other powerful transmitter. Cross-modulation causes the broadcast program to be heard in the back-

Under-chassis view of the Novice station receiver. The audio transformer is seen at left, below the regeneration control. Phone tip jacks and power cable can be seen along rear edge of chassis. Coil socket is at extreme right. Note roomy layout.



ground along with the desired signal even though the receiver is tuned to a frequency far removed from the broadcast station's. To eliminate this effect, decrease the capacity in the antenna trimmer condenser. This condenser also helps take out any "dead spots" in the tuning range caused by antenna resonance effects. The receiver tunes through the range 3.5 to 18 megacycles with the two coils described in the parts list. Other coils could be suitably proportioned to extend the range if desired. The Novice can learn much by experimenting with other coils wound with the aid of the inductance-capacity charts and other data found in the various radio handbooks. —30—

UNUSUAL SERVICE CALL

By JAMES B. TAYLOR

THE phone rang and the voice on the other end of the line asked, "Can you send a serviceman out to check my television set? The last commercial that the station ran over an hour ago is still on the screen."

"What?" I asked, "do you mean that the station is running one commercial for over an hour?"

"Oh no," replied the voice on the other end, "but when they ran a cottage-cheese ad about an hour ago, it must have been awfully strong for it stuck to my picture-tube screen and stayed there. I can still see the other programs through the ad, but they are not clear."

Muttering to myself that somebody is either drunk or crazy, I picked up my service kit and headed for the address given. What I saw can be seen in the accompanying photograph. There was the cottage-cheese ad as clear as you would want on the screen in black, with the set still working and getting a picture, except for the black portions being masked by the ad. The only clue the set owner could give was that he heard a dull thud when it happened.

EDITOR'S NOTE: Such an effect may be due to ion acceleration in the tube and the resultant bombardment of the screen by heavy ions. Where there is a large accumulation of electrons on the screen (light portions of the picture) there will be a great attraction for the ions, and this portion of the screen will receive heavy bombardment resulting in a burn on the screen. Darker portions of the picture will be burned-in less than lighter portions. Hence, the picture reversal effect. —30—

TV picture tube with commercial burned onto screen due to ion bombardment.