a complete

Novice Ham Station

Contents

Barely a week goes by when amateur radio doesn't hit the news in one way or another. In recent months hams handled life and death message traffic in a midwest tornado area and communicated between the East Coast and England by bouncing signals off an earth satellite. We are going to show you how you can obtain the two essentials—a license and a station—which will enable you to join this fascinating fraternity of amateur radio enthusiasts.

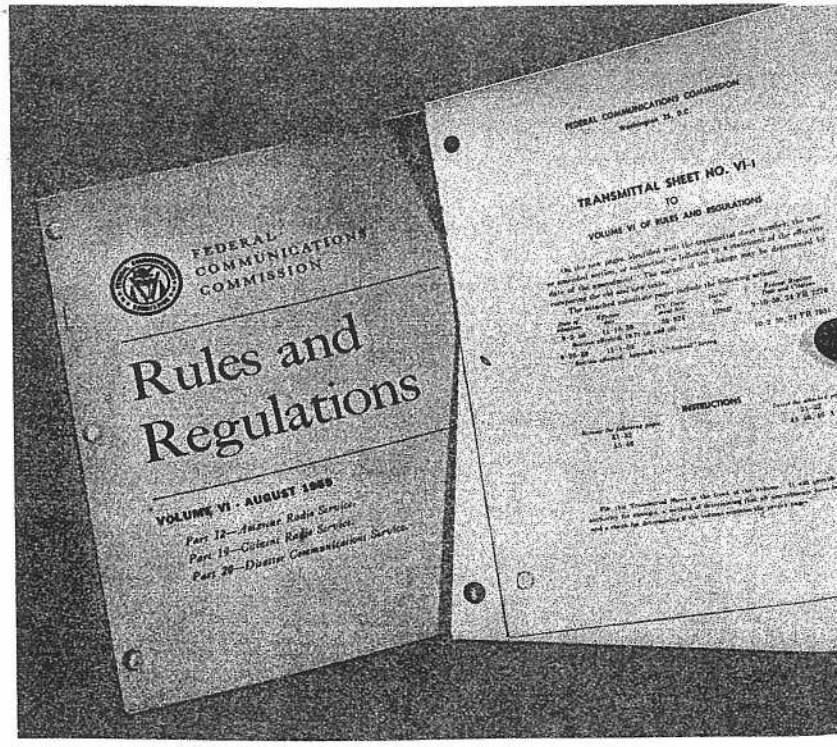
by Len Buckwalter

The Novice License

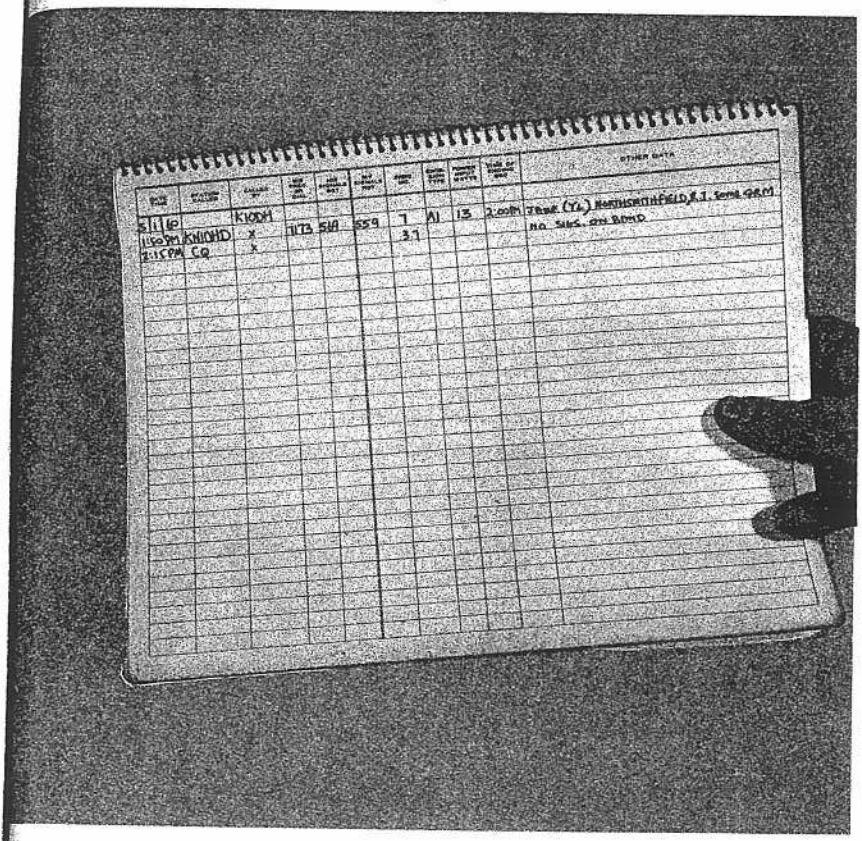
BACK in September, 1949, the Federal Communications Commission considered an entirely new kind of ham license—the Novice Class. The idea was to strip away much of the complex theory and code speed requirements of the higher grades. A reality by 1951, it offered the beginner, especially youth, a chance to get on the air with an easily-acquired license.

The Novice is really a ham-in-training. He has a 1-year (nonrenewable) term to raise his code speed and build up a background in basic electronics, prerequisite to a renewable type of ticket with full privileges. The Novice license has limitations; transmitter power can be no greater than 75 watts and the frequency bands are restricted. However, it does provide a splendid opportunity to "learn by doing"—a far more fascinating process than working with textbooks and code machines alone.

Your first step toward the Novice license is to acquire a copy of Part 12 of the FCC's rules and regulations covering the amateur service. Due to a recent change in format, it appears in a 3-section volume which also contains rules for the Citizens Radio and the Disaster Communication Service. The cost of the volume is $1.25 and entitles the purchaser to all the new rules and amendments as they appear. Part 12 is an invaluable "handbook" of information for the prospective ham. Though written in legal language, it nevertheless is an understandable guide to the ham's obligations under the law. It is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Ask for FCC Rules and Regulations, Volume VI.



Rules and Regulations are available from Government Printing Office. "Transmittal Sheets" contain new rules, amendments, etc.



Log book, required by law, is a written record of transmission.

Ham radio is one of the few hobbies which require a license from the federal government. In fact, two are necessary; an operator and station license. Actually, a single white card contains both authorizations. The license covers transmitting equipment only—no need for regulations on the receiver—and must be in your possession while operating.

Once you have mastered the test questions (on pages 83 to 85) the application and exam papers are requested in writing from the FCC Engineer-In-Charge of your district. Field office addresses are given in Part 12 of the rules and regulations. Ask for an operator and station license form for the Novice Class license and the mail examination papers. The material is free and will probably reach you in about 10 days.

Carefully follow the instructions accompanying the sealed examination. The person you choose to administer the code portion must hold a General, Advanced or Extra Class license—or be a commercial telegraph operator. He may also act as witness, if over 21 years old, to the written part of the test. If necessary you can request assistance from the FCC Engineer-In-Charge of your district.

Achieving the code speed requirement of the test (5 words per minute) can be easy if you use one of the systems available to the prospective Novice: phonograph records, magnetic tape recordings and automatic keyers. Unless you have the services of an experienced ham, these systems are recommended.

How to Build a Novice Station

Enclosed in one metal cabinet, the *Electronics Illustrated* Novice station includes the receiver, transmitter and power supply. The only additional item required—the license itself. Since the waiting period for a call-letter assignment runs about six weeks; that time can profitably be used for construction.

The design of the rig resulted from an effort to see just how much a rig could be stripped away and still match the performance of a Novice station costing much more. It's portable too.

Receiver

The receiver is the first of the rig's three basic sections (the other two are transmitter and power supply). It consists of the single tube V1. The first section, V1A, is a regenerative detector; the second half serves as an audio amplifier to boost the signal to comfortable earphone level. See schematic diagram on page 77.

When compared to a big superhet, the performance of a regenerative receiver is amazing. The regen's sensitivity is high and it can't be beat for low cost and simplicity. Any drawbacks? Yes—very strong signals at close range will tend to occupy a large space on the dial blocking out the weaker ones.

The receiver plug-in coil L1 has three separate windings; A, B and C. Signals enter winding L1A from the antenna and couple into L1B. C1 ("Calibrate" on side) and C2 (tuning capacitor on

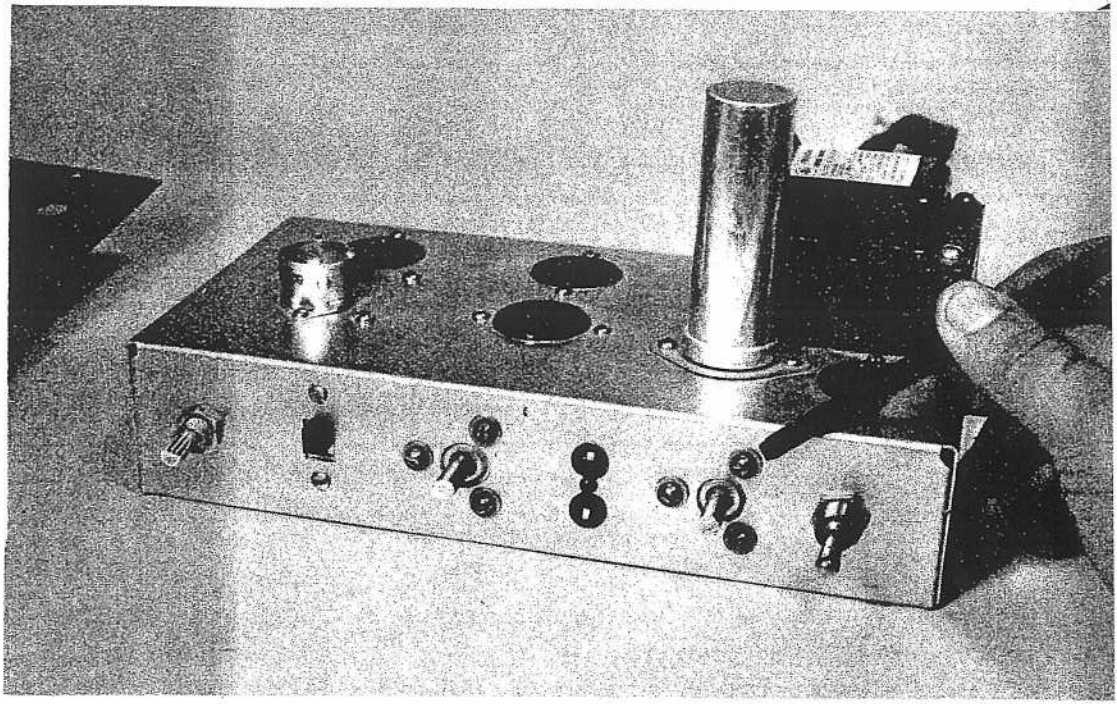
front panel) form a tuned circuit with L1B for selection of the desired station. The last winding is L1C, the "tickler." It feeds energy from the screen (pin 3) of tube V1A back to the grid through coupling with L1B. The result is a sustained oscillation. Both antenna and oscillation frequencies mix and an audio tone results. The tone appears in V1A's plate circuit and proceeds to the second half of the tube (V1B) for straight audio amplification. A network of RFC1, C4, and C5 filters out radio frequencies which may appear in the plate circuit.

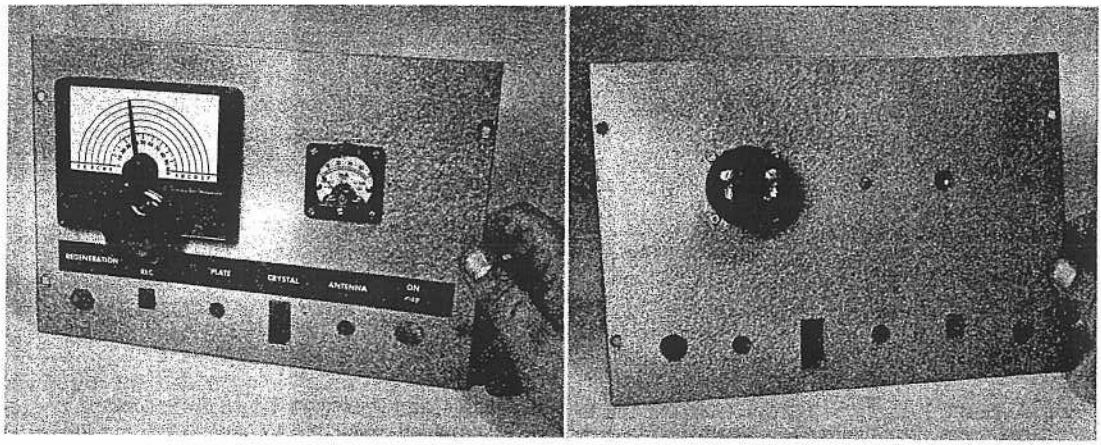
The keying circuit opens and closes the current path from ground to the cathode of V2. This can pose a slight shock problem with high-powered rigs, but nary a tickle is felt when the fingers are placed across the bare metal of the key. The meter (M1) is in series with the key and monitors cathode current, useful during tune-up. Although M1 specified in the Parts List had no polarity indications, its negative terminal goes to J1. If the meter reads in the wrong direction, reverse the connections to the meter.

There is nothing critical in the rest of the transmitter circuit. Don't attempt to use this stage as a frequency doubler (that is, using an 80 meter crystal and a 40 meter coil) as its stability will be adversely affected.

The *Send-Receive* switch SW2 connects the outside antenna to L2 when in the *Send* position. The tube's high voltage is not switched (as in the receiver) since the key itself accomplishes this. This will be important during the calibration procedure

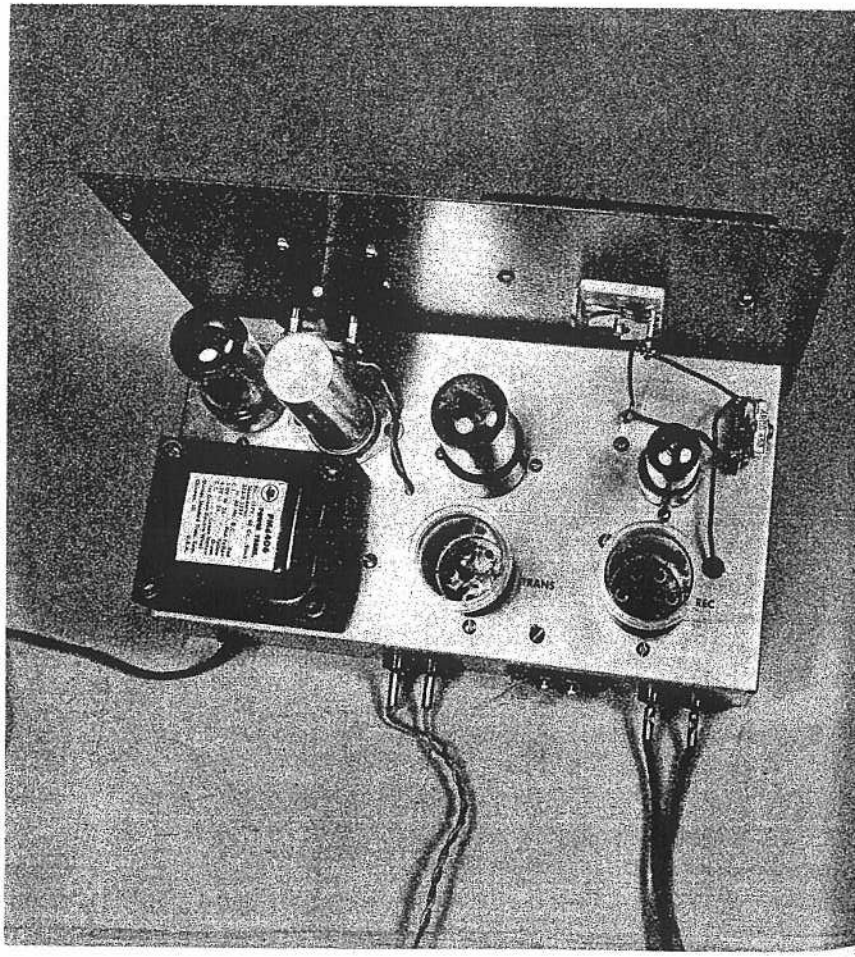
Front view of chassis after major parts have been mounted. Use washers under screwheads which hold tuning capacitors, to prevent hitting plates.

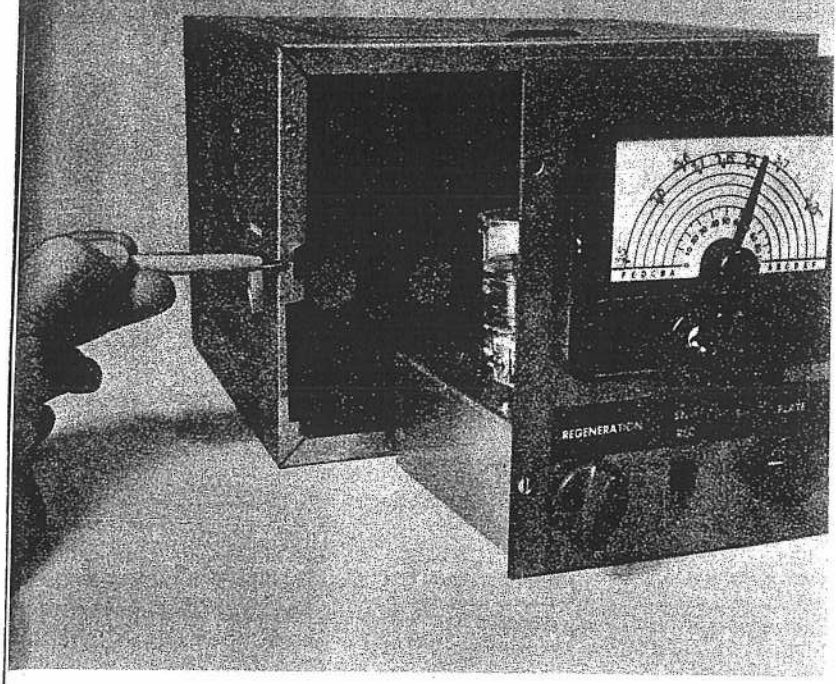




Holes have been cut along bottom edge of front panel to allow controls to pass through. Rear of front panel shows meter at left, dial mechanism bushing, right. Panel is held to chassis by Regeneration, On-Off controls.

Top view shows location of major components. Note heavy enamel wires (upper right) which run from tuning capacitor to calibration capacitor on right side chassis.





Cabinet flange must be filed away to permit chassis to slide in. Pencil points to notch to fit calibrating capacitor.

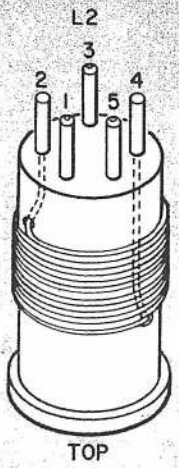
where the receiver and transmitter must be on at the same time.

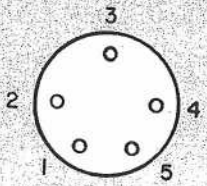
Typical operating voltage of the transmitter is +300 volts, measured at the ungrounded side of bleeder resistor R10. This is with the key down and the meter indicating about 40 milliamperes (input power: 12 watts).

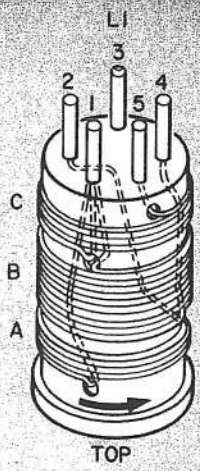
The regeneration control R4 varies the screen voltage of V1A. As R4 is advanced, the screen voltage rises and imparts enough gain to the tube for it to break into oscillation. Perhaps the only critical aspect of the receiver is to ensure feedback from screen to grid. If coils B and C are not wound in the correct direction, the tube won't oscillate. No difficulty should be encountered if the coil winding chart is carefully followed. However, there is an easy way of remedying an incorrect winding. After the rig is complete, advance the regeneration control and listen for the characteristic "pop" in the earphones as the circuit begins to oscillate. If you don't hear it, and no other error exists, try reversing the two wires of L1C which go to pins 1 and 5 of SO1.

The *Send-Receive* switch (SW2) connects the outside antenna to L1 (terminals 2 and 3) when in the *Receive* position. Terminals 5 and 6 of this switch connect the receiver section to the high voltage B+.

The only other consideration in constructing the receiver is the wiring between tuning capacitors C1, C2, and the tube socket. This is done with heavy enamel or Formvar insulated wire, #14 or larger. These stiff wires aid in receiver stability. Note that the ground lead runs from the rotor tab of C2 to a ground lug on the top of the chassis, and continues on to one lug of C1. The other wire runs from a stator lug (post) on C2 to a lug on C1 and through a rubber grommet on the chassis to the coil socket SO1. When choosing the lug for the ground wire on C1, check with an ohmmeter to be certain it's the one which connects to the tuning screw of this trimmer capacitor. If the tuning screw is at ground potential, the calibration procedure is far less tricky. The final







NUMBER OF COIL TURNS	
80 METER	29 TURNS
40 METER	14 TURNS
USE NO. 20 ENAMEL WIRE	

To wind transmit coil: Drill small hole in coil form 1½" from tip of pin 2. Scrape ends of wire, insert into drill hole and solder to pin 2. Wind proper number of turns, drill hole over pin 4, insert wire through it and solder.

NUMBER OF COIL TURNS			
80 METER	5T(A)	24T(B)	5T(C)
40 METER	3T(A)	11T(B)	3T(C)
USE NO. 24 ENAMEL WIRE			

To wind receiver coil: Drill small holes over pins, 5, 4 and 1. Insert wire and solder to pin 5. Wind C in direction of arrow. After correct number of turns, insert in hole and through pin 1. Wind coils B and A in same way.

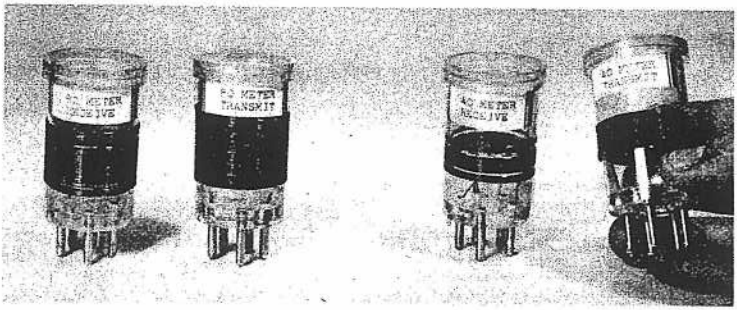
step in the receiver section is to dope the coil with polystyrene cement or other suitable liquid.

The Transmitter

The one-tube transmitter uses a 6V6 tube V2 as an oscillator operating at a power input level of about 13 watts. This definitely is above the "flea-power" class and, with a reasonably good antenna, will give a good account of itself many hundreds of miles away.

Oscillation frequency is controlled by the crystal (Xtal), and is sustained by the feedback path from the cathode to the grid of V2 through a capacitor divider—C12 and C13. Energy in V2's plate circuit is tuned by plug-in coil L2 and plate tuning capacitor C16. Capacitor C17 is the antenna loading control. This output circuit is a pi-network and will match into

One pair of coils is used for 80 or 40 meter operation. Receiver coil wires are spaced about 1/16" apart. All coils plug into top of chassis.



PARTS LIST

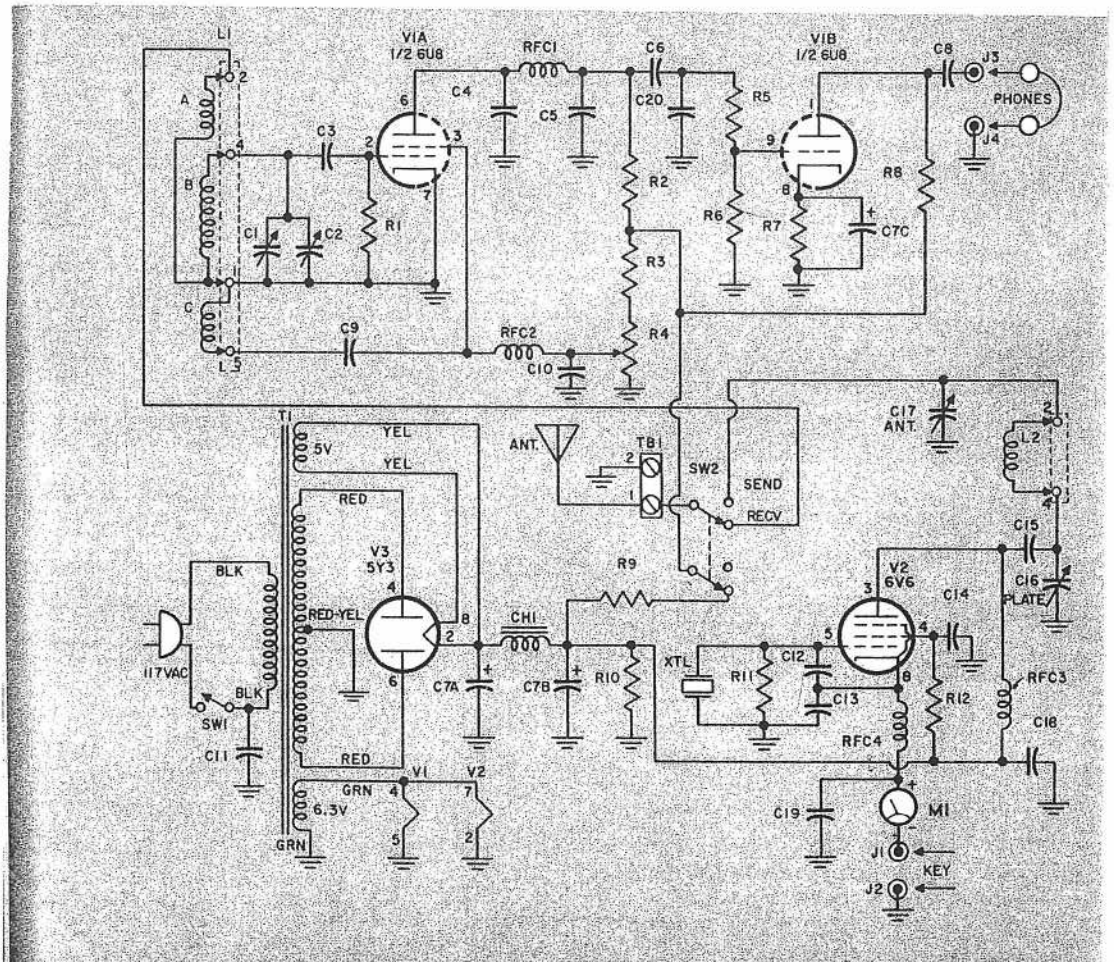
Resistors (½ watt unless otherwise noted)
R1—1 megohm
R2—22,000 ohm
R3—47,000 ohm 2 watt
R4—50,000 ohm potentiometer 2 watt, linear taper
R5,R11—100,000 ohm
R6—470,000 ohm
R7—470 ohm
R8—1800 ohm 1 watt
R9—3900 ohm 2 watt
R10—100,000 ohm 2 watt
R12—15,000 ohm 2 watt

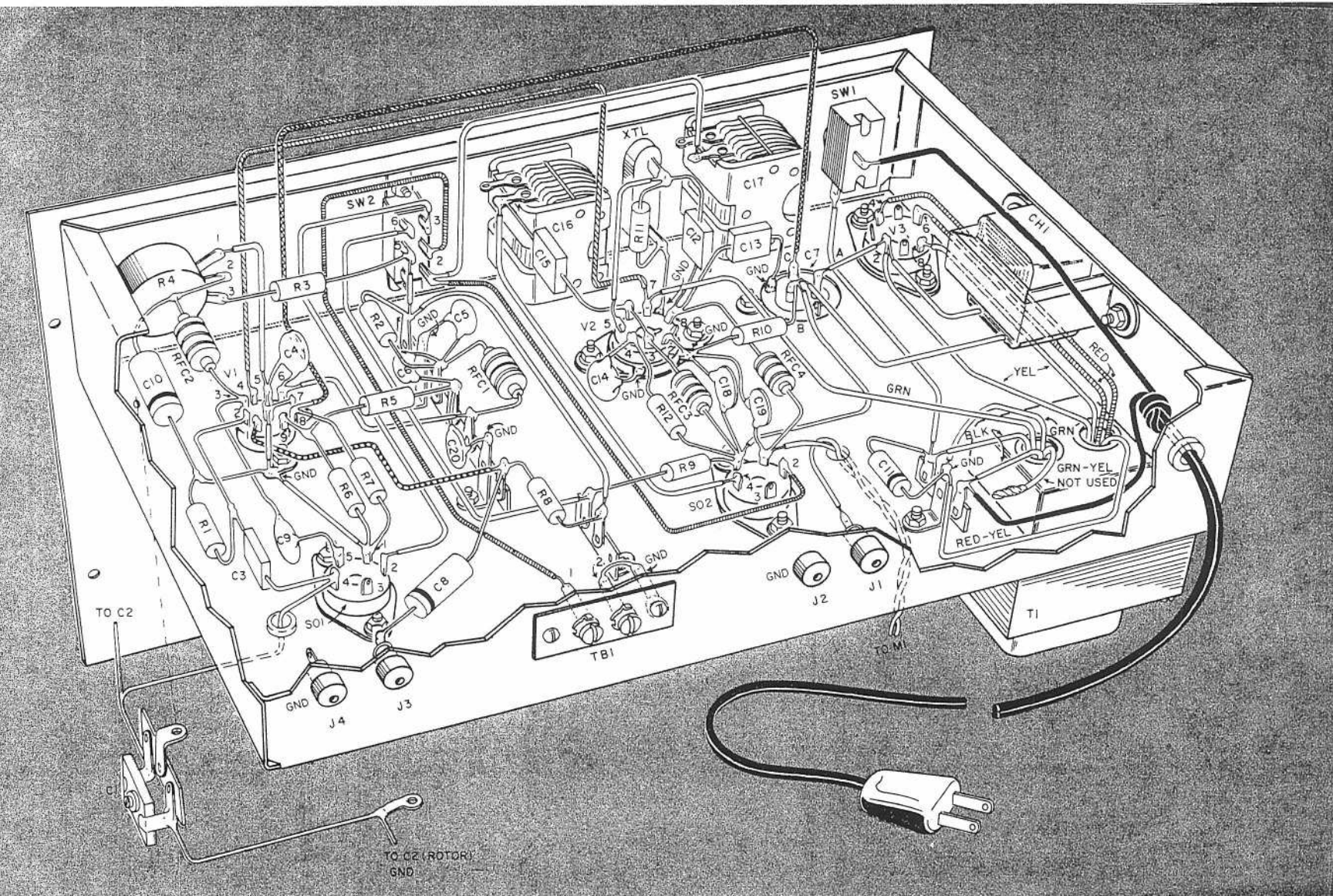
Capacitors
C1—180 mmfd mica trimmer
C2—15 mmfd variable air (Hammarlund HF-15)
C3—100 mmfd mica, 500 volt
C4,C5,C9,C14,C15,C18,C19—.001 mfd disc ceramic, 1000v
C6—.0047 mfd disc ceramic, 1000 volt
C7A,C7B,C7C—Triple-section electrolytic: 20 mfd @ 450 volts; 15 mfd @ 450 volts; 20 mfd @ 25 volts
C8—.02 mfd paper, 600 volt
C10—.1 mfd paper, 600 volt
C11—.01 mfd paper, 600 volt
C12—22 mmfd mica, 500 volt
C13—220 mmfd mica, 500 volt
C16,C17—365 mmfd air variable (Miller 2111)
C20—500 mmfd disc ceramic, 1000 volt

Tubes
V1—6U8 V2—6V6 V3—5Y3
SO1,SO2—5-prong tube sockets

RFC1 to RFC4—2.5 MH RF choke (National R-50)
CH1—Filter choke, 7 henries @ 50 ma
J1 to J4—Pin tip jacks; 2 red, 2 black (remove insulating washers on black ground jacks)
TB1—2-screw terminal strip for antenna connections
XTL—Crystal (see Novice Frequency Chart)
M1—0-50 ma DC meter
T1—Power transformer; 117-volt pri.; 325-0-325 volt sec @ 40 ma; 5 volt @ 2 amp.; 6.3 volt @ 2 amp. (Stancor PM-8406 or the equiv.)
SW1—SPST toggle switch
SW2—DPDT slide switch
L1—Receiver coil (see chart) wound on 5-pin coil form (Amphenol 10039)
L2—Transmitter coil (see chart) wound on 5-pin coil form (Amphenol 10039)
Misc.—Crystal socket, ½" spacing; two octal tube sockets, one with 4 ground lugs for V2; one 9-pin miniature tube socket with centerpost; Multiscale Dial (Millen 10039); aluminum chassis, 9½"x5"x2"; four 5-pin coil forms (Amphenol 24-5P); length #20 enamel, #24 enamel wire; four terminal strips (check wiring guide for lug layout); rubber grommets; AC line cord and plug; three knobs for ¼" shaft; cabinet 10"x7"x8" (Bud C993)
Accessories—Telegraph key; antenna wire, insulators; headphones, 2000 ohm or higher

Complete schematic of novice rig. Receiver plug-in coil has three separate windings, A, B and C. Transmitter section is V2 in X-tal oscillator circuit.




SW1
SW2
XTL
CH1
V1
V2
V3
R1
R2
R3
R4
R5
R6
R7
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R10
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
RFC1
RFC2
RFC3
RFC4
S01
S02
TB1
T1
J1
J2
J3
J4
GND
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NOT USED
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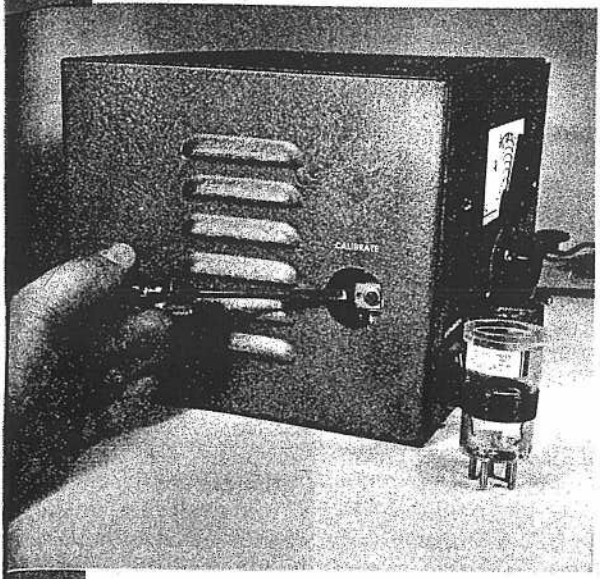
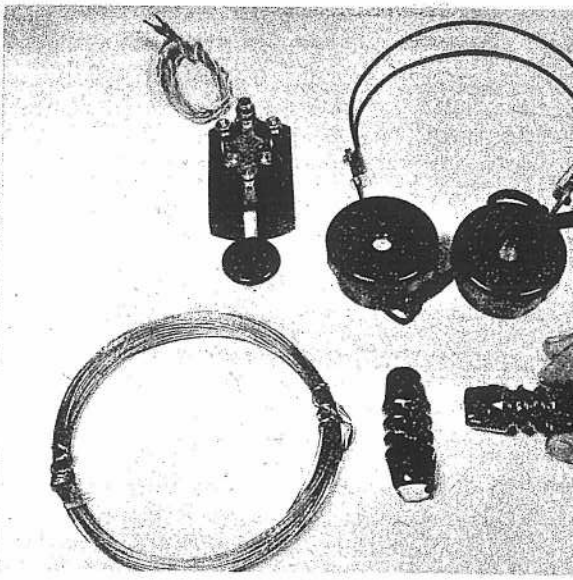




Hole is made in cabinet for easy access to calibration capacitor. This capacitor should be fully clockwise and temporarily remove transmit coil.

Novice rig accessories include key, pair of earphones and roll of antenna wire. Hand holds standard insulator which is used for antenna tie-points.

antennas of various lengths. Since it is fed through blocking capacitor C15, there is no dangerous power supply voltage on the coil. High voltage does not appear anywhere above the surface of the chassis, leaving just one point of precaution; the tubes run quite hot in normal operation.

Construction Tips

Before cutting any holes in the chassis, shift the parts around (tube sockets, etc.) to find their exact mounting locations. Use the illustrations as a guide, but the parts themselves are the best templates. A point of possible conflict is the large filter capacitor can (C7) touching J1 and J2. This can be prevented by positioning power transformer T1 as close to the rear of the chassis as possible. Mount C7's metal mounting wafer (comes with capacitor) close to the transformer and check for clearance between C7 and the rear of M1.

There is one economy measure used in the rig which could cause confusion to beginners. The sockets used for the tubes and coils have several unused or "dead" lugs. In some cases they are used as convenient tie-points for the wiring and have nothing to do with the coil or tube itself. Lug 5, for example, on transmit coil socket SO2 has five wires soldered to it—with none connecting to the coil itself.

The use of tube socket punches greatly facilitate the metal-working aspect of the construction. Square holes can easily be made with a "nibbling" tool, listed in the electronic catalogs. Another indispensable aid is a rat-tail file for coaxing a hole to the correct diameter—the crystal socket, jacks, etc.

Putting the Rig on the Air

After construction is completed, the license and operating accessories acquired, you're ready for the first on-the-air check. It is very helpful when putting a new rig on the air for the first time, to have a neighboring ham listen for your signal—but not absolutely essential. The bands are loaded with stations ready to be of assistance.

Setting Up

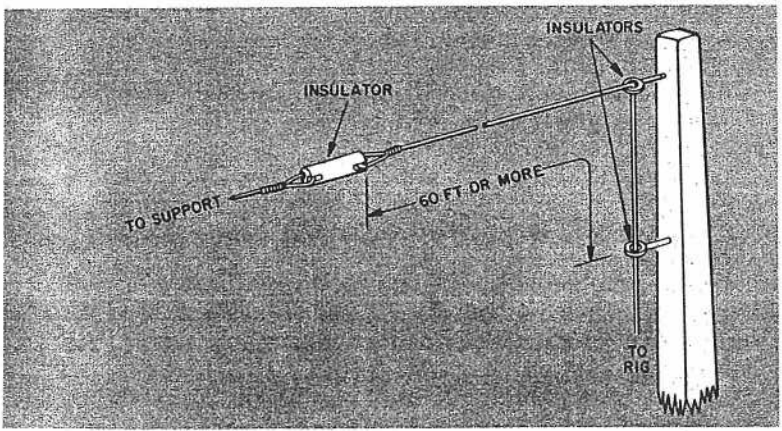
The initial tune-up should be on the 80-meter band since the adjustments are less critical than on 40. Plug the receiver and transmitter coils into their respective sockets. The key, headphones and crystal may be inserted into their sockets without regard to polarity. When ordering the 80-meter crystal, avoid the risk of operating out of the band by choosing a frequency not closer than 5 kc from the band edges. Thus, the frequency should be somewhere between 3705 kc and 3745 kc. Rotate the three knobs; *Regeneration, Plate,* and *Antenna,* to their counterclockwise positions and flip the *Send-Receive* switch SW2 to *Receive.* Insert a screwdriver into the *Calibrate* hole on the side of the cabinet and gently screw the capacitor in a clockwise direction (toward its maximum capacity).

Before proceeding, we'll pause to consider one of the most important elements for success—the "sky hook."

Antennas

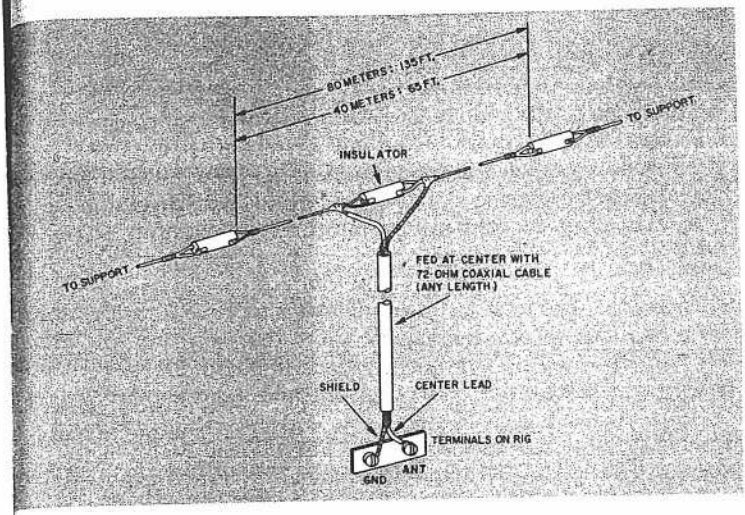
Although a great variety of antennas exist for ham radio, two of the simplest (but effective) types are shown here; the long wire and the dipole. The long wire is just a random lead run from the antenna terminal to a tie-point outdoors. Its minimum length should be about 60′. Height is also a factor. You don't have to clear every tree or nearby building, but get it up as high as you can. Some amount of zig-zagging of the wire is permissible; too much will squeeze the radiation pattern and limit your coverage. Ideally, the long wire looks like an inverted "L," running up the side of the building and horizontally to its far tie-point.

A long wire antenna is perhaps the simplest to set up. 60 feet should be its minimum length. Mount it as high as possible.



Insulators are essential to keep power from being lost. A look through the catalogs will reveal the types of insulators needed for your particular installation. The long wire will operate on both 80 and 40 meters.

A dipole on each band is more effective and less of a compromise than the long wire. It doesn't radiate along the feed line, and it places the power where you want it—up high. The dipole is bi-directional, e.g., the maximum power is transmitted broadside to the wire. As shown in the



A dipole antenna for each band is more effective than a long wire. 72-ohm coaxial cable doesn't need stand-off insulators.

diagram at left, the feed line is 72-ohm coaxial cable, which can be permitted to touch the side of the house as it runs up to the radiating portion of the antenna.

Calibration of the Receiver

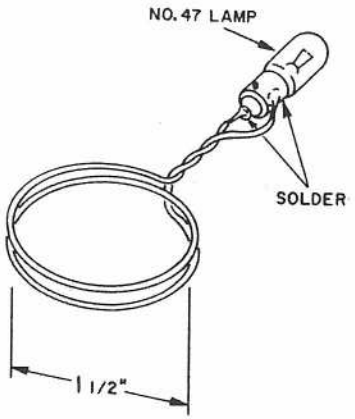
Since the antenna feeding a regenerative receiver can affect its frequency, the receiver should not be calibrated until the antenna has been permanently installed. A ten minute warmup period is also recommended. It allows the circuits to reach operating temperature and minimizes drifting. The regeneration control should now be advanced to about half-way open.

Receiver dial calibration is accomplished with the aid of the transmitting crystal. Using the photo of the author's rig as a guide, rotate the tuning knob so it points to the place on the dial which corresponds to the frequency marked on the transmitting crystal. Notice that the 80 meter Novice band appears at the upper right hand corner of the dial face. Now, pull the transmitting coil out of its socket completely, and depress the key. This procedure will cause the crystal to oscillate sufficiently to provide a calibrating signal without blocking the receiver.

Keeping the key down, insert a screwdriver into the calibrating hole and unscrew capacitor C1 *slowly* until a loud tone is heard in the earphones. Keep tuning slowly until you pass a dead spot in the tone (known as the "zero beat"). The receiver will be tuned to the transmit frequency when calibrated on zero beat.

It is possible that after two or three turns of C1 no tone is heard. This can be corrected by changing the position of the *Regeneration* control R4 slightly and trying again.

With the key up, it should now be possible to receive stations. Starting at its minimum position, slowly advance



Transmitter output and tuning may be checked with this RF indicator. Solder wire to bulb.

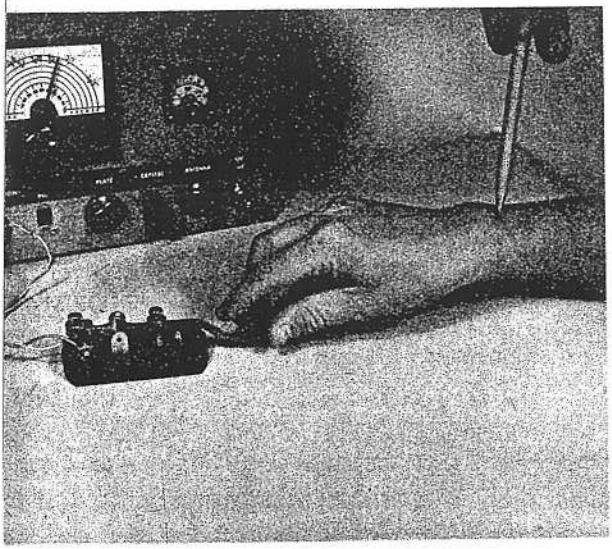
R4 until a "pop" is heard (usually accompanied by a soft rush of atmospheric noise). Tune around the band for signals and then use R4 to peak them up.

With the antenna connected, *Send-Receive* switch on *Send* and the transmit crystal and coil in their sockets, the transmitter section is ready for tune-up. Depress the key and slowly advance the *Plate* knob. At one precise point in tuning, a dip in plate current, as indicated by the meter, will occur. Shift over to the *Antenna* knob and try to bring the current up two or three milliamperes. Now back to the *Plate* for re-dipping.

The idea of this tune-up is to load as much current as possible (up to 40 ma) from the tube into the antenna. It's a back and forth process between *Plate* and *Antenna* knobs; up to the point where Antenna knob will produce no further increase in plate current.

There is, however, a possibility of error in the above procedure. You can bring the current way up with the Antenna knob, dip the plate, and end up with no output power. The check on this is simple. Make up the little RF indicator shown. While tuning, hold the loop as far above the turns of the transmit coil without losing the glow. By placing the indicator around upper rim of transmit coil and leaving it there while operating, you'll always have a positive indication of output power.

NOVICE BANDS		
BAND	FREQUENCIES	OPERATION
80 METERS	3700 KC — 3750 KC	CW
40 METERS	7150 KC — 7200 KC	CW
15 METERS	21,100 KC — 21,250 KC	CW
2 METERS	145 MC — 147 MC	CW OR PHONE



Proper key technique consists of grasping key gently and imparting an up-down wrist action.

Colorful QSL cards, confirming contacts, can make a very colorful, interesting wall display.

Questions and Answers for the Novice Exam

The questions listed below are representative of those you'll encounter on the test. If you become thoroughly acquainted with the material you'll probably breeze through the actual exam. Of course, the real understanding comes during the year of apprenticeship the Novice license provides.

Ques. *What is the maximum input power permitted to the final stage of a transmitter operated by a Novice?*

Ans. **75 watts. Thus, if you want to operate a friend's 100-watt transmitter, the input power must be reduced.**

Ques. *What is the maximum penalty for violation of FCC rules and regulations?*

Ans. **A fine of up to $500 for each day during which the offense occurs, revocation of the station license and suspension of the operator's license.**

Ques. *On which bands may a Novice operate?*

Ans. **3700 kc-3750 kc, 7150 kc-7200 kc, 21,100 kc-21,250 kc, 145 mc-147 mc.**

Ques. *On which bands may a Novice operate on radiotelephone?*

Ans. **145 mc-147 mc.**

Ques. *What is a station log, what information must it contain and how long must it be preserved?*

Ans. **A log is a written record of transmissions. It must contain: date and time of transmission, type of emission, call sign of the station called, transmitter power input, frequency, signature of each licensed operator, and name of any unlicensed person who speaks over a radiotelephone transmitter directly, or by recording, or operates a teleprinter keyboard, location of station and message traffic handled. Entries which do not change may be entered once: power, station location, etc. Logs and message traffic must be saved for one year.**

Ques. *What is the term of a Novice Class license?*

Ans. **The Novice license is good only for one year and may not be renewed.**

Ques. *What are the rules regarding the transmission of improper language, false signals, or malicious interference?*

Ans. **They are prohibited and there are heavy penalties for violations.**

Ques. *What are the rules regarding purity and stability of emission?*

Ans. **Spurious radiation below 144 mc must be reduced in accordance with good engineering practice.**

Ques. *What method of frequency control is required to be used in the transmitter of a station licensed to the holder of a Novice Class license?*

Ans. **The frequency must be *crystal controlled*. Variable frequency oscillators (VFO) are not permitted.**

Ques. *What are the rules regarding the measurement of frequency?*

Ans. **The frequency of emission must be measured regularly and must be done by a means independent of the means to control the transmitting frequency. Accuracy must be high enough to ensure operation within the frequency band used.**

Ques. *Who may operate the transmitter licensed to the holder of a Novice Class license?*

Ans. **Any amateur radio operator.**

Ques. *Under what circumstances may an amateur radio station be used by a person who does not hold a valid license?*

Ans. **An unlicensed person may not operate an amateur radio station. However, he may speak over the microphone or use the keyboard of a teleprinter if a licensed operator controls the emissions.**

Ques. *What is the maximum permissible percentage of modulation of an amateur radiotelephone station?*

Ans. **100 percent.**

Ques. *At what intervals must an amateur station be identified by its call sign. May any transmission be made without station identification?*

Ans. **Identification must be made at the beginning and end of each transmission and at least every ten minutes if a single transmission lasts**

longer than ten minutes. No transmission may be made without identification except during a sequence of transmissions each less than three minutes long, in which case the call sign need be given only once every ten minutes as well as at the beginning and end of the work.

Ques. *Under what conditions is notice of portable or mobile operation required to be given, and to whom in each case?*

Ans. **Notice of intended mobile or portable operation must be given the FCC Engineer-In-Charge of the district in which such operation is contemplated only when the operation is or is expected to be for longer than 48 hours.**

Ques. *What are the recognized abbreviations for: kilocycles, megacycles, Eastern Standard Time, Greenwich Mean Time, continuous wave, frequency modulation, amplitude modulation?*

Ans. ***Kilocycles*—kc, *megacycles*—mc, *Eastern Standard Time*—EST, *Greenwich Mean Time*—GMT, *continuous wave*—CW, *frequency modulation*—FM, *amplitude modulation*—AM**

Ques. *What is the relationship between a fundamental frequency and its second harmonic; third harmonic, etc.?*

Ans. **Second harmonic is twice the fundamental frequency, the third harmonic is three times the fundamental frequency, etc. Note that the fundamental is the same as the first harmonic.**

Ques. *What is the relationship between a cycle, kilocycle and a megacycle?*

Ans. **One *kilocycle* is 1000 cycles. One *megacycle* is 1000 kilocycles (or 1,000,000 cycles).**

Ques. *What instrument is used to measure: electrical potential, electrical current, electrical power, electrical energy?*

Ans. ***Electrical potential*—voltmeter**
***Electrical current*—ammeter, milliammeter or microammeter.**
***Electrical power*—wattmeter**
***Electrical energy*—watt-hour meter**

Ques. *What is the purpose of: a modulator, amplifier, filter, rectifier?*

Ans. ***Modulator*—varies the amplitude, frequency of phase of the transmitter output for the purpose of transmitting intelligence, or information.**
***Amplifier*—increases amplitude, or power, of a signal.**
***Rectifier*—changes alternating current into pulsating direct current.**
***Filter*—reduces undesired frequencies without affecting desired ones. A power supply filter, for example, attenuates pulsating current and passes direct current. A band-pass filter rejects frequencies above and below a given band.**

Ques. *What is meant by: amplification, modulation, detection, attenuation?*

Ans. ***Amplification*—the process of increasing the power level or amplitude of a signal.**
***Modulation*—the process of varying the amplitude, phase or frequency of transmitter output, primarily to super-impose information on it.**
***Detection*—the process of recovering the information super-imposed (by modulation) on a radio-frequency signal.**
***Attenuation*—the reduction of amplitude, or strength.**

Ques. *What is the purpose of: a radio-frequency choke, an audio-frequency choke, a filter choke?*

Ans. **A *radio-frequency choke* opposes the flow of radio-frequency current, permits audio frequencies and direct current to flow.**
An *audio-frequency choke* opposes the flow of audio-frequencies and permits direct current to flow.
A *filter* choke smooths out the ripples in the direct current output of a rectifier.

Ques. *How is the power input to the tube or tubes supplying energy to the antenna of an amateur transmitter determined?*

Ans. ***Input power* is determined by multiplying the plate voltage and plate current of the final tube(s). For example: the input power of a tube with a plate voltage of 250 volts and a plate current of 40 milliamperes is 10 watts. Note that milliamperes must be changed to**

amperes before multiplying with plate voltage. Thus, 40 milliamperes becomes .04 amperes. 250X.04 = 10.

Ques. *Why are a rectifier and filter required in the plate power supply system of an amateur transmitter when operated from alternating current?*

Ans. **The rectifier changes alternating current into direct current and the filter smooths out the ripples, or pulsations. According to the regulations, adequate power supply filtering must be used on operating frequencies below 144 mc.**

Ques. *What is a frequency multiplier?*

Ans. **This is a device, often a vacuum tube, which delivers output at a multiple of its input frequency. Output will be a harmonic of the fundamental, or applied frequency.**

Ques. *What are the undesirable effects of overmodulation in radiotelephony?*

Ans. **The generation of spurious sidebands which lie outside of the operating channel. They cause interference to other stations both in and out of the band through an effect called "splatter."**

Ques. *What is meant by a "parasitic" oscillation?*

Ans. **An oscillation which is not essential for operation and often occurs on a frequency different from the operating frequency.**

Ques. *What is the purpose of a key-click filter and when should it be used?*

Ans. **A key-click filter reduces spurious radiation produced by a radiotelegraph transmitter and should be used whenever such suppression is required.**

Ques. *What is Ohm's Law?*

Ans. **This expresses the relationship between voltage, current and resistance in a circuit. The symbols used are; I = current in amperes, E = potential in volts, R = resistance in ohms. Three expressions of Ohm's Law are:**

$$E = IR \qquad I = \frac{E}{R} \qquad R = \frac{E}{I}$$

Ques. *What precautions should be taken to avoid danger of shock from high-voltage electrical circuits?*

Ans. **Such circuits should not be exposed where accidental contact can occur. Work on equipment with the power turned off. Power supply capacitors should have bleeder resistors across them to discharge the capacitors after power has been turned off.**

Ques. *What is the relationship between the frequency and the wavelength of a radio wave if its velocity in space is 300,000,000 meters per second.*

Ans. **Frequency (in cycles) multiplied by wavelength in meters equals 300,000,000. Wavelength is inversely proportional to frequency. The formula is:**

$$\text{f (frequency in cycles)} = \frac{300{,}000{,}000}{\text{Wavelength (in meters)}}$$

Ques. *What symbol is used in the amateur rules to designate amplitude-modulated telegraphy without the use of modulating audio frequencies (on-off keying)?*

Ans. **A1. "A" is for amplitude modulation, and "1" indicates telegraphy by on-off keying.**

Ques. *What is the ruling regarding eligibility for re-examination?*

Ans. **An applicant who fails an operator examination may not take another examination for the same or higher privileges within 30 days. This does not apply to an examination for a General Class license following a mail examination for a Conditional, Novice or Technician Class license.**

Ques. *What factors are responsible for harmonic radiation and what practical means can be used to detect and correct such condition?*

Ans. **Factors which favor harmonic radiation are; excessive excitation voltage to the final radio-frequency amplifier, poor shielding and filtering of transmitter, improper tuning and improperly matched antenna. Harmonics can be detected by tuning to their frequency with a receiver or a field-strength meter. Steps to correct harmonic radiation: use of minimum final-stage excitation voltage; shielding of all RF circuits; filtering audio and power leads to RF circuits; harmonic traps in the final stage; low-pass filter and antenna tuner between final stage and antenna; correct matching to antenna.**