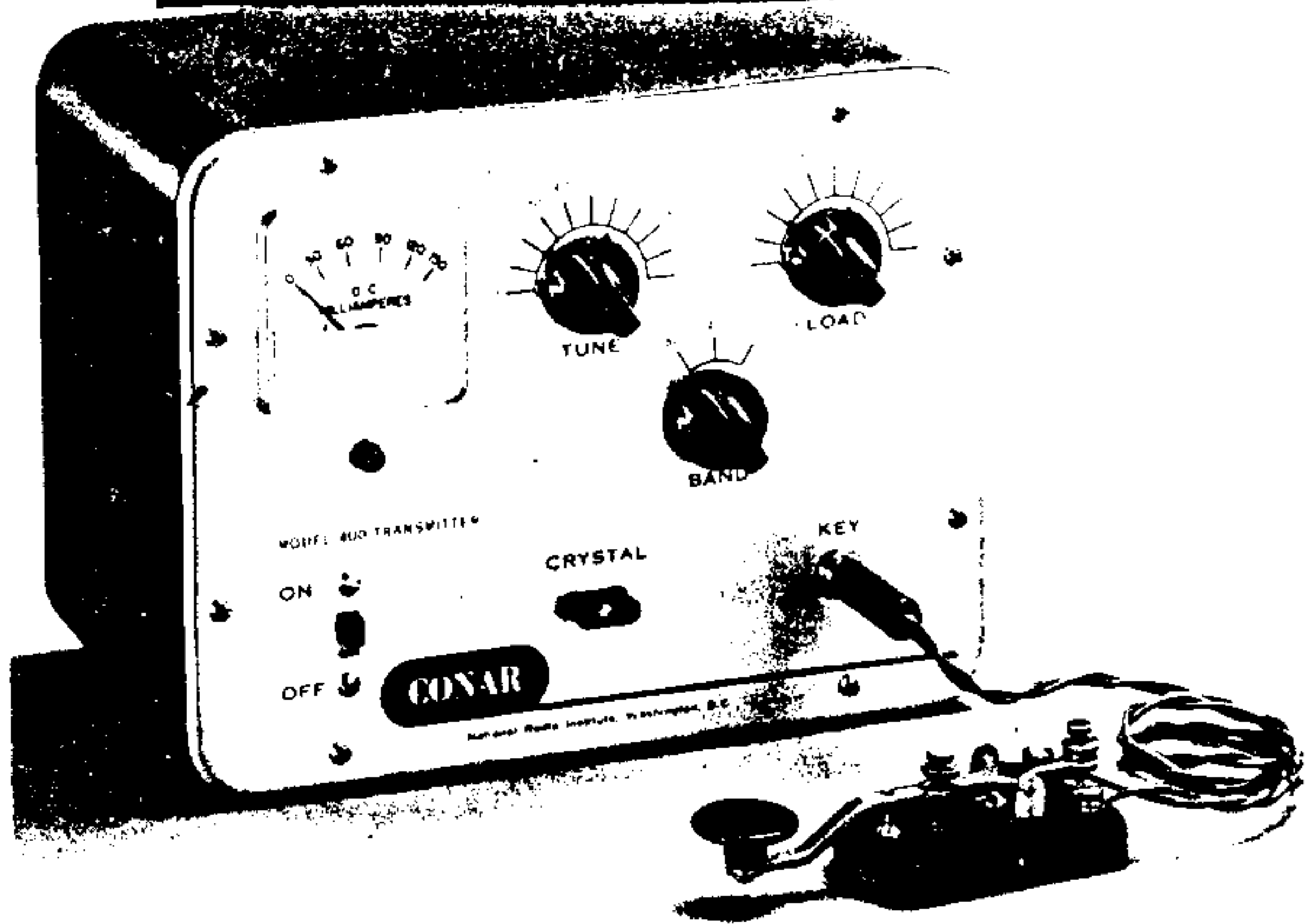


# TRAINING KIT 3R



## Your Novice Transmitter

By the time you receive this kit, you may already have taken and passed your Novice Class examination. If so, you will want to build the transmitter as soon as possible, in order to get on the air when you have your license and call letters.

If you have not yet passed the test, it might be well to put the kit aside for the present, and concentrate on getting your license. Remember, any radiation of an unlicensed radio signal is illegal. Even if you think you have passed the examination, you cannot legally put a transmitter on the air, for testing purposes or otherwise, until you have the actual license in hand.

Training Kit 3R provides you with the parts needed to build a 25-watt cw transmitter for the three most used Novice bands. This kit is identical to the Conar Model 400 which has been sold by the Conar Instruments Division of National Radio Institute for several years. The transmitter has been successfully built and used by many beginning amateurs during that time.

Construction of this kit is simpler than was the construction of Training Kit 2R, as the transmitter consists of one stage and power supply, compared with seven stages in the receiver. Completion of the transmitter should not require more than

six or eight hours of actual working time.

Review the General Assembly instructions (which are the same as those received with Training Kit 2R), and then follow the step-by-step procedure of Assembly Sheet No. 1, No. 2, and No. 3. A word of caution is in order about Fig. 4 on Assembly Sheet No. 2. To some students (understandably) the drawing looks as if the parasitic choke, RFC3, shown in red, goes inside the 80 and 40 meter coil, L2. It does NOT. The parasitic choke wound on the 100-ohm resistor goes directly from terminal 39 to the tube plate cap clip, without touching or going inside the turns of coil L2. The leads of the 100-ohm resistor are long enough to span this space.

One item not covered by the assembly instructions is connecting the key, Part No. KE4, to the plug, PL2. Use the three-foot length of twisted pair wire, WR220, for this purpose. Strip 1/4" of

insulation from each wire at one end of the twisted pair, and solder one wire to each lug in the plug, just as you did with the headphone leads in Kit 1R. Strip 3/4" of insulation from the other ends of the wires, and connect these wires to the binding posts of the key. If the three-foot length is inconveniently long for the position of the key and the transmitter in your set-up, the wires may be shortened to a desired length.

After you have completed construction, following the assembly sheet instructions, refer back to this manual for information about tuning the transmitter and connecting it to an antenna.

When you have had an opportunity to tune and test your completed transmitter, answer the questions contained in the Report on Training Kit 3R, a separate sheet inserted in this manual. Your grade for this training kit will be recorded along with your regular lesson grades.

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## Safety Precautions

At this point it is well to give a few words of warning regarding safety when operating your transmitter, or for that matter any piece of electronic equipment in which high voltages are present. Even though the dc voltages developed by the power supply are fairly low (300-350V) and not in themselves fatal, even a minor shock can cause a reaction which could put you in danger of having a serious fall or coming into contact with other more dangerous voltages.

In addition, radio frequency voltages

of rather large magnitude are present at the plate of the power tube and the tank coil. These rf voltages can cause severe burns if you touch these parts while the transmitter is in operation, even if you are not touching anything else at the same time.

For these reasons, always be careful when operating or testing your transmitter. Make it a habit to observe and follow the points outlined below:

1. Do not operate the transmitter out of its cabinet.

2. Always discharge the high voltage capacitors before taking measurements or other tests.
3. Avoid touching components on top of the chassis when power is on.
4. Disconnect the power cord when making checks or tests on the chassis.

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## Specifications

### Power Consumption:

Stand by: 15 watts, 115V, 60-cycle  
Transmit: 50 watts

Output impedance: 50-600 ohms non-reactive

Tube complement: 1-6DQ6B beam tetrode

Output coupling: Pi-network

DC plate power: 25 watts

Frequency control: Crystal

Band coverage: 21-21.45 mc (15 M)  
7-7.3 mc (40 M)  
3.5-4.0 mc (80 M)

Size: 7-1/2" X 10"W X 6-1/2"D

Weight: 7 lbs.

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## Circuit Description

Your transmitter uses a high perveance beam tetrode in a grid-plate power oscillator circuit. Output power for the three bands is taken from the plate circuit and coupled to the antenna by a pi-network tank circuit.

A dual-silicon rectifier, full-wave voltage doubler power supply, furnishes approximately 320V dc for the plate of the 6DQ6B. A combination voltage divider-bleeder resistor furnishes lower voltage for the screen grid of the tube at

the same time it acts as a fixed load on the power supply to improve voltage regulation and discharge the filter capacitors when the transmitter is turned off.

On 80 meters, fundamental frequency crystals (3.7 mc-3.75 mc) must be used. On 40 meters, either fundamental crystals (7.15 mc-7.2 mc) or 80-meter crystals (3.575 mc-3.6 mc) may be used. Using 80-meter crystals on 40 meters will produce less output power than 40-meter crystals because the oscillator must oper-

ate as a frequency doubler in the plate circuit, a less efficient manner of operation than operating at the fundamental frequency.

On 15 meters it is necessary to operate the plate circuit as a frequency multiplier since fundamental frequency crystals in the 21.1 mc-21.25 mc range are very expensive in addition to being hard to find. Therefore, crystals in the range of 10.55 mc to 10.625 mc are recommended for 15-meter operation. As an alternative, 40-meter crystals in the range of 7.034 mc to 7.083 mc may be used. The plate circuit must be tuned to the third harmonic of the crystal frequency when 40-meter crystals are used for 15-meter operation, a less desirable method of operation than using crystals in the 10.55 mc range, since frequency tripling results in lower efficiency and less output power. Table I summarizes the crystal selection for the three bands.

To provide stabilization of the crystal frequency and to protect the crystal from excessive crystal current, a positive temperature coefficient resistor in the form of a pilot lamp is used in the crystal circuit. This variable resistance lamp

virtually eliminates any chirp frequency shift of the output signal when the transmitter is keyed. At the same time it protects the crystal from excessive currents if the transmitter should happen to be operated out of resonance accidentally. The large out-of-resonance crystal currents, which could fracture the crystal, will burn out the lamp before they build up to a level sufficient to damage the crystal.

A cathode bias resistor is used in the transmitter to limit the plate current to a safe level as the plate tank is tuned. If the transmitter did not have this protection, the plate current would drive the plate current meter off scale and possibly damage the tube.

The pi-network tank circuit provides a good load match into unbalanced resistive antenna loads of 50 to 600 ohms impedance, the most widely used antenna impedances. In addition, the large output capacitor helps suppress harmonics from the transmitter. Adequate harmonic suppression is required by the FCC so that you will not interfere with other radio services by radiating harmonic signals.

BAND	CRYSTAL	
	First Choice	Second Choice
80M 3.7 mc - 3.75 mc	3.7 mc - 3.75 mc	
40M 7.15 mc - 7.2 mc	7.15 mc - 7.2 mc	3.575 mc - 3.6 mc
15M 21.1 mc - 21.25 mc	10.55 mc - 10.62 mc	7.034 - 7.083 mc

TABLE I. Crystal selection chart.

# Controls and Connections

The front panel of the transmitter is shown in Fig. 1, and the rear of the cabinet is shown in Fig. 2. The following discussion of the various controls and connections refers to these figures.

The slide switch labeled OFF (A) controls the line power and is ON in the up position. With power applied, the pilot light (B) will light.

The socket labeled CRYSTAL (C) accepts the crystal, and the jack labeled KEY (D) is for the key. This jack accepts a standard 1/4" diameter phone plug.

The meter (E) measures the transmitter cathode current and is calibrated in dc milliamperes, 150 ma maximum.

The band switch (F) selects the desired amateur band. In the full counter-clockwise position the pointer indicates 80 meters; straight up is 40 meters and fully clockwise is 15 meters.

The TUNE (G) and LOAD (H) controls tune and load the output circuit for each crystal frequency on all bands. Their use is explained in the section on operation beginning on page 9.

There are two openings in the rear of the cabinet, one for the ac power cord (A) and one for the antenna connection (B). The antenna connector accepts a standard coax fitting for the transmission line.

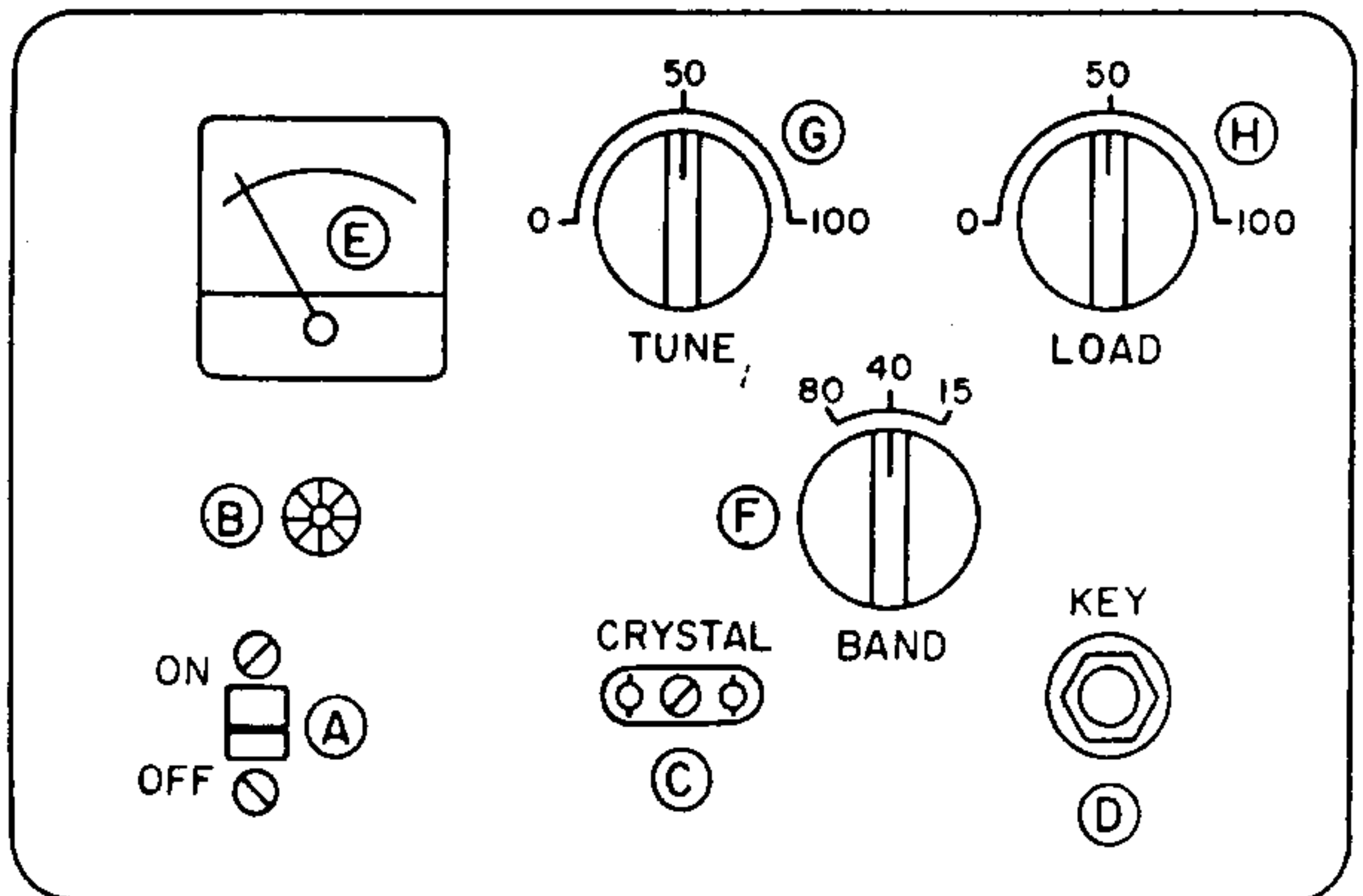


Fig. 1. Front panel of the transmitter.

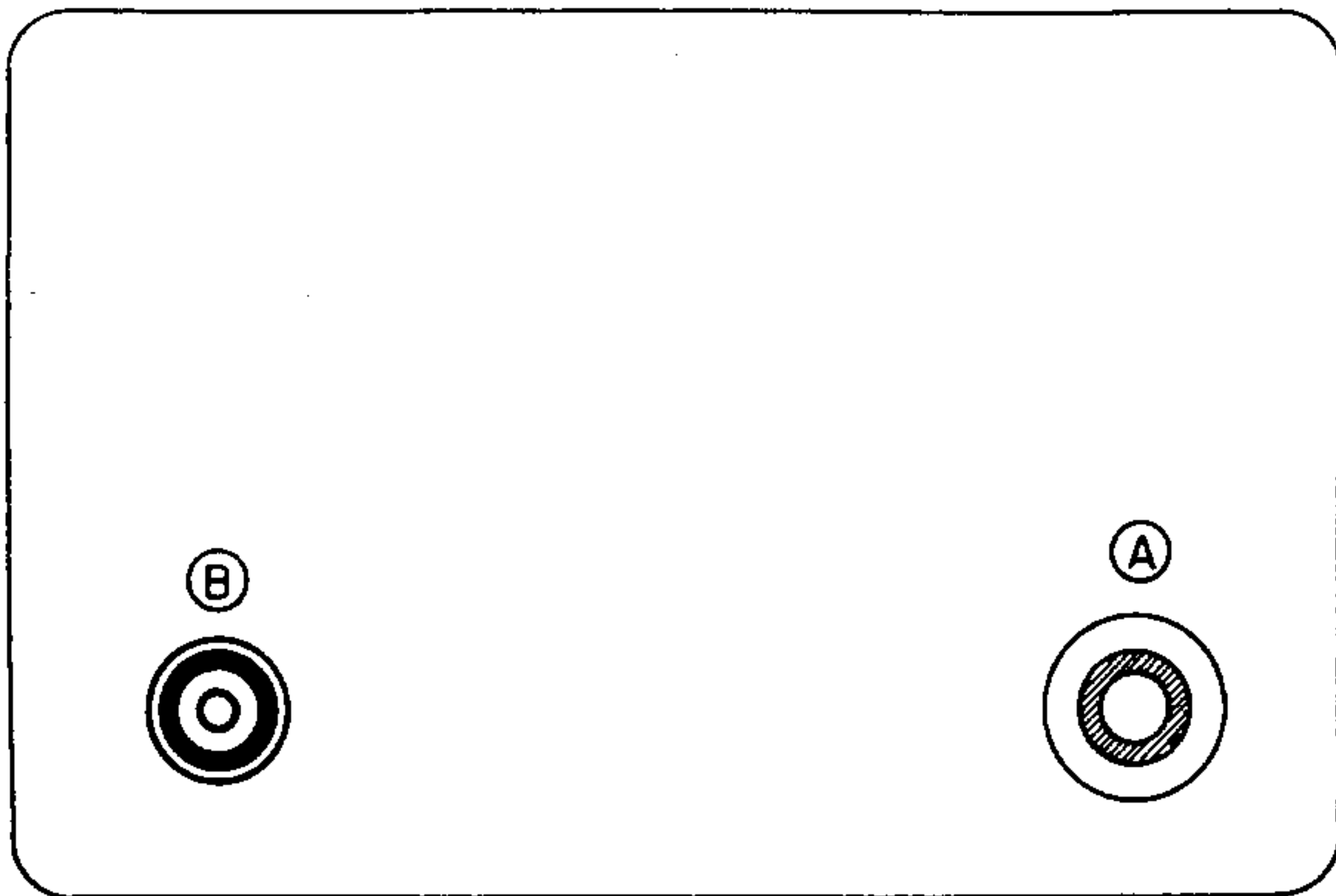


Fig. 2. Rear of the transmitter.

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## Operation

The ease of operation of your transmitter is outstanding. There are no confusing preliminary adjustments to make, no neutralization is necessary, and there are only two controls to adjust. If you follow the procedures outlined below, you should have no difficulty at all in operating your transmitter and having a lot of fun making radio contacts.

### INITIAL PROCEDURE

We again emphasize that before you can operate your transmitter on the air, you must have your license. Assuming that you have it, we will go ahead with

instructions on how to operate the transmitter. You will need three things not furnished with this kit in order to operate:

1. A crystal
2. A dummy load
3. An antenna

Lesson R102 told you some of the characteristics of the three amateur bands available to you. From that information, and from your experience in listening to the bands on your receiver, you may already know which band you wish to try first. Remember, if you want to operate

on all three Novice high-frequency bands, three different crystals will be needed. Table I shows the range of frequencies you may choose for operation in any given Novice band. However, as we mentioned in Lesson R102, it is unwise to choose a frequency too close to the edge of a Novice band. Crystals will normally oscillate only at one frequency, but the circuit in which a crystal is used may affect this frequency by one or two kilocycles. For example, a crystal marked 7151 kc by its manufacturer, based on accurate measurements in the oscillator the manufacturer used, could possibly oscillate at 7149.8 kc in your transmitter. Even though this frequency would be only 200 cycles outside the Novice band, its use by a Novice could result in a violation notice from the FCC. Therefore, in buying your crystals, allow a small margin for these possible differences, and select frequencies at least two kilocycles inside the edges of the Novice bands.

If there is an electronics parts distributor in your locality, you will probably be able to select your crystals from his stock. Otherwise, you can order crystals from one of the mail-order electronics distributors.

A dummy load takes the place of the transmitting antenna for tuning and testing purposes. The load should dissipate the power output of your transmitter in the form of heat, instead of in the form of radiation which is the case with the antenna. With a dummy load, you can tune up and experiment as much as you like, without fear that you are causing needless interference on the crowded Novice bands. If you make your dummy load from a light bulb as suggested, you will also be able to see the effect of your transmitter's output as the bulb lights.

The output of your transmitter is connected to a coaxial cable receptacle at the back of the cabinet. Therefore, you will need a coax plug to fit the receptacle, whether you are coupling an antenna or a dummy load. We recommend that you use a 52- or 73-ohm coaxial cable such as RG58 or RG59 to connect the antenna (or the dummy load) to the transmitter. These cables are small in diameter and are easy to work with. A coax plug and adapter are shown in Fig. 3.

Fig. 4 shows how the coax is prepared and fitted to the plug.

First, remove the outer black plastic cover for exactly 1-3/4 inches from one end of the coax. To do this, cut around the coax with a knife and then slit the plastic from that point back to the end.

Next, use a small-bladed screwdriver to unravel the braid for 1-1/4 inches so you have 1/2-inch of braid left, as shown in Fig. 4A.

Slide the adapter onto the coax, from the opposite end, until the smaller end of the adapter is exactly at the edge of the black plastic. Fold the braid over the end of the adapter, as shown in Fig. 4B. Cut off the excess braid so that none projects over the threaded portion of the adapter. Then, remove 1-1/2 inches of the center polyethylene insulation to expose the center conductor. Be extremely careful not to nick the center conductor or it will easily break.

The coaxial plug is made up of two parts: the plug itself, and an outer sleeve. Unscrew the sleeve and set it aside. Slide



Fig. 3. The coaxial plug and adapter.

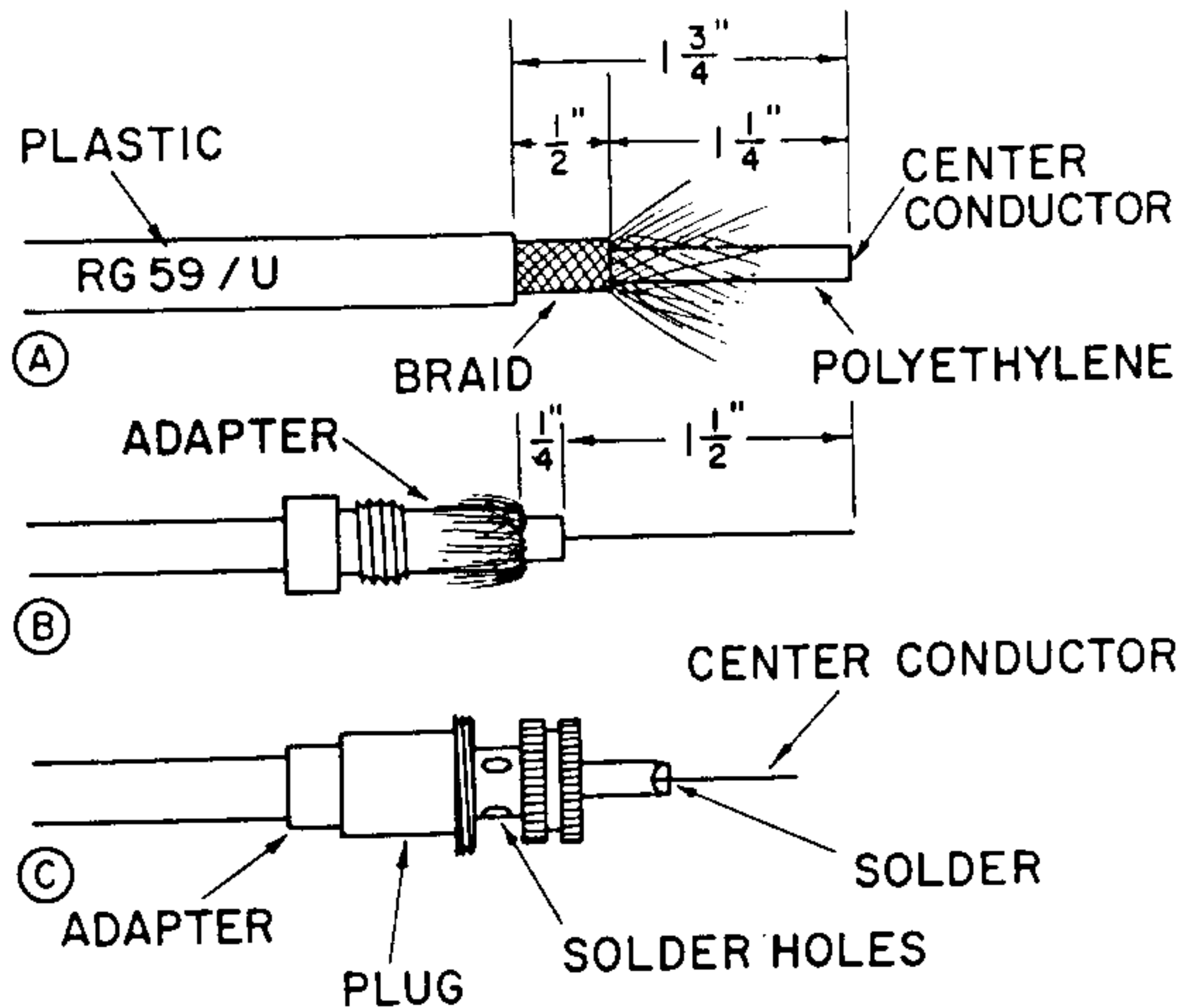


Fig. 4. Assembling coax connector to cable.

the plug (the inside part) onto the prepared end of the coaxial cable until it comes into contact with the threaded portion of the adapter. Now hold the adapter and cable tightly in your left hand, being sure the adapter is exactly in place at the edge of the plastic, and with your right hand, screw the coax plug onto the adapter until the end of the adapter is flush against the plug. This should be a very tight fit and you may need to use a pair of pliers.

Before soldering the coax, check it for a short with your ohmmeter. Connect the ground clip to the center conductor and touch the probe to the plug. You should not get a reading on the  $R \times 100K$  range. If you do get a reading, some of the braid on the unprepared end of the cable may

be touching the center conductor. Check this end carefully. If the unprepared end appears to be all right, disassemble the plug and adapter, and check for braid not properly folded over the adapter.

As shown in Fig. 4C, the plug has a series of "solder holes" through which you can see the braid you folded back over the adapter. Now fill two or three holes with solder. Work fast, since excessive heat will melt the polyethylene insulation of the cable. Only a drop of solder is needed to make the connection - do not attempt to flow solder all over this section of the plug.

After you solder, recheck the cable for shorts, and then solder the center conductor in place in the protruding end of the plug, and clip off the excess lead. You



need not fill the entire center portion of the plug with solder either, as the excess heat will cause a short.

Thread the sleeve of the plug over the unprepared end of the cable (threaded end first), slide it up to the plug, and screw it on as far as it will go. When it is screwed all the way on, it will be free to slide back and forth, but will not come off the end.

**Making a dummy load.** For maximum convenience in initial tune-up of your transmitter, it is suggested that you make up a dummy load using a 15- or 25-watt light bulb. The lamp is connected to one end of a 2-foot length of coaxial cable, and a coaxial connector to the other end. Remove about one inch of the outer covering from the cable and separate the strands of the braid with a small screwdriver. Gather the loose strands of the braid and twist them together. Now tin this lead, just formed, with solder to make it easy to solder the bulb.

You should use a lamp that does not have an aluminum base, so you can solder directly to the metal base. Tin the center conductor of the cable and quickly solder it to the end of the lamp. Then solder the tinned braid lead to the base.

We will tell you more about the actual antenna after we discuss the tuning procedure with the dummy load.

## TRANSMITTER TUNING

When you are ready to test your transmitter, take the following steps:

1. Connect the dummy load.
2. Set the BAND switch to the band you are going to use.
3. Plug in a crystal which will furnish output in the band you have selected (see Table I).

4. Set the TUNE and LOAD controls to 100 (capacitor plates fully meshed.)
5. Plug in the key.
6. Plug in the line cord.

Turn the line switch on and allow the tube filament to warm up a minute or two. Now when you close the key, the meter will show a high reading, possibly about 125 ma. Do not hold the key closed more than a few seconds when the transmitter is not tuned up, as damage to the tube could result. Now let's see how the tuning goes, band by band.

**80 meters.** A crystal between 3700 and 3750 kc should be in the crystal socket, and the BAND switch should be on the 80-meter position (switch in its most counterclockwise setting.) Hold the key closed and quickly move the TUNE control counterclockwise until the plate current, as shown on the meter, decreases to a minimum value. This should be at a setting of about 80 or 85 on the TUNE scale. The minimum reading on the meter should be somewhere between 50 and 90 ma, depending on the value of the load. Fig. 5 shows the plate current plotted

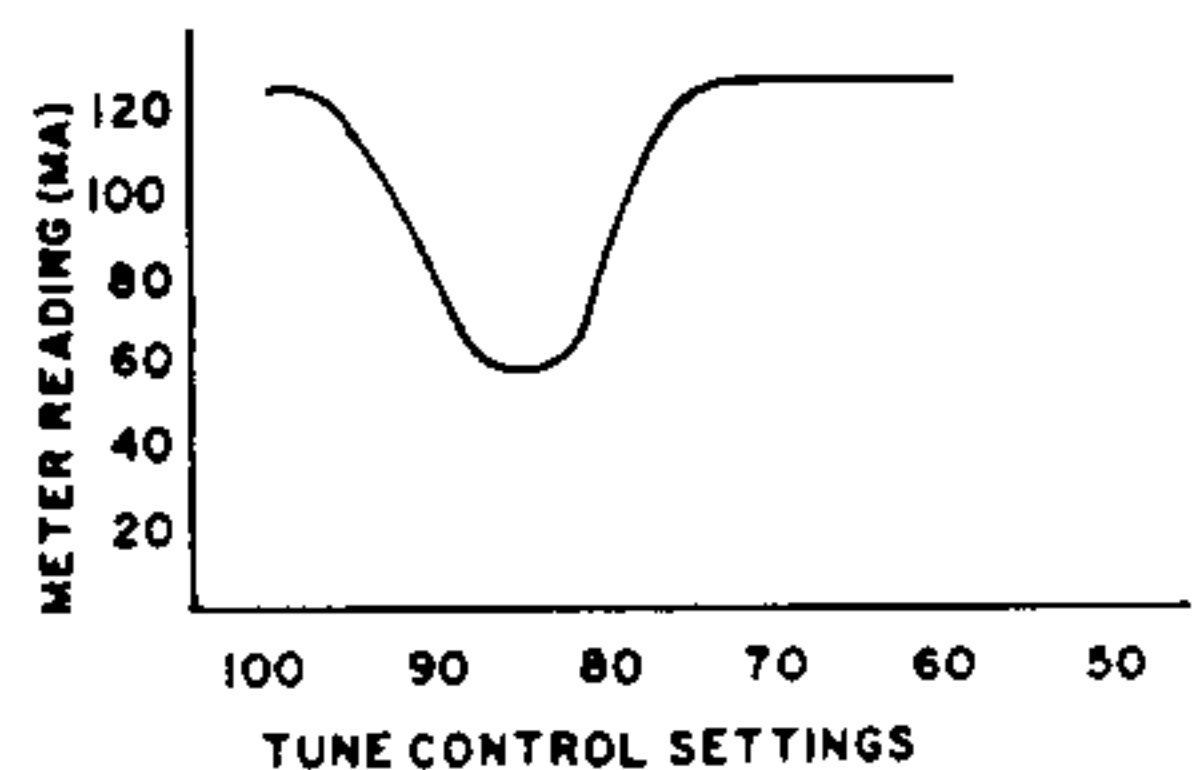


Fig. 5. Plate current readings as you move the TUNE control on 80 meters.

against the tuning settings, and shows you why this phenomenon is known as a "plate current dip." Suppose the minimum reading you get with your dummy load connected is 60 ma. If you are using a light bulb as the load, it should show some glow, indicating that power is being delivered to it. Now, leaving the TUNE control at the point where you obtained the lowest plate current reading, turn the LOAD control counterclockwise from its "100" position until plate current increases about 10 ma, in this example to 70 ma. Readjust the TUNE control for minimum plate current. Adjust the LOAD control counterclockwise until the plate current reaches 80 ma, and then retouch the TUNE control for minimum. Increase the loading by turning the LOAD control a little more in the counterclockwise direction, to a meter reading of 90 ma, and readjust the TUNE control slightly to be sure you are at the plate current minimum. When the transmitter is loaded to 90 ma of plate current, the input power is just about 25 watts, and the output power should be about 15 watts, in this example. If you have a 15-watt light bulb as your dummy load, it should show about the same brilliance as it would if it were turned on in a regular house wiring circuit. (A 25-watt bulb would light to about half brilliance.) Your transmitter is now furnishing its full rated power output to the load -- it is tuned up on 80 meters. **CAUTION:** If you continue turning the TUNE control counterclockwise, you will probably find another plate current dip at a setting of about 10 or 15. **DO NOT** tune the transmitter at this point. Its output, if you were using a 3700 kc crystal, would be on 7400 kc, which is outside the amateur bands.

40 meters. Set the BAND-switch to

the straight up, or 40, position. You have a choice of crystal frequencies on this band, either from 7150 to 7200 kc, or from 3575 to 3600 kc. The tuning will be similar in either case, and will not differ greatly from the procedure you used on 80 meters. With the LOAD control at 100, the plate current dip should occur at a setting of about 40 to 60 on the TUNE scale. Increase the loading in steps, resetting the TUNE control for minimum plate current, until you reach a plate current of 90 ma. The transmitter is then fully loaded, and the light bulb should show nearly full brilliance. If you are using an 80-meter crystal, in which case the plate circuit of the tube acts as a frequency doubler, the output will be slightly less than if you are using a crystal for 40 meters.

15 meters. For 15-meter operation, you have a choice of two frequency ranges of crystals; 10,550 to 10,625 kc, and 7034 to 7083 kc. In either case, the plate circuit of the transmitter tube acts as a frequency multiplier, doubling the crystal frequency when 10.5 mc crystals are used, and tripling with 7 mc crystals. Efficiency is greater and tuning easier with 10.5 mc crystals, but the 7 mc crystals are more readily available. Set the BAND switch to the clockwise, or 15-meter, position, and plug in the crystal. With the LOAD control at 100, the plate current dip for the 21.1 mc (15 meter) resonance will occur at a TUNE control setting of about 15 to 25. Be careful that you tune to the correct dip point. With a 10.5 mc crystal, you may possibly get another dip at a setting of 95 or 100, which would represent the fundamental frequency of the crystal at 10.55 mc, and is unwanted. With a 7 mc crystal, you will find a plate current dip at a TUNE setting of about 55, representing the resonance

point when doubling the frequency of the 7 mc crystal to 14 mc. There is no Novice band at 14 mc, so this is also an undesired response. Once you have found the correct setting of the TUNE control for the 21.1 mc plate current dip, you can load the transmitter just as you did on 80 and 40 meters, to a plate current reading of 90 ma. The output of the transmitter, as shown by the brilliance of the light bulb, will not be as great at 15 meters as it was at 80 or 40 meters, because the tube is operating as a frequency multiplier at lower efficiency and at a higher frequency.

On all three bands, once you have learned the approximate settings of the TUNE and LOAD controls, you will not need to be so careful about increasing the loading just 10 ma at a time. You can increase it in larger steps, loading to 90 ma with just one or two adjustments.

## ANTENNAS

Your transmitter cannot be heard very far away when it is connected to a dummy load. A receiver within a few hundred feet of the transmitter would be able to pick up your signal, but for the

distances you want to cover, you need an antenna to radiate the signal. Worldwide distances are possible even with low power when the transmitter feeds its power output to a good antenna system.

Notice above that we have said "antenna system" rather than simply "antenna". The antenna system includes everything that follows the antenna connector on the rear of the transmitter chassis. In most cases this will be made up of a coaxial cable "transmission line" and an antenna. You might use an "antenna tuner" to couple the low impedance coaxial cable to certain high impedance antennas; however we shall not discuss these more elaborate systems at this time. You will learn more about antennas and transmission lines later in the course, but for the present we will discuss only the simpler systems which do not require any additional antenna coupling devices.

The simplest and most widely used antenna of all on the lower amateur frequencies is the dipole shown in Fig. 6. It consists simply of two identical lengths of No. 14 antenna wire, three glass insulators, and a length of 73-ohm coaxial cable (RG59) to reach the transmitter. The antenna is supported at each end as

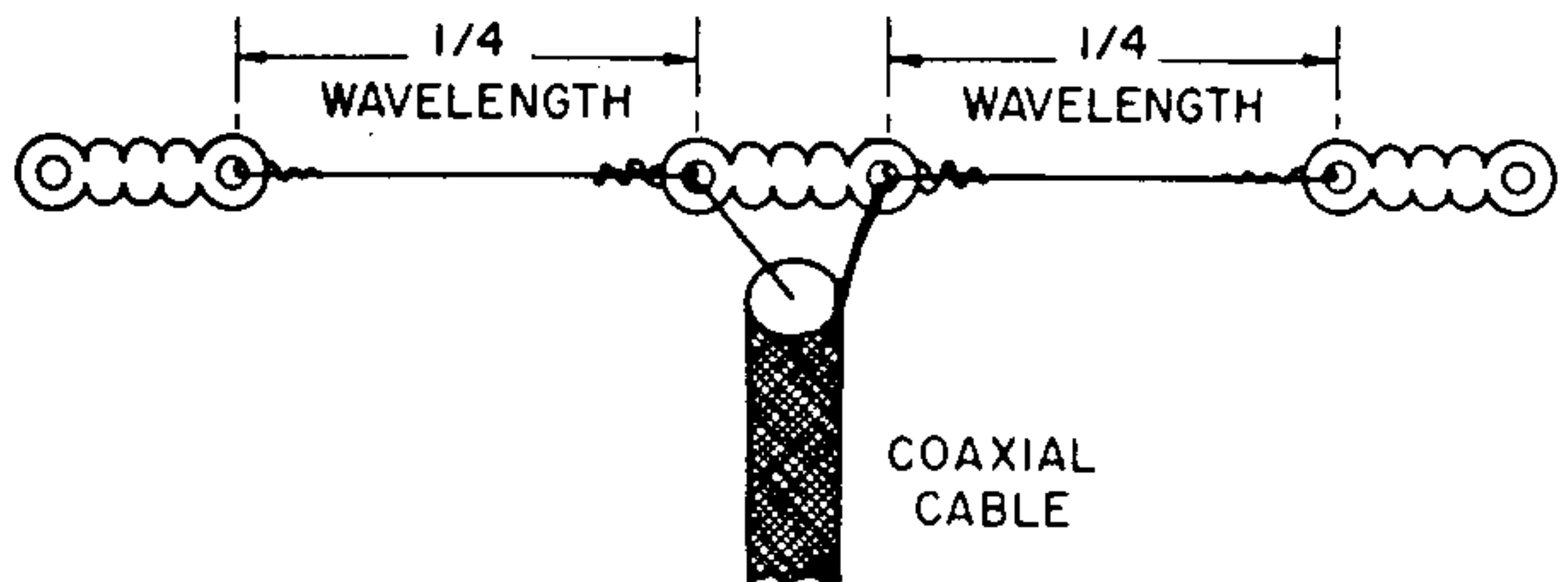


Fig. 6. Simple dipole antenna.

high above the ground as possible and away from all nearby obstructions (such as tree limbs and power poles, etc.). The side of your house and a tree in the yard, for example, make two good supports. The antenna should be placed as nearly horizontal as possible, and must be kept away from all power lines and utility poles. The latter is very important for reasons of safety.

As generally used by amateurs, the term "dipole" means a center-fed antenna one-half wavelength long. A half-wavelength for the lower amateur frequencies, in feet, may be found by the formula:

$$\frac{468}{\text{Freq. (mc)}}$$

Therefore a dipole for 3.7 mc is 126 feet long; one for 7.15 mc is 65-1/2 feet long; and for 21.1 mc, 22 feet, 2 inches long. The quarter wavelength sections shown in Fig. 6 would therefore each be one-half of these measurements.

Because the dipole has a center impedance of about 73 ohms, it is a good match for the RG59 coax. This only

applies when the antenna is one-half wavelength long at the frequency in use, although a difference of a few inches either way will not normally affect the performance of the antenna. However, a 126-foot antenna which matches the RG59 transmission line very well at 3.7 mc will not work at all when used with that transmission line at 7.15 mc. Therefore, if you intended to operate on all three bands, three separate dipoles would theoretically be needed. Actually, because the 40-meter antenna would be close to three half-wavelengths long at 15 meters, it is possible to use it on that band also, and you can therefore get by with two antennas for the three bands.

Fig. 7 shows how you can combine these two antennas into one very simply. This antenna is made entirely from a 130-foot length of 300-ohm twin lead: the kind used for TV lead-in wire.

Fig. 8 shows how to construct this antenna. First, locate the exact center of the twin lead and slit the conductors away from the webbing a distance of 1-1/2" at the center as shown in Fig. 8A. Cut each of these wires, as shown, one

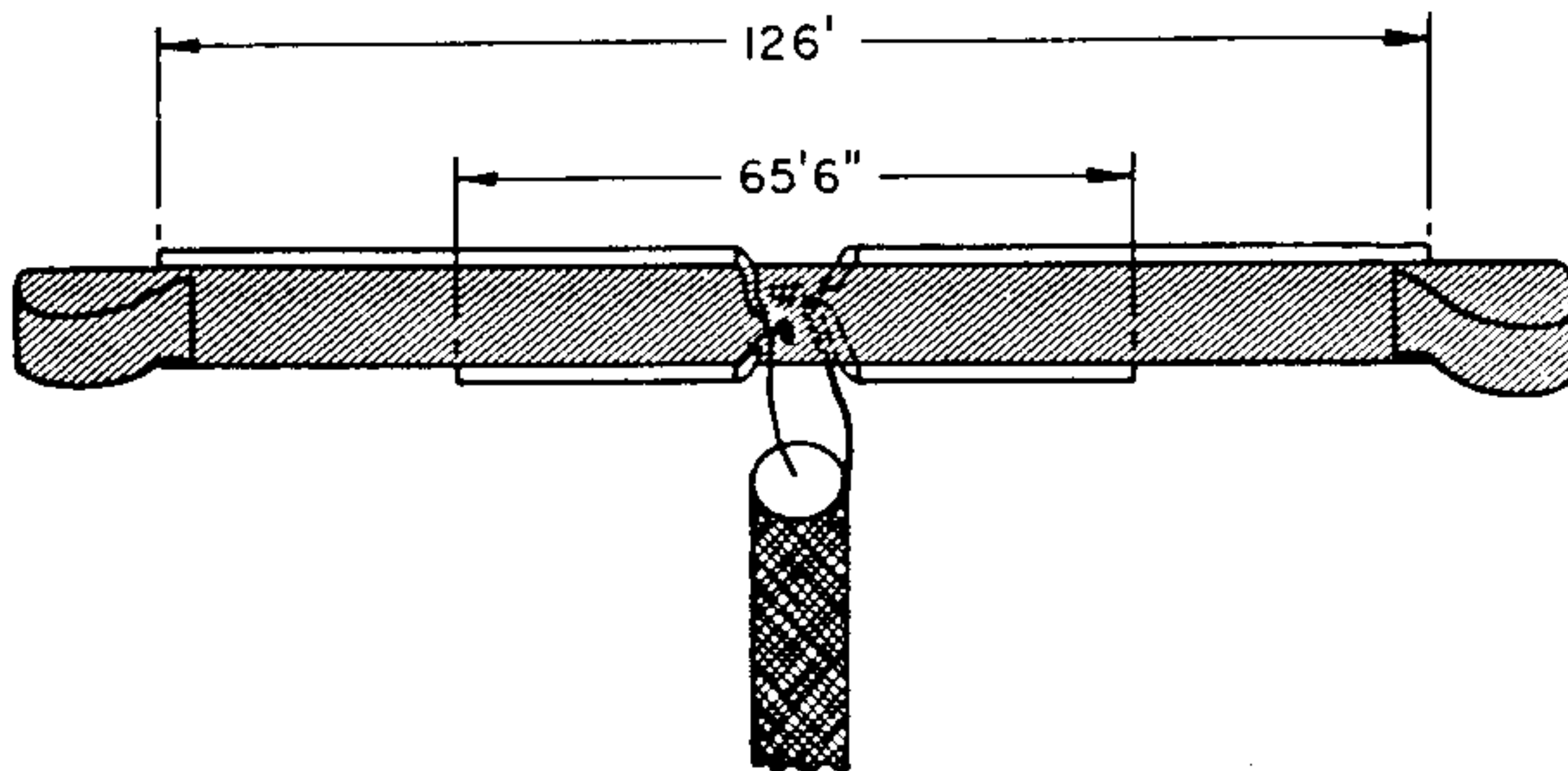


Fig. 7. Three-band dipole antenna.

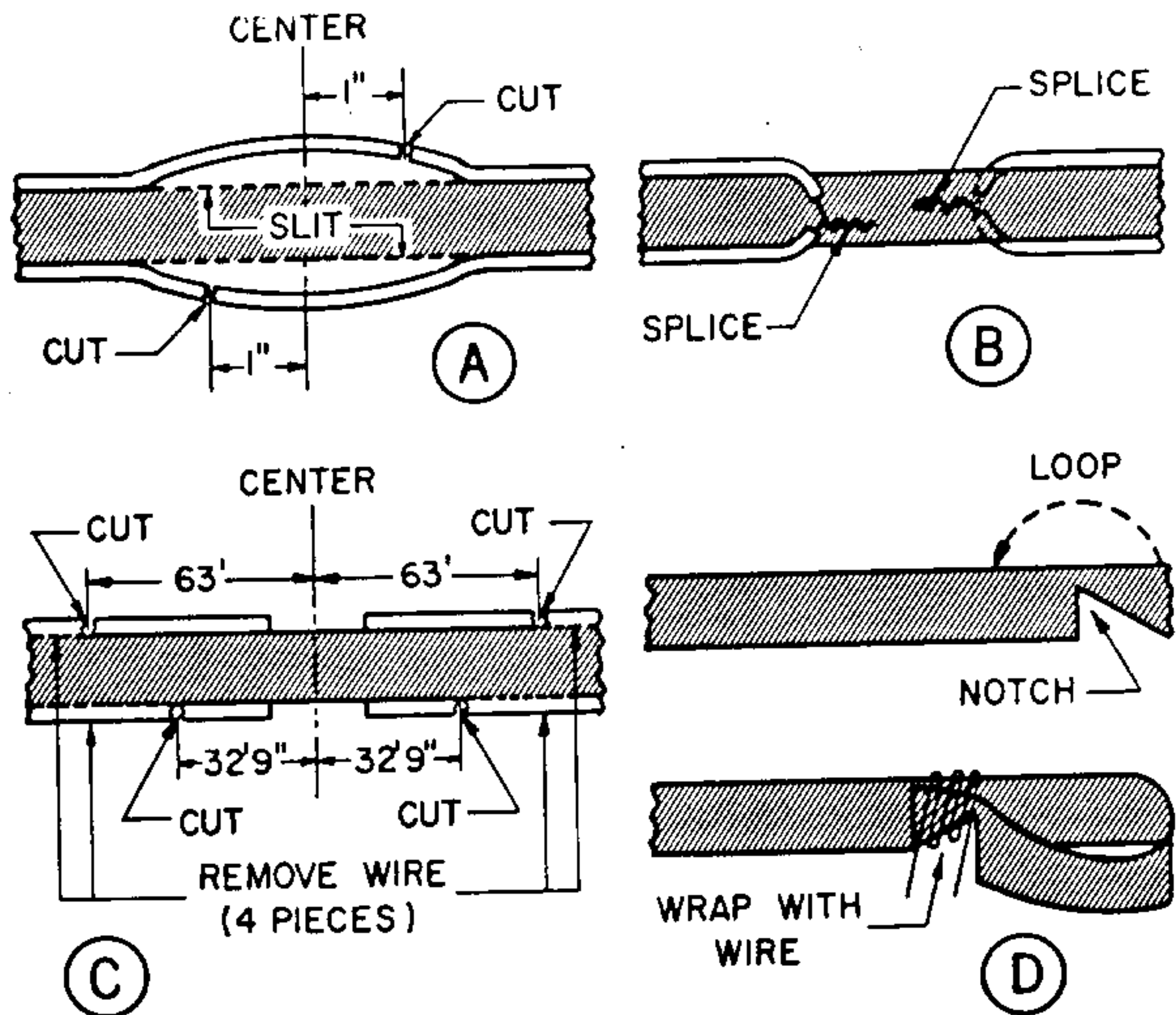


Fig. 8. Assembling a three-band dipole.

inch from the end of the slit. Strip the insulation from each of the four ends and twist together as shown in Fig. 8B.

Now measure exactly 63 feet from the center and cut one of the leads as shown in Fig. 8C. Carefully scrape the insulation from the wire just past the cut (toward the end of the wire) and rip the wire from the insulation all the way to the end of the lead.

Next, go back and measure a distance of 32 feet, 9 inches from the center along the other lead of the twin lead. Be sure you have the correct wire, then cut as before. Remove the insulation from the wire just past the cut and rip out the wire from the insulation.

Cut a notch in the end of the lead as shown in Fig. 8D, and fold it back to make a loop about 3 inches from the end. Tightly wrap a length of the wire you have just removed around the notched end to secure it in place. You may, if you wish, wrap the exposed wire with plastic tape to keep the wire from corroding and to make the joint more secure.

Repeat the above process on the other half of the antenna to finish the job. Finally, connect the center conductor and shield of your transmission line to the two exposed ends at the center of the antenna. Solder both connections and wrap with plastic tape for protection. The antenna may be erected simply by tying

ropes or cords to the two loops at the ends of the antenna and securing to suitable supports.

Although a simple dipole antenna will permit you to make contacts in all directions, its best radiation is in the direction perpendicular to the direction the wire runs. For example, if your antenna runs from east to west, your best radiation will be to the north and south. If you have a choice as to where to mount the antenna, select the direction which gives maximum radiation towards areas you are most interested in contacting.

#### TUNING WITH THE ANTENNA CONNECTED

The procedure for tuning the trans-

mitter when connected to the antenna is exactly the same as when using the dummy load, but the setting of the LOAD control may differ slightly because the antenna impedance may not be the same as that of the dummy load. In some cases, loading to 90 ma of plate current may occur with the LOAD control at or very near the 100 setting.

In order to speed the tuning-up process, and thus avoid causing unnecessary interference, many amateurs mark the TUNE and LOAD settings for the three bands on the transmitter panel with small pieces of masking tape. They can then preset these controls when changing bands, and need only "touch up" the tuning before being ready to transmit.

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## Operating Your Station

Lesson R102 contains information on cw operating procedure. If you are preparing to put your transmitter on the air for the first time, it would be well to review that lesson, particularly the Q signals and ending signals. You will also need to set up your log book, to record all of your transmitting operations as required by the FCC. You may make up your own log in any form which complies with the regulations, or you may buy log forms available from the American Radio Relay League and others (and sold by most electronics parts stores.)

To speed up the conveying of information by radio-telegraphy, most amateurs use cw abbreviations of commonly used words and expressions. Some of the most used abbreviations are shown in the

following list. The meaning of others will usually be clear from the context. Don't try to abbreviate everything - you may not be understood.

U	= you
UR	= your
VY	= very
ES	= and
FB	= fine business
HI	= laughter
OM	= old man
YL	= young lady
XYL	= wife
RX or RCVR	= receiver
TX or XMTR	= transmitter
OP	= operator

GE = good evening  
 AGN = again  
 CUL = see you later  
 CUAGN = see you again  
 BCNU = be seeing you  
 ADR = address  
 CUD = could  
 HW = how  
 HR = here, hear  
 PLS or  
 PSE = please  
 SRI = sorry  
 TNX = thanks  
 TU = thank you  
 WX = weather  
 CONDX = conditions  
 B4 = before  
 73 = best regards  
 88 = love and kisses

### SIGNAL REPORTS

One of the first things any amateur wants to know is how his signal sounds at the other end. It is therefore customary for each station in a contact to give a signal report to the other soon after a contact begins. The system which has evolved for doing this in a standard way is known as the RST report, meaning Readability, Signal strength, and Tone. If someone tells you your signal is RST 579, he means it is perfectly readable, moderately strong, and has a "pure dc" tone. The definitions for the RST report are:

- 1 - Unreadable
- 2 - Barely readable, occasional words distinguishable
- 3 - Readable with considerable difficulty
- 4 - Readable with practically no difficulty
- 5 - Perfectly readable

### SIGNAL STRENGTH

- 1 - Faint signals, barely perceptible
- 2 - Very weak signals
- 3 - Weak signals
- 4 - Fair signals
- 5 - Fairly good signals
- 6 - Good signals
- 7 - Moderately strong signals
- 8 - Strong signals
- 9 - Extremely strong signals

### TONE

- 1 - Extremely rough hissing note
- 2 - Very rough ac note, no trace of musicality
- 3 - Rough low-pitched ac note, slightly musical
- 4 - Rather rough ac note, moderately musical
- 5 - Musically-modulated note
- 6 - Modulated note, slight trace of whistle
- 7 - Near dc note, smooth ripple
- 8 - Good dc note, just a trace of ripple
- 9 - Purest dc note

# Maintenance

In the unlikely event that you encounter difficulty with your transmitter, the following information may help you locate the difficulty. Carefully inspect your work for poor solder joints, incorrect wiring, and the proper parts in the proper places.

Check your symptoms against those in Table II, then look for the possible causes given.

Tables III and IV give typical voltage and resistance measurements for the

transmitter. Voltage measurements were taken with a 20,000-ohms-per-volt meter, with a line voltage of 118 VAC, transmitter loaded to a current of 90 ma on the 80-meter band. Resistance measurements are made to ground (chassis). Remember to disconnect your transmitter from the power line before taking resistance measurements. A schematic diagram of the transmitter is on page 20.

If your transmitter develops a trouble that you cannot locate, write to your

SYMPTOM	CHECK FOR:
Dead - no filament, no pilot light	<ol style="list-style-type: none"> <li>1. Incorrect wiring of on-off switch and terminal strip U</li> <li>2. Blown house fuse</li> <li>3. Defective wall outlet</li> </ol>
Current meter shows no reading when key is closed	<ol style="list-style-type: none"> <li>1. Incorrect wiring of keying and meter circuits.</li> <li>2. Defective meter, rectifier, or transformer</li> <li>3. RFC1 open</li> </ol>
Does not load properly	<ol style="list-style-type: none"> <li>1. Antenna impedance incorrect</li> <li>2. TUNE control set to wrong frequency</li> <li>3. BAND switch on wrong band</li> </ol>
No oscillation (I <sub>1</sub> does not light, current does not dip)	<ol style="list-style-type: none"> <li>1. S1 incorrectly wired or set</li> <li>2. L1, L2, C12, or C14 incorrectly wired</li> <li>3. I<sub>1</sub> or crystal defective</li> </ol>
Unable to load to 90 ma	<ol style="list-style-type: none"> <li>1. R3 or R4 defective (check key up and key down voltages at terminal 24)</li> <li>2. Incorrect antenna</li> </ol>
"Chirps" when keyed	<ol style="list-style-type: none"> <li>1. TUNE control improperly set</li> <li>2. Weak or dirty crystal</li> </ol>

TABLE II. Transmitter troubleshooting chart.



NRI Instructor, explaining the exact nature of your trouble. Include the results of any tests that you have conducted in trying to locate the difficulty. Make a voltage chart giving the reading that you get on your instrument. Try to give us enough information so we can analyze your trouble, and send you the information necessary to put your transmitter into operating condition. If all else fails, we will ask you to send the transmitter to us for repair. We do not want to do this, because you would not then have

the confidence-building experience of finding and fixing the difficulty.

TER-MINAL	VOLTAGE	
	Key Up	Key Down
23	+ 380 vdc	+320 vdc
24	+320 vdc	+170 vdc
43	+72 vdc	0 vdc
V2	6.9 vac	6.8 vac

TABLE III. Voltage table.

TER-MINAL	RESISTANCE	
	Key Up	Key Down
V1	$\infty$	$\infty$
V2	0.2 $\Omega$	0.2 $\Omega$
V3	$\infty$	$\infty$
V4	47K	47K
V5	47K	47K
V6	$\infty$	$\infty$
V7	0	0
V8	$\infty$	150 $\Omega$
23	57K	57K

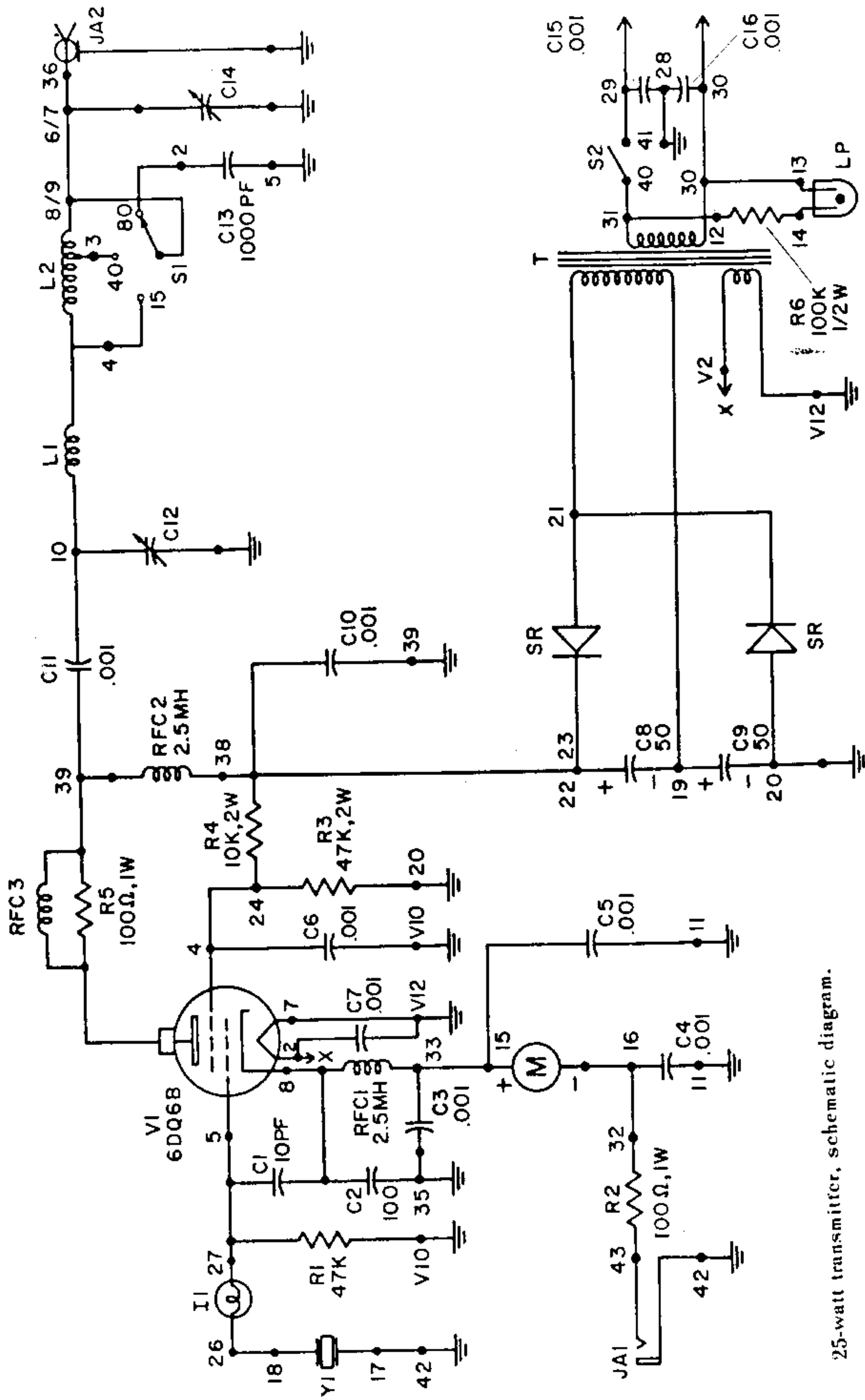
TABLE IV. Resistance table.

# Parts List

QUAN.	PART NO.	SYMBOL	DESCRIPTION	PRICE EACH
<b>CAPACITORS</b>				
1	CN36	C1	10 mmf, ceramic	.15
1	CN4	C2	100 mmf, mica	.19
1	CN6	C13	1000 mmf, mica	.45
9	CN34	C3, C4, C5, C6, C7, C10, C11, C15, C16	.001 mfd, disc ceramic	.15
2	CN149	C8, C9	50 mfd, 200-volt electrolytic	.82
2	CN156	C12, C14	2 section variable	1.57
<b>COILS</b>				
1	C04	RFC1	2.5 mh rf choke	.60
1	C061	RFC2	2.5 mh self-supporting rfc	.99
1	C094	L1	15 meter	.50
1	C095	L2	80-40 meter tapped	1.30
<b>HARDWARE</b>				
1	CL12		Plate cap clip	.15
3	GR1		3/8" grommets	12/.25
6	HA5		3/8" spacers	.08
1	HA31		Potentiometer ground lug	12/.25
1	LU5		No. 6 ground lug	12/.15
2	LU7		Solder lugs	12/.15
1	NU8		Hex nut, 2-56	12/.15
4	NU5		Hex nuts, 4-40	12/.15
8	NU1		Hex nuts, 6-32	12/.15
4	NU3		Hex nuts, 8-32	12/.15
1	ST4		6-lug terminal strip	.14
3	ST15		4-lug terminal strips	.10
1	ST22		1-lug terminal strip	.05
1	WA14		Flat washer	12/.15
18	WA15		Lockwashers No. 6	12/.25
1	WA16		Lockwasher No. 8	12/.15
<b>RESISTORS</b>				
(All resistors are 10%, 1/2-watt unless otherwise specified)				
1	RE35	R1	47K, 1/2 watt	.15
1	RE36	R6	100K, 1/2 watt	.15

QUAN.	PART NO.	SYMBOL	DESCRIPTION	PRICE EACH
2	RS6	R2, R5	100-ohm, 1 watt	.18
1	RS87	R4	10K, 2 watt	.24
1	RS78	R3	47K, 2 watt	.24
<b>SCREWS</b>				
1	SC34		1/2" X 2-56	12/.25
4	SC6		1/4" X 4-40	12/.15
11	SC1		1/4" X 6-32	12/.15
6	SC47		9/16" X 6-32	12/.25
2	SC45		Self-tapping, No. 6	12/.25
8	SC46		No. 6 Phillips head	12/.25
<b>MISCELLANEOUS</b>				
1	CB4		Cabinet	6.76
1	CH52		Chassis	2.10
1	HA29		1-1/2' length solder	.06
1	JA2	JA1	Key jack	.35
1	KE4		Telegraph key	1.30
3	KN11		Red bar knobs	.17
1	LP1	I1	No. 40 pilot lamp	.12
1	LP8	LP	Neon lamp assembly	.32
1	ME17		150 ma DC milliammeter	3.02
1	PA20		Panel	5.00
1	PC1		Line cord	.40
1	PL2		Plug	.63
1	SO4		Pilot lamp socket w/grommet	.16
1	SO16		Octal tube socket	.16
1	SO34		Crystal socket	.36
1	SO37	JA2	Chassis coax socket	.82
1	SR8	SR	Dual silicon rectifier	1.75
1	SW14	S1	1-pole 3-position rotary switch	1.10
1	SW30	S2	Spst slide switch	.21
1	TR48	T2	Power transformer	6.12
1	TU33	V1	6DQ6B tube	2.10
1	WR57		4' length hookup wire.	*
1	WR220		3' length twisted pair	.35
1	WR275		5' length twisted pair	.59

\* Additional wire available in 12' lengths only each color 25¢.



25-watt transmitter, schematic diagram.