HOW TO GET THE MOST OUT OF A SHORT-WAVE RECEIVER

By ROBERT HERTZBERG

THERE are many owners of short-wave receivers who have picked up broadcasting stations in distant parts of the world with little trouble. There are also many who barely manage to bring in the harmonics of some badly adjusted local stations, and who are beginning to think that this whole short-wave business is a lot of bunk. For people in the latter class this article, telling how they may improve their reception, is intended.

The advice contained herein applies to the Super-Wasp receiver.—EDITOR.

THE following instructions and hints on the tuning of short-wave receivers may be applied to practically all existing types of short-wave instruments. However, because so many readers of RADIO DESIGN have made "Wasp" sets in accordance with the data published in our Fall, 1928 number, this particular outfit will be taken as the model.

Let us assume that you have already assembled the set and have it connected to the necessary batteries and the usual aerial and ground. You have already used it for a while —a few evenings, let us say—and are rather disappointed in not hearing those much-mentioned foreign stations. We will also assume that all the wiring is correct; few people fall down on this point, because the hook-up is such a simple one and the large blueprint furnished with the kit makes every connection plain.

SET MUST OSCILLATE

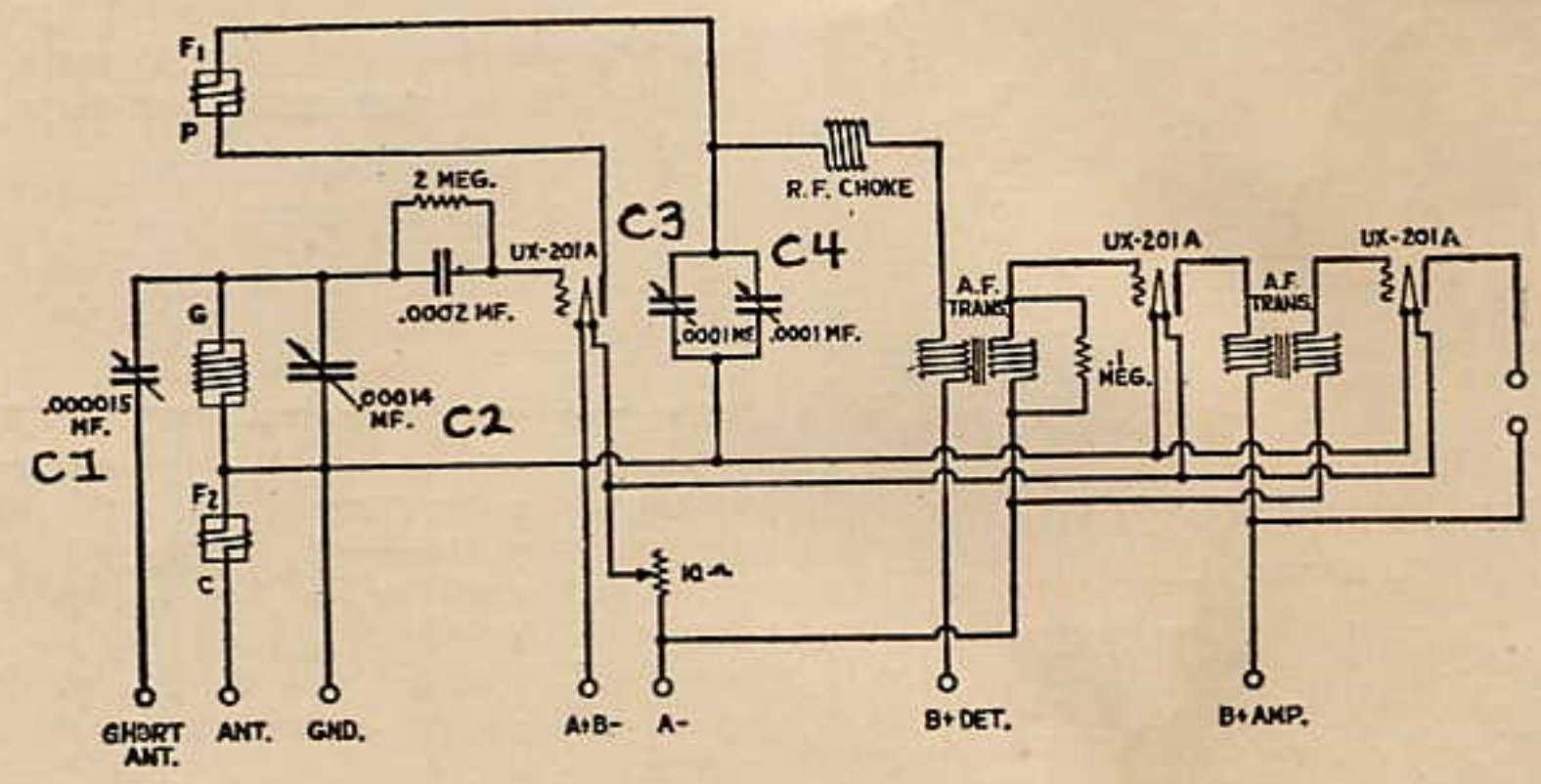
The first thing to learn is that a short-wave receiver is absolutely worthless unless it can be made to oscillate smoothly over the entire range of the tuning condenser, with each coil. Oscillation in a regular broadcast set is usually a nuisance, because it is difficult to control, but in a short-wave outfit it is the whole life of the circuit.

If your tubes and batteries are good the factor that determines whether or not the set will oscillate is the aerial series condenser—the small one on the sub-panel. However, before starting to adjust this, fasten the aerial wire under the post marked "ant." This will connect it to the fixed primary winding on the Pilot plug-in coil.

Put the green-ring coil in the socket and switch on the set by turning the rheostat knob around to the right. Set the tuning condenser C2 (the one controlled by the vernier dial) at O, and set the upper regeneration condenser (which we will call C3 for convenience) about half way up. Now slowly advance the lower regenerations condenser C4. Somewhere along it you should hear a soft, hushing sound which will build up into a sharp plop and then disappear. If you don't hear anything more than the usual slight tube noises, which indicate that the circuit is alive, the set does not oscillate, and you should connect the aerial wire to the other post, marked "Short Ant."

ADJUSTING THE AERIAL CONDENSER

By doing so, you connect the aerial to the grid of the detector tube through the midget condenser C1 on the sub-panel. Set this condenser at about half its capacity, and repeat the foregoing operation. Try turning the tuning condenser to different settings, and listen



The hook-up of the Pilot "Wasp." C1, antenna condenser; C2, tuning condenser; C3, C4, regeneration condensers.

and with the set pushed back so that your elbows are resting on the table.

TWO METHODS OF TUNING

There are two methods of tuning-in broadcasting stations with a regenerative receiver.

Starting at O, turn up the tuning condenser slowly with the left hand, and keep the set oscillating by manipulating the regeneration condenser C4 with the right hand. When you run into the signals of a broadcasting station you will hear a whistle mixed in with badly distorted music or voice. You hear this mixture because the incoming signals are beating or "heterodyning" with the oscillations produced locally in the receiver. To clarify the signals, turn down the regeneration condenser very, very carefully, at the same time twisting the vernier dial back and forth a fraction of a degree to keep the tuning accurate. The music should clear up just as the whistle disappears. If the music disappears *with* the whistle, or becomes too weak to be understandable, you will have to try the second method, which is known as "zero beating."

With the foregoing method, you hear a whistle because the frequency of the broadcasting station's carrier wave is just a little different from the frequency of the oscillations generated by the receiver circuit. If you leave the set oscillating, but tune it with extreme accuracy to the *same* frequency as the incoming carrier wave, you will not hear a whistle, because the difference between the local and the incoming oscillations is zero, and no beat notes will be produced. However, the voice and music impulses, which cause the carrier to wobble slightly, will come through, and you will be able to distinguish the program. The signals are likely to be somewhat distorted, but you won't mind that.

You can tell when you are zero-beating a station by turning the tuning condenser a hair's breadth above and below the point at which the signals are understandable and clear of whistling. You will hear a whistle each time, as each time you move the condenser you change the frequency of the local receiver circuit and therefore cause a beat note to be set up.

Zero beating is an excellent means of fishing out very weak stations, because the receiver is in a very highly sensitive condition when it is oscillating.

Many weak and distant stations that you cannot hear at all with the set thrown just out of oscillation you at least will be able to identify if you zero-beat them.

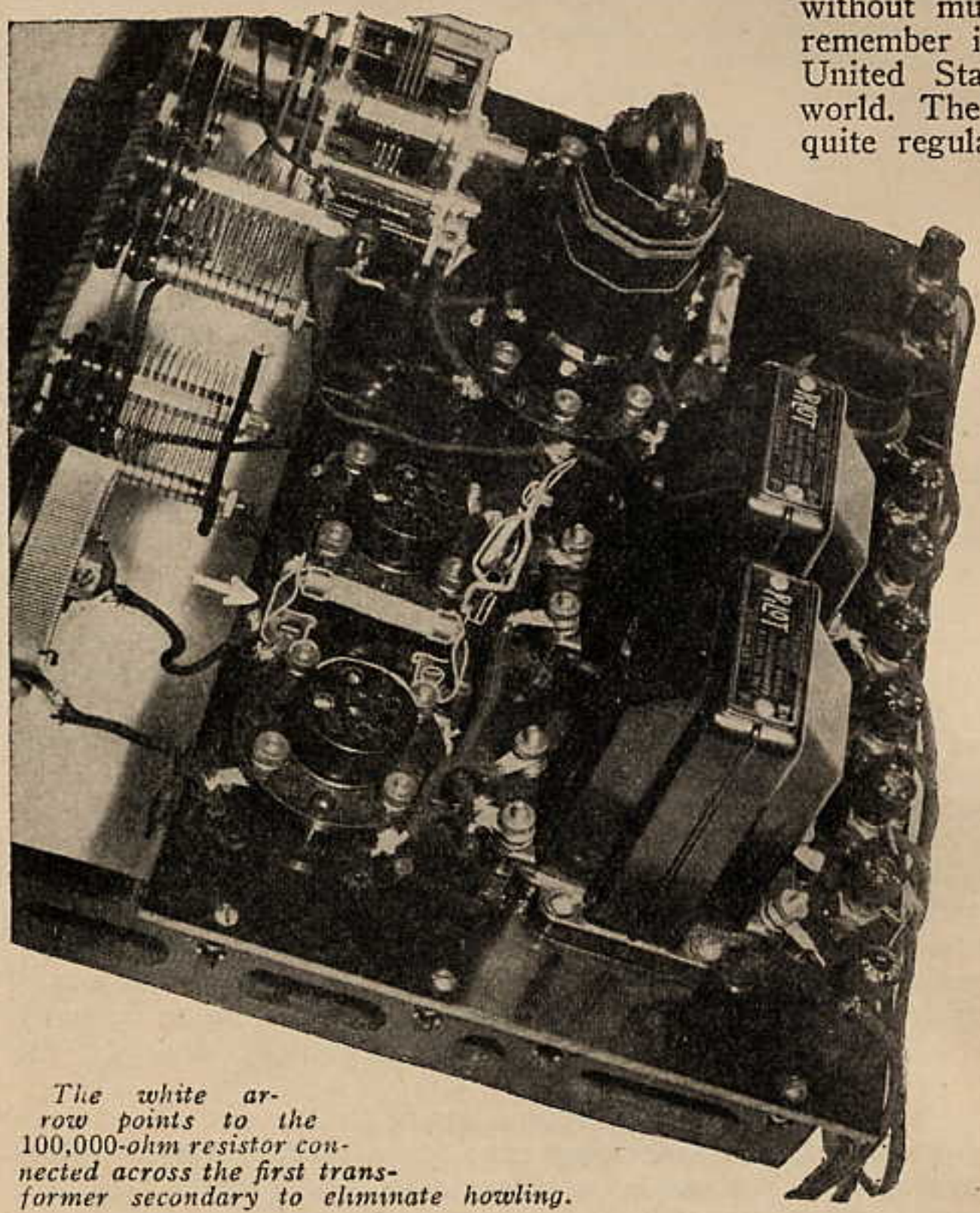
LEARN THE CODE!

In running up and down the scale with each coil you will encounter hundreds of code stations. If you learn the code you can have loads of fun identifying them and listening to their exchange of messages. An easy method of learning the code is described in "The Radio Amateur's Handbook," the official manual of the American Radio Relay League. You can obtain copies through RADIO DESIGN at a dollar apiece.

Once you have mastered the two tricks of tuning described in this article you will begin picking up short-wave broadcasting stations without much trouble. One thing you must remember is the time difference between the United States and other countries of the world. The European stations are heard here quite regularly around supper time, 5SW at Chelmsford, England, and PCJJ, at Eindhoven, Holland, being the star performers. PCJJ in particular comes through with terrific volume sometimes, many Wasp owners reporting fine loud-speaker signals. The Australian stations also roll in nicely, and you can hear them if you care to roll out of bed about 5 o'clock in the morning.

The directions given in this article apply to the new Super-Wasp as well as to the regular Wasp. The only difference is that you have to advance two tuning dials. This sounds complicated, but in practice is really easy. The same tricks of regeneration control and zero-beating can be used.

RADIO DESIGN will be interested in hearing from short-wave set owners and of their experiences with their receivers. Drop us a line, especially if you are having some little trouble; we will try to help you.

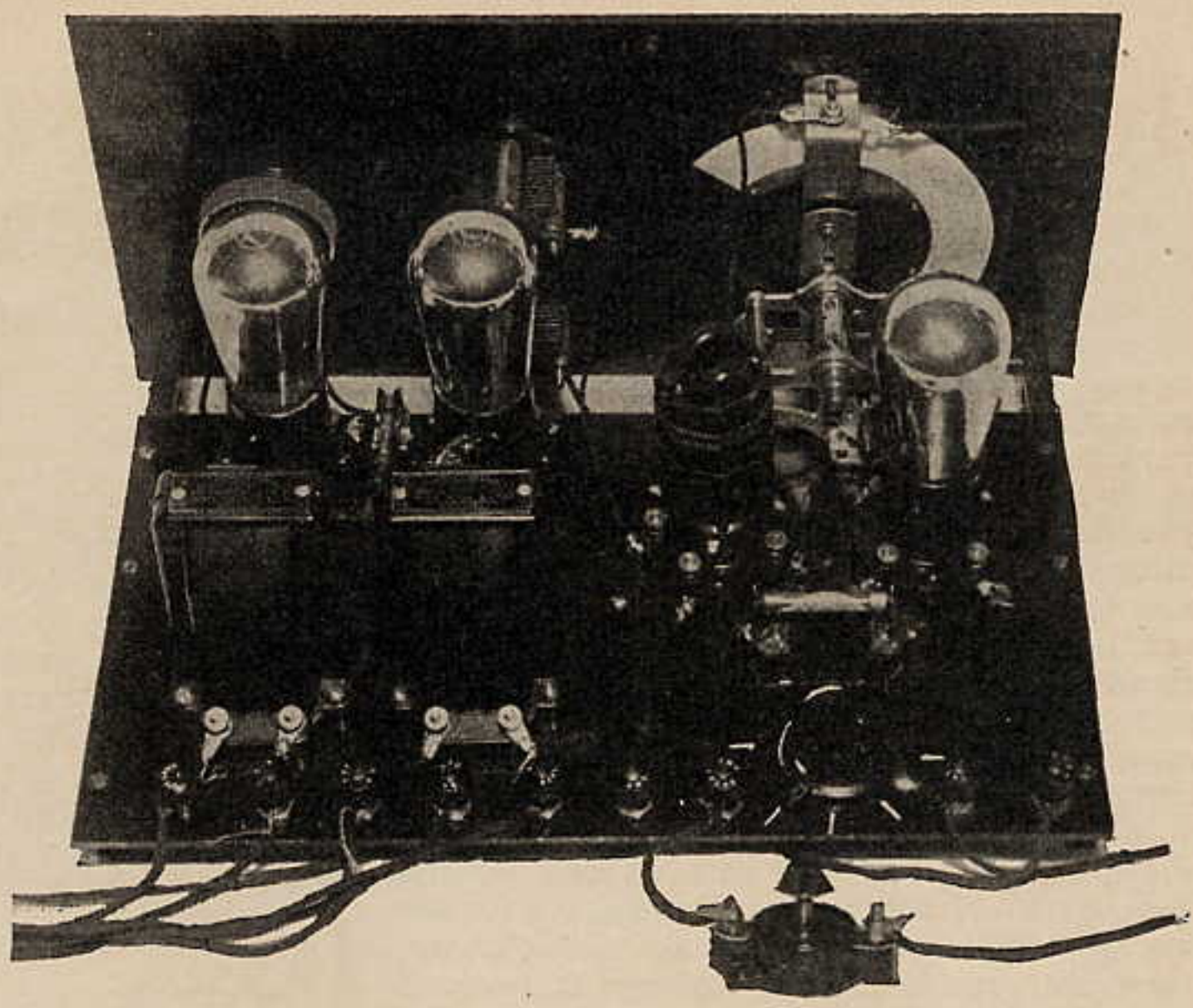


The white arrow points to the 100,000-ohm resistor connected across the first transformer secondary to eliminate howling.

for the telltale hush and plop. If you still are unsuccessful, or obtain the sounds over a limited portion of the tuning condenser scale, reduce the setting of the aerial condenser C1, and try again. You can determine the correct position for this condenser after ten minutes of trial. Mark a line or scratch on the sub-panel for this position, so that you can go back to it any time you want.

If the hush is followed by a prolonged squeal instead of a plop, don't worry about this yet, as you can clear it later.

Repeat these operations with each of the plug-in coils, in each case noting the setting of the aerial condenser. The primary connection in many instances works very well, but most Wasp owners report better results from the series-condenser arrangement.



Above: A "Wasp" receiver with a VM80 Micrograd in series with the aerial wire.

With the red and orange ring coils you may find that even with the antenna condenser at zero, the set will refuse to oscillate. This means that your aerial is too long. Instead of climbing up on the roof and cutting out a few yards of wire, connect another midget condenser in series with the aerial lead. The Pilot No. VM80 Micrograd, which has a capacity range of .00001 to .00005 mf., is ideal for this purpose. Try different settings of this condenser in conjunction with the sub-panel condenser C1.

The use of an external condenser is almost a sure cure for a non-oscillating set, especially when an aerial intended for long-wave broadcast reception is used.

If you happen to have twenty or thirty feet of insulated wire of any kind on hand, hang it out of the nearest window and use it as an aerial. You will find that even a shorter piece, thrown along the floor, will yield good results. The Wasp without any aerial at all will bring in many stations, as the pick-up effect of the coils themselves is enough to affect the sensitive circuit.

The blue ring coil, which is intended to cover the regular broadcast band, very rarely gives trouble. For loudest signals you probably will have to turn the antenna condenser C1 all the way in; or use the fixed primary. With the latter the tuning will be somewhat broader than with the series condenser arrangement.

KILLING THE SQUEAL

If you now can make all the coils oscillate readily at any setting of the tuning condenser C2, but find that the hushing sound is followed by a terrific squeal, first look at the 100,000-ohm fixed resistor connected across the secondard of the first A. F. transformer, and make sure that it *is* connected. Many severe cases of howling are due to defective or missing resistors.

The grid leak and the value of the "B" voltage applied to the detector tube are also important factors that determine how smoothly the set oscillates. Grid leaks of two, three, four and five megohms should be tried, and the "B" voltage varied by means of a series resistance like the Pilot Resistograd. A voltage of 22½ is usually about right for 201A tubes, although 45 may sometimes work better.

A word about tubes. The 201A's are the most satisfactory tubes for all three sockets in the Wasp. A 200A may be used as the detector and will prove more sensitive than a 201A, but it is somewhat noisy in operation. A 112A or 171A can be used as the second audio amplifier, but this means more "B" batteries. The 201A's in general are more convenient, as they require only 90 volts and will even work very well with only 45 volts. If you do not care to make much of an investment in batteries, and will do all your short-wave listening with earphones, a single 45-volt block will produce just as many signals—if slightly weaker ones—as two or three blocks.

After you have made the foregoing adjustments the receiver should be capable of smooth oscillation, under ready control of the two midget condensers C3 and C4. You will find that with the two smaller coils (those with the red and orange rings) the top condenser can be set at zero and all adjustments made with the bottom one. As you go up the wavelength scale you will need more and more capacity in the regeneration condensers. Use the top condenser as an auxiliary to the bottom one, as the latter is easier to handle, being nearer the bottom of the panel.

You are now ready to try for short-wave broadcasting stations. Make yourself comfortable, with your feet well under the table