A Monthly Department Edited by HERB BRIER, W9EGQ*

Good news for Novice operators is the prospect of additional frequencies. The Federal Communications Commission has proposed to permit Novice operation between 7,175 kc and 7,200 kc and to substitute 21,150 kc to 21,300 kc for the present 27-mc assignment.

At their annual meeting in May, the Board of Directors of ARRL voted in favor of a 7-mc assignment, but recommended that it be 7,150 kc to 7,200 kc. They voted opposition to moving the 27-mc Novice band to 21 mc, but they recommended that 51 mc to 53 mc be opened to Novice phone and c.w. operation.

It appears likely that Novice operation on 7 mc will be permitted very shortly, possibly early in July; however, it may be several months before the divergent views regarding the other bands are reconciled and an FCC regulation formulated. Incidentally, almost every amateur with whom I have discussed Novice frequencies believes that the FCC should authorize Novice operation on all amateur c.w. frequencies, retaining present Novice License regulations. It would be interesting to hear the opinions of more amateurs on this idea.

Multi-Band Novice Antennas

Half-wave antennas for the centers of the proposed new bands are 65 feet 3 inches, 22 feet, and 9 feet long, respectively. Few amateurs, however, have either the room or the inclination to erect separate antennas for each band they operate. This is especially true for frequencies below 30 mc. Fortunately, one properly-designed antenna can take the place of several, with no loss in efficiency. Although certain of the Novice bands are subject to change, it seems that now is the time to give some data on such antennas, especially when, as far as I know, no Novice operator wants an antenna usable only in the Novice bands.

Figure 1 shows the current distribution and the resulting radiation pattern of an antenna on its fundamental frequency (the frequency on which it is ½-wave long) and several multiples (harmonics) of this frequency. Each ½-wave segment of a multi-wave antenna radiates as if it were a simple ½-wave antenna, but it takes the r.f. current in the antenna a certain definite length of time (0.5/freq. (mc) seconds) to travel from one segment to the next. As a result, radiation does not occur from each segment at the same moment, resulting in increasing radiation in some directions and zero radiation (a null) in others. (Those who are familiar with Vector Algebra know how differing forces can produce a resultant different from any of the original forces.)

As the antenna becomes longer (measured in wavelengths), the percentage of power in the lobe of radiation closest to the axis of the antenna slowly increases. A 3.7-mc ½-wave antenna, therefore, becomes a rather effective beam antenna in directions approximately twenty-five degrees from the axis of the antenna on 27 mc and 50 mc, where it is seven and fourteen ½-waves long, respectively. Even on these frequencies, the radiation from the minor lobes make it a good all-around radiator.

Center-fed antennas perform differently than end-fed antennas in several respects on even harmonics. Compare *1E* with *1B*. Whereas the currents in each half of the end-fed antenna are out of phase, they are in phase on the center-fed one. This current distribution makes the latter type of antenna act like two antennas in parallel on even harmonics, causing the most significant difference in radiation patterns on the second harmonic. Instead of the clover-leaf pattern of the end-fed antenna, it produces a sharpened version of that from a ½-wave antenna. The sharpening results in not-quite two db gain in its favored direction, compared to a ½-wave antenna,

The neat station of Dick Powell, W8IJM, who recently graduated from the Novice ranks. The transmitter ends up in a pair of 807s. The receiver is a National NC-240D. Dick is fifteen years old and in the ninth grade

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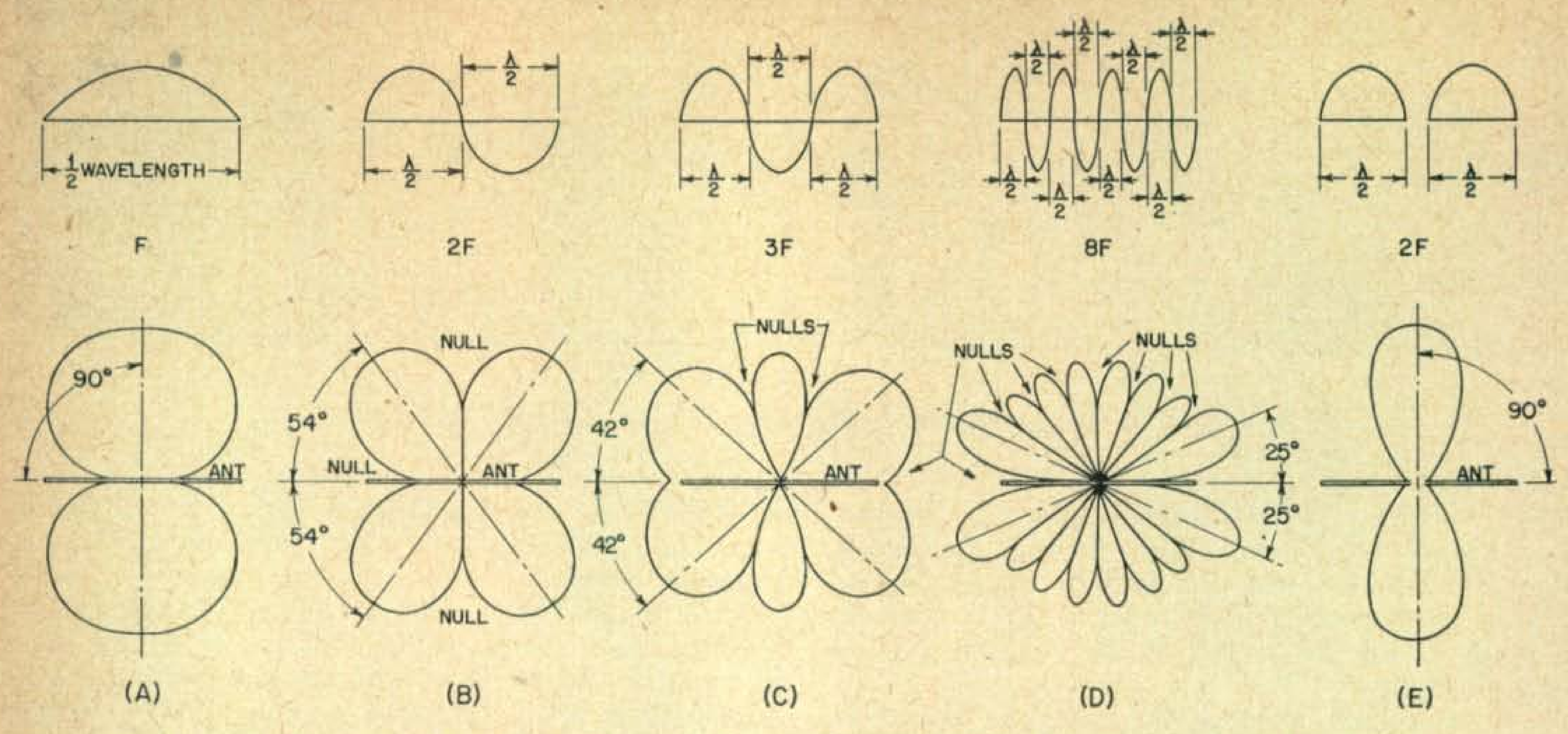


Fig. 1. Current distribution and radiation patterns of typical harmonically related and operated antennas. A to D are end-fed. E is center-fed. See text for details and application to Novice problems.

at the cost of lessened radiation in other directions.

At higher even harmonics, the pattern of a center-fed antenna resembles that of a ½-wave antenna half as long.

Another characteristic of a simple antenna is that its center impedance changes from around seventy ohms on its fundamental frequency to a very high impedance on even harmonics. This makes a doublet fed with a low-impedance feed line or a folded dipole an inefficient multi-band antenna. Either works on odd harmonics; therefore, one cut to a length of 68 feet 5 inches can be used on both 7mc and 21 mc. The folded dipole is to be preferred in this application, because it is more tolerant as to length than the doublet.

Determining The Length Of A Multi-Band Antenna

It takes no genius to discover that there is no exact harmonic relationship between frequencies in the various existing and proposed Novice h-f bands. We also know that, because of so-called "end effects," a ½-wave antenna is approximately five per cent shorter than a ½ wave in space. On the other hand, no matter how long an antenna is, it has only two ends; therefore, a long one is less affected by end effects than a short one. The general formula for calculating antenna length recognizes this fact. It is:

Length (feet) = 492 (N-0.05) / Freq. (mc)

Where N equals the number of ½-waves on the antenna.

When N equals 1, this formula reduces to the familar one used for calculating ½-wave antennas:

Length (feet) = 468/Freq. (mc).

By manipulating the formula, it will be found that a length of approximately 126 feet is resonant near the low-frequency end of the 3.7-mc band as a ½-wave antenna and near the high-frequency end of the 27-mc band as a seven ½-wave antenna. This length is about 9 feet too short for a two ½-wave antenna at 7.175 mc, but will be satisfactory for this frequency, because the antenna tuner will resonate the entire system—feed line and antenna—to the operating frequency.

Although this length would be usable on 21 mc, better results would be obtained by making it six ½-waves long at this frequency, or 138 feet. It might be thought that there is little to choose between the two lengths, because, while 126 feet is twelve feet too short for 21 mc, 138 feet is twelve feet too long for 3.7 mc. However, twelve feet is over a ¼-wave at 21 mc, but is less than ten per cent of ½-wave at 3.7 mc. This indicates why it is usually better to make the length of a multi-band antenna correct for the highest frequency to be used. The resulting error will be less, percentage-wise, on the lower frequencies than it would be on the higher frequencies if the procedure were reversed.

Details are given in *Fig. 2*. If there is a choice, center feed is to be preferred, because the equal loading on each conductor in the feeder will reduce line radiation. Do not fret too much about it, however, if your layout makes end feed necessary. You won't lose too much.

Antennas For Restricted Space

Three antennas, suitable for use where space is limited, are sketched in *Fig. 3*. Their operation as bent or partially-folded ½-wave antennas on certain frequencies should require no explanation, but operating *3C* in conjunction with a ground connection merits some explanation.

A grounded antenna exhibits many of the characteristics of an ungrounded one twice as long, and under proper conditions, it is an efficient radiator. The conditions are that the ground connection must have very low resistance and that the lower part of the antenna (which does most of the radiating) must be out in the clear. Neither are often met in practice; therefore, an appreciable portion of the power fed into the antenna is wasted as heat in the ground connection, and the radiated fields are subject to absorption and distortion by nearby trees, buildings and similar objects. In spite of these handicaps, some grounded antennas erected in poor locations radiate surprisingly well.

Constructional data and the theory of operation of an efficient, grounded, vertical antenna, usable on 3.7 mc and 7 mc, is described in *QST* for May, 1952. ("The Truth About The Vertical Antenna," by B. W. Griffith, W5CSU.) Particular

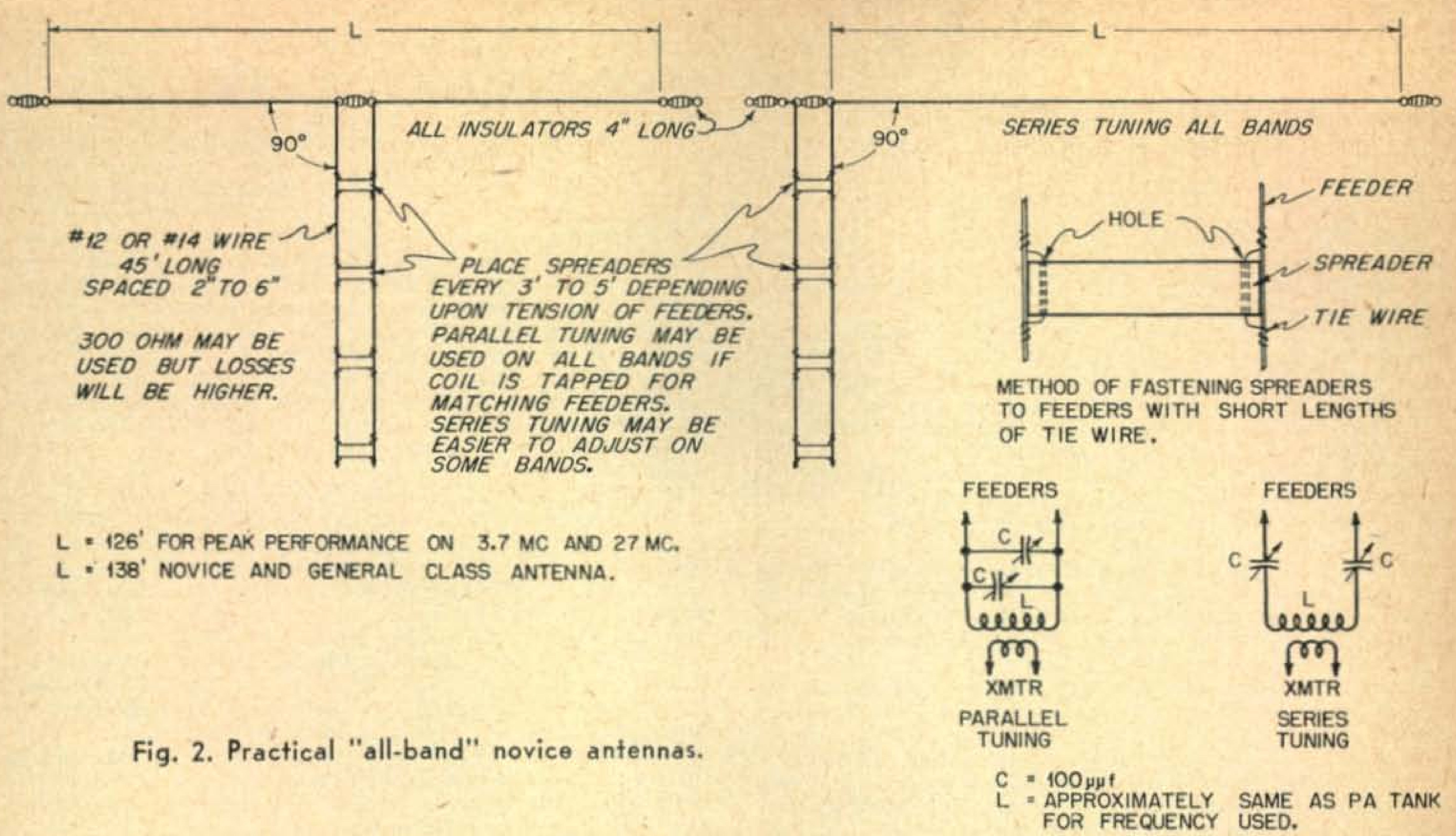


Fig. 2. Practical "all-band" novice antennas.

attention is called to the effort required to obtain a low-loss ground.

A Simple Rotary Beam For 146 Mc

Until the question of whether 21 mc or 27 mc is going to be the Novice assignment is settled, there seems to be little point in describing beams for either band. One of the 146-mc band, however, would be desirable for any occupant of the band, and the one to be described is simple enough to be duplicated by almost any Novice.

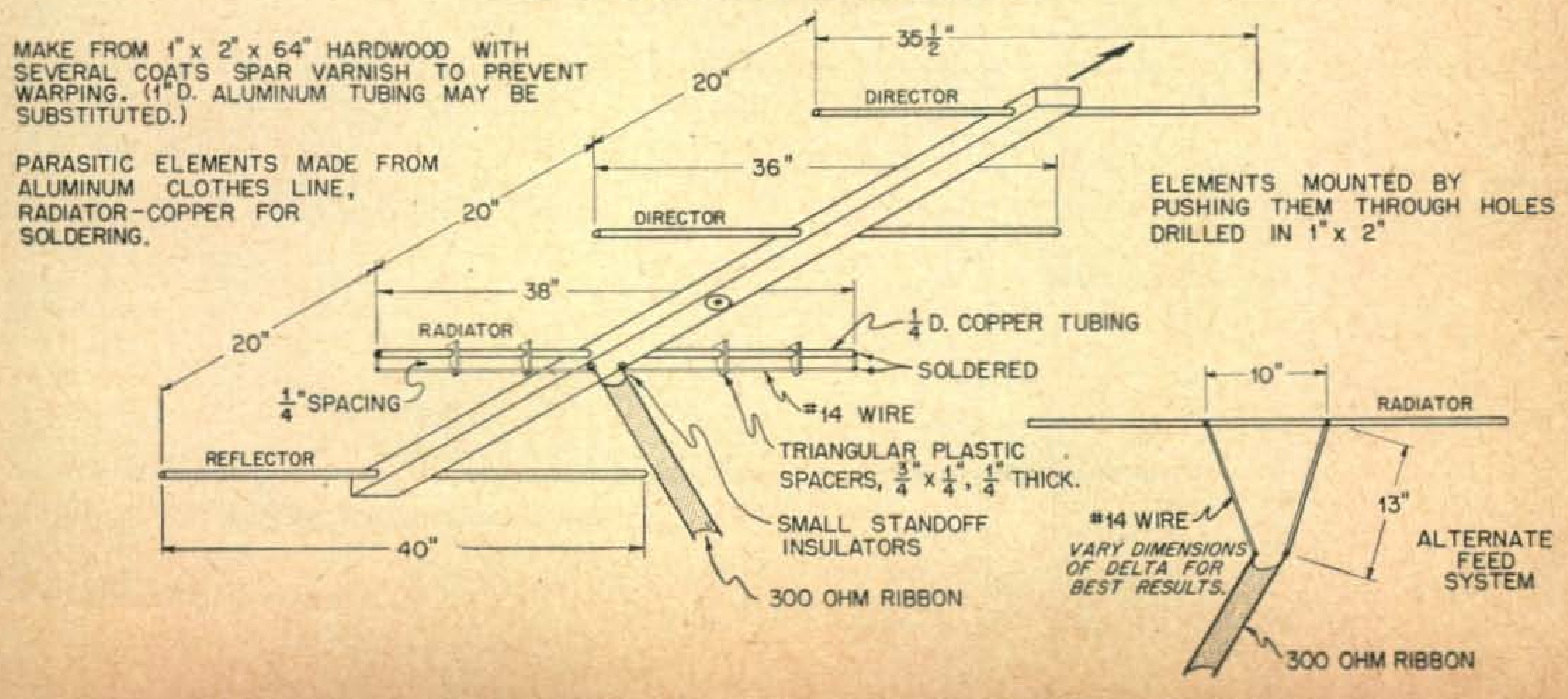
Most rotary beams consist of a ½-wave radiator and one or more parasitic elements, spaced 1/10 to 1/3 of a wavelength from the radiator. Within these spacings, a parasitic element approximately five per cent shorter than a ½-wave is a director, and one approximately five per cent longer is a reflector. The wider spacings make element lengths less critical and give slightly higher gain, when more than two elements are used, compared to closer spacings.

A good, two-element beam will increase effective power about two times, compared to a ½-wave doublet, and a four-element one will increase it up to five times. Gains of over 100 are possible with many elements in the proper configuration, but they are hardly Novice antennas. Four elements is a good compromise for a first 146-mc beam, because it gives excellent results, without excessive complications.

The dimensions in *Fig. 4* are for a frequency of 146 mc, making the beam usable over the entire Novice band. 300-ohm ribbon is used to feed the beam, because it is easier to make work reasonably well at this frequency than some other types. If it is exactly matched to the antenna, its length will have negligible effect on transmitter loading. You probably will not be that lucky; therefore trimming line length a few inches at a time may help in getting it to draw power from the transmitter. In any event, do not make the line any longer than necessary, as losses in it will decrease the effective gain of the beam.

Over normal VHF paths, receiving and transmitting antennas must use the same type of polarization for best results. Arguments over whether it should be horizontal or vertical resemble arguments over the relative beauty of blondes and red heads.

Fig. 4. The 2-meter novice antenna.



The figures cited are interesting, but prove little. The wisest thing to do is to use the polarization preferred in your area or to mount the array on a hinge; so that either may be used.

Miscellaneous

Gene, **WN4UVR**, writes, "I read Don's note about how long it takes to get a license, but he needn't worry. They told me the same thing (three to six months delay), but it only took a month and a day."

Spencer, **WN1NVN**, writes, "I received my license six weeks after taking the examination. I had made previous arrangements with Charles Wood, W2VMX, operator at W1AW, to operate that station when I got my license; so I went out there the same day. My first contract was with W1KOW on 146-mc phone. Then I contacted WN2HCZ on 3,706 kc. It was a little work cranking the normal kilowatt input used by W1AW down to fifteen watts. The rhombic antenna helped a wee bit in getting out, hi, hi.

"W2VMX said, to his knowledge, I was the first Novice ever to operate W1AW. It was a real thrill for me to make my first contacts from such a famous station. I sent WN2HCZ a W1AW QSL card with my name and call on it to confirm the contact.

"My own station consists of an SX28A receiver, 6-9 mc standby receiver, 35-watt transmitter, and a ¼-wave antenna."

(W1AW is the headquarters station of the ARRL.)

Jim, **WN9OZN**, and his station received a very fine write-up in **The Tipton (Ind.) Tribune.** Louis, **W9ESQ**, forwarded it to me, and Miss Kathleen O'Banion, Associate Editor of **The Tipton Daily Tribune**, who wrote the article, has granted permission to quote from it and use the photographs accompanying it. The photographs make it unnecessary to describe Jim's equipment, and the QSL cards prove he gets out. Antenna is end fed and 125 feet long, with one end tied in a tree. Power input averages thirty-five watts. Best DX has been 1,700 miles, and Jim's ambition is to work Rhode Island. With over 400 contacts in less than five months, its realization should not be too long delayed. Jim will then "dig happy."

Ira, now **W2HMR**, suggests a box in each **Novice Shack**, containing the calls of Novices who have knocked the "N" out of their calls in the preceding month. I wonder if other readers would prefer such a special listing over the present method of making the news part of the item concerning the station. At any rate, George, **W2JGB** is ex-WN2JGB.

"As for code, I recognize this as part of their grade in my Electricity Class. In the laboratory, we have oscillators, a code machine, and three transmitters—75 watts on 4-mc phone, and two one-tubers on the 3.7-mc Novice band. Most of the studying was done at noon and after school. One stunt was for me to put W1AW's code-practice transmissions on a wire recorder, which I brought to school for the boys to copy."

Brother Louis, **W3RZZ**, writes, "At West Catholic High (Philadelphia, Pa.), we have a radio club. Five of the members, WN3PTA, WN3TPB, WN3TPC, WN3TPN, and WN3TPP, have obtained their Novice licenses. One, Frank Thornton, age 14, has earned his General-Class license. We will also send ten more boys down next week for their Novice and Technician licenses.

"Six of the boys have good receivers, because other hams have given them nice prices on their used receivers, and they want the old-timers to know that they appreciate this.

"I think the boys deserve a lot of credit, because they come in for lessons at 8:00 AM, which is one hour before school starts. This means a lot, because half of them travel to the city from the suburbs."

W1NOA is responsible for the following items. Steve, WN1TUC, and Freq., WN1UHU, son of W1UJS, are members of the Stamford, Conn., AREC. Steve saw experience with the AREC in a recent surprise CD drill. Both would be eligible to operate one of the club's nineteen 146-mc mobiles if they were not too young to obtain a driver's license, being Junior High School pupils. One of their teachers is W1PCZ. The Stamford Radio Club is proud of their youngest members. . . . Paul, WN1USF, is secretary of the Radio Club of Fairfield University, Fairfield, Conn.

WNØHFY reports a new Novice net. WØDYD and WNØGHX are net controls. It meets a 3:00 PM Saturday and Sunday and 5:00 PM Tuesday and Thursday. All Novices around Minnesota are welcome to join. Write to Bill Blass, WNØHFY, 3309 Abbott, N., Robbinsdale, Minn., for further information. . . . Ladd, **W9CYD**, reports that the Chicago Suburban Radio Association meets the first Friday of each month at the Broadview Village Hall, Broadview, Illinois. Novices and Technicians welcome. Contact Peter P. Forst, Jr., Secretary, 2016 South 11th Ave., Maywood, Ill., for further information. . . . Dick, **WN8IJM**, is now W8IJM. He is fifteen years old, and in the ninth grade. He worked forty-one states on the 3.7-mc band with sixty watts input and a ½-wave antenna fifteen feet high. Present transmitter ends up with a pair of 807's completely shielded, with built-in low-pass filter, and is TVI-proof, feeding an all-band, center-fed antenna, 136 feet long.

Two beginners who would like the assistance of someone in their localities in obtaining Novice licenses are, Peter Stanck, 9355 S. Peoria St., Chicago 20, Ill., Telephone, Hilltop 5-0314, and Gerald Bakke, 3801 Proctor St., Flint, Michigan.

Questions From Novices

Q. Can you suggest a method of improving the keying of TBS-50 transmitters?—WN4VIV

A. Disconnect the end of RFC1, oscillator cathode r.f. choke, from the keying line and connect it to chassis ground. This change will permit the oscillator to run as long as plate voltage is applied to the transmitter, which will improve keying, but will prevent working "break in." A SPDT toggle switch may be installed, to permit choice of either connection.

Q. How can I improve the selectivity of my 3-6 mc "Command" receiver?

A. Connect a 1-10 $\mu\mu$f trimmer condenser between the grid and plate terminals **(pins 8 and 4)** of the first i.f. tube to introduce regeneration in the i.f. amplifier. Adjust its value; so that the stage breaks into sustained oscillation, indicated by a steady whistle from the phones with the BFO on, with the gain control near maximum. Setting the gain control just below the oscillation point will increase selectivity considerably. Touch up i-f tuning after adding capacity.

Keep the letters and pictures coming. See you next month.—Herb.

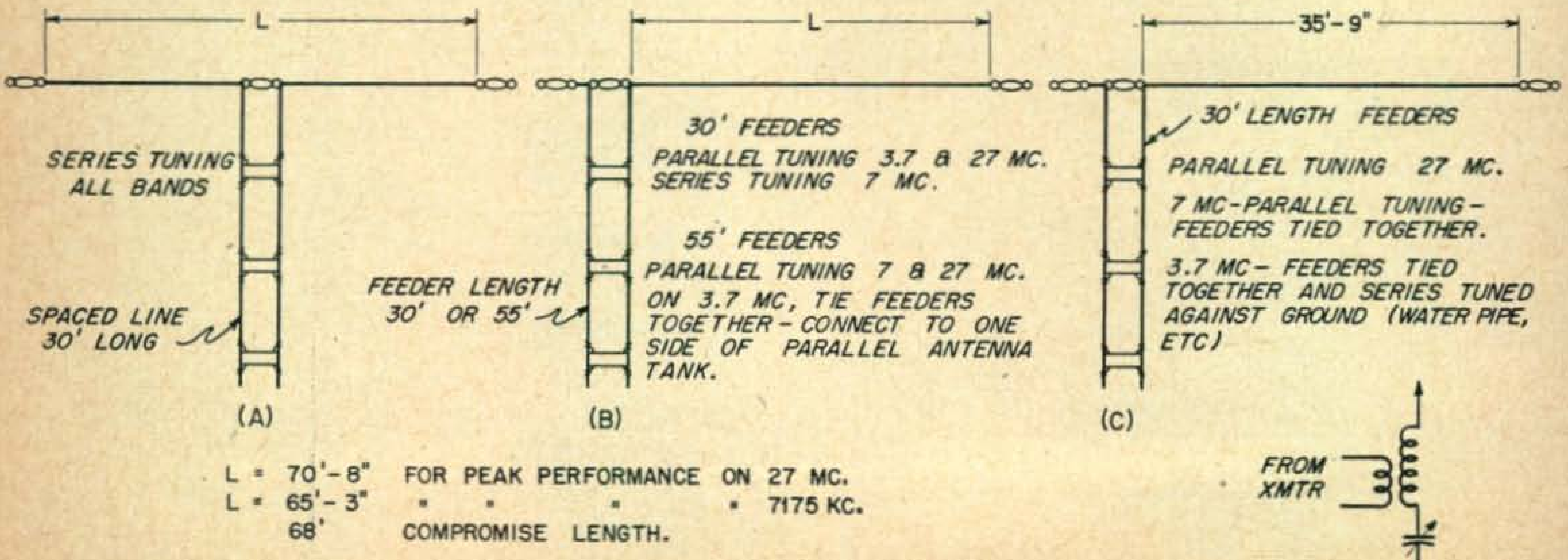


Fig. 3. All-band antennas for restricted space.