### Components for Every Application

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<th>Component Type</th>
<th>Description</th>
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<tr>
<td>Linear Standard</td>
<td>High Fidelity Ideal</td>
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<tr>
<td>Hiperm Alloy</td>
<td>High Fidelity . . . Compact</td>
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<tr>
<td>Ultra Compact</td>
<td>Portable . . . High Fidelity</td>
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<tr>
<td>Ouncer</td>
<td>Wide Range . . . 1 ounce</td>
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<tr>
<td>Sub Ouncer</td>
<td>Weight ½ ounce</td>
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<tr>
<td>Special Series</td>
<td>Quality for the &quot;Ham&quot;</td>
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<tr>
<td>Power Components</td>
<td>Rugged . . . Dependable</td>
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<tr>
<td>Toroid Filters</td>
<td>Accuracy . . . Stability</td>
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<tr>
<td>Mu-Core Filters</td>
<td>Any type to 300KC</td>
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<tr>
<td>Equalizers</td>
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<td>Impedance Matching</td>
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<td>Fosterite</td>
<td>Grade 3 JAN Components</td>
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<tr>
<td>Cable Type</td>
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<tr>
<td>Vertical Shells</td>
<td>Husky . . . Inexpensive</td>
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<tr>
<td>Replacement</td>
<td>Universal Mounting</td>
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<tr>
<td>Step-Down</td>
<td>Up to 2500W . . . Stock</td>
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<tr>
<td>Line Adjustors</td>
<td>Match any line voltage</td>
</tr>
<tr>
<td>Channel Frame</td>
<td>Simple . . . Low cost</td>
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**United Transformer Co.**
THE KEN-RAD 12AY7 MINIATURE—
A REAL CHAMPION, WITH STANDOUT
QUALITIES OF DESIGN!

When building a high-gain, low-level amplifier, your guard must be up against hiss, hum, and microphonics—the “unholy three” in audio circuits. You’re safer from these bugaboos if (1) your circuit is properly designed, (2) you have the right audio-amplifier tube.

Selection of the latter narrows down quickly to the Ken-Rad 12AY7—the pace-setting new miniature specially developed by Ken-Rad and General Electric designers to reduce the noise by-products in audio amplification.

In originating Type 12AY7 with its low-noise and low-microphonics character, a miniature-tube design was chosen not alone because miniatures are modern, but because small electrodes mean low mass . . . and low mass aids in reducing microphonic output.

The result is a compact twin triode with a place to itself in the ham’s list of tubes for early application . . . a new miniature to give your rig new clean signal characteristics.* Ask your Ken-Rad distributor or dealer to show you the 12AY7. Study how this finely engineered tube is built. Here are quality of design and quality of manufacture, the two combining for topnotch audio-amplifier performance!

*Illustrating the kind of amplifier which can be built with the 12AY7, a recent article in the trade press describes a wide-frequency-response amplifier using 3 of these tubes with a harmonic-distortion figure of only 1/2 of 1 per cent, and the average noise 87 db down (from a +24 dbm level).

FOR KEN-RAD QUALITY
LOOK BEYOND THE DATA SHEET!
How does the 75A-1 do on SSSC?

RAYMOND F. HOFFMAN, W5NRP, HAS FOUND OUT "FROM THE OUTSIDE LOOKING IN."

HE WRITES: "I have been meaning to write this letter for about the last six months but have never quite gotten to it. During this time I have had my transmitter on SSSC and quite recently have put it on the twenty-eight megacycle band. As you may well imagine, I talk to myself on many of my contacts because of very bad receiver stability on ten—much more so than on twenty, and that was bad enough.

"I have kept a fairly accurate log of the receivers used on the other end and although I cannot say that Collins 75A-1's are in the majority, they certainly have had the least amount of trouble by a very large margin. I have never yet had a Collins user who was not able to copy the SSSC signals and do a good job of it.

"Quite recently on ten I had a contact with a man using the 75A-1. We talked for about twenty minutes on SSSC and at the end of the contact he noted the fact that he HAD NOT TOUCHED THE RECEIVER.

"You know that your receiver is good; perhaps you might like to quote a satisfied user in a new sense of the word. I find a great deal of pleasure in ‘using the other man’s 75A-1’."

NOTE: If radio is also your business, look to Collins for very high performance in broadcast station equipment, and airborne and ground station radio communication gear.

FOR SUCCESS IN AMATEUR RADIO, ITS...

COLLINS RADIO COMPANY, Cedar Rapids, Iowa
11 West 42nd Street, New York 18, N. Y. 458 South Spring Street, Los Angeles 13, Calif.
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15-in. Custom Installation TV

150 sq. in. picture

MODEL T-69
$259.50
complete with 15-in. tube

A new chassis, specially designed for big picture-tube operation.
Completely aligned and tested.
Regular RMA 90-day guarantee applies to all parts. See your local parts distributor for details.

Send for folder of original custom-installation designs by Hallicrafters.

There is vital need in the Armed Services for young men with professional skill, particularly physicians and dentists. For information write to the office of the Secretary of Defense, Washington, D.C.

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4401 WEST FIFTH AVENUE • CHICAGO 24, ILLINOIS

Sole Hallicrafters Representative in Canada: Rogers Majestic Limited, Toronto, Montreal.
NOW YOU CAN \ GO PLACES!

QSY is as easy as pie! Yes, the Crystal Shifter illustrated above gives you INSTANT SELECTION of as many as eleven crystal controlled frequencies within a 100 kc. or so range on phone ... without removing excitation, turning off plate current, or retuning of transmitter stages ... without danger of getting out of the band ... with positive knowledge of where you are ALL THE TIME! You can build this PR Crystal Shifter in a half hour or less with a soldering iron and a pair of pliers. You can follow the construction easily from the above photo. Components needed are: Centralab 11 position rotary switch assembly No. 1402; eleven (or less) Cinch No. 9827 single crystal sockets; a length of No. 12 tinned copper wire; a Mosely 75-5 adapter plug; a piece of 300-ohm Twinlead; and a group of PR Precision Crystals. Use PRs you now have and add more frequencies as you want to. Mount the completed assembly on the front panel, plug into your crystal socket and you're ready to flit from frequency to frequency at will! It occupies less than 3½ inches of panel space. Many 10 meter phone men are already using the Crystal Shifter. Make it! Try it! — Petersen Radio Company, Inc., 2800 W. Broadway, Council Bluffs, Ia.
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<td>Eastern Pennsylvania</td>
<td>W1BKS Jerrry Mathis</td>
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<td>Maryland-Delaware-D.C.</td>
<td>W1PKI Edson W. Getz, N.E.</td>
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<td>Southern New Jersey</td>
<td>W3ONX G. W. Illig Tannell</td>
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<td>Western New York</td>
<td>W1CA Harding A. Clark</td>
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<tr>
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<td><strong>Central Division</strong></td>
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<tr>
<td>Illinois</td>
<td>N8BYV Lloyd R. Hopkins</td>
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<td>Indiana</td>
<td>W9SGS Charles H. Conway</td>
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<td><strong>Dakota Division</strong></td>
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<tr>
<td>North Dakota</td>
<td>W6GDZ Paul M. Bosseletti</td>
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<td>South Dakota</td>
<td>W6GMG John B. Morgan</td>
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<td>Minnesota</td>
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<td>Arkansas</td>
<td>W5IC Marshall White</td>
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<td>Louisiana</td>
<td>WSCT W. J. Wilkinson, Jr.</td>
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<td>Mississippi</td>
<td>W2PIA J. C. Waller Greer</td>
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<td><strong>Great Lakes Division</strong></td>
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<tr>
<td>Michigan</td>
<td>W4CA W. C. Alcock</td>
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<td><strong>Hudson Division</strong></td>
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<tr>
<td>Iowa</td>
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Here is advance information on a new Hallicrafters Ham receiver, the SX-71. It will have top performance features in a price to please you—considerably under $200.

Band width will be less than 14 kc, 1000 times down from resonance. The double superheterodyne design will give image rejection at 28 Mc of better than 300 to 1. And the sensitivity will be in the order of 1 microvolt.

Five bands will give continuous coverage from 538 kc to 56 Mc; also, there will be calibrated band-spread scales for 80, 40, 20, 10, and 6 meters. NBFM reception will be available, via built-in limiter and balanced detector stages.

Here is a receiver expressly designed for you, for superior Ham operation. It is coming soon.

Watch for it.

P.S. A New Portable receiver will be announced next month!

the hallicrafters co.
4401 W. Fifth Ave., Chicago 24, Ill.
THE AMERICAN RADIO RELAY LEAGUE, INC.,
is a noncommercial association of radio amateurs, bonded for the promotion of interest in amateur radio communication and experimentation, for the relaying of messages by radio, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a Board of Directors, elected every two years by the general membership. The officers are elected or appointed by the Directors. The League is noncommercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its board.

"Of, by and for the amateur," it numbers within its ranks practically every worth-while amateur in the nation and has a history of glorious achievement as the standard-bearer in amateur affairs.

Inquiries regarding membership are solicited. A bona fide interest in amateur radio is the only essential qualification; owner's prerequisite, although full voting membership is granted only to licensed amateurs.

All general correspondence should be addressed to the Secretary at the administrative headquarters at West Hartford, Connecticut.

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Delta Division
VICTOR CANFIELD ............. W5BDR
P. O. Box 965, Lake Charles, La.
Alternate: James W. Watkins ....... W4FLS
230 N. Howell St., Chattanooga, Tenn.

Great Lakes Division
HAROLD C. HODD .............. W9DEP
114 Hickory Dr., Crescent Lake, Pontiac, Mich.
Alternate: John H. Brabro .......... W8FPP
1251 Berkshire Grove, Berwick Park 30, Mich.

Hudson Division
JOSEPH M. JOHNSTON ......... W9X0X
28 N首mouth Ave., Bradley Beach, N. J.
Alternate: Gay E. Johnson, Jr., W2WJP
170 Broadway, New York 7, N. Y.

Midwest Division
LEONARD COLLETT ............ W7DEA
17th Aeronautical Administration
Box 715, Joplin, Mo.
Alternate: Alvin C. Keys .......... W8KJQ
1291 Merchants Nat'l Bank bldg., Cedar Rapids, la.

New England Division
PERCY C. NOBLE .............. W1IVR
37 Broad St., Westfield, Mass.
Alternate: Clayton C. Cutron ...... W1HRC
70 Columbia Ave., Providence 6, R. I.

Northwestern Division
R. REX ROBERTS ............. W7CPY
110 W. Freeman St., Gladview, Mont.
Alternate: Allen D. Gunston .......... W7GDP
7210 Wright Ave., Seattle 6, Wash.

Pacific Division
WILLIAM A. LADLEY ............ W8BEN
328 Naylor St., San Francisco 12, Calif.
Alternate: Kenneth E. Hughes ........ W8CIB
910 W. Orange Ave., San Francisco, Calif.

Roanoke Division
EVERETT L. BATEY ............ W4IA
1707 N. Cleveland Ave., Arlington, Va.
Alternate: J. Frank Key .............. W4ZA
Box 707, Buena Vista, Va.

Rocky Mountain Division
FRANKLIN R. MATEJKA ......... W9MHD
P. O. Box 2512, Estes Park, Colo.
Alternate: William R. White ...... W8PDA
1519 Pearl St., Denver 4, Colo.

Southwestern Division
WILLIAM C. SHEETON .......... W9AAB
572 Revillo Rd., Las Vegas Beach, Fla.
Alternate: William R. Sides .......... W4ALP
Fleming Road, Montgomery, Ala.

Western Division
JOHN R. GRIGGS .............. W6KX
3212 Grape St., San Diego 2, Calif.
Alternate: John E. Hesel .......... W6NY
1834 Whittier Blvd., Whittier, Calif.

West Gulf Division
WAYLAND M. GRIGGS ........ W5NW
P. O. Box 596, Odessa, Texas
(W5NW at Humble Pipe Line Camp, Odessa)
Alternate: David W. Calk ........ W8HTO
7750 Jolin St., Houston 17, Texas
"It Seems to Us..."

F.C.C.'S AMATEUR RULES PROPOSALS

Beginning on page 20 of this issue of QST we print what appear destined to be among the most controversial proposals for changes in the amateur rules in recent years. That, at least, is the conclusion that must be drawn as we write this, approximately a week after the Commission's release of the proposals. Already at ARRL Headquarters, we have been in receipt of telephone calls, telegrams, radiograms and letters supporting or denouncing, or simply asking for information. Almost all, however, wind up wanting to know whether the League had anything to do with the formulation of the proposals and, if not, what our stand is going to be and what we are going to do about them. That is what we propose to go into here.

Let us make one thing perfectly clear at the outset. These are FCC proposals for changes in the amateur rules, worked out in recent months entirely within the Commission by members of the FCC's staff without consultation with the ARRL or anyone else. They were formulated by the Radio Operator and Amateur Division of the Commission under the direction of George K. Rollins, W3GA, its chief, after coordination with all other divisions of the Commission, and now announced as the Commission's ideas on the subject. In drawing up these proposed rules the Commission clearly states it has made use of a great variety of suggestions and recommendations received by it (including ARRL's recommendations of last May). As it then goes on to say in paragraph 3 of its Notice accompanying the proposals:

The resulting judgment of the Commission is that the Amateur Radio Service would very much benefit from, and needs, a new overall plan or blueprint to provide scope and direction for immediate and long range development of the service.

These proposals are the result.

Second, there seems at this writing to be a disposition on the part of many amateurs to think these are mere suggestions on the subject from the Commission. Not so; this is a notice of intention to make actual changes in our rules. FCC gives all interested parties formal notice that they have until July 20, 1949, to comment on them. After that date, and depending on the nature of the comment received, it may simply put the rules into effect, with or without revision, or it may deem the comment of such nature as to warrant the holding of a hearing or oral argument at Washington before final action is taken.

As to the position ARRL will take about the FCC proposals, it is not possible at the moment for the writer of this editorial to say. Traditionally, that will be a prerogative of the League's Board of Directors, the elected representatives of the membership; it is the directors who will decide what the League's comments will be on these proposed rules. Happily, the Commission has issued its proposals in time to permit full discussion of every detail at the annual meeting of the League's Board to be held at Hartford beginning May 27th, shortly after the appearance of this issue, and has given ample time for filing of comment thereafter. For our part, immediately after announcement of the proposals, ARRL Hq. circulated the complete text of the proposals and the Commission's accompanying Notice to every League director, alternate and assistant director, to all the 575-plus radio clubs affiliated with ARRL, to every one of the Communications Department's appointees (all field officials, ORS, OPS, OES, OO, etc.) to a total of nearly 3500, and advertised availability of copies of the proposals to any amateur on request. Thus there is a month available for full examination and discussion by the membership prior to the meeting of the Board. It is reasonable to assume that by the time the directors meet they will have had ample opportunity to sound out the opinions of the membership, to weigh the merits of the proposals, and to come to the meeting prepared to give their best thought on the League's position with respect to them. Until the Board makes its decisions, however, we do not know what the answer will be as to the League's position. That will be for the directors, not the Head-
quarters, to decide. The directors will consult with members of the Headquarters staff, and the League’s general counsel, upon technical and legal aspects, but the final decision will be the Board’s, and its alone.

The position of the League up to this time has already been spread on the record, and reported in QST. It is represented by the recommendations of the League’s Board made as the result of its meeting in May, 1948. These were reported, and the philosophy behind them expounded, on page 20 of the June, 1948, issue, pages 9 and 30 of the July, 1948, issue, and page 9 of the August, 1948, QST.

The basic recommendations have been recently summarized in the March, 1949, issue, page 36, at which time we also summarized the counterproposals of two other groups referred to in the Commission’s notice. To save you time in looking up that issue, the pertinent ARRL Board’s recommendations of last year were:

1) Expansion of the 75-meter Class A ‘phone band to 3800–4000 kc.
2) No change on 40, 20 or 10 meters.
3) A 16-w.p.m. code test for future Class A license examinations.
4) One year “apprenticeship” for new amateurs before permitting them use of ‘phone below 29.7 Mc.
5) An exclusive c.w. assignment 50–50.1 Mc.; A9 or “duplex” above 51 Mc.; and n.f.m. permitted above 50.1 Mc.

Comparison of these recommendations with the current FCC proposals will serve as a fair basis for estimating what the 1948 Board’s thinking would be on the Commission’s ideas. However, conditions change even in one short year; the 1949 Board may have somewhat different views on these problems.

At this point we think it pertinent to note, as will the directors at the Board meeting, that the Commission’s announcement is more than a simple set of proposals for changes in the rules affecting ‘phone bands and ‘phone licensing. During the first week of discussion on the air, the ‘phone aspects appeared to overshadow other features of the Commission’s proposals, and opinion for or against the proposed rules seemed to be based largely on the ‘phone features. The Commission’s proposals go far beyond these matters, however; read the prefacing “Notice of Proposed Rule Making” carefully, and then read the proposed rules down to the end. As can be seen, the matter of extension of the 75-meter ‘phone band (although with a bandwidth of emission limitation of 3 kc.) and eventual reexamination of all Class A licensees with a 20-w.p.m. code test represent only a small part of the proposals. We have such new things as an initial declaration of purpose for the amateur service; the introduction of what may be termed apparatus specifications in our regulations (which the League has always opposed in principle); new renewal requirements; two new classes of license, with reduced code speed, in addition to the ones we now have; new examination elements; and even a regulation proposal with respect to round-table operations.

There is far more involved in these rules than matters of ‘phone policy; evaluation of their merits will require the most careful study by the Board.

In conclusion, we want to mention one aspect of the current development, perhaps the most important of them all, whose significance should not be overlooked. That is that these proposals, in the aggregate, represent the first time in our recollection that the Commission or any of its predecessor bodies has on its own motion injected itself into the major aspects of our regulations touching on basic amateur internal policy and intra-service philosophy. In all the long history of amateur radio in this country, the regulatory agency has heretofore always looked to the amateur himself, through the ARRL’s Board of Directors, for thought on these matters. Differences of amateur opinion about them there have always been and always will be; nevertheless, in all this time the amateur body has ended up with a single set of recommendations at Washington from one group — ARRL — speaking for amateur radio as a whole. In consequence, its recommendations have almost without exception been accepted by the Commission in writing its rules, resulting in our enjoyment of a privilege unique among the radio services, that of virtually writing our own internal regulations. As against this, we have during the past year witnessed the action of minority groups, dissatisfied with the Board’s recommendations, undertaking to form “national” societies in order to appeal direct to Washington in an endeavor to promote acceptance of their particular points of view.

To our way of thinking, it is no coincidence, therefore, that for the first time FCC is doing the job itself. We believe the present action of the Commission stems directly from this demonstrated inability of amateur radio to settle its differences within its own ranks, thus forcing FCC to do our thinking for us. If these current FCC proposals find general acceptance among amateurs, then perhaps this is a sound idea. But if the Commission’s proposals do not meet with general acceptance by the amateur body, then we must all realize there will be a continuation of the Commission’s policy unless amateurs recognize that in the long run their best interests will be served by speaking with one voice before our government authorities.

— A. L. B.
The all-band VFO. The two switches to the left are the control switches. The key jack is below and the trimmer-adjusting hole behind the tuning crank.

The ’phone-band VFO is built in a standard steel cabinet accommodating a 7 × 7 × 2-inch chassis. The tuning control is a National type A vernier dial.

**VFOs for 'Phone or C.W.**

*Build Your Frequency Control To Suit Your Requirements*

**BY BEN W. ROBERTS,* W9IEU**

There is no doubt that the series-tuned Colpitts (Clapp) oscillator circuit is rapidly becoming the standard basis on which ham VFOs are built. However, there will always remain room for individualism in constructional design and variation in details of the circuit to suit some particular operating interest. The accompanying photographs and diagrams show that while two VFO units may be built around a common basic circuit, the finished products may bear little resemblance, in either physical appearance or operating features.

The unit that will be described first might be called an “all-band” model. That is, the tuning system is designed to spread the single range of 1700 to 2000 kc. over most of the dial scale. Those portions of the range whose harmonics cover the narrower higher-frequency bands, of course, occupy smaller portions of the dial range, but the tuning rate is slowed down to a satisfactory pace by the use of a high-ratio worm-gear tuning drive.

The circuit is shown in Fig. 1. A 6J5 triode oscillator drives two untuned buffer stages using 6F6s. C1 is the tuning condenser, while C3 is a fixed mica padder. C5 is a small trimmer for centering the band on the dial. RFC1 and C8 comprise an r.f. filter in the keying lead.

The amplifier input is coupled to the cathode of the oscillator, the plate being grounded for r.f. through C7. Resistors are used in the grid circuits of the amplifiers and r.f. chokes in the plate circuits. RFC2 is altered by removing one of the pies to make it dissimilar to RFC3, and C12 is reduced to 10 µfd, to prevent low-frequency parasitics. Both amplifier stages are provided with cathode-resistor protective bias.

S1 connects the three VFO cathodes to the key for adjustment of the VFO without energizing the entire transmitter. S3 also connects the VFO cathodes to the key, and in addition can be used to turn on an external piece of equipment through terminal A. The VFO may be turned on and off by an external switch through the use of terminal B.

The unit is designed to operate from a small supply delivering 250 to 300 volts with a VR-regulated tap at 150 volts for the oscillator plate.

**Building the All-Band Model**

Being an old-fashioned breadboard man at heart, I spent many hours trying to decide how to construct a breadboard VFO without exposing a lot of parts that should be shielded from the rest of the rig. The double-chassis idea shown in the photographs was finally chosen as a simple solution. With this type of construction, the heat from the tubes is excluded from the frequency-determining components. Very little heat is generated inside the chassis.

The two 7 × 7 × 2-inch chassis are fastened together, bottom to bottom, by tapping holes in the lip of the upper chassis for machine screws.

*Lostant, Illinois.

June 1949
Fig. 1 — Circuit diagram of the all-band VFO.

**Table of Components:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C₁</td>
<td>100-µfd. midget (Bud MC-1855).</td>
<td></td>
</tr>
<tr>
<td>C₂</td>
<td>12-µfd. midget trimmer (CRL).</td>
<td></td>
</tr>
<tr>
<td>C₃</td>
<td>100-µfd. silver trimmer (CRL).</td>
<td></td>
</tr>
<tr>
<td>C₄, C₅</td>
<td>0.001-µfd. silver mica.</td>
<td></td>
</tr>
<tr>
<td>C₆, C₇, C₈, C₉</td>
<td>100-µfd. mica.</td>
<td></td>
</tr>
<tr>
<td>C₁₀, C₁₁, C₁₂, C₁₃</td>
<td>0.0033-µfd. mica.</td>
<td></td>
</tr>
<tr>
<td>RFC₁, RFC₂</td>
<td>2.5-mh. r.f. choke.</td>
<td></td>
</tr>
<tr>
<td>RFC₃</td>
<td>Same as RFC₁, with one pie removed.</td>
<td></td>
</tr>
<tr>
<td>R₁, R₂</td>
<td>0.1 megohm, ½ watt.</td>
<td></td>
</tr>
<tr>
<td>R₃</td>
<td>47,000 ohms, ½ watt.</td>
<td></td>
</tr>
<tr>
<td>R₄, R₇</td>
<td>390 ohms, 1 watt.</td>
<td></td>
</tr>
<tr>
<td>R₅, R₆</td>
<td>10,000 ohms, 1 watt.</td>
<td></td>
</tr>
<tr>
<td>L₁</td>
<td>92 turns, 1-inch diam., 3 inches long (B &amp; W Miniductor type 3016 with 4 turns removed).</td>
<td></td>
</tr>
<tr>
<td>J₁</td>
<td>Closed-circuit jack.</td>
<td></td>
</tr>
<tr>
<td>S₁</td>
<td>S.p.s.t. toggle switch.</td>
<td></td>
</tr>
<tr>
<td>S₂</td>
<td>D.p.s.t. toggle switch.</td>
<td></td>
</tr>
</tbody>
</table>

that are passed up, through large holes in the bottom chassis, on the end of a screw-holding screwdriver. Alternatively, sections of threaded rod with nuts at both ends could be used to clamp the two chassis together.

The only parts fastened to the bottom chassis are the key jack and part of the dial mechanism. This mechanism, taken from a BC-375 tuning unit, provides 2500 dial divisions for a condenser rotation of 180 degrees. One of the three mounting pillars is fastened to the top chassis, while the other two are anchored to the bottom chassis after the two chassis are joined together. It was necessary to cut the chassis lip away in spots to clear the framework. The tuning shaft is fitted with a homemade crank fashioned from a scrap of aluminum and a hardware-store knob. This makes it easy to tune from one end of the band to the other in a matter of seconds. The tuning condenser is mounted on ¾-inch cone insulators. The trimmer, C₂, connected directly across the terminals of the tuning condenser, is adjusted with a screwdriver through a hole in the side of the chassis just to the rear of the tuning control.

To eliminate a slight mechanical instability that developed during initial tests, a strip of ⅛-inch polystyrene, just wide enough to fit snugly, was slipped inside the coil vertically and cemented to the coil spacing strips. The coil was then mounted on stand-off insulators alongside the tuning condenser by means of machine screws through holes drilled edgewise through the polystyrene strips.

The three tubes are lined up at the rear of the chassis with the oscillator tube to the right. A power-supply receptacle, a coaxial output connector and terminals A and B are at the rear in the back edge of the upper chassis.

After the mounting holes were located and drilled, the chassis were given the same hard smooth finish found on automobiles by having them sprayed with two coats of auto-body under-
coating and four coats of dove grey Du Pont No. 202-39112 lacquer and rubbing them down with auto-body compound.

The 6J5 should draw a plate current of about 7 ma., while the total for the two amplifier stages should be in the vicinity of 50 ma. The output is sufficient to drive a 6L6 doubler to a grid current of 3 ma. through a 30,000-ohm grid leak when coupled by the 100-µfd. condenser, C15, and a foot of coaxial cable.

The 'Phone-Band Model VFO

The circuit of the second model is shown in Fig. 2. The oscillator circuit basically is the same as that shown in Fig. 1, but a more complicated tuning arrangement is incorporated to bandspread the frequencies whose harmonics fall within the 75-, 20- and 10-meter 'phone bands. The tuning range is changed by a switching system that selects one of two tuning condensers that differ in capacitance, and an appropriate padder. C3 and C4 are sections of the dual tuning condenser. The 15-µfd. section, C6, in parallel with C5, gives a tuning range of 1900 to 2000 kc. to cover 3800 to 4000 kc. in the output stage. In the 10-meter position, the extra padder C1 is switched in, which changes the oscillator range to cover about 1756 to 1855 kc. whose harmonics will embrace the range of 28,100 to 29,700 kc.

When the switch is in the 20-meter position, the smaller section of the tuning condenser, C4, is in use together with padder C2. This spreads out the harmonics that fall in the 14-Mc. 'phone band over most of the dial.

Following the oscillator is a 6AC7 untuned buffer amplifier which drives a 6V6 doubler. Provision is also made for using the 6V6 stage as a pentode crystal oscillator, the opening of S2 disabling the preceding stages. While C17L2 normally covers 80 meters, plug-in coils may be used with higher-frequency crystals. The key is in the cathode circuit of all three tubes.

Construction of the 'Phone-Band Model

While there is no reason why this model couldn't be built along the same lines as the all-band version, I chose to vary the design to fit a standard cabinet enclosure. All of the parts can be mounted on a 7 X 7 X 2-inch chassis without crowding. The dual tuning condenser is mounted at the center behind the main tuning dial, with L1 and L2 on either side at right angles to each other. The tubes are lined up along the rear and power-supply and output connections along the back edge.

Fig. 2 — Circuit diagram of the 'phone-band VFO.

C1, C2, C3 — 100-µfd. midget air trimmer (Hammarlund APC-100).
C4, C5 — Sections of dual 15-µfd. midget variable, 3 plates removed from C5 section (Hammarlund HFD-15X).
C6, C7 — 0.01-µfd. silver mica.
C8, C9, C10, C11, C12, C14, C15 — 100-µfd. mica.
C13 — 100-µfd. midget variable.
R1, R3, R4 — 0.1 megom, 1 watt.
R5 — 10,000 ohms, 2 watts.
L1 — 90 µh. (Bud OEL-160).
L2 — 32 turns No. 18, 1.5-inch wind, close-wound.
L3, L4 — 2 turns No. 18 on same form as L2.
J1 — Closed-circuit jack.
RFC1, RFC2 — 2.5-mh. r.f. choke.
S1 — Two-section 3-position wafer switch (Mallory 1315-1).
S2 — S.p.s.t. toggle switch.
Underneath, the doubler tuning condenser, C11, is near the doubler-coil socket, with the bandspread switch balancing it in the opposite corner. The three air trimmers are in line just far enough off the center line of the chassis to permit their shafts to be adjusted from the top through holes in the chassis. Holes also are drilled for the connecting leads between the tuning condenser, the switch and the trimmers.

To provide ventilation three socket holes were punched along the back of the box near the top.

Adjustment

If the crystal-oscillator feature is included, the 6V6 stage should be checked first, with an 80-meter crystal in the socket and S3 open. With this part of the circuit operating properly, the other two stages can be turned on.

To set the oscillator tuning ranges, first turn S1 to the 80-meter position. Set the tuning condenser to maximum capacitance and adjust C5 until the oscillator harmonic is heard at 3800 kc. The tuning condenser should then cover the range up to 4000 kc. With the switch in the 20-meter position, C3 should be similarly adjusted for 14,200 kc. The last adjustment, for 28 Mc., is made with S1 in the 10-meter position, setting C1 so that the harmonic falls at 28,100 kc, with the tuning condenser set at maximum capacitance.

As mentioned previously, the output of the 6V6 doubler stage is always in the 75-meter band, suitable external doubler stages being necessary to reach the higher-frequency bands.

With a 300-volt supply having a VR-regulated tap for 150 volts, the oscillator tube should draw about 7 ma. and the other two stages a total of about 45 ma, with the 6V6 loaded. The output obtainable from the 6V6 should be about 5 watts.

Checks on both models show excellent stability. With either model it has been possible to key the oscillator without hearing an audible beat while listening to the 10-meter harmonic set at zero beat. The frequency drift was found to be less than a half kilocycle over a period of hours when checked against the harmonic of a local broadcasting station. Most of this drift occurred during the first few minutes of operation.

COMING CONVENTIONS

August 5th-7th — Vanalta Division, Vancouver
August 26th-28th — West Gulf Division, Dallas
September 3rd-5th — Maritime Division, Halifax
September 17th — New Hampshire State, Manchester
October 5th-7th — Midwest Division, Omaha

IS YOURS ON FILE
WITH YOUR QSL MGR?

Bottom of the chassis in the 'phone-band model VFO. The three air trimmers are at the center. The condenser in the lower left-hand corner is the doubler tank condenser. The bandspread switch is to the right.
What! No Antenna?

Getting Results with Indoor Radiating Systems

After working several stations in a row that were all using indoor antennas, we were hit with the idea that perhaps a lot of operators have denied themselves the use of the low-frequency bands because they feel that they don't have the room necessary for the antenna. A few letters in the right directions brought back the dope on these indoor antennas, and it is presented here in the hope that it will demonstrate that you don't need a Rocky Point, j.e.g., to enjoy low-frequency operation.

This just represents a sample of a very few of the indoor antennas that are in use. We will be pleased to hear from operators with other different types of inside antennas that have worked well.

W2ALO, RUTHERFORD, N. J.

The antenna used by Jules Obester, W2ALO, is an excellent example of how to keep from being licked at anything. Located on the top floor of a 4-story 28-family brick apartment house, the only spot for the 14-Mc. antenna was in the 12 by 16 operating shack. What with fire escapes, BX cable, and steam and water pipes all around, this was bound to put the antenna something less than the "several wavelengths from surrounding objects" recommended by the books. But the antenna that was evolved is shown in Fig. 1, and it works well. It is, of course, a half-wavelength dipole folded to fit into the room and fed with RG-8/U coaxial cable. The cable was made an electrical half wavelength long, so that it acts as a half-wavelength transformer and the antenna impedance value appears at the end of the line. By trimming the original 33-foot length of the dipole down to the value that showed maximum line current (for constant transmitter input), the loading effects of surrounding objects and the folding of the wire were compensated for, and the final length worked out to be something just under 30 feet. When the right length was found, it was noticed that no retuning of the final-amplifier tank was required, from no load to full load, indicating that little or no reactance is introduced.

On the theory that the maximum-current portion of the antenna does the most radiating, the center of the antenna is mounted on the north wall of the room, in an effort to get into Asia a little better. However, the antenna is not too directional, and 164 countries have been worked postwar on 14 Mc., with never more than 350 watts input. The Pacific islands seem to be the most difficult to work, but this might be accounted for by the need for the signal to travel through 150 feet of apartment house before getting out into the open! However, the more distant stations — VKs and ZLs — can be worked easily, in the same direction.

Snow on the roof seems to have some effect in confining the signal, but the performance of the antenna has amazed any and all who have seen it. The wire is about 40 feet above ground.

W2HZY, BLOOMFIELD, N. J.

There is nothing very unusual about the indoor antenna used by George Wright at W2HZY — it is a folded dipole made of No. 14 wire spaced 2 inches and fed with Amphenol tubular 1-kw. 300-ohm line — but it gets out nicely. Located in the attic of a two-story house, it is about 33 feet above ground, and power lines and telephone wires run fairly close to the house on two sides. The antenna is used in the normal fashion on 14 Mc. and as a Marconi (by tying the feeders together) on 7 and 3.5 Mc. The location is an ordinary one, on a small hill in the residential section, and the transmitter input runs approximately 750 watts.

Results? A two-year schedule with ZL3AB with hardly a miss, several S8 and S9 reports in Asia and the Philippines, and a total of 192 countries worked! While W2HZY hastens to admit that he received some help on about 10 or 15 of these countries and might not have them if he were a "lone wolf," we submit that he had to be putting a good signal there to work them under present conditions!
W2PLR, BAYSIDE, L. I., N. Y.

Let's be practical about the whole thing—a fellow needs power or a 27-hour day to run up a string of countries these days, because he's competing against a lot of fellows with power and some mighty good antennas. So it isn't surprising to find that the lower-powered indoor-antenna fellows don't have the big strings of countries, but neither do the low-powered stations with outdoor antennas. For example, Ben Tyson, of W2PLR, runs 50 watts on 7, 14 and 28 Mc., but has managed to grab himself WAC on 14 and 28 Mc., and a total of 87 countries. He knocked off 64 sections in the 1947 SS Contest, just in case you think our only yardstick of effectiveness is one's countries total.

The antenna at W2PLR is shown in Fig. 2. It is a square loop, 15 feet on a side, supported in the attic of a two-story house. The house has "hip-roof" construction, and four sloping roof rafters furnish good points for fastening the antenna insulators. The transmitter is located in the attic and remotely controlled, so the feedline from the antenna to transmitter is just a 4-foot length of 300-ohm Twin-Lead. The same antenna is used for receiving, through an antenna relay and some more Twin-Lead.

As W2PLR puts it, "The antenna is a loop on 14 and 28 Mc., with point X shorted, but this is opened for 7-Mc. operation and the antenna becomes a badly bent-up dipole." The antenna seems to get out fairly well in all directions, with a slight edge in the east-west directions.

W5ONJ, TUCKERMAN, ARK.

The operations of James Brock, W5ONJ, are confined to 40 meters, but he isn't complaining about the results with his attic antenna. The wire, bent as shown in Fig. 3, is located in the attic of a two-story house near the business section of town. Running 200 watts, W5ONJ has just about all he needs for WAS, which should indicate that his work isn't confined to local rag-chews. A three-turn coil at the center of the antenna helps to make up for the shortened length of antenna and also seems to provide a better match for the RG-8/U line. The line couples at the transmitter through a 3-turn link.

W0EVW ST. LOUIS, MO.

Running only 40 watts, Tom Million of W0EVW has little fault to find with the results he gets with a 14-Mc. folded dipole of 300-ohm Twin-Lead tucked away in the attic. The shack is located in a flat only seven blocks from the downtown section, and is surrounded by apartments, a factory, a school and a church steeple, but he gets out on 3.5, 14 and 28 Mc. The feeders are tied together for 3.5-Mc. work, and the power is fed in the normal manner for 14 and 28 Mc. Although this isn't what the book says for folded dipoles working on twice their design frequency, it doesn't seem to bother either W0EVW or the stations he works. The antenna is about 40 feet above ground. One continent is lacking for WAC, and a few states for WAS.

W2BRC, ELIZABETH, N. J.

When John Nicholas built his antenna for W2BRC, he had a problem that was solved in a novel manner. While fortunate enough to have an attic long enough for a 68-foot flat top under the peak of the four-family frame house, his shack is located on the first floor and the attic corresponds to a third floor. How to feed the antenna for multiband operation? It's simple—just run an open-wire feedline up the outside of the house to the eaves, through the eaves to the inside of the attic, and along the roof rafters to the center of the flat top! He thus has multiband operation with a low-loss tuned feedline — if he were to use Twin-Lead or other solid-dielectric line and run it inside the house, as might seem to be a good idea at first glance, the losses would run much higher. The antenna flat top is 28 feet above ground, and the 807 final amplifier is usually run at 50 watts input on 80 and 40 meters. This is plenty for W2BRC to work into the traffic nets on 3.5 and 7 Mc., run up good scores in the CD contests, and acquire a 7-Mc. WAC and 36 countries.
**VE3PB, TORONTO, ONT.**

The first efforts of Stanley Dane, VE3PB, to work out with 40 watts and an indoor antenna from his third-story shack were not very successful. While short lengths of wire could be coupled to some extent with a “universal coupler,” the thing seemed to be good for only local contacts on 40 and 80. Many tests and careful pruning on 40 meters evolved the antenna shown in Fig. 4A, which works well on the band and has given him some good West Coast contacts. The antenna is hung along two walls and down the back of a door. Anyone duplicating the antenna should secure the wire firmly on the walls, because changes in angles or even a half-turn difference on the coil will make a difference in loading. The antenna was checked by how far away from the far end a neon bulb would light, keeping the transmitter input constant for the various tests.

On 80 meters VE3PB ran into trouble. The 40-meter antenna worked against ground was unsatisfactory. An antenna similar to that in Fig. 4A but with a larger coil and longer wire lengths loaded fine. But one could light the neon bulb on the transmitter, metal ash trays, bed springs, and the frame of an aquarium. Mittens had to be worn while tuning the receiver. Reports four miles away were RST 229. It wasn’t much good.

**WIDX, WETHERSFIELD, CONN.**

**Fig. 5** — A horizontal 7-Mc. quarter-wave antenna used at WIDX. Half of a 3-wire dipole is used and fed with 300-ohm Twin-Lead. To ground one side of the transmission line and the end of the antenna, a capacity (a 20-foot length of wire scattered on floor) and an inductance, $L$, are made series resonant at the operating frequency.

But everything was cooled down and the rig worked out on 80 by adding the arrangement shown in Fig. 4B to the end of the 40-meter antenna, with this extra wire lying on the floor near the third wall. It, too, must be carefully pruned and fixed in a definite position. VE3PB concludes that the low-powered indoor-antenna operator must be careful in pruning his antenna so as not to shoot the whole system above ground, but with an indoor antenna and sensible operating he can have all of the fun and contacts he desires.

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The 40- and 80-meter indoor antennas used at VE3PB. The antenna at A is used on 40, and it runs around the wall on two sides of the room and down the back of a door. On 80, the addition shown in B is clipped to the end of the 40-meter antenna. The antenna tuner is a coil-and-condenser combination that will resonate to the band in use.

But everything was cooled down and the rig worked out on 80 by adding the arrangement shown in Fig. 4B to the end of the 40-meter antenna, with this extra wire lying on the floor near the third wall. It, too, must be carefully pruned and fixed in a definite position. VE3PB concludes that the low-powered indoor-antenna operator must be careful in pruning his antenna so as not to shoot the whole system above ground, but with an indoor antenna and sensible operating he can have all of the fun and contacts he desires.
Happenings of the Month

INTER-AMERICAN CONFERENCE

Delegates of 25 countries of the American region convened in Washington on April 25th to open the joint sessions of the Fourth Inter-American and Region 2 Radio Conferences. The FIAR portion of this series of meetings, expected to last about six weeks, will consider revision of the Santiago (1940) agreement, including regional allocations up to 4000 kc.; the Region 2 portion, which consists of the FIAR countries plus several European nations which have colonies in this hemisphere, will implement the regional allocation of frequencies under the Atlantic City table.

With unusual speed—a fact, right during the formality of opening the conference—the delegates promptly set up committees to handle the agenda items; meeting the very next day, several of those committees were broken down into subcommittees to begin actual work on the documents. Of immediate importance to amateurs is Subcommittee 4A, the allocations group of the FIAR committee, which is currently examining the table of frequencies from 10 up to 4000 kc. The position of the United States, as has been previously reported, is to provide amateurs sharing rights in 1800-2000 kc., and the exclusive band 3500-4000 kc. We shall have more to report next month, or perhaps before then via WIAW. Meanwhile, Acting Secretary Budlong and Assistant Secretary Huntoon are nearly permanently in Washington, participating in the committee meetings. Amateurs from other countries serving as delegates or advisors are: CP5EL, PY1DR, VE8AC, VE8NW, VE4CC, HK3GT, HK3CM, TI2AW, CM2GM, CO2DA, YV5AA and YV5CB.

REPRESENTATIVES COMMEND AMATEURS

The House of Representatives has passed a Resolution commending amateur radio operators for their contributions to the public welfare. Introduction of the Resolution was by Rep. Frederic R. Condart, jr. (N. Y.), and the idea originated with New York City amateurs. Chairman Coy of FCC expressed that body’s endorsement of the resolution while it was in committee. The text (H. Res. 106):

RESOLUTION

Whereas amateur radio operators serve the Nation in war and peace; and
Whereas amateur radio is a hobby involving the sending and receiving of messages by code or voice without pecuniary gain; and
Whereas the right to practice that hobby is granted only to those who have passed an examination given by the Federal Communications Commission; and
Whereas such amateurs have aided in keeping the lines of communication open during floods, storms, and other disasters, and so helped in the rescue of life and property; and
Whereas amateur or ham radio has provided a reservoir of self-trained operators for national defense; and
Whereas amateur radio has through research and experimentation enriched the radio art, the products of which are enjoyed by all citizens; and
Whereas several thousand of such licensed amateurs live in the United States of America and its possessions; Therefore be it

Resolved, That the House of Representatives of the United States, on behalf of a grateful citizenry, expresses its gratitude to radio operators of amateur standing for their service both past and present.

27-MC. BAND TO BE SHIFTED

The long-awaited change in our 27-Mc. band to accord with the Atlantic City table is being made effective July 1st. Our present assignment is 27,160 to 27,430 kc., but as of July 1st it will be shifted to 26,960-27,230 kc. The pertinent portion of Section 12.111 of the amateur rules will then read:

(5) 26,960 to 27,230 Mc., using unmodulated carrier, radiotelegraphy, radiotelephony, radio printer, or facsimile, with any type of emission except damped waves and pulse, subject to such interference as may result from the emissions of industrial, scientific and medical devices within 160 kc. of the frequency 27,120 Mc.

Simply to bring it in line with the foregoing change, Section 12.134 will be amended as follows:

12.134. Modulation of carrier wave. — Except for brief tests or adjustments and except for operation in the band 26,960 to 27,230 Mc., an amateur radiotelephone station shall not emit a carrier wave on frequencies below 144 Mc., unless modulated for the purpose of communication.

RADIO OPS-TECHNICIANS WANTED

The United States Government has openings for radio operator-technicians who are interested in careers in radio communications and general electronics involving extensive overseas duty. There are also openings for highly-qualified instructors and executives, which involve a higher proportion of duty in the United States. Applicants are being accepted whose radio training ranges from none to many years of experience plus engineering degrees, although only young and very promising candidates are accepted if they have no previous training or experience in radio. Base salaries range from $2724 for trainees to $3255 per year for communications executives.

Before employees are assigned to duty they are
given training designed to bring their telegraph code speed to 25 w.p.m. using speed key and mill, and to enable them to maintain and overhaul communications receivers and transmitters up to 500 watts output. Base salaries upon completion of training and assignment to overseas posts ordinarily range from $3351 to $3727, and up to $4479 for unusually well-qualified men and junior supervisors. Overseas assignments are widely scattered. Length of overseas tours of duty (usually 24 months), leave, promotion, employee benefits, transportation and baggage allowances, annual salary increases, etc., are in accordance with standard Government regulations. Because special allowances fluctuate widely, only base salaries are mentioned here.

Because the nature of the work places maximum responsibility upon the individual radio operator-technician, and because a maximum flexibility of adjustment to new and unusual situations is required, successful amateurs with highly-developed skills both as operators and technicians, and with pronounced characteristics of loyalty, dependability, judgment, discretion, and ingenuity, are most in demand. Adaptability to this work as a career depends to a considerable extent upon flexibility — both ability to cope with different situations, and willingness to accept a wide variety of posts. Most executive and training positions will be filled at salaries of $4479 or $5232, with a few initial salaries of $6235 possible. All such positions require extensive experience. Engineering degrees are desirable.

Interested applicants are requested to write a brief application letter to Box 73, Administrative Headquarters, the American Radio Relay League, West Hartford 7, Conn. Considerable duplication of effort will be avoided by the applicant if he follows the form given below in his letter answering all questions as briefly as possible and in the same order:

1) Type of position desired (i.e., radio operator-technician, instructor, executive, etc.)
2) Experience and Training:
   a) Number of months radio training and type (college, service school, technical or trade school).
   b) Number of years radio experience and type (military, merchant marine, commercial, Government).
   c) Amount of this experience in telegraphy and amount in construction or maintenance.
   d) Present radiotelegraph speed.
   e) Present or past radio licenses, including amateur.
3) Parts of the world (or climates) in which duty is not desired.
4) Age and marital status, including number and ages of children.

If your initial application appears promising, you will be sent full application forms upon which detailed information can be entered.

F.C.C. AMATEUR RULES PROPOSALS

On April 21st FCC released a notice of proposed rule-making to amend amateur regulations in rather substantial respects. We publish in the following pages both the text of the notice and the proposed changes in regulations. As they are involved, let us summarize here the highlights, first pointing out that the FCC proposals in most respects go far beyond the comparatively simple recommendations made to the Commission by ARRL as a result of the 1948 Board meeting (see the editorial in this issue for a summary).

FCC proposes a complete revision of license classes: an Amateur Extra Class (new) eventually to replace Class A, to be required for operation on the 75- and 20-meter 'phone bands and to include a 20-w.p.m. code test and an advanced technical exam; an Advanced Class (temporary name for Class A until it is abolished) which will not be issued or renewed after December, 1950; a General Class and a Conditional Class, which are essentially new names for Classes B and C, the requirements and privileges to remain substantially as at present; a Technician Class, with code test at 5 w.p.m. and privileges only above 220 Mc.; and a Novice Class, with a 5-w.p.m. test and simplified examination, but with 75 watts maximum; crystal-controlled c.w. only in 3700-3750, 14,100-14,150, 28,000-28,500 kc.; and c.w. or 'phone in 145-147 Mc. New requirements for renewal of all classes of license are proposed.

Elaborating a moment on the Class A matter, which seems to have been the principal subject of on-the-air discussions so far, we would point out that in effect the Commission proposes to reexamine every amateur, including a code test at 20 w.p.m., before permitting him to continue operation in the 'restricted' 'phone bands. This would be accomplished by not issuing or renewing the Advanced Class (Class A) license after December of 1950. Present Class A licenses expiring after that date would not be renewed except as General Class (Class B privileges); to be able to continue operation in the "restricted" 'phone bands, such licensees would have to take the new examination with higher code-speed test.

Frequencwise, FCC proposes that any type modulation except pulse (e.g., frequency or phase or amplitude or single-sideband) would be permitted in all amateur 'phone bands, but with limits on bandwidth of emission. In 3850-4000 and 14,200-14,300 kc., the limit for emitted bandwidth would be 6 kc.; FCC proposes to open 3800-3850 to 'phone, but with a 3-ke. limit. In the 10-meter band, 28.5-29.05 Mc., would have a 10-ke. bandwidth restriction, and the remainder of the 'phone band would have a 6-ke. bandwidth limit. On 6 meters, the bandwidth permitted would be 20 kc., and there would be an exclusive c.w. portion 50.0-50.1 Mc.
FCC 49-502
33017

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D. C.

In the Matter of
Amendment of Part 12
of the Commission’s
Rules Governing
Amateur Radio Service

DOCKET No. 9295

NOTICE OF PROPOSED RULE MAKING

1. Notice is hereby given of proposed rule making in the above-entitled matter.

2. Therefore the Commission has received from the American Radio Relay League, Inc., of Hartford, Connecticut, the National Amateur Radio Council, Inc., of Indianapolis, Indiana, and the Society of American Radio Amateurs of Washington, D. C., all national organizations of radio amateurs, various proposals in writing for certain changes in the Commission’s Rules Governing Amateur Radio Service. The first proposals were submitted by the American Radio Relay League, followed by the others in the order named. Through channels outside of the Commission, publicity was given to the text or substance of one or more of these proposals. As a result, the Commission has received a number of comments from individual amateurs and groups of amateurs, dealing in one way or another with the subject matter covered by the proposals of the above organizations.

3. The receipt of the aforementioned items was not itself the occasion for the Commission to commence consideration of the fundamental and controversial issues involved in the proposals that have been received. However, the receipt of these items did serve to point up the timeliness of a study of these matters and to provide the Commission with a number of very valuable suggestions and an indication of the variety of views held by various members and segments of the amateur body.

4. The Commission has considered all of the proposals received. Also, it has reflected upon the general situation in which the Amateur Radio Service finds itself today and the general course of events leading up to that situation. The resulting judgement of the Commission is that the Amateur Radio Service would very much benefit from, and needs, a new overall plan or blueprint to provide scope and direction for the immediate and long range development of the service.

5. In entering upon this course, the Commission has used freely of the many splendid suggestions received. The sincerity and thoughtfulness behind these suggestions, as well as behind those not actually used, are evident and recognized. Great appreciation, therefore, is expressed for all of these suggestions, as well as for the spirit of cooperation demonstrated by those interested.

6. It will be noted upon examination that the proposals herein made, while numerous, are interrelated and constitute an overall plan. The purpose of this plan is as follows:

(a) To provide for the continued and directed enhancement of the Amateur Service in its value to the public as a voluntary, non-commercial, communications service, particularly with respect to providing emergency communications;

(b) To provide for the continued extension of the amateur’s proven ability to contribute to the advancement of the radio art;

(c) The continued improvement in the Amateur Service through a program which provides for encouragement for advancing skills in both the communication and technical phases of the art;

(d) To provide a reservoir of trained operators, technicians and electronic experts for:

1. The growing radio industry in peacetime;

2. The vastly increased demands of both the radio industry and the military services in times of national emergency.

7. The foregoing purposes are herein, or will later be, encompassed in proposed rules along the following general lines:

(a) Recognition of the communications system aspect of the service by specific encouragement of the establishment and use of traffic nets and of handling on a voluntary impartial basis, non-commercial third party messages, emphasizing at all times the importance of emergency operations. Examinations and license requirements would be geared to this phase of amateur activity.

(b) Establishment of an integrated and continuously reviewed and revitalized plan for improving operations and techniques and providing more efficient frequency utilization through the adoption of progressively higher performance standards, such as:

1. Immediate designation of certain portions of the amateur bands for narrow bandwidth techniques and

2. Immediate establishment of realistic limits on bandwidth of emissions in all heavily-occupied bands.

(c) Creation of initial interest on the part of the novice, particularly youth, through the establishment of a short term, non-removable beginner’s license of comparatively easy attainment. Also the encouragement of continued interest on the part of all amateurs through the progressive raising of standards at the highest level of license. As a companion measure, and particularly to promote developments on the higher frequencies, licensing at the first level above the beginner would permit alternate routes. One route would be for the communicator who would substantially resemble today’s Class B * and C * amateur. The other would be for the experimenter or technician who today has no precise counterpart and who would be permitted to operate only on the higher frequency bands. Class A *, B *, and C * licenses would be continued as at present, except that commencing with January 1, 1951, Class A * licenses would no longer be issued and would be renewed only as Class B *. The special privileges associated with Class A * licenses would be absorbed in a new special top grade of license of diploma form which would be called the Amateur Extra Class * license. Eligible applicants could qualify for the Extra Class license as soon as it was established, but there would be no compulsion, based on the desire for Class A * special privileges, to qualify for it until it was no longer possible to obtain or to renew a Class A * license. Qualifications for the Extra Class license would include a minimum number of hours operating experience as a Class A *, B *, or C * amateur, a higher speed telegraphic code test and other advanced requirements of knowledge in both technical and communications fields as well as all the knowledge usually required for a Class A * license.

20 QST for
This license would have practical values in that it would constitute evidence of exceptional proficiency for such consideration as this factor might warrant, and, in addition, would constitute a very real target for the amateur in whom pride of superior ability and accomplishment would constitute a spur to special endeavor.

* See paragraph (d), below.

(d) In paragraph (e), above, reference is made to Class A, B, and C operator licenses (which exist today) and also to three new classes of operator licenses (which do not exist today). The latter are proposed to provide for the beginner or novice, the experimenter or technician, and for the amateur who has extraordinary qualifications. As hereafter shown, it is proposed to call these new classes of operator licenses, respectively, the Amateur Novice Class, Amateur Technician Class, and Amateur Extra Class.

At the last one conditionally on geographical location with respect to quarterly examination points.

8. From the standpoint of the problem whether to provide a different sharing arrangement of frequencies between those used for telephony and for other types of emission, the present Commission proposes to provide for an additional 50 kc (3800-3850 kc) for telephony in the 3500-4000 kc band with a permitted total bandwidth of emissions of 5 kc. The band 50.0-50.1 Mc would be designated exclusively for radiotelegraphy with 

"A" modulation. The proposed beginner's class of license would permit telephony only in the band 145-147 Mc. Permanent provision is made for the use of NBFM and other narrow band techniques throughout all the bands available for telephony. Limitations on the bandwidth of emissions for telephony, ranging from 3 kc to 20 kc, are proposed for all bands except the new 27 Mc band and the bands above 54 Mc for which no bandwidth limitations are immediately proposed. The bands so limited are 3800-3850 kc, 3 kc; 3500-4000 kc, 6 kc; 14300-14300 kc, 8 kc; 25.5-26.65 Mc, 10 kc; 26.65-27.9 Mc, 6 kc; and 50.1-54.0 Mc, 20 kc. Wide band frequency modulation would be no longer permitted in the sub-bands 26.5-26.75 Mc and 53.5-54.0 Mc. Additional provision for 

9. As part of the plan described in paragraphs 7 and 8 above, it is proposed to revise the renewal service requirements for existing classes of amateur operator licenses (Classes A, B, and C proposed to be called Advanced, General, and Conditional respectively) in order that such requirements will be consistent with those which are being proposed for the new classes of licenses herein described (Amateur Extra Class and Technician Class). It has been thought for some time that the present renewal service requirements (three separate radiotelegraph contacts with other amateur stations in the United States during the last six months preceding the date of filing application for renewal) have little or no practical value as proof of qualification for renewal without examination. Accordingly, the attached Notice of Proposed Rule Making sets forth renewal service requirements for the existing and proposed (excluding Novice Class 12.0, which is not renewable) classes of amateur operator licenses. The one year grace period set forth in the recently published Notice of Proposed Rule Making (Docket 9240) has been incorporated in this proposal.

10. The proposed amendments, authority for which is contained in Sections 403, 303(b), (c), (e), (f), (g), (d), and (r) of the Communications Act of 1934, as amended, are set forth in an appendix attached to this notice.

11. Any interested party who is of the opinion that the proposed amendments should not be adopted, or should not be adopted in the form set forth may file with the Commission, on or before July 20, 1949, a written statement or brief setting forth such comments. All persons favoring the amendments as proposed may file statements in support thereof. The Commission will consider any such comments that are received before taking any final action regarding the proposed amendments, and if any comments are received which appear to warrant the holding of a hearing or oral argument before final action is taken, notice of the time and place of such hearing or oral argument will be given.

12. In accordance with Section 1.764 of the Commission's Rules and Regulations, an original and at least fourteen copies of all statements, briefs or comments shall be furnished the Commission.

FEDERAL COMMUNICATIONS COMMISSION

Adopted: April 20, 1949
Released: April 21, 1949

T. J. Slovie,
Secretary

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Proposed Changes in Amateur Rules

PART 12 RULES GOVERNING AMATEUR RADIO SERVICES, is amended as follows:

Directions for altering text: Insert the following text of new Section 12.111, Frequencies and Types of Emission for Use of Amateur Stations,

(a) The continued and directed enhancement of the amateur service in its value to the public as a voluntary noncommercial communication service, particularly with respect to providing emergency communications.

(b) The continued extension of the amateur's proven ability to contribute to the advancement of the radio art.

(c) The continued improvement in the amateur service through a program which provides for encouragement for advancing skills in both the communication and technical phases of the art.

(d) The providing of a reservoir of trained operators, technicians and electronics experts for:

1) The growing radio industry in peace-time; and

2) The vastly increased demands of both the radio industry and the military services in times of national emergency.

Substitute the following text for the present text of subparagraph 2 of paragraph (a) of Section 12.111, Frequencies and Types of Emission for Use of Amateur Stations:

(2) 3500-4000 kc. Use of this band is restricted to amateur radio stations as follows:

(i) 3500-4000 kc, radiotelegraphy using type A-1 emission only, to those stations located within the continental limits of the United States, the Territories of Alaska and Hawaii, Puerto Rico, the Virgin Islands and all United States possessions lying west of the Territory of Hawaii to 170 degrees west longitude.

(ii) 3500 to 3580 kc, radiotelephony using any type of modulation, except pulse, provided that the total bandwidth of emissions does not exceed 3 kilocycles, to those stations located within the continental limits of the United States, the Territories of Alaska and Hawaii, Puerto Rico, the Virgin Islands and all United States possessions lying west of the Territory of Hawaii to 170 degrees west longitude.

(iii) 3580 to 3590 kc, radiotelephony using any type of modulation, except pulse, provided that the total bandwidth of emissions does not exceed 6 kilocycles, to those stations
located within the continental limits of the United States, the Territories of Alaska and Hawaii, Puerto Rico, the Virgin Islands and all United States possessions lying west of the Territory of Hawaii to 170 degrees west longitude, subject to the further restriction that radiotelephone types of emission may be used only by an amateur station which is licensed to an amateur operator holding an amateur extra-class or advanced-class (Class A) operator license and then only when operated and controlled by an amateur operator holding an amateur extra-class or advanced-class (Class A) operator license.

Substitute the following text for the present text of paragraph (4) of paragraph (a) of Section 18.111, Frequency and Types of Emission for Use of Amateur Stations:

(4) 14,000 to 14,400 kc, radiotelegraphy using Type A-1 emission only; 14,200 to 14,300 kc, radiotelephony using any type of modulation except pulse, provided that the total bandwidth of emission does not exceed 6 kilocycles, subject to the restriction that radiotelephone types of emission may be used only by an amateur station which is licensed to an amateur operator holding an extra-class or advanced-class (Class A) operator license and then only when operated and controlled by an amateur operator holding an amateur extra-class or advanced-class (Class A) operator license.

Substitute the following text for the present text of subparagraph (6) and (7) of paragraph (a) of Section 18.111, Frequency and Types of Emission for Use of Amateur Stations:

(6) 28.0 to 28.7 Mc, radiotelegraphy using Type A-1 emission, radiotelephony using carrier-shift techniques provided that the maximum shift does not exceed 1 kilocycle; 23.6 to 23.65 Mc, radiotelephony using any type of modulation, except pulse, provided that the total bandwidth of emissions does not exceed 10 kilocycles; 23.65 to 23.7 Mc, radiotelegraphy, using any type of modulation, except pulse, provided that the total bandwidth of emissions does not exceed 6 kilocycles.

(7) 50.0 to 54.0 Mc; 50.0 to 50.1 Mc, radiotelegraphy using Type A-1 emission only; 50.1 to 54.0 Mc, radiotelegraphy using Type A-1 emission only; 50.0 to 54.0 Mc, radiotelephony using any type of modulation except pulse, provided that the total bandwidth of emissions does not exceed 20 kilocycles, or radiotelegraphy using any type of tone modulation or facsimile using amplitude modulation.

Substitute the following text for the present text of Section 18.31, Eligibility for License:

18.31 Eligibility for License:--Persons are eligible to apply for the various classes of amateur operator licenses as follows:

Amateur extra-class.--Any citizen of the United States whose application shows that while operating under a valid amateur operator license, advanced-class, general-class, or conditional-class (or Class A, B or C) issued by the Federal Communications Commission, the applicant has accumulated a minimum of 26 hours of operating experience during the last 12 months immediately preceding the date of his application.

Advanced Class (Class A).--Any citizen of the United States who at any time prior to the receipt of his application by the Commission has held, for a period of a year or more, an amateur radio operator license, general-class or conditional-class (or Class B or C) issued by the Federal Communications Commission. New advanced-class amateur operator licenses will not be issued after December 31, 1950: Commencing with January 1, 1951, valid advanced-class (or Class A) licenses will be renewed only as general-class, although holders of expired advanced-class (or Class A) licenses may, if eligible, apply for amateur extra-class licenses.

General Class.--Any citizen of the United States.

Conditional Class.--Any citizen of the United States whose application shows that while operating under a valid amateur operator license, an amateur station is more than 125 miles airline distance from the nearest location at which examinations are held at intervals of not more than 3 months for amateur operator licenses; or whose application shows that his physical condition makes him unable to appear for examination because of protracted disability; or who is shown by certificate of the commanding officer to be in the armed forces of the United States at an Army, Air Forces, Navy or Coast Guard station, and, for that reason, unable to appear for examination at the time and place designated by the Commission.

Technician Class.--Any citizen of the United States.

Novice Class.--Same eligibility requirements as conditional class except that the following classes of persons are not eligible for the novice class license: (a) Former holders of the amateur novice-class license, and (b) present or former holders of any class of commercial operator licenses issued on the basis of a technical examination.

Substitute the following text for the present text of Section 18.85, Classification of Operating Privileges:

18.85 Classification of Operating Privileges:

12.23 Classes and Privileges of Amateur Operator Licenses. -- Amateur extra-class.--All authorized amateur privileges as designated and limited as follows:

(a) The d.c. plate-power input to the vacuum tube or tubes supplying the power to the antenna shall not exceed 75 watts.

(b) Only the following frequency bands and types of emission may be used, and the emissions of the transmitter must be crystal-controlled except in the 145-147 Mc band:

(1) 3700 to 3750 kc, radiotelegraphy using only Type A-1 emission, in accordance with the geographical restrictions set forth in Section 18.111 (a) (2) (i).

(2) 14,100 to 14,150 kc, radiotelegraphy using only Type A-1 emission.

(3) 28.0 to 28.5 Mc, radiotelegraphy using only Type A-1 emission.

(4) 145 to 147 Mc, radiotelegraphy or radiotelephony using any type of emission except pulse emission and Type B emissions.

12.27 Renewal of Amateur Operator License. -- Application for renewal without examination of an amateur operator license, except the novice class, shall be filed not more than 120 days prior to the date of expiration, and the follow­

Substitute the following text for the present text of Section 18.97, Renewal of Amateur Operator License:

18.97 Renewal of Amateur Operator License:--Application for renewal without examination of an amateur operator license, except the novice class, shall be filed not more than 120 days prior to the date of expiration, and the follow­

Substitute the following text for the present text of Section 18.42, Element 1 (5) of the rules:

Advanced Class (Class A).--After December 31, 1950, may not be renewed, as advanced class (Class A) but may be renewed as general class on application which includes a statement, subject to proof upon request, that the applicant has accumulated a minimum of 50 hours of lawful operation during the entire term of and under the license being re­
General Class (Class B). — The application shall include a statement, subject to proof upon request, that the applicant has accumulated a minimum of 50 hours of lawful operation during the entire term of and under the license being renewed, or a minimum of 10 hours of such operation during the last 6 months immediately preceding the date of application, and that he can send by handkey and receive by ear, in plain language, messages in the International Morse code at a speed of not less than 15 words per minute in the manner described in Section 12.42, Element 1 of these rules.

Conditional class (Class C). — The application shall include a statement, subject to proof upon request, that the applicant has accumulated a minimum of 50 hours of lawful operation during the entire term of and under the license being renewed, or a minimum of 10 hours of such operation during the last 6 months immediately preceding the date of application and that he can send by handkey and receive by ear, in plain language, messages in the International Morse code at a speed of not less than 13 words per minute in the manner described in Section 12.42, Element 1 of these rules.

Technician class. — The application shall include a statement, subject to proof upon request, that the applicant has accumulated a minimum of 50 hours of lawful operation during the entire term of and under the license being renewed, or a minimum of 10 hours of such operation during the last 6 months immediately preceding the date of application, and that he can send by handkey and receive by ear, in plain language, messages in the International Morse code at a speed of not less than 13 words per minute in the manner described in Section 12.42, Element 1 of these rules.

Novice class. — This class of operator license may not be renewed.

Substitute the following text for the present text of Section 12.29, License Term:

12.29 License Term. — Amateur operator licenses are normally valid for a period of 5 years from the date of issuance of a new or renewed license, except the novice class which is normally valid for a period of one year from the date of issuance. Modified and duplicate licenses shall bear the same date of expiration as the licenses for which they are modifications or duplicates.

Substitute the following text for the present text of Section 12.43, Elements of Examination:

12.43 Elements of Examination. — The examinations for the various classes of amateur operating privileges comprises combinations of various of the following elements:

Element 1. Conditional Class (Class C). — Ability to send by handkey and receive by ear, in plain language, messages in the International Morse code at a speed of not less than 13 words per minute, free of omissions or other errors, for a continuous period of at least 1 minute, during a test period of 5 minutes, counting 5 characters to the word, each numeral or punctuation mark counting as 2 characters. (Advanced class, general class, and exceptional class (Classes A, B and C).)

Element 2. Code test. — Ability to send by handkey and receive by ear in plain language, messages in the International Morse code at a speed of not less than 20 words per minute free of omissions or other error for a continuous period of at least 1 minute during a test period of 5 minutes, counting 5 characters to the word, each numeral or punctuation mark counting as 2 characters. (Amateur extra-class.)

Element 1 (NT). Code test. — Ability to send by handkey and receive by ear in plain language, messages in the International Morse code at a speed of not less than 7.8 words per minute (each character formed at a speed of 7.8 words per minute, but with increased spacing between characters and words so as to result in an overall speed of 5 words per minute.) (Novice and technician classes.)

Element 2. Amateur radio operation and apparatus, including telephone and telegraph. (Amateur extra-class, advanced class, general class, conditional class (Classes A, B, and C), and technician class.)

Element 3(N). Rules and Regulations essential to beginners’ operation including sufficient elementary radio theory for the understanding of these rules (Novice class).

Element 4. Advanced amateur telephony. (Amateur extra class and advanced class (Class A).)

Element 4(E). Advanced amateur radio theory including techniques for operating within bands designated for narrow bandwidths of emission. (Amateur extra class).

Substitute the following text for the present text of Section 12.45, Elements Required for Various Privileges:

12.45 Elements Required for Amateur Operator License Examinations:

Amateur extra class. — Examination consists of Elements 1(E), 2, 3, 4, and 4(E).

Advanced class (Class A). — Examination consists of Elements 1, 2, 3, and 4.

General class and conditional class (Classes B and C). — Examination consists of Elements 1, 2, and 3.

Technician class. — Examination consists of Elements 1(NT), 2, and 3.

Novice class. — Examination consists of Elements 1(NT), and 3(N).

Substitute the following text for the present text of the first paragraph of Section 12.44, Manner of Conducting Examinations:

12.44 Manner of Conducting Examinations. — The examinations for all amateur classes of operator licenses except the conditional and novice classes will be conducted by an authorized examiner designated or representative at locations and times specified by the Commission.

Substitute the following text for the present text of the first paragraph of Section 12.45, Examination Credit:

12.45 Examination Credit. — An applicant holding a valid amateur operator license, other than the conditional class (Class C) or novice class, applying for a higher class of amateur operator license will be required to pass only those elements of the examination that were not included in the examination for the presently-held amateur license.

An applicant for amateur advanced class (Class A) operator license will be given credit for examination Element 4 if within two years prior to the receipt of his application by the Commission he held Class A privileges.

An applicant for any class of operator license, except the novice class and the extra class, will be given credit for examination Element 1 or 1(NT) if within five years prior to the receipt of his application by the Commission he held a radiotelegraph first or second class operator license. An applicant for the amateur extra class operator license will be given credit for examination Elements 1, 2, 3, 4 and 4(E) if within five years prior to the receipt of his application by the Commission he held a radiotelegraph first class operator license.

No examination credit, except as above provided, shall be allowed on the basis of holding or having held FCC amateur or commercial operator license.

A holder of an amateur conditional (Class C) or novice operator license will not thereby be accorded an abridged examination for any other class of amateur operator license.

Substitute the following text for the present text of Section 12.65, License Period:

12.65 License Period. — The license for an amateur station is normally valid for a period of five years from the date of issuance of a new or renewed license, except that an amateur station license issued to the holder of a novice class amateur operator license is normally valid for a period of one year from the date of issuance. Modified or duplicate licenses shall bear the same issue date and expiration date as the licenses for which they are modifications or duplicates.

Insert the following text for new Section 12.107, Roundtable Operations:

12.107 Roundtable Operations. — Whenever more than two amateur stations are in communication with each other, one of them shall act as control station in the interest of orderly communications procedure.
AMSATEURS who are now using teletype machines for communications work may be interested in a system that was developed and tested by the writer in 1946. As at that time there seemed to be no amateur interest in this form of communication the work was dropped. This system uses off-on keying and gets around the necessity for using two-tone modulation or frequency-shift keying. It has a very substantial capability of discrimination against noise.

A loop circuit was set up between locations in downtown and midtown New York over a 5-mile path. The 11-meter and 2-meter bands were used. Both teletype machines were located downtown, as shown in Fig. 1. Transmission north was accomplished with a surplus 144-Mc. crystal-controlled transceiver with one-watt output. The signal was received on a similar unit and retransmitted south by a 10-watt 11-meter transmitter. The signal was picked up on an SX-28 and fed into the receiving teletype machine.

This location is extremely noisy — the S-meter readings average around S7 on building noises of all types. Haywire antennas were employed so the signal never boosted the S-meter reading much beyond S9. Despite this severe handicap, the system worked very well. Amateur teletype fans should obtain excellent results as they will rarely, if ever, encounter such poor receiving conditions.

The receiver circuit is shown in Fig. 2. A reverse-diode r.f. noise limiter is used in conjunction with a blocking-oscillator "tone-noise generator." The audio amplifier of the receiver can be followed by an audio filter, if desired, or the output can be fed directly into the rectifier. The rectified audio output of an SX-28 is sufficient to operate the teletype relay directly. The low-current teletype relay generally used in radioteletype work will reduce the audio output requirements.

The blocking oscillator shown in the diagram operates at the receiver's intermediate frequency. The repetition rate can be adjusted to any convenient frequency. Between 400 and 600 cycles is a good choice. The output level of this oscillator is not important because the noise limiter

(Continued on page 108)
Multiple-Circuit Tuners from Grid to Feeder

A Six-Band R.F. Amplifier and Antenna Coupler

BY C. VERNON CHAMBERS,* WIJEQ

In the attempt to obtain rapid band changing, many of us have either constructed or purchased an exciter unit that will hop from band to band at the flip of a single control. Frequently, though, means for rapid and simple band changing end right there—at the output circuit of the exciter—because the power amplifier and the antenna coupler use plug-in coils. In other words, our fancy exciter hasn’t minimized the band-changing ordeal so very much after all.

The use of an all-band tuner in the plate circuit of an amplifier as demonstrated by W1CJL was one new step toward speeding up and simplifying the job of changing bands at the output end of the transmitter. After studying King’s data we began to wonder if the multiple-band tuner idea couldn’t be expanded to include the amplifier grid circuit and the antenna coupler. The only commercial model of such a tuner—the MB-150—was a 150-watt unit and no doubt could be modified for use as an antenna coupler. But it seemed unnecessarily large for the grid circuit of a 150-watt amplifier, so we felt it advisable to try constructing a lower-power unit using the same principles.

Although we had some misgivings at the start, it turned out that the design of the grid tuner was a simple matter; we just duplicated the and values of the MB-150 with components of smaller physical size. Construction was an even lighter task and getting it to work gave no trouble at all. In fact, the three operations—design, construction and testing—involves far less time and labor than is usually expended on a 6-band tuned circuit using either bandswitching or plug-in coils.

In addition to the multiple-circuit tuners that permit rapid band changing without plug-in coils or r.f. switches, the amplifier described here uses economical and easy-to-drive 807 tubes and is complete with heater supply, protective-bias system, TVI filters and provision for matching a wide range of antenna impedances. Effective shielding and a finished appearance are provided by an inexpensive steel utility can. Changing bands becomes a simple task when this unit is used along with a single-control exciter capable of delivering approximately 3 watts output.

The Amplifier Circuit

The circuit diagram of the amplifier is given in Fig. 1. The push-pull arrangement is conventional except for the grid and plate tuners. Operating bias for the 807s is developed across R1 and R2 is the series-dropping resistor for the screen grids. A Type 6Y6G tube, connected between R1 and R2, serves as a screen-voltage limiter when excitation is removed from the amplifier. RFC1 and RFC2 in the grid circuit, and C19, C11, C1L4 and C5L4 in the plate circuit combine to prevent parasitic oscillation. However, the primary function of the condensers and coils is the suppression of v.h.f. harmonics falling in the television channels between 54 and 88 Mc. Filters installed in the heater and high-voltage leads attenuate the flow of harmonic currents in the external wiring.

This 150-watt amplifier-antenna coupler, covering 3.5 to 30 Mc, without bandswitches or plug-in coils, includes means to reduce TVI and is complete except for plate supply. Grid and plate meters are to the left and right of the grid-circuit tuning control. The tuning controls for the antenna coupler and the amplifier tuner are at the left and right sides of the panel just above the meters.

June 1949
AMP.

C, C2 - 125-μf variable (National SSII 125).
C3, C4, C5, C6 - 110-μf. per-section variable (part of National MB-150 tuner).
C1, C5 - 50-μf. variable (National PSE).
Cv - 0.0047-μf. mica.
C10, C11 - 10-μf. tubular; SM text.
Cm, C12 - 0.005-μf. ceramic (Centralab DA 0,18).
C14 - 0.001-μf. mica, 1200 volts working.
C15 - 470-μf. mica, 1200 volts working.
R - 12,000 ohms, 1 watt.
R2 - 25,000 ohms, 20 watts.
L1 - 30 turns No. 22 enam., center-tapped, 1¾-inch diam.
L4, L5 - 4 turns No. 16 tinned, 1 inch long, ¾-inch diam.
L6, L7 - 5 turns No. 12, 5¾-inch long, ⅝-inch diam.; L6 is center-tapped.
L8, L9 - 12 turns No. 12, 2⅞-inch long, ⅝-inch diam. (Note: L8 to L12, inc. - part of MB-150 tuner.)
L10, L11 - 7 turns No. 22 enam., ¾-inch long, 1-inch diam.

Excitation for the amplifier is fed through a low-impedance link to the low-frequency coil, L1, of the grid tuner. Output from the plate circuit is transferred to the antenna coupler through two coaxial cables. One of the lines, a section of RG-11/U, is tapped on output-coupling coil L9 and carries output at 3.5 and 7 Mc. A length of RG-11/U, link-coupled to L8 and L11, completes the coupling circuit at 14, 21, 27 and 28 Mc.

**Antenna-Coupler Circuit**

The circuit diagram of the antenna coupler is also given in Fig. 1. The MB-150 assembly has been rewired so that the low-frequency section of the circuit, C6L6L11, can be used for either series or parallel tuning at 3.5 and 7 Mc. C8, C9, L12 and L13 form a parallel-tuned coupler at 14 Mc. and above.

Selection of series or parallel tuning is accomplished by making proper use of terminals A, B, C, D and E. The flexible clip lead, E, connected to the rotor side of C6, permits either shorting out one section of the capacitor or using the two sections in series or parallel. A connection chart shows the jumper and feeder connections required for low-, medium- and high-C operation of the series and parallel circuits.

**Construction**

The front view shows a Middletown No. UC 11128 utility can, with the bottom plate removed, fastened to the chassis by means of aluminum strips and a front panel. The cabinet measures 8 by 11 by 12 inches and the chassis 8 by 10 by 12 inches. The panel is 12¼ inches wide by 10½ inches high and the aluminum strips measure 1 by 10 inches.
Ventilation for the amplifier is provided for by the 1-inch hangover at the rear of the assembly and by holes cut in the top cover of the cabinet. A slot in the top cover, covered with a small aluminum plate as seen in the front view, permits adjustment of the harmonic traps with the cover in place.

The inside view shows the plate and antenna-coupler tuners and the "clamper" tube mounted on the main chassis. The 807s, submounted on an aluminum channel, are to the right of the plate tuner and the tubular by-pass condensers, C10 and C11, are between the 807s. The harmonic traps, C7L4 and C8L5, are supported by a 1 1/2" x 3 1/2-inch piece of polystyrene which is in turn mounted on the frame of the plate tuning assembly.

Antenna-Coupler Connection Chart

<table>
<thead>
<tr>
<th>Tuning</th>
<th>&quot;C&quot; Terminals</th>
<th>Jump Terminals</th>
<th>Connected Clip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series Low A &amp; C</td>
<td>—</td>
<td>—</td>
<td>B or C</td>
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<td>Series Medium A &amp; C</td>
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<td>B or C</td>
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<tr>
<td>Series High A &amp; D</td>
<td>B &amp; C</td>
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<tr>
<td>Parallel Low A &amp; B</td>
<td>A &amp; C</td>
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<td>Parallel Medium A &amp; B</td>
<td>A &amp; C</td>
<td>B or C</td>
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<tr>
<td>Parallel High A &amp; B</td>
<td>A &amp; C</td>
<td>A</td>
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</tbody>
</table>

The cabinet is divided into compartments by a partition made from the bottom cover of the can. Holes drilled in the partition pass the coaxial cables which run between the plate and the antenna-coupler circuits. Notice that the high-frequency coaxial link is made from heavy-duty cable; the RG-59/U breaks down under this application. The rear right-hand corner of the cabinet has been cut free and then hinged, thus providing access to the antenna-coupler terminals. Normally, the door is held closed by the top cover.

A bottom view shows the 807 tube sockets and the tubular condensers mounted on a 2 1/2-inch wide channel which is bolted to the front and rear walls of the chassis. Rolled-over edges give the channel adequate strength. The heater and screen by-pass condensers and the grid r.f. chokes are connected directly at the socket terminals. The heater transformer and the screen resistor are at the front left-hand corner of the chassis and the plate by-pass condenser and the TVI-filter components are to the rear. Jacks for the r.f. and power-input cables are mounted on the rear wall of the chassis and the grid tuner is located to the right of the subchassis.

To obtain symmetry the control for the grid tuner is set at the center of the panel as shown by the front view. This necessitates a pulley arrangement between the panel-bearing assembly and the control shaft of the tuner. Inexpensive pulleys were made by cutting "V"-shaped slots around small tuning knobs. The cutting was done with a 3-cornered file after the knobs, equipped with 3/4-inch shafts, were mounted in a drill chuck. Two holes, large enough to clear dial cable and at right angles to the "V" slot, are drilled in each knob to prevent the cable from slipping.

Construction of the grid tuner is a simple matter. The two split-stator condensers, C1 and C2, are mounted on a strip of bakelite by means of "L"-shaped metal brackets. An insulated coupler is used between the shafts of the condensers. The grid coils, wound on 1-inch diameter forms, are mounted on the condenser frames. Spacers 1/4-inch long are placed between the bottom of the coil forms and the condensers to provide a reasonable space between the windings and the metal frames. A lug strip mounted on the front stator terminal of C1 as shown in the bottom view of the amplifier is used as the tie point for the center-tap of L1 and the c.t. by-pass condenser, C9.

Modification of the MB-150 used as an antenna coupler is a few minutes' work. First, the r.f. choke is removed from the unit. Second, one end of the low-frequency coil, L9 of Fig. 1, is disconnected from the tuning condenser. The four feeder terminals and the clip lead are now mounted and the unit rewired to resemble the circuit of Fig. 1. The photograph of the amplifier shows only three feeder terminals mounted along the bottom edge of the terminal block at the rear of the tuner, but it is recommended that a fourth one be included.

The output leads of the MB-150s are equipped with clips. We removed the clips and soldered one of the flexible leads (at both plate tuner and antenna coupler) to the third turn of the coupling winding. The second flexible lead, in both cases, is terminated with a flat-jaw Mueller clip and the original MB-150 clips are used as permanent taps on windings L9 and L10.
The tubular-typo plate by-pass condensers, $C_{10}$ and $C_{11}$, are homemade affairs. The outer tubes are 43/4-inch lengths of 9/16-inch i.d. copper pipe. The internal members, 1/4 inch in diameter by 5 inches long, may be cut from either aluminum or copper rod. These rods should be drilled and tapped at one end and rounded off at the opposite end. The large tubes are soldered to a flat copper mounting plate after the latter has been drilled to accommodate the o.d. of the tubes. Millen 47001 coil forms serve as the spacers between the inner and outer sections of the condensers. The outsides of the coil forms should be coated with cement before the forms are forced into the copper tubes.

**Power Supply**

The power supply should deliver 750 volts for c.w. operation or 600 volts if the amplifier is plate-modulated. In either case the current drain will be approximately 220 mA - 200 mA for the plate circuit and 15 to 20 mA for the screen grids.

**Preliminary Tests**

Testing of the grid tuner is done with heater voltage and r.f. excitation applied to the amplifier. Output from the exciter should be adjusted to cause an amplifier grid current of approximately 10 ma. at all amateur frequencies from 3.5 through 20.7 Mc. When operating the multiple-circuit tuner, it must be remembered that the effective resonant frequency does not increase in the usual sequence as the ganged condensers are rotated through the tuning range. Starting with maximum capacitance, the low-frequency edges of the 6 bands tune in the following order: 14, 3.5, 21, 7, 27 and 28 Mc.

The plate circuit of the amplifier is tested in the usual manner. With both excitation and high voltage applied, the plate current should be approximately 20 ma. when the plate tuner is resonated without load. A full-load current of 200 ma. may be obtained with a 100-watt lamp connected across several turns of $L_9$. The screen grid input should be approximately 16 ma. at 300 volts when the amplifier is loaded. Output from the exciter may now be readjusted so the 807 grid current will be 8 ma. The normal bias developed across $R_1$ is 90 volts.

With the 6Y6G in place, excitation cut-off and plate voltage applied, the plate current should not exceed 35 ma. Screen voltage will be approximately 30 volts under these conditions.

The antenna coupler may be tested with either an antenna or a dummy load connected to the feeder terminals. Lamp-bulb combinations that will simulate antenna loads of various impedances are listed elsewhere. Coupling between the amplifier and the antenna coupler at 3.5 and 7 Mc. is adjusted by positioning the taps on the coupling coils, $L_9$ and $L_{10}$. Once these taps have been located to give proper coupling, it is only necessary to change the positions of the flexible clip leads when going from 3.5 to 7 Mc. Just where the taps should be placed, as well as the selection of either series or parallel tuning, will depend on the load impedance that is worked into. Low-impedance loads usually require fairly large coupling coils and series tuning while high impedances are ordinarily coupled to with smaller links and parallel tuning.

At frequencies above 7 Mc., the low-frequency coupling link is shunted out at the plate-circuit end. The modified MB-150 must be used as a parallel-tuned coupler at 14 Mc. and above. Coupling between amplifier and antenna tuner is fixed by the coaxial-type link, which provides adequate coupling on all four bands. Because parallel tuning is a must at 14 Mc. and above, it is essential that the antenna system be designed for parallel tuning at these frequencies. Multiband antennas that will meet this requirement are described in The Radio Amateur's Handbook and in the A.R.R.L. Antenna Book.

**Harmonic Traps**

Adjustment of harmonic traps has received previous treatment, and this operation should be carried out with the transmitter coupled to an antenna. When testing the original model with full input at 28 Mc., it was possible to tune out every indication of r.f. at the second and third (Continued on page 108)

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A Filter Design for the Single-Sideband Transmitter

BY FRED M. BERRY,* WØMNN

Single-sideband transmission has been in use on the amateur bands for well over a year, and its theoretical advantages over a.m. and n.f.m., both in reducing QRM and its ability to "get through," have been proved in practice. Although there is room for improvement in receiver stability and selectivity, this has not proved such a handicap as it first seemed.

The greatest obstacle to greater single-sideband activity is the need for a simple and inexpensive means of converting existing a.m. transmitters to single-sideband operation. While it has been used commercially for many years, single sideband is new to most amateurs. Like any new technique, it appears complicated at first glance. However, many excellent articles have appeared in QST and other publications, for anyone who is still unfamiliar with the basic principles.

Briefly reviewing: One basic method of producing single sideband, termed the "phasing" method, eliminates carrier and undesired sideband by employing two balanced modulators with 90-degree carrier and audio networks. This system enables the sideband to be produced directly at the desired output frequency. While this has certain advantages, there is little assurance that the necessary high degree of phase and amplitude balance will be maintained over long periods of time. There is also difficulty in determining with simple test equipment whether the undesired sideband has been sufficiently suppressed.

In the filter method of generating single sideband, a double sideband is first generated in a balanced modulator (where the carrier is eliminated), and the filter removes the undesired sideband by "brute force." While this method does not have the "finesss" claimed for the "phasing" method, it is positive, and requires no critical adjustments. Since the filter is a passive network, sideband suppression is not affected by other circuit variations, tube gains, etc.

Filters using only inductors and capacitors are practical only at frequencies in the order of 10 to 50 kc., and the sideband must be obtained at some low frequency and heterodyned to the desired output frequency. This is not a serious handicap, and enables the output frequency to be varied without disturbing the sideband-generating portion of the circuit. Contrary to the statement made by some, the selection of either upper or lower sideband is simple, requiring only a frequency change of one of the oscillators.

The block diagram of a practical single-sideband transmitter is shown in Fig. 1. The selection of upper or lower sideband is accomplished by switching the frequency of the second oscillator. In the notation of Fig. 1, "USB" and "LSB" indicate the position of sideband at the points noted with respect to the input speech frequencies. This is not to be confused with the particular sideband of the second oscillator that is selected by the second i.f. Careful study of Fig. 1 will make this clear.

Although not directly indicated in Fig. 1, the

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Fig. 1 — Block diagram of a typical single-sideband suppressed-carrier transmitter or exciter. The equipment inside the dashed area is described in this article.
requirements of the various filters might be briefly reviewed. The first i.f. filter must select a band of frequencies from about 19.8 to 17 kc and have high attenuation to frequencies of 20.2 to 23 kc (the other sideband). The second i.f. selectivity must be such that it will greatly attenuate the frequencies of the unwanted sideband generated in the second modulation process. This unwanted sideband will be removed by twice the frequency of the first i.f. (34 to 40 kc for 17-20 kc, first i.f.). The second-oscillator frequency must also be prevented from being transmitted. A balanced modulator for the second modulator will remove most of this undesired sideband of frequencies from about 19.8 to 30 kc. (the other sideband). The second oscillator on the same frequency when transmitting either upper or lower sideband, and it is a little easier.

In considering the design of this filter, quality of components and desirable characteristics were of first consideration; low cost and ease of construction were achieved by selection of the type of filter sections and impedance transformations. Sharp cut-off is restricted to the high-frequency edge of the passband, concentrating the attenuation where most needed, and resulting in a minimum number of inductors. This filter is designed for selection of the lower sideband, but since the position of the sideband may be altered at the output of the transmitter in a succeeding modulator stage, this is no handicap.

A figure of approximately 40 db. reduction of the undesired sideband was selected as a practical value. It is believed that values much lower may tend to limit operation on the adjacent channel (when sufficiently selective receivers are in use). Values much over 40 db. would probably not be worth while even if a greater ratio were obtained at the output of the filter, because intermodulation in succeeding stages of the transmitter is likely to introduce spurious beat products of low intensity. (Note: In any single-sideband transmitter, improper amplifier bias and overloading in the linear amplifiers is to be avoided as the effect is similar to an overmodulated s.m. transmitter, with its resultant spatter.)

A bandwidth of 2800 to 3000 cycles has proved satisfactory for commercial communication and is thought to be a practical one for amateur use.

A frequency band of 17 to 20 kc. was chosen in preference to one of lower frequency to reduce the selectivity requirements of the second i.f. filter, as previously noted. This rather high frequency (for a single-sideband filter) also has the feature of lower component values, lowering cost and making hand winding of the inductors feasible.

The filter consists of two m-derived pi sections of the type shown in Fig. 2. This type of section has one frequency of infinite rejection on the high-frequency side of the passband. By using two sections, one with the rejection frequency at

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**Filter Design**

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3 The general technique is shown by Nichols, "A Single-Sideband Transmitter for Amateur Operation," QST, Jan., 1949.

4 In the original manuscript, Mr. Berry showed the 2nd oscillator (Fig. 1) on either 448 or 485 kc. It was changed as shown because this maintains the output (suppressed) carrier on the same frequency when transmitting either upper or lower sideband, and it is a little easier.

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***QST for***

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20.5 kc. and the other at 21.5 kc., the resultant attenuation on the high-frequency side is quite high. When the two sections are combined, the inductors and capacitors at the junction may be combined, to reduce to five the total number of inductors in the complete filter.

The input and output impedance characteristics are the same as that of the mid-shunt constant-k type of filter of the same cut-off frequency. This sort of termination impedance is economical and works well either directly from a ring modulator or resistance terminations.

The design impedance \(R\) of 1000 ohms was selected to give desirable component values and desirable input and output impedances obtained by transformer action in the end inductors.

The resultant values calculated from the design formulas of Fig. 2 for each section are given in Fig. 3, and in Fig. 4 for the two sections combined.

To those who may wish to calculate similar filters, note that if sections are to be joined, the design impedance and the cut-off frequencies must be the same for both sections, although the frequencies of infinite attenuation may be different.

The filter of Fig. 4 might now be constructed, and if proper components are available, the insertion loss between 1000-ohm resistive impedances would be approximately that of Fig. 5. A low dissipation factor (high \(Q\)) is necessary in most of the components to obtain the required characteristics. Resistive losses internal to the filter not only will cause a greater loss at all frequencies but will "round off" the edges and prevent the rapid rise of attenuation needed just outside the passband.

Except in the case of \(C_1\) and \(C_7\) (Fig. 4), mica or other low-loss types of capacitors are necessary for proper filter action. \(C_1\), \(C_4\) and \(C_7\) are large values for mica capacitors and would be expensive. Ordinarily they would have to be made from a large number of paralleled units. \(C_1\) and \(C_7\) appear directly in parallel with the terminating resistances and it has been found that good-quality paper capacitors are satisfactory here.

Fig. 4 — Component values of the filter after combination of the parallel components. Values are in \(\mu\)fd. and mh.

Component Tolerances

In the filter of Fig. 4, the tolerance of some of the elements is quite critical, particularly that of the series arms. It has been found in the design of filters of this type that the tolerance of LC ratios is not particularly critical provided the correct resonant and antiresonant frequencies are maintained. Practically, this leads to the selection of capacitors to a tolerance of ±5 per cent or better, and resonating each LC circuit to the correct frequency by turn adjustment of the inductor. The maximum possible error of 10 per cent in the impedance match between junctions of the filter arms is not serious. Greater tolerances will cause a "ripple" in the passband and other deviations from the desired characteristics. In following this procedure, note that the series arms of the filter have both a resonant and an antiresonant frequency, with the inductor as a common element for both. Obviously, the inductor could not be adjusted...
independently for both frequencies. To permit this desired independent adjustment, a tapped-inductor arrangement is used.

Considering the series arm \( L_2 \) and \( C_2 \), \( C_3 \) is selected with a tolerance such that it will always be larger than the calculated nominal value. \( L_2 \) may then be adjusted with this new value of \( C_3 \) to the correct antiresonant frequency and will have fewer turns than the original calculated value of \( L_2 \). Leaving \( C_3 \) connected across the exact number of turns necessary for antiresonance, turns may be added to \( L_2 \) until the entire combination of \( L_2 \), \( C_2 \) in series with \( C_3 \) and the added winding of \( L_2 \) will series-resonate at the correct frequency. The exact value of \( C_3 \) will set the impedance of the entire arm, and \( \pm 5 \) per cent is permissible.

![Fig. 6 - Revised filter of Fig. 4, with provision for balanced or unbalanced input and output.](image)

\( L_1 (1-4) \) - 0.7 mH, 33 turns No. 26, bifilar.
\( L_2 (5-6) \) - 1.4 mH, approx. 47 turns No. 26, bifilar.
\( L_2 (1-4) \) - 2.0 mH, approx. 80 turns No. 26, bifilar.
\( L_2 (5-6) \) - 0 to 20 turns No. 26, single.
\( L_3 (1-4) \) - 0.7 mH, approx. 47 turns No. 26, bifilar.
\( L_3 (1-8) \) - 2.3 mH, approx. 96 turns No. 26, bifilar.
\( L_3 (1-4) \) - 5.0 mH, approx. 125 turns No. 26, bifilar.
\( L_3 (5-6) \) - 0 to 20 turns No. 26, single.
\( L_4 (5-8) \) - 14.0 mH, 160 turns No. 26, bifilar.
\( L_4 (1-1) \) - 1.4 mH, approx. 47 turns No. 26, bifilar.

All wire Formvar or d.s.c. — see text.

\( L_1 \) and \( L_3 \) wound on Western Electric P476930 core ring.
\( L_2 \), \( L_3 \) and \( L_4 \) on Western Electric P284395 core ring.

Approx. turns \( P476930 = 1000\sqrt{\frac{164}{L}} \)

Approx. turns \( P284395 = 1000\sqrt{\frac{70}{L}} \)

**Resonant Frequencies**

<table>
<thead>
<tr>
<th>Inductor</th>
<th>Capacity</th>
<th>Freq. kc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( L_1 (5-8) )</td>
<td>( C_1 )</td>
<td>19.1</td>
</tr>
<tr>
<td>( L_2 (1-4) )</td>
<td>( C_3 )</td>
<td>20.5</td>
</tr>
<tr>
<td>( L_2 (1-6) ) with ( C_3 ) connected</td>
<td>( C_2 )</td>
<td>19.1</td>
</tr>
<tr>
<td>( L_4 (1-4) )</td>
<td>( C_4 )</td>
<td>18.9</td>
</tr>
<tr>
<td>( L_4 (1-8) )</td>
<td>( C_4 )</td>
<td>18.9</td>
</tr>
<tr>
<td>( L_4 (1-4) ) with ( C_4 ) connected</td>
<td>( C_5 )</td>
<td>21.5</td>
</tr>
<tr>
<td>( L_5 )</td>
<td>( C_6 )</td>
<td>18.9</td>
</tr>
</tbody>
</table>

The series arm \( C_6 \) is considered and modified in the same manner.

This now leaves only four capacitors, \( C_1 \), \( C_2 \), \( C_5 \), and \( C_6 \), to be selected to plus or minus 5 per cent. Each capacitor may of course be made up of two or more units in parallel if necessary to obtain the correct value.

The filter may be further modified by the addition of separate windings to \( L_1 \) and \( L_4 \) to permit operation directly from a ring modulator and into the grids of a balanced tube modulator. This adds little additional cost, and accurate balance can be easily obtained by using bifilar windings.

In the design given, an impedance of 500 ohms was selected for the input winding of \( L_1 \), since a copper-oxide ring modulator operates quite satisfactorily into this impedance. The impedance of the output winding of \( L_5 \) is a compromise between desired voltage step-up and keeping the number of turns to a value that permits hand winding. The completed filter design after all modifications is shown in Fig. 6. In the event other input or output impedances are desired, the number of turns and method of connection of these added windings may be altered to meet the requirements. Since the impedance varies directly with the inductance of the windings (with 1.4 mH the inductance for 1000 ohms impedance), the required inductance in millihenrys for any new impedances may be found by dividing the new impedance in ohms by 1000 and multiplying the result by 1.4. The number of turns required can be found from the formulas for the inductors given in Fig. 6.

**Filter Alignment**

As has previously been mentioned, the \( LC \) combinations must be resonant at the desired frequency. In an \( s \)-type filter with closely-spaced rejection frequencies, it is very important to hold to very close frequency tolerances; while a constant error is not serious the spacing of one frequency to the next is critical.

Hitherto, it has been considered necessary to use expensive laboratory equipment, which is out of the reach of many. Signal generators for the range of 15 to 30 kc. are not common, and those available are usually not of sufficient accuracy. However, with the aid of a BC-221 frequency meter the main obstacle has been removed. The fundamental frequency range of the low band of the BC-221 is 125-250 kc., and it has sufficient output voltage to give a reasonable indication on most oscilloscopes. The BC-221 is used only as a calibration means for the test signal generator. The test generator may easily be made from the junk box, and the usual calibration problem
solved by the BC-221. In fact, good procedure is to use only a rough calibration and use the BC-221 continuously for frequency set. The method of connection of the frequency-check system is shown in Fig. 7. The oscilloscope vertical and horizontal inputs are used to give the familiar Lissajous figures as a means of comparing frequencies. Since most of the frequencies needed from the test generator are one-tenth that of the BC-221 it is convenient to use the chart calibration points for 125–250 kc. By moving the decimal point one place to the left and obtaining a 10:1 Lissajous pattern on the oscilloscope the frequency may be read directly. Other multiples must, of course, be used for some frequencies.

An LC-type signal generator is recommended for best stability, and particularly if one has to be constructed.

A method of resonating that gives accurate results is shown in Fig. 7. This method measures all LC combinations as a series-resonant circuit. With the LC combination connected as shown, a sharp dip in amplitude occurs when the frequency is at the exact series-resonant point, since the impedance is then a minimum. Although not critical, \( R \) of Fig. 7 should be the smallest value that will still give a readable indication. When an entire series arm is resonated the dip will not be as great but will be very sharp.

**Coil Construction**

In selecting inductors for the filter, the \( Q \) is of primary importance. \( Q \) values of at least 150 are necessary for all inductors except possibly \( L_1 \) and \( L_5 \), as in the case of \( C_1 \) and \( C_7 \), are in parallel with the terminations, and losses here have much less effect. While many types of inductors might be used, the toroidal type has many advantages and core rings of molybdenum Permalloy are now available to the amateur.

![Diagram](image)

**Fig. 7** — The method used for checking coil-and-condenser combinations. An accurate frequency check is obtained by using a BC-221 to check the 10th harmonic of the test signal generator. The LC combination under test is adjusted for minimum horizontal amplitude at the desired frequency.

- \( R \) — 1 to 10 ohms, \( \frac{1}{2} \) watt. See text.
- \( T \) — Step-down transformer. A 500-to-6-ohm audio transformer is suitable with generator outputs of 500 ohms or less.

Toroidal coils of this material are small in size and have a very low external field, and the inductance remains quite constant with power level and temperature. The coupling between turns is high, so that leakage reactance may be neglected in the design of the built-in transformers and tapped coils. The one disadvantage of using toroidal coils is the difficulty of winding, since the wire must be threaded through the core. However, in this filter special attention was given to keeping the inductances low, and winding is not too difficult. Two different grades of core material were used in the inductors for the filter of Fig. 6 (attenuation characteristics shown in Fig. 5).

Inductors \( L_2, L_3 \) and \( L_4 \) use cores having an effective permeability of 60, producing \( Qs \) of 200 to 250 at 20 kc. \( L_1 \) and \( L_5 \) cores were of 125 permeability, reducing the required number of turns and still permitting \( Qs \) of over 100. The construction data in Fig. 6 give the approximate number of turns of the inductors when using Western Electric core rings P476930 for \( L_1 \) and \( L_5 \), and P284395 for \( L_2, L_3 \) and \( L_4 \). P476930 and P284395 have nominal inductances of 164 and 79 millihenrys respectively per 1000 turns. The approximate number of turns for a specified inductance, as given by the manufacturer, is found by the formulas given in Fig. 6.

Since a tolerance is allowed on the capacitors, and the permeability of the cores varies slightly, the exact number of turns will vary and must be determined by measurement. For this reason sufficient length of wire should be allowed for the windings so that the additional number of turns necessary may be found by test. The extra length of leads will not
In order to reduce the number of times the wire must be threaded through the core ring, all windings are bifilar except the adjustment windings 5-6 of $L_2$ and $L_4$. In the bifilar type of winding, two wires are held together and wound as one. After winding, the start of one wire (3) may be connected to the finish of the other (2), thus connecting the two in the series-aiding manner. As in telephone practice, the numbering of turns necessary may be obtained by winding on singly, with care that the wire continues through wire in the core ring, and then winding in opposite directions through the core ring respectively with each end of the bifilar wire. The wire should be evenly distributed around the core ring, but this is not particularly critical.

The following procedure for proper identification and labeling of bifilar windings may be used: Select one of the ends of the completed winding and arbitrarily label them 1 and 3. Now by use of an ohmmeter, locate the wire at the opposite end of the winding which checks continuity to “1.” This of course will be “2” and may be spliced to “3.” With the exception of the input and output winding of $L_1$ and $L_3$, the free wires, 1 and 4, may be left long and any additional turns necessary may be obtained by winding on singly, with care that the wire continues through the core in the same direction.

The bifilar windings 5-6 and 7-8 follow the same procedure. However, when two windings are to be series-connected such as 1-2, 3-4 and 5-6, 7-8, care must be taken in selection of the end of winding to label 5, 7. The proper labeling is such that the wire ends 5, 7 pass through the core center in the same direction as the wire ends 1, 3.

The input windings of $L_1$ (1-4) and output windings of $L_2$ (5-8) are not critical in inductance and may be wound first to the specified number of turns. If desired, a layer of tape may be applied over these windings before application of the second windings.

$L_1$ (1-4) is wound and resonated with a 0.1-µfd. test capacitor to 19.0 kc. Adjust to the nearest turn that produces resonance closest to the exact frequency. $C_1$ and $C_3$ may be paralleled and used temporarily for the test capacitor. The second winding of $L_2$ (5-8) is now applied and series-connected with the inner winding, 1-4. Turns are adjusted to secure resonance with $C_4$ at 19 kc. No connection is made to the tap during adjustment. Note that wide tolerances on $C_4$ are allowed and the exact number of turns of $L_2$ will depend on this tolerance.

$L_3$ (5-8) and $L_4$ (1-4) are wound and resonated with their associated capacitors, $C_1$ and $C_2$. As previously mentioned, the value of $C_2$ may vary over a wide range (plus tolerance), and will determine the number of turns of windings 1-4. Note that the total number of turns for $L_3$, including adjustment winding 5-6 depends only on the exact value of $C_2$. Thus if $C_3$ is large, winding 1-4 will have fewer turns, and 5-6 will have more. After resonating $C_3$ connect it in parallel with windings 1-4 and the combination in series with

\[ L_3 \]
C2. Check the resonant frequency of the entire series arm, less winding δ−6. It should be higher than the frequency as given in Fig. 6. Now, wind turns on for the trimming winding δ−6; and, with it connected, recheck the resonant frequency. Adjust turns of δ−6 until correct frequency is obtained. In the event that the resonant frequency was lower than the correct value before the addition of δ−6 it is an indication that C3 was too low; and the entire adjust-and-check procedure must be repeated with a larger value for C3.

L4 is now wound and resonated with C5 and C6 following the same procedure as for L2, C3, C5.

The filter may now be wired temporarily for test before mounting. The method of connection for test is shown in Fig. 5. While a sensitive voltmeter or decibel meter of high impedance is necessary for accurate measurement, an oscilloscope may be used instead for an approximation. If the filter is flat through the passband and attenuates rapidly on the high side it is likely that no errors have been made. If the oscilloscope gain is adjusted for full deflection at the center of the passband, the deflection at points above about 20.4 kc. should be barely visible if at all.

The mounting of the components will be left to the builder, but it is to be noted that the inductors may be mounted very close together and nearly metal surfaces without harmful effect, with the possible exception that L1 and L5 should be given some separation from one another. A metal screw may be used through the center of an inductor without harm provided it does not constitute a shorted turn, as it would if metal washers were used on both sides and the washers connected together.

A suggested schematic using the filter is shown in Fig. 8. The speech amplifier should feature low- and high-frequency cut-off as with any ‘phone transmitter. Some high-frequency attenuation may be obtained by the action of the secondary of T1 with C1, C2. It is well first to run a frequency-response check on the speech amplifier including T1, C1, C2 with the modulator disconnected and a 500-ohm resistor substituted.

The 20-kc. oscillator shown uses a toroidal inductor. Other types of oscillators will perform satisfactorily if the output impedance is held low. The number of turns of inductor L4 and value of C3 may be adjusted for proper frequency using the BC-221 and the proper feed-back adjusted by the secondary winding 3−4−5−6. The taps on this winding are desirable to adjust the voltage at the junction of R4, R8 from 2 to 5 volts. Selection of 100 to 500 ohms for R6 also permits some adjustment. R8 should be as high as possible for least loading on the oscillator and filter, still permitting enough 20-ke. output for any desired amount of carrier re-injection.

One point not obvious is that R2 and R3 with R1 in parallel are actually in series with the input to the filter. The values chosen normally give a good impedance match between the modulator and filter. If 1N34s or vacuum tubes are used instead of copper oxide for the modulator, a resistor may have to be placed across filter terminals 1 and 4, and R2 and R3 lowered in value. Proper match may be noted when audio is fed into the speech amplifier and varied from 200 to 3000 cycles. If the speech amplifier has previously checked flat, the output from the filter at terminals δ and 8 as measured with a voltmeter or noted by the oscilloscope should vary as the response through the filter alone with frequencies of 19.8 to 17.0 kc. A ripple in output amplitude indicates incorrect modulator match.

Copper-oxide “Varistors” available in surplus, which have proven satisfactory with the values given, are Western Electric D162258, D163139 and D08914. The terminal numbering given for “COR” of Fig. 8 is for these types.

Modulator balance for maximum carrier reduction is normally quite simple. A sensitive voltmeter or oscilloscope is connected to output terminals δ and 6. With no input to the speech amplifier and R4 turned for minimum carrier, adjust the carrier balance control R1 for minimum output.

Balance should be obtained near the center of the adjustment range. If not, a trimming resistor may be paralleled with R2 or R8. Some capacity unbalance in the Varistor or input winding of the filter may prevent sufficient carrier balance and small values of capacity may be added from filter terminal 1 or 4 to ground. Capacity may also be tried across C1 or C2.

Note that any hum in the speech amplifier will appear as an output carrier, but of course will be 60 or 120 cycles from the true carrier. Hum may be identified by temporarily shorting the primary of T1.

Audio is now connected to the input of the speech amplifier and the level adjusted to a maximum of 0.25 volt at the output of T1.

If the output of the speech amplifier is a pure tone the output of the filter should be a single frequency of 20 kc. minus the audio frequency. Using a sweep rate that is a submultiple of the audio input frequency, a check may be made for the presence of a modulation envelope. Such a trace represents more than one frequency in the output and may be caused by distortion in the speech amplifier or overloading of the modulator. A slight modulation pattern is permissible as this represents only a slight distortion of speech and not spurious signals out of the passband.

The modulator is now ready to be connected to the succeeding stages of the exciter.
The V.H.F. Sandwich
Stacked Arrays for 50 and 144 Mc.

BY EDWARD P. TILTON, V.H.DQ

Not so long ago anyone with a 3- or 4-element beam on a v.h.f. band really had something. His signal stood out like a beacon over the best efforts of the stations equipped with various forms of dipoles. But times have changed, and so have fashions in v.h.f. antennas. The possessor of a 4-element array now just about breaks even with his fellows, for nearly everyone has found that the erection of a rotary array for 6 or 2 meters presents no insurmountable problems.

The arrangement of a few parasitic elements in the proper physical relationship to the driven dipole does work wonders, but the simple parasitic array fails in one respect: it does not materially lower the minimum angle of radiation. Since grazing the horizon is nearly always our objective in v.h.f. work, we can add miles to our coverage if we can pull our radiation angle down a few degrees. This can best be accomplished with stacked systems, wherein arrays are mounted one above the other and fed in phase.

The stacked array shown in the accompanying photograph was installed at WIHDQ to see just what improvement could be effected with such an arrangement. At points where we were already consistently readable the change was not spectacular, but the stacking really paid off on the more difficult paths. The 50-Mc. signal of WICG-X, Brattleboro, Vt., for instance, had been barely audible on c.w., and never readable on voice, with the former 4-element array. With the 4-over-4 providing just about its theoretical 4-db improvement, Ray became readable 90 per cent of the time on phone, and a nightly schedule instituted the first evening the 8-element array was up on the tower has never failed, in more than a month of operation.

The 2-meter job, erected primarily to see what could be done with horizontal polarization in the vertical East, is not a big array, as 144-Mc. antenna systems go, but we just couldn't see that nine feet of pipe between the two 6-meter bays going to waste. Thus far it has been useful principally for DX attempts when the band is open, but a contact with Western New York and heard reports from as far away as southern Virginia, during a recent aurora opening, are marked up to its credit.

Mechanical Details

The structure incorporates all-metal design. Booms for the 50-Mc. section are 1 1/4-inch 21ST tubing. Elements are 3/4-inch tubing of the same alloy, forced through holes in the booms. Element spacing is 0.2 wavelength for the directors and 0.15 for the reflector. These somewhat smaller dimensions than were used in the 4-element system described by the writer previously in QST and the Handbooks were decided upon in order to reduce the size, weight and wind resistance of the stacked system. The booms are mounted on the vertical member (a 1 1/4-inch o.d. pipe) by means of blocks of wood, the only nonmetallic parts employed. These were made from pieces of two-by-four one foot long. A hole the size of the mast is made in the block near one side, at the middle of the block lengthwise. The block is then sawed lengthwise in a vertical plane, through the middle of this hole. Bolting the two portions together provides a tight fit around the vertical pipe.

A "four-over-four" array for 141 Mc., mounted between the bays of a similar array for 50 Mc. Stacking of two bays a half wave apart lowers the radiation angle appreciably below that obtainable with elements in a single plane, and nets a gain of about 4 db. over that of a single array.

QST for
boom is bolted to the block at three points. This method of mounting provides a rigid assembly. The booms should be bonded to the main support to provide lightning protection.

The 2-meter array employs somewhat similar design but uses smaller components, because of its lower weight. Booms are of one-inch tubing, and elements of \( \frac{3}{4} \) inch, mounted through the booms, as with the 6-meter assembly. The booms are mounted through the vertical member, which is \( \frac{1}{2} \) inch tubing. As the vertical support for the 6-meter array takes quite a bit of strain, it was thought inadvisable to make holes through it, so the 2-meter array was fastened to the main pipe with a pair of "U" bolts. This has the advantage of making the smaller array a completely separate assembly, which can be detached from the main stem at will. Element spacing is 0.2 wavelength throughout.

The Feed Systems

The same principle is used in the feed arrangement of both arrays, but it is worked out in a slightly different manner. The bays are a half wave apart, with the feeder connected at the midpoint between the two, the phasing line operating as a double "Q" section in each case. Folded-dipole radiators are used in the 6-meter array, while a "T" match was used in the 2-meter one. There is, of course, no reason why the same system could not have been used in both.

The main transmission line for each array is 300-ohm Twin-Lead, the heavy-duty tubular type being used on the 6-meter portion. In each case the method of feed was checked out for minimum standing-wave ratio with one bay alone; then the phasing section for the two bays was proportioned so that it would serve as a "Q" section as well. Dimensions are given in the accompanying table. The feed lines are brought at right angles from the phasing sections to stand-off insulators on the main vertical support. They drop vertically to a combination tie point and bearing, just below the lower boom of the 6-meter array. From this anchor, which rotates with the beams, they drop loosely to a fixed tie point, with enough slack left to permit slightly more than 360 degrees of rotation.

The feed sections of the 50-Mc. folded dipoles are made of \( \frac{3}{4} \) inch copper tubing, mounted on \( \frac{5}{8} \) inch cone stand-offs. The outer ends are supported on metal pillars of the same length. Two stand-offs are used for each side of the dipole; otherwise the rather soft tubing tends to sag and disturb the spacing between it and the larger element. The copper tubing is flattened in a vise at the points where it is to be mounted. The 4-to-1 conductor ratio, and the spacing of one inch, center to center, between the two conductors gives the necessary impedance step-up to match 300-ohm line, in a 4-element array of the spacings mentioned earlier.

A similar arrangement might have been used in the 2-meter array, but the "T" match was substituted for variety, and because a suitable conductor ratio was not so practical with the smaller-sized elements used. Adjusting clips for the "T" section were made from grid clips slipped over the respective elements and soldered together in such a position as to give a spacing of about \( \frac{1}{2} \) inch, center to center. A one-inch ceramic stand-off was used on each section, to hold the "T" section in alignment with the main element. The phasing section is the same as in the larger array: No. 12 wire spaced one inch. The point of connection between the "T" section and the dipole turned out to be approximately 5 inches from the center, but this should be adjusted for minimum standing-wave ratio.

![Dimensions of the 6- and 2-Meter Stacked Arrays, in Inches](image)

It will be noted that the dimensions given in the table are strictly conventional. Actually the elements in one of the 6-meter bays were made adjustable, just to check on the figures we'd obtained in several previous beam workouts. Adjustments were made carefully for maximum forward gain, but the lengths came out so close to formula dimensions that we once more came to the conclusion that tuning of elements for forward gain is a waste of effort, when spacings of this order are used and the antenna is mounted in an average clear position.

To the Compilers of the Antenna Book

To beam, or not to beam,
That is the question.

Whether it be better to try a newborn quad,
With shorted stubs a-dangling on the sod,
Or flat-topped jobs, with T-match all complete,
With all dimensions changed from wavelengths to feet.

Aye, there's the rub,
Whether to discard the good delight
That's served us well these happy postwar summers,
For something that we did not of.
Whose crucifix of Oregon may yet transfix
Our puny hopes of working rare DX,
And wake; to find in our more saner spells,
We've lost an awful lot of useful decibels.

— Z85HX in "Radio-ZS"

June 1949
Aurora DX openings, like oysters, are best in months with an "r," and April, 1949, was one of the best. The aurora session of the 7th was probably the best of this species yet to be experienced by 50-Mc. men, and it produced a flurry of 144-Mc. contacts as well. Again on the 12th, coincident with an eclipse of the moon, both bands were open. Both occasions found quite a few operators on 144 Mc. blissfully unaware that anything unusual was going on, so that those who were on the alert were not able to make too many contacts. Work by means of aurora reflection probably does not present much of a threat of breaking the existing 144-Mc. record, but it does offer an unparalleled opportunity for working into sections of the country on both 6 and 2 meters that are otherwise out of reach. More important, aurora DX is possible from almost any location, leaving the fellows having exceptionally good radio locations without their customary advantage.

By the time that this material appears in print the spring aurora period will be largely past, but openings can happen any time. So let's be on the lookout for them, and be ready to get in there, with c.w., when opportunities break. Some new states and call areas may be worked if we play our cards right. It is probable that 144-Mc. openings occur more often than we have previously supposed, and our slowness in recognizing the presence of this form of DX on 2 may be charged to our fairly recent, and still only partial, conversion to c.w. technique on this band.

Moving our lowest v.h.f. band from 50 to 50 Mc. made possible a few aurora contacts on voice, the character of the signals approaching that heard on 28 Mc., but experience on 144 Mc. to date has indicated that c.w. is the sole medium by which DX contacts are possible on the higher band. Signals take on a quality best described as "an intermittent roar superimposed on a steady one," and the sound is changed hardly at all when the b.f.o. is turned on or off.

Neither of the dates mentioned above provided any appreciable amount of visible aurora in most locations, yet the 50-Mc. opening of the 7th lasted for at least four hours, and signals were of good intensity. The 144-Mc. signals were in only when the phase-distortion effects were most pronounced on 50 Mc., but even 2 was open for an hour or more.

* V.H.F. Editor, QST
we called W8WSE, who was known to have a big 2-meter beam. Would he listen on 2? You bet —
so over to 144-Mc. c.w. at W1HDQ. No result
with Mike, but a "CQ DX" raised W2RPO, North Tonawanda, N. Y., for our first 2-meter
aurora QSO. Other aurora signals could be heard,
but Ralph was the only one on c.w. Next day,
however, came a heard report from W4IKZ,
Lynnhaven, Va., whom we missed because of
failure to tune the high end. Shame!
W2RPO reported hearing and calling W9JLIS
and W8WSE, without result. W8WSE never did
hear W1HDQ, but he worked W9PVJ, Toledo,
III., and heard W9JLIS. W4IKZ heard no other
aurora signals than W1HDQ, though he listened
on both horizontal and vertical for the duration
of the opening. All the above contacts were made
with horizontal polarization. It is believed that
some work was done with vertical also, but we
do not have details. This aurora business on 144
Mc. is still very much news, and we know very
little about it. If you hear or work anything by
this medium on 144 Mc. be sure to
let us have
the full story.

Winthrop, Mass. — Activity low on 6? Not at
W1DJ! Arthur, whose hamming covers a span of
nearly 50 years, 17 of them on v.h.f., took time
out recently to pull some activity figures from his
1948 logs. During the year 2138 50-Mc. contacts
were made, of which 523 were in connection with
net, activities, leaving 1615 individual QSOs.
This is what comes of having two licensed oper­
ators in the family. Martha, W1OIR, is also an
avid 50-Mc. enthusiast.

Bremerton, Wash. — If you’ve missed the call
of W3CIR/1, now no longer appearing in his
comfortable spot near the top of the states­
worked-on-6 list, look for it to reappear as
W3CIR/7. Ed is working on 6 from Bremerton,
and though his states-worked listing would be 2
at this writing we have no doubt that things will
be different after May.

Monterrey, Mexico — After having frequent
trouble with 6-meter operators who could not
handle the code, XE2O got a modulator going,
and will be making plenty of contacts with Ws
this spring and summer. His location is 175 miles
west of the southern tip of Texas, so he should
be in a better position to work much of this coun­
try than the XEls down in Mexico City. He had
numerous contacts with South American sta­
tions, and one opening to W5, in late March and
early April.

Sheridan, Wyo.— Probably not many outside
Wyoming have worked this state on 144 Mc., but
the total will be swelled if W7JRG has his way.
After working W7GBI, W8DNW and W8BJV
for three new states on 50 Mc. by the aurora
route, Ken is looking forward to doing the same
on 144 Mc. He has a 24-element array (originally
vertical, but being changed over to horizontal),
and 80 watts to a 3E20 on 144.238 Mc.

Huntington, L. I. — Two-meter men who want
to put on fairly high power are overlooking a good
bet in the 826 tubes, now available at ridiculously
low prices on the surplus market, says W2GPO.
Puss is running 600 watts to a pair of 826s, in
the amplifier shown in the accompanying photo­
graph. The layout is unconventional, but effect­
tive. The tube sockets are mounted on edge, by
means of hook bolts made from ordinary machine
screws, and are maintained in alignment by stiff
rods connecting the filament terminals. The grid
circuit is a tuned loop of wire, and the plate tank

With this amplifier of unusual design, W2GPO is able
to run 600 watts input on 144 Mc. Final tubes are 826s,
mounted in a horizontal position. An electric fan is
turned on the tubes and tank circuit for forced-air
cooling. See text for further details.

is ¾-inch silver-plated copper, bent into a semi­
circular shape. This is also condenser-tuned,
so that the position of the shorting bar is not
changed in the course of ordinary adjustments.
Neutralizing condensers are pieces of aluminum
mounted in the two top socket holes on each side.
Initial experiments with this amplifier showed
that far beyond the normal tube ratings could be
run, but the tank circuit ran very hot. Larger
tubing, plus a blast of air from a small electric
fan, took care of this. Plate current is 400 ma.,
at 1600 volts. The driver is an ARC-5, with 400
volts on the 832-A. This provides 10 ma. grid
current, at 140 volts bias, in the 826s. Grid re­
sistor is 3500 ohms.

Clacton, Essex, England — The 50-Mc. open­
ings between England and South Africa which
began in late March continued well into April,
crossband contacts being made between G6DIH

June 1949
on 28 Mc. and Z81P on 50 Mc. on April 5th and 11th. The path was also open for brief intervals on the 6th. Excerpts from G6DH's report follow: "As on many past occasions the days of high southerly m.u.f. found conditions disturbed over paths involving transmission through the northern auroral zones, and m.u.f. for these paths was apparently far below normal. It is difficult to say whether this is actually a case of low m.u.f., or whether it is due to absorption (and/or reflection at shorter distances) by regions lower than P2. On two occasions when Z81P was receivable on 50 Mc. at G6DH it was found that no other signals could be heard above 37 Mc., yet several signals up to 45 Mc. are known to be receivable under suitable conditions. It appeared that reception was limited to a comparatively narrow band from the m.u.f. down. Z81P says that this effect is often noticeable in TV reception from England. Generally either the video on 45 Mc. or the sound on 41.5 Mc. is receivable with good strength, but seldom are both simultaneously good." G6DH also points out that southerly m.u.f. reaches 50 Mc. more often than was formerly supposed: that 50-Mc. contacts might have been possible with South Africa on many occasions in the past when observers have given up simply because the highest signals they heard were about 38 Mc.

Guayaquil, Ecuador — The 50-Mc. band was opened for HC2OT to W5 on March 26th, 30th, April 3rd, 7th, 15th, 17th, and 20th; and W1HJ was worked on the 7th for Steve's first Florida contact. Mexico was worked on March 26th, 29th, 31st, April 2nd, 7th, 15th, 17th, and 19th; and Chile on March 29th and 31st. KZ5NB and T12 AFC have both been heard, but are not yet added to the countries-worked column, which stands at 10. Steve is still looking for a W3 for 50-Mc. WACA.

Shawnee, Okla. — Here's one which didn't quite make last month's news: W5GQN had a solid QSO with LU6DO on March 30th, at 8:20 p.m. CST. Avery is still running only 15 watts input on 6.

Sharon, Pa. — The Mercer County Radio Association will conduct an expedition to a 4700-foot elevation in the Allegheny Mountains, 15 miles from Elkins, W. Va., for the June V.H.F. Party on the 4th and 5th. The Mountaineer Radio Association of Fairmont, W. Va., is joint sponsor of this project, and will furnish their 10-kw. emergency generator for power. The call will be W3CJB/8. Power is to be 100 watts on 144.15, 145 and 146.8 Mc., as well as several frequencies in the 6-meter band.

Puukimäki, Finland — A few Finnish amateurs are now in business on 144 Mc., according to OH2PK, who is working with 2NY, 2NV, 2OK and 2OJ. On 50 Mc., with temporary peripherals, are OH3NB and 2PK, working daily over a 90-mile path.

Jacksonville, N. Y. — Central New York, never very active v.h.f. territory heretofore, has a growing 2-meter population as a result of the efforts of W2ZUZ, who is on from the 2100-foot elevation of WVFC-FM, near Ithaca. His frequency is 147 Mc., and he is on nightly from 7:30 to 8:30, and as much later as there is anything to be worked in the way of DX. Since this is a location toward which few beams would ordinarily be aimed, Walt asks that the boys in Pennsylvania and other

(Continued on page 110)
It becomes our sad duty to record the passing, on April 27th, of Clinton B. DeSoto, W2IU, technical editor of the Proceedings of the I.R.E. and former editor of QST. Mr. DeSoto, who was 37 years of age, died of a heart attack.

Clinton DeSoto combined with rare skill his two main interests—radio and journalism. Licensed in 1926 as W9KL in his home state of Wisconsin, while studying journalism, he came to the attention of ARRL Hq. because of the research work he was doing on a history of amateur radio. He became an assistant secretary of ARRL and W1CBD in 1930, a position he held for 12 years. Clint handled the League’s publicity work, the “JARU News” and “Correspondence” departments of QST as well as numerous feature stories and, in addition to routine office duties, visited many amateur clubs and conventions as a representative of Hq. In 1936 the League published his completed history of amateur radio, Two Hundred Meters and Down. Just before the war, as an independent project, he authored Calling CQ, a popular book on the exploits of amateur operators.

In 1942 Clint became, in quick succession, assistant editor, executive editor and, finally, editor of QST. His innumerable QST articles during almost 16 years of association with League Hq. witness that he was both a good technician and an unusually competent journalist. His comprehensive interest in amateur radio is well illustrated in the subject matter of his QST writings, such as improved ham receivers and transmitters, recording principles, radio control of models, military wartime developments, and his wartime training series for beginners, “Who Killed the Signal?” That Clint had a keen sense of the dramatic and human-interest aspects of amateur radio is attested by his capable handling of “Hamdom” pages as well as feature stories concerning amateur work in communications emergencies.

In late 1945 DeSoto resigned from the employ of the League and accepted an editorship of the journal of the professional society, a post to which he brought a wealth of amateur-acquired skill and which he ably filled to the time of his sudden passing.

NEW BOOKS


June 1949
Some Ideas for High-Frequency Antenna Systems

We have received several sets of notes from Mr. Dean O. Morgan,* W2NNT, in which he describes some interesting antennas he has developed for TV work. In the hope that they may offer possibilities for further development of amateur-band antennas, he is passing along his findings to anyone interested in antennas, which means just about everyone.

The Inverted Rhombic

The first of these systems W2NNT calls the “inverted rhombic.” In amateur circles the basic unit of this system will be recognized as the “bi-square” that has been used by itself or with a reflector by some of the 28-Mc. gang. The basic unit is shown in Fig. 1A, and it is seen to have a square configuration with half-wavelength sides. Fed at the bottom (or top) with either a tuned line or a flat line and matching system, it gives a horizontally-polarized signal at right angles to the plane of the antenna. Mr. Morgan’s first contribution is some design formulas and a method for feeding the thing with 300-ohm line, as shown in Fig. 1B. He gives for the lengths,

\[ l_1 = \frac{468}{f \text{(Mc.)}} \]
\[ l_2 = \frac{472}{f \text{(Mc.)}} \]

The 300-ohm line is attached at points 0.14 below the center of the \( l_2 \) sides. Thus an antenna for 29 Mc. would have upper sides of \( l_1 = \frac{468}{29} = 16.15 \) feet = 16 feet 2 inches and \( l_2 = \frac{472}{29} = 16.25 \) feet = 16 feet 3 inches. The feedline would be attached 20 inches below the center of \( l_2 \) (0.1 \( \times \) 16.25 = 1.625 feet = 20 inches). W2NNT’s measurements indicate the gain of such an antenna to be 3.8 db. with an interior angle of 90 degrees (as shown), and with an interior angle of 60 degrees the gain was 3.6. Since the smaller angle represents a saving in the total height required, this would seem to be worth investigating for amateur work. Such an antenna backed up

A double inverted-rhombic antenna for high-frequency work is easily supported by a single wooden mast. The TV antenna shown here uses an interior angle of 60 degrees—slightly more gain is obtained by increasing the angle to 90 degrees.

*% Morgan Television Co.,
725 Seward St.,
Rochester, N.Y.
Fig. 1 — The 90-degree inverted rhombic at A is better known to amateurs as the "bicross" antenna. It can be fed without special matching sections by tapping the feeders on to the elements, as shown in B (see text for dimensions). How several sections can be stacked and fed at the bottom is shown at C.

by a reflector from 0.1 to 0.2 wavelength away (tuned to the proper frequency either by adjusting the lengths or with a parallel-tuned circuit at the base of the reflector) might have some real merit. The point of connection of the 300-ohm line would change, of course, but the proper point of attachment shouldn't be too hard to find.

For TV work, the "inverted rhombic" is stacked, as shown in Fig. 1C and the photograph. This arrangement results in a large structure for 28 Mc., but it shouldn't be out of proportion at 50 and 144 Mc. More than two can be stacked, to lower the vertical angle of radiation, but when four or more are used it is advisable to feed the system at the center, for better current distribution.

Fig. 2 — The "bicross" beam uses a double element for each element in the usual 3-element beam. Crossed elements as shown at A are used, and the 60-degree angle has been found to give maximum gain. The driven element can be fed with 300-ohm line by tapping it on the elements a little distance each side of the crossover point. See text for dimensions.

The Biconical Beam

The other antenna tried by W2NNT looks as if it might have considerable application among amateurs on 28 and 21 Mc. It follows the general scheme of the normal 3-element beam, except that the elements are "X"-shaped, as shown in Fig. 2A. The angle of 60 degrees between elements has been found to give maximum gain. The detail in Fig. 2B shows how the elements are joined at the point of crossing, and how the driven element is fed with 300-ohm or other line, by simply tapping on at the correct point.

The elements can be made with telescoping ends for adjustment of the lengths, in the usual manner. For 0.2-wavelength director spacing and 0.15-wavelength reflector spacing, W2NNT gives the element lengths (l in Fig. 2A) as

Director = \frac{450}{f} \text{ (Mc.)}

Antenna = \frac{452}{f} \text{ (Mc.)}

Reflector = \frac{466}{f} \text{ (Mc.)}

For a design frequency of 28.6 Mc., this works out to be 15 feet 9 inches for the director, 15 feet 10 inches for the antenna, and 16 feet 4 inches for the reflector. Using 300-ohm transmission line, the line taps on 10 inches either side of the crossover point.

In his experimental work, W2NNT has found this 28-Mc. beam to show approximately 3 db. gain over a similar beam with ordinary elements, or about 10 to 11 db. over a dipole. The bandwidth over which the s.w.r. did not exceed 2 to 1 was 3 Mc. There are, of course, many different mechanical arrangements that can be used to obtain this element configuration.

--- B. G.

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Probably most amateurs who have been troubled with TVI do not realize that it makes a great deal of difference just where in the TV channel the offending harmonic falls. This point stood out in the engineering studies made of picture interference some years ago, but it is not too easy to put definite numbers on it because interference is a subjective thing — one person will not be greatly bothered by interference that another would consider bad enough to spoil enjoyment of a program. Also, it varies with the program material, scene lighting, and many other factors. But it is quite possible to make some general observations, and a little attention to the choice of an operating frequency may be enough to get you over the hump when you think you've reached the limit of what can be done to prevent harmonic radiation.

There is no question at all but that a harmonic falling near the picture carrier will do the most damage. The greater the separation between harmonic and picture carrier the better, providing that the harmonic does not run into the sound channel in the process of moving away from the picture carrier. Fig. 1 shows the results of some measurements we made recently on the one TV signal available on a “service” basis in West Hartford. At the time the measurements were made the signal was not strong enough to give more than about half contrast with the receiver gain full on; we have been told that field-strength measurements made in the Hartford area show the signal to range from about 50 to 200 microvolts per meter — well below the 500-microvolt figure that FCC considers to be the minimum required for good reception in noise-free locations (which ours is not!).

The data from which Fig. 1 was plotted were obtained by loosely coupling a v.h.f. signal generator to the antenna connections of the receiver and then adjusting the generator output until interference was just detectable in the picture. This was done throughout the television channel. The signal-generator readings were then reduced to a relative basis, using as a reference the smallest signal strength that caused detectable interference. As shown by the curves, the interference was worst when the interfering frequency was on or near the picture carrier. Taking the relative amplitude here as “1,” it can be seen that when the interference was 1 megacycle away from the picture carrier (either 0.25 Mc. or 2.25 Mc. from the low edge of the TV channel) a signal 10 times as strong was required to produce just-visible interference. At the upper edge of the picture signal — about 4 Mc. from the picture carrier or 5.25 Mc. from the low edge of the channel — almost 3000 times as much voltage was required to cause just-discernible interference as on the picture carrier itself.

Now such a tremendous ratio probably will not hold for all TV receivers. The relative response at the high end of the picture signal will depend on the receiver’s i.f. and video bandwidths.

Fig. 1 — Relative voltage required to produce equal interference in various parts of TV channel.

![Diagram showing relative amplitude of interfering signal](image)

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**TVI Tips**

***Fig. 2*** — Harmonic relationship of 28-Mc. band to Channels 2 and 6.
and the state of circuit alignment. However, the picture quality with this particular receiver does not suffer by comparison with other receivers we have used. Although the ratios should not be taken too literally, they are probably dependable in indicating the order of magnitude.

No means were available for determining the relative strength of the TV signal and the interference. However, it was approximated by indirect methods. It is well known that in f.m. reception if two signals are on the same frequency a difference of 6 db. in strength will enable the stronger one to suppress the weaker. The graph shows the interfering signal strengths that were necessary to meet two conditions — (1) the value where the interference was just suppressed by the TV sound carrier, (2) the value where the interference just suppressed the TV sound carrier. The presumption was, then, that the sound-carrier strength was just midway between these two values. On the further assumption that the sound and picture carriers had the same strength (this was supported by other measurements) the TV signal was assumed to have a relative strength of 200 on the scale used on the graph. Consequently the signal that just caused interference at the frequency of the picture carrier was 46 db. below the picture carrier. This checks rather well with the 40-db. figure that has been generally accepted as the necessary ratio of TV signal to interference, for good TV reception.

But note this: When the interfering signal was 4 Mc. from the low edge of the channel it had to be as strong as the picture carrier to cause detectable interference, and at the upper edge of the picture signal it had to be ten times as strong! Furthermore, the “annoyance factor” of the interference varies as well, being much less in the upper reaches of the channel. This has been shown in a rough way on the graph. At the upper edge the cross-hatching is so fine that the picture must be inspected rather closely to see it; at normal viewing distance it shows up mostly as a sort of graying over of the picture. The bigger the bars — and the closer the interfering frequency to the picture carrier the bigger they get — the more objectionable the interference, even when the bars are just visible.

In terms of frequencies in the ten-meter band, Fig. 2 shows how this information can be applied. The second and third harmonics from 28 Mc. fall in Channels 2 (54—60 Mc.) and 6 (82—88 Mc.). In neither case is it possible for a harmonic to fall right on the picture carrier; in both channels the lowest harmonic frequency is 2 Mc. above the low edge of the TV channel. (The small numbers above the frequencies correspond to the Mc. from the low edge as shown in Fig. 1.) In areas where Channel 2 is in use harmonic interference should be considerably reduced by working above 29 Mc. — as far toward the upper edge of the band as is possible without getting into trouble with the sound carrier. The sound carrier is at 59.75 Mc., so no harmonic reaches it, but the harmonic should be kept 250 to 500 kc. away from it to be on the safe side. In Channel 6 areas there are two optimum regions — between about 28.7 and 29 or 29.1 Mc., and above 29.5 Mc. In the latter case the harmonic is entirely outside the TV channel and is least likely to cause interference. The shaded region should be avoided in these areas because the harmonic will fall near enough to the sound channel to be in danger of doing damage. In the data shown in Fig. 1, the interfering signal showed up in the sound channel when the frequency was about 350 kc. below the sound carrier — this with a signal ten times as strong as the sound signal.

So choosing the proper operating frequency can be of considerable help in reducing harmonic TVI. It is conceivable that in mild cases it may be all that is required. But mostly it will be a last resort, not a cure-all. It is distinctly not a substitute for harmonic-reduction measures at the transmitter nor for protecting the receiver against overload from a strong fundamental signal.

— G. G.

**Silent Keys**

It is with deep regret that we record the passing of these amateurs:

- W1EAV, Charles R. Washburn, Marion, Mass.
- W1QZY, David W. Taylor, Medford, Mass.
- W2IU, ex-W1CRD-W9KL, Clinton B. DeSoto, former editor QST, New York City
- W5AIK, Millard M. Walker, Wharton, Texas
- W5IKU, Lyndon E. Dawson, Ruston, La.
- W6HVS, Leon S. Kruger, San Diego, Calif.
- W6PHX, Harry L. Elliott, North Sacramento, Calif.
- W8TGU, Harold C. Ramsey, Zanesville, Ohio
- EA1AH, Luis de Requie
- G3BMM, Lawrence G. Hayns
- G4MH, J. F. Fish, Blackpool, Lancs.
- G6HP, Thomas B. Wimbush, Burnley, Lancs.
- GM3BZP, Ian A. Bates, Perth

June 1949
15th ARRL DX Contest

High 'Phone Scores

Based on reports received during the first few weeks following that annual battle of the DXers, the 'phone section of the Annual ARRL DX Competition, we are pleased to present a preview of the high scores and performance records of those who took part.

Among the W/VE DXers engaged in the battle, top talker was W1ATE, who worked 89 different countries, made 468 contacts and a multiplier of 160 for a claimed score of 223,040 points. Trailing closely behind, W3BES logged 500 contacts with 77 countries for a multiplier of 160 and a score of 221,040.

500 contacts with 77 countries for a multiplier of 160 for a claimed score of 223,040. The only other score above the two hundred thousand mark received this year is


Entries from points outside the U. S. and Canada are still coming in each day. In that category, the highest score thus far received is that of W8IRV, 219,765. The only other score above the two hundred thousand mark received at this writing is that of W8IRV, 219,765, resulting from 434 contacts and 167 multiplier (76 different countries worked).


Entries from points outside the U. S. and Canada are still coming in each day. In that category, the highest score thus far received is that of HC1KP, 189,465 points, 743 contacts, 55 multiplier. TC9AN claims an even 1000 contacts, multiplier of 48 and 148,388 points. P2Y2C's results that may be expected in the final analysis.

Ballots have been counted in the first election to be held under the League's new constitution, resulting in the following Board membership: A. H. Keith Russell, Canadian 9AL, George L. Bidwell, C. M. Jansky, jr., 9XI, B. F. Painter, 5MB, H. F. Dobbs, 4ZA, L. B. Laizure, 9RR, A. H. Babcock, 6ZD, Clyde E. Darr, 8ZZ, G. H. Pinney, lCKP, Karl W. Weingarten, 7BG, W. T. Gravely, 3BZ, Paul M. Segal, 9EEA, and F. M. Corbett, 5ZC.

After an anxious month, amateur radio has successfully reestablished contact with the MacMillan Expedition in the Far North. Fifteen-year-old Everett Sutton, 7DJ, was the amateur to work two-way across the Atlantic. An equally creditable performance has been turned in by Canadian amateurs who assisted news services during a trans-Atlantic cable breakdown.

The past spring was a great season for ARRL conventions, Halifax, Seattle and Philadelphia serving as hosts for rousing get-togethers. The Philadelphia meeting, ably reported in this issue by W. Bradley Martin, was marked by the awarding to Traffic Manager Schnell of the QST brown derby for being the first North American amateur to work two-way across the Atlantic. Editor Warner has already collected on his latest Transatlantic wager with W. W. Burnham of London, his winnings this round being a handsome mantel timepiece.

Gleanings: 4KU, Atlanta, and 6C6GW, Long Beach, merit the approbation of the station descriptions section. . . . ARRL is cooperating with the French government in running reception tests of the Eiffel Tower station, PL . . . A promising piece of "New Apparatus" is an adjustable resistor known as the "Bradleyohn."
How's DX?

CONDUCTED BY ROD NEWKIRK,* W9BRD

How:

We note a gratifying decrease in the number of manufactured DX QSOs turned out by the previously frowned-upon "buddy system." Apparently it has been widely realized that DXCC rank should be reserved for McCoy DX men who stand on their own two feet, and should not be used as a measure of how many "friends" and how much callous nerve an individual might possess.

No, a mediocre location and/or the use of microcosmic power does not entitle anyone to DX served on a silver platter. Hundreds of guys in this same boat stand by and take their fair shots at the rare ones, come what may. In their case it may be a long, winding road to the top but when they do get their hands on that fancy diploma it's all theirs.

Jeeves, if you've finished making out our SWL cards for the DXCC Round-up, order some more for the next one. Then read us the mail.

What:

Could be that most of the boys are up on 160 after their postwar 1.7-Mc. WAC but things on eighty have slowed down to a walk. W4L VV comes through with a tasty morsel in VPSAT, Caicos (::!510). PY7WS (::!515) made it 51 on the band for W2QHH while WSPCS needed but eight watts to a VFO unit to snare VO2CD and ZLIHM (3545) ....... W9PNE clings to a 77-6J5 battery bopper receiver for 80 and had little trouble completing his 3.5-Mc. W AO with same plus 200 watts to an 8005 ....... New ones for W9CFB were VP1AA, VP2LX, OZ1W and EI4Q.

The variety of stuff making its appearance on forty has grown limited but the band still bears watching. ZL1CH/VR4 (7050) and VR2AR (7070) are a pair of nifties holding forth during the wee hours, for instance ......... Europeans aren't so plentiful but W3JAK ran down UA3KB, UB5AZ, OH1NW and OH3NU ....... Now up over 130 on 40, W2RDX added ZD4AB (7035) and YS1RA (7020) during dawn hours ......... 50 watts netted ZB1Q (7020), SU1CR (7000), HK5CR, EA5BE, EA4LQ, VP5ACS (7010) and YY5AL (7010) for W2YZG ......... W2OWX has 15 watts less than that but raised LA7Y, OK1SX, PZ1WX (7010), VP4TR, VP6SJ, VP9CC and CT9HT ......... Among W5ONL's list we spot KM6AK (7035) and W7MGO now awaits cards from ZS5GF (7031), 1LX, KV4AA (7019), CE7CD (7025) and VS2BX (7028) ........ W6CFB has QRT for the summer months after adding W2WMV/C1, JA3AA and CE4AD ........ W2BJ is an old 7-Mc. enthusiast and bagged people like CPAIQ, FA8IH, CT1AZ, EA1AB and EA5BE with his 33-up-33-out skyclawn.

If Tilton hadn't once had a buffer-doubler on twenty we'd say he was just too lazy to wind coils with so many turns, Anyway, KH6PM likes the band what with EL3A (14,075), FA8IH (14,120), IS1AFM (14,125), FUSAA (14,020), TAJ3GYU (14,120), VO8AY (14,065), ZD4AB (14,060) and two people signing EP8EA (14,150) and FP8AF (14,090). Those are still on Fred's stalk list but he did capture CX6AD (14,065), CPAIQ (14,060), FO8AD (14,050), HPIPL (14,075 18), NY4DD (14,030), OQSOF (14,100) and VP8AK (14,125) ........ G6RH sneaked past the Ws to the tune of W8QOH/HS (14,085), E8CO (14,185), EAGA2 in the Balearics (14,065), FEB8AB (14,030), F18ZZ (14,015), F6DRG (14,045), FKS8AB (14,020), FO8AC (14,030), VK9PJ (14,110), KC6EA (14,085), VO4CUR (14,010 t8), VR2AP (14,150), VR2BJ (14,070), UP2AA (14,100), ZK2AA (14,135) and W9MCF/Formosa (14,040) ........ ZC4AC (14,070), YT7DD (14,080), 4X4CJ (14,090), W3CHH/Iwo (14,000), ZC1CL (14,070) and YK1AF (14,080) were snapped up by W1KUF while W1KMY hooked VK9NR (14,

* DX Editor, QST. Please mail reports of DX activity to W9BRD's home QTH: 1517 Fargo Ave., Chicago 26, Ill.
The hands have certainly been brightened by the activity of the ZC6UN crew in Haifa. A group of the operators are, l. to r., SM5LR, W2NUP, PA8BB and W2BSP.

The strictly-'phone reports are few but we surmise the A3 adherents are all busy making out QSLs with meat like ZD3A, VR3A, CI/DH/C8, CT7TY, ZS8A, HLI/BJ, ISIAYN, LX1JW, YS2AG, KR6e AS AX BG and BO, JAs 2AZ 2BF 3AB 4AD 7AA, M13SC and YS2AG being collected by W2DMJ's 810s. . . . . W3QLW hollered happily at HC2JR (14,305), KG6EQ (14,265), VP2GG (14,375), VP5AR (14,170), VP6CDI (14,145) and ZL1MR. . . . W2MPA adds PQ8SN, ZD2S, YK1AB, ZC1AZ, EA8CO, M13SI, TA5GVU, CIPL, DU1VVS, FA3JX, QQ5LL, ISIAHK, HAI/BJ, W7LZJ/C6, UB5KAG, 4XACZ, W2JUV/PK3, V8NHG, LX1BU, ZC6XY and EL7A to the list of juice you might uncover sans BFO QRM.

Blowing alternately hot and cold in true style, ten dished out CN6ER (28,016), ISIAFM (28,010), U8ZKA6 (28,005), YS1H, GC4LI (28,040), OA4AS and VP5AS to W2YIIY's 807 while six consecutive 'phone contacts formulated a fast WAC for W8YAN, namely VP4RF, DL4PQ, CX1ME, VK2KZ, JAz2AZ and a VE6. . . . U8RF regularly runs into CP5FB, LUI1ZA, LU2ZB, KHzs RE and RR, and VP4TAN via the voice route and G6RJ pinned down AC4RF (28,050), VP2AJ (28,020), VQ8AD (28,050 t7 QRH) on c.w. plus VO5PBD (28,390) on A3. . . . Traffic-hound W8KOH sampled ten and liked EA4FA (28,015), UB5BK (28,030), OA1F (28,250) and KG6DI. . . . W8KOH did well with SW8WA and APSZ while W0LNT pitches in with KV4AA, EA5BE, OH8NF, LA6O, UB5AZ, FA8CR, CX4CZ and OE8AN.

W8SWG finds things booming on eleven, picking off KG6DG, PY2AC, YR5A, TG9KJ, SP8XA and EL3A on c.w. and LX1JW, EA4LA, OA1E, VP6CDI, HC1KP, PY2CK and TG9AN using voice. . . . TA3GVU (27,220) completed W2QIH's 11-meter WAC so this part of the spectrum is worth a listen now and then.

Where:

It might be well to reiterate that the addresses given herein are by no means vouched for by this department (nor results therefrom guaranteed!). Obviously, were we to check and verify each one, by the time they appeared in print their value would be nil. So take your chances and good luck, OMs. . . .

AG2AB Cpl. E. Metrick, Hq. & Eq. Co., 351 Inf., F.T.T., APO 203, 6% PM, N.Y.C., N.Y.
ex-D4AEQ W6FRRS, 1250 Ressenick Avenue, Los Angeles 23, Calif.
EASC60 Box 346, Las Palmas, Canary Islands
Rurik Lonnroth, OH12QQ, has enjoyed contacts with hundreds of Ws from his meticulous layout in Helsinki. 120 main (250 volts) limit the input to 50 watts and two antennae are employed, a long wire and an end-fire east-west beam. Receiving is done with an NC-lOOXA.

A few call signs are:

EA8MC  Manuel Cenulmer, Sol Y Ortega, 22, Lasana, Tenerife, Canary Islands
EK1DP  HFO No. 57, Tangier Zone, North Africa
ELSA  (via W2QCE)
EU3AD  (same as EU2)
HL18A  (via W2MQD)
IRMO  Via San Rocco, 10, Cromona, Italy
KC6WA  Navy 3054, FPO, San Francisco, Calif.
LU1ZB  QSL to R. Marques 255, San Isidro (P.B.A.), Argentina
LU2ZA  Alberto Torres, Isla Laurie Observatorio Meteorologico, Argentina
LZ1AB  Box 242, Sofia, Bulgaria
LZ6AA  (Franca Poula, Box 274, Sofia, Bulgaria
MD2AC  S/Sgt. M. E. Gailaher, 1950 AAC Sqdn., APO 231, % PM, N.Y.C., N.Y.
MD7RCS  (via RSGB)
NH2S  Radio Marina, Asmara, Eritrea
MT2D  K. L. Williams, % BOAC, Tripoli, Tripolitania, North Africa
PK3MT  (via ARRL)
SP5BA  (via W5KC)
ST2RA  Box 25, Madakal, Southern Sudan
ST2WB  John Birch, Juba, Sudan
SU2AA  (via W2CYC)
V4FLJ  % Dept. of Civil Aviation, Port Moresby, Papua Territory
V0CQ  Bristol Airfield, Argentina, Rfd., Navy 103, FPO, N.Y.C., N.Y.
V04AD  H. H. Koping, Box 13, Port aux Basques, Newfoundland
ex-V4PTY  D. E. Young, 22 Sussex St., Charlottown, Georgetown 10, British Guiana
V27NK  Box 703, Nassau, Bahamas
VR2BG  D. Rumina, % RNZAF, Suva, Fiji Islands
VR2BK  J. L. Byrne, % Sata. Mess, RNZAF Stn., Taualala Bay, Fiji Islands
VR2BL  % Nadi Airport, Fiji Islands
VR2AJ  P.O. Box 27, Nukualefo, Tonga Islands
VR5PL  (now same as above)
VS2CH  (via RSGB)

This variety thanks to WIs IOZ KUF Q1Q QMJ RWS, W2s BJ GJX DMJ EQS LXI MPA SN, W3NOH, W4s MR VE, W5s LY JC, W6PH, W8s KPL SWG WWU, W9CF, W6s BNU TKX, KH6PM, LU8BF, OK1WY.

Tidbits:

Local QRM around Fiji is growing fierce, reports VE2BC. There are now seven active stations within a half-mile radius of Nadi Airport and more newcomers are expected directly. Graham has a yen for magnetic recording and would welcome a few rag-chews on this subject. NY4DD informs us that the six present Guantanamo Bay licensees are NY4s AW BA JB LB RD and his truly. ET3AD reports sparse Ethiopian activity but holds forth on 80, 40 and 20, phone and c.w., to furnish more than his share of contacts with this rare point. W3JT's P1YRC DX News speaks of VQ2DJ's planned visit to ZD6 during April. Anybody grab this one? The following sidelights of KH6VP's sojourn to VR4 trickle through: Bill (ex-W7BE, W31W) worked 88!l in 8.5 hours of operation on three bands. A rhombic headed toward KH6 was used and power ranged from 40 to 400 watts. Intending to give W7s a decent break, he found conditions stacked against him with all U.S. areas except the northwest coming through. Atmospherics made things really rough. W4CYC was the first station raised and S9 reports became the rule thereafter. KH6VP has done his DXing from many parts of the U.S. and maintains that the W7 gang has the toughest row to hoe. [Guess he never had to use a skywire atop a Cicero two-flat, eh, boss? — Jeeves] Maybe not, Jeeves, but that VR4 clambake was a job well done. A DXer of the old school, GE6YX, proposes a toast to this modern generation of DX stalwarts who can hang on for hours on end to grab a new one.

(Continued on page 118)
QSL BUREAUS OF THE WORLD

For best service on delivery of your QSLs to foreign amateurs, simply mail cards direct to the bureau of the proper country, as listed below (boldface type indicates a recent change from previous listings). Do not send foreign cards to A.R.L.L. headquarters except those for which no bureau is here listed.

For service on incoming foreign cards, see list of domestic QSL bureaus in previous issues of *QST* under the heading, “A.R.L.L. QSL Bureau” (page 30, April *QST*).

**Bureaus for Domestic QSLs**

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Modernizing the Prewar HRO

BY LOREN G. WINDOM,* W8GZ

Some months ago the writer had occasion to compare his prewar HRO receiver (No. Y-219) with several of the new HRO-7 receivers. My conclusion was that the old HRO was still a top-notch receiver but that several improvements were indicated — conversion of the high-frequency oscillator and the addition of a noise limiter. After extended use at W8GZ with certain minor modifications dictated by simplicity.

Conversion of the H.F. Oscillator

Conversion of the high-frequency oscillator consists of substituting a 6C4 and associated 0A2 regulator tube in place of the 6C6 or equivalent oscillator and the adding of a temperature-compensating condenser across the oscillator bandspread trimmer condenser. Circuit details are given in Fig. 1.

Remove the present h.f. oscillator tube and socket from the chassis. With a hack-saw blade or similar tool enlarge the present tube-socket hole into a rectangular hole approximately 1\(\frac{1}{4}\) by 2 inches. Cut a piece of sheet aluminum into a rectangle approximately 2\(\frac{3}{4}\) by 2\(\frac{3}{4}\) inches. On this piece of aluminum mount the sockets for the 6C4 and 0A2 tubes. Space these sockets approximately 1\(\frac{1}{4}\) inches between centers. This socket assembly is now centered over the rectangular hole in the chassis and fastened in place by means of small bolts or rivets in each corner of the aluminum sheet. The 6C4 tube must be toward the front. Connect the 6C4 and 0A2 as shown in Fig. 1.

Temperature Compensation

Temperature compensation is obtained by connecting a 10-µfd. ceramic condenser, with a coefficient of \(-0.00077 \mu\text{fd.}/\mu\text{fd.}/^\circ\text{C}\), across the oscillator bandspread trimmer condenser. This temperature compensation is used on the 28-, 14- and 7-Mc. coils. It cannot be used on the 3.5-Mc. coils without modifying the coil-assembly components, which is hardly worth while.

* Pickerington Road, Reynoldsburg, Ohio.

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A top view of the "modernized" HRO. The old oscillator tube and socket have been replaced by an aluminum plate that mounts a 6C4 oscillator tube and 0A2 regulator tube. A 6H6 second detector has been substituted, and a 6H6 noise limiter and 6SJ7 audio amplifier have been added.

---

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Remove the h.f. oscillator brush board (the bar with four contact fingers in the right-hand coil slot) and add a fifth contact arm to this brush board, by using a piece of spring brass or any other similar material. The brush board is already drilled and slotted for the fifth contact. All that is necessary is to fashion the arm out of suitable metal and fasten it on the board with a small bolt or rivet. If you desire, a new 5-contact brush board can be purchased very cheaply directly from the National Company, Malden, Mass.

Connect the temperature-compensating condenser from this new contact arm to ground. Be sure to leave the condenser leads long enough so that the compensating condenser can be pressed against the 6C4 oscillator tube. Use a small ceramic stand-off insulator to support this condenser and give it mechanical rigidity.

Next remove the 28-Mc. h.f. oscillator coil can from the plug-in rack and remove the coil assembly from its shield can. Solder a connection from Contact 1 (it is plainly marked and was previously unused) to the stator connection of the bandspread trimmer condenser. Make it short and stiff for mechanical rigidity. Replace into the shield can and back onto the rack. Repeat the operation for the 14- and 7-Mc. coils. Leave the 3.5-Mc. coils untouched.

Warm up the receiver and realign the bandspread trimmer on the h.f. oscillator coils for 28, 14 and 7 Mc. This is Adjustment 7 in the HRO instruction manual. A slight decrease in capacity is necessary, because you have added 10 µfd. across this trimmer. Remember that the h.f. oscillator should always be on the high-frequency side of the signal, so if your oscillator tunes at two points the counterclockwise one is the correct point. See page 8, HRO instruction manual. Check your bandspread. On the 28-Mc. coil, 28.0 Mc. should come at 50 on the dial and 29.7 Mc. should come at 450 on the dial. Similarly, the band limits for the 14- and 7-Mc. coils should come at 50 and 450. If the bandspread is out, realign as outlined on pages 8 and 9 of the manual.

Exact temperature compensation is secured by pressing the compensating condenser closer to or farther away from the 6C4 oscillator tube. In the writer’s receiver the correct point is approximately ¼ inch from the center of the side of the 6C4 tube. At WSGZ this adjustment gives a maximum drift at 29.7 Mc. of plus or minus one (1) dial division, starting with a cold receiver.

If the oscillator “segs,” or operates at several frequencies simultaneously, reduce the grid leak to around 18,000 ohms or else use a grid condenser of lower capacity. Do not change the oscillator coil!

A final point on temperature compensation. Remember that a cold coil plugged into a hot receiver will have some drift in spite of your compensation. You can correct this by keeping the extra coils on top of the receiver or any other place where their temperature will be substantially the same as that of the receiver. If you desire, you can introduce additional temperature compensation directly into the plug-in coils by removing the coils from their shield cans and soldering a small negative-coefficient condenser from Terminal 1 to Terminal 4 on the 28-, 14-

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Fig. 2 — The revised second detector and first audio, and the new limiter, are from the circuit of the HRO-7.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>270-µfd. mica or ceramic.</td>
<td></td>
</tr>
<tr>
<td>C2, C3</td>
<td>100-µfd. mica or ceramic.</td>
<td></td>
</tr>
<tr>
<td>C4, C5, C6, C7, C10</td>
<td>0.1-µfd. 600-volt paper.</td>
<td></td>
</tr>
<tr>
<td>C8</td>
<td>0.01-µfd. 600-volt paper.</td>
<td></td>
</tr>
<tr>
<td>R1, R2</td>
<td>0.22 megohm.</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>17,000 ohms.</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>0.47 megohm.</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>1.5 megohms.</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>0.5 megohm potentiometer tapped at 22,000 ohms (IRC Type D17-13X) or as in Fig. 3.</td>
<td></td>
</tr>
<tr>
<td>R7, R8</td>
<td>0.22 megohm.</td>
<td></td>
</tr>
<tr>
<td>R9</td>
<td>0.5-megohm volume control.</td>
<td></td>
</tr>
<tr>
<td>R10</td>
<td>0.82 megohm.</td>
<td></td>
</tr>
<tr>
<td>R11</td>
<td>0.82 megohm.</td>
<td></td>
</tr>
<tr>
<td>R12, R13</td>
<td>0.2200 ohms.</td>
<td></td>
</tr>
<tr>
<td>R14</td>
<td>0.1 megohm.</td>
<td></td>
</tr>
</tbody>
</table>

All resistors half-watt.

R5 — Switch mounted on R5 (IRC No. 43).
and 7-Mc. coils. The exact size of this condenser will depend upon your own particular HRO. After adding the condenser you must still be able to "zero" the oscillator with the bandspread trimmer condenser. The writer's experience has been that condensers of from 3 to 5 \( \mu \mu F \), with a coefficient of \( -0.00077/\mu \mu F/\mu \mu F/°C \), are about the maximum usable capacities. A little trial and error will give you the best possible combination. However, unless you do a lot of coil shifting this coil compensation is hardly necessary.

**Noise Limiter**

At W8GZ one of the rhombic antennas parallels a state highway for nearly 1000 feet. The ignition interference is terrific! After much cut and try, the writer settled upon the circuit shown in Fig. 2 as giving the best results with a minimum of change in the HRO.

![Fig. 2](image)

**Fig. 2** — A substitute circuit for Rs of Fig. 2.

The first step is to take your HRO "as is" (either with or without the h.f. oscillator conversion). Connect a signal generator or some source of definitely fixed and unvarying signal to the antenna terminals and feed a 28- or 14-Mc. signal into the receiver. The exact frequency is unimportant. Tune in this signal very carefully and make a note of the S-meter reading. You are now ready to begin work.

Remove the 6B7 second detector and its socket from the chassis and replace with a 6H6 socket and tube. Connect it as shown in Fig. 2. Mount the 6H6 noise limiter and 6S7 first audio into the chassis directly behind the S-meter, the 6H6 noise limiter to the front. The noise-limiter control is mounted to the lower right of the headphone jack. Connect as in Fig. 2. Both 6116 tubes use 4.3-ohm 2-watt resistors in series with the heaters to reduce the voltage at the sockets to 5.0 volts.

The noise-limiter control may be either a 0.5-megohm potentiometer with a tap at 20,000 to 25,000 ohms (Fig. 2) as is used at W8GZ, or it may consist of a 0.5-megohm potentiometer shunting a 22,000-ohm and a 0.47-megohm resistor (Fig. 3) as in the HRO-7.

After completing the wiring realign the 6H6 second detector for maximum output. (Adjustment 13 and 14, HRO instruction manual.)

Reconnect the signal generator or signal source and again tune the signal in carefully as before. The S-meter reading will now be somewhat lower than it was before adding the noise limiter. Using a long screwdriver or similar tool very carefully increase the capacity of the crystal-filter output coupling condenser by turning clockwise (Adjustment 9, HRO instruction manual) until the S-meter reads the same as before installing the limiter. Do not go beyond this point or you will lose selectivity.

Your conversion is now complete. The S-meter should operate exactly as it did before conversion. You have a receiver with an extremely stable oscillator and an excellent noise limiter — and best but not least the over-all gain of your receiver is slightly higher than it was before you started work. While you are at it hadn’t you better check your tubes and then touch up the alignment of the entire receiver in accordance with the instruction manual?

(Continued on page 118)
An Experimental All-Band Nondirectional Transmitting Antenna

Some Possibilities Offered by the Tilted Folded Dipole

BY G. L. COUNTRYMAN,* W1RBK, W3HH

Few improvements in antennas for the lower-frequency bands have been forthcoming for several years. The arrangement to be discussed is not entirely original with the author but was based on some Navy antenna studies. Initial tests indicate that it may provide an acceptable solution to amateur multiband operation.

Briefly, it is an aperiodic system that will give uniform output over a frequency of approximately a 5-to-1 ratio with nondirectional characteristics and without critical adjustment. In fact, the only adjustment is to couple the final tank to a 600-ohm line.

The practical experiments conducted by the author are incomplete, but it is hoped that the publication of the data contained herein will encourage experimenting by other amateurs.

Fig. 1 — General diagram of the terminated folded dipole. Dimensions for A and B are suggested in the text.

There are many questions unanswered: measured variation in standing-wave ratio over a given frequency range, loss in power attributable to the resistance termination, experimentally-obtained radiation patterns, etc.

Essentially, the system — shown in Fig. 1 — is a nonresonant folded dipole. It is fed with a 600-ohm line. This antenna, if horizontal, will be quite directional at right angles to its axis, with pronounced minima off the ends. As the antenna is tilted with respect to ground, this pattern gradually changes until at an angle of 30 degrees it becomes nondirectional for all practical purposes. Translated into terms of amateur construction this means that only one mast is required, together with a short pole six feet or so in height supporting the low end. There seems to be no marked advantage in an increase in over-all height of the antenna. On the contrary, reports from a distance indicate that signals are definitely better with one end of the antenna only six feet from the ground, perhaps because of a resulting lower angle of radiation.

Because complications are introduced by the resistance termination, it is difficult to make an adequate analysis or evaluation of a terminated folded dipole by conventional methods. It becomes necessary to measure performance experimentally.

One of the Navy laboratories has investigated the performance of this type of antenna and has reported unfavorably upon it. However, the laboratory study was based upon a vertical monopole erected over a metallic ground plane, using conventional measuring instruments, and the characteristics obtained were applied mathematically to arrive at theoretical characteristics for the resistance-terminated folded dipole. Operational tests were not made by this laboratory and their theoretical findings are not borne out by the limited practical tests conducted by the author.

It is of interest to note that the standing-wave ratios estimated by the laboratory for various frequencies from 4 to 22 Mc. ranged from a minimum of 1.4 to a maximum of 2.6, with an average close to 1.7. These ratios compare favorably with average s.w.r.s found in amateur installations. It should be remembered that these standing-wave ratios were not measured but were arrived at by calculation.

Dimensions

Fig. 1 gives a general idea of the system with the important dimensions indicated except for

---

*Comdr., USN; Electronics Officer, Boston Naval Shipyard, Boston, Mass.
the angle of tilt. Fig. 2 indicates the required tilt with a suggested pole arrangement and dimensions pertaining thereto. Two particular sizes should be of interest to amateurs, one of which will have maximum efficiency from 3.5 Mc. to 17.5 Mc. and the other being optimum from 7 Mc. to 35 Mc. Dimensions may be developed using the formulas set forth to cover higher-frequency bands, but at 28 Mc. and higher frequencies directional arrays are easy to construct and preferable because of the increased gain. The following dimensions are applicable to the frequency ranges selected above:

<table>
<thead>
<tr>
<th>Dimension</th>
<th>3.5 to 17.5 Mc.</th>
<th>7 to 35 Mc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2 ft. 10 in.</td>
<td>1 ft. 6 in.</td>
</tr>
<tr>
<td>B</td>
<td>46 ft. 10 in.</td>
<td>23 ft. 5 in.</td>
</tr>
<tr>
<td>C</td>
<td>56 ft. 0 in.</td>
<td>32 ft. 0 in.</td>
</tr>
<tr>
<td>D</td>
<td>80 ft. 0 in.</td>
<td>44 ft. 0 in.</td>
</tr>
</tbody>
</table>

For an impedance of 600 ohms, the center-to-center spacing of the feeder wires, divided by the diameter of the feeder wires, must equal 70. This means that No. 12 wire spaced six inches will be acceptable. Six-inch spreaders are readily available and the wire will not stretch unduly. No. 10 wire should be spaced 7 inches and No. 16 wire should be spaced 3½ inches.

**Terminating Resistor**

The terminating resistor should be non-inductive and have a minimum rating equal to 35 per cent of the input power to the final stage. It may be a carbon or graphite rod, adequately protected from the elements, or merely a long 600-ohm transmission line constructed of resistance wire. If the latter is used, the line may be carried vertically down from the center of one leg of the antenna to a short pole and then, if required, extended to one of the masts and doubled back and forth between the masts. If a carbon resistor is used, there is apparently no difference whether the rod is connected directly into the antenna as shown in Fig. 3, or at the end of a transmission line, as shown in Fig. 1. However, it is easier to adjust the resistance and protect it from the elements when it is installed at a fixed location on the ground than when it is suspended across an insulator in the antenna wire.

**Formulas**

The following formulas will be of assistance in developing antennas for different frequency coverages:

\[
\text{Antenna-wire spacing (A)} = \frac{3000}{f \text{ (kc.)}} \times 3.28
\]

\[
\text{Antenna length, each half (B)} = \frac{50,000}{f \text{ (kc.)}} \times 3.28
\]

To convert decimal parts of one foot into inches, multiply by 12.

One meter = 3.28 feet.

\[
\text{Frequency (kc.)} = \frac{300,000}{\lambda \text{ (meters)}}
\]

The length of the antenna and the wire spacing may well be the object of further experiments but initial tests indicate that the first two formulas shown above are reasonably accurate and that the system is operable over a 5-to-1 frequency range as previously mentioned.

**NATIONAL EMERGENCY FREQUENCIES**

<table>
<thead>
<tr>
<th>C.W.</th>
<th>'PHONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7100 kc. (day)</td>
<td>3875 kc.</td>
</tr>
<tr>
<td>3550 kc. (night)</td>
<td></td>
</tr>
</tbody>
</table>
A Two-Bit Tower with Million-Dollar Performance

BY W. C. RIPPY, JR.,* W4HYR

Antenna trouble, mate? Then lend an ear to a plan for a sky hook that's simple and cheap to build, yet strong enough to withstand winds and other inclemencies of the weather. The idea was borrowed from steel towers used in constructing the Allatoona Dam in North Georgia. Those 100-foot towers were unusually strong, capable of supporting 40-ton buckets of concrete between them.

The antenna mast is a small replica of the construction tower. It looks like a 40-foot-high vine trellis, one foot square in cross section, with fourteen 3-foot 1 × 2s nailed zigzag fashion from bottom to top on four sides. The whole structure weighs only 180 pounds.

The unusual feature of this tower is the simplicity of construction. Some towers decrease in width and breadth as you build toward the top but in this case width and breadth are uniform and cross boards are all the same size, thereby saving you a lot of time measuring and sawing.

Construction

To construct the mast, lay out two sides first. Get twelve 15-foot 2 × 2s, three for each corner. Splice each three of them with 8-foot 1 × 2s, and you have four 45-foot pieces. Nail the fourteen 3-foot 1 × 2s zigzag fashion between each pair of the 45-foot lengths: The distance between each pair of long pieces is now one foot. Then nail 1-foot braces across the sides at the bottom, middle and top, three on each side.

The two sides are now ready to be put together—with more of the 3-foot 1 × 2s and short braces. When finished, you will have fourteen zigzag 1 × 2s and three braces from top to bottom on each side.

The ladder comes next, and then the paint. Future builders of such towers can profit by the writer's experience in two respects. First, put the ladder on the outside rather than on the inside of the structure! While having it on the inside may add to the beauty of the finished product, the pressure of climbing feet slowly presses the steps away from the corner pieces and in time weakens the nails to the danger point. Use conveniently-spaced short 1 × 2s for the ladder.

Fig. 1 — Details of the tower construction. The general assembly is shown at A, with a cross-sectional view at C. The method of joining the 2 × 2 corner posts is shown in B.

* 3542 Kingsboro Road, N.E., Atlanta, Ga.
The finished tower was painted with white creosote. White was fine, probably the best color for outside work of this type. However, the creosote flaked and peeled in about six months, making it necessary to repaint the tower with more durable outside white house paint. So use house paint the first time.

**Putting Up the Tower**

The tower uses two sets of guy wires, four from the top to support the structure and four from the middle to prevent sympathetic vibration.

First, level the site for the base. Iron stakes driven into the bedrock and bolted to the tower will help steady it. Lay bricks level within the iron stakes for the wooden mast to rest on, to discourage termites.

Now for erecting the tower. In spite of the light weight, its shape calls for the strength of six men to stand it on end. A gin pole and block-and-tackle simplify the job of getting the tower up to the middle to prevent sympathetic vibration. When it is up, tighten the guy wires and the job is finished. Hang your antenna on it, and all is set.

The long pieces for your corner posts, white pine, should run about $7. The rest of the lumber, crosspieces, braces and splicers, will be about $10. Paint, one gallon of good-grade outside white, costs $5.40. New stranded stainless-steel wire (enough for this job) runs about $5.60. Also, you will have to invest in some strain insulators for your guy wires and the iron spikes. Although this totals $30, you should be able to build this tower for half the price if you dig around the secondhand lumber piles.

The tower is strong, stable and sturdy in all types of weather, including heavy wind. The tower shown in the photograph completed its second winter with flying colors — no sign of weakness in spite of much sleet and many windstorms. Such a tower should last as long as a house built of similar materials.

And when you want to paint again, don't hesitate to climb to the top. True, it seems risky to climb a 1 x 1 x 40-foot structure, but don't be afraid — it is stable. No "rocking" was detected when the job was done at W4HYR. Stable, weatherworthy and cheap, this tower is well worth your time and money to build.

**Strays**

It is only natural that Salesman-SCM W0RA should haunt the Ham Building in Saint Paul in quest of business!

Another record fell by the wayside recently when ten-year-old Jane Bieberman, W3OVV (our December cover), and nine-year-old Kent Lattig, W9FZE (our March cover), worked each other. Frank, VE2TA, who is eleven years old, has also QSOed Jane. The pre-Teen-Agers are now out to make it an international three-way.

**HAMFEST CALENDAR**


**CALIFORNIA** — June 26th, at Chico. Staged by Golden Empire Radio Club of Northern California. Registration, $1.50, includes contests. Dutch lunch, entertainment, program. Tickets or information from Secy. Winston E. Roberts, W6GUV, P. O. Box 19, Chico, Calif.

**CALIFORNIA** — June 12th, at Coyote Point, San Mateo. (Turn east at Peninsula Ave. overpass, look for the 10-foot balloon.) Two-meter hidden-transmitter hunt, brass pounder's contest, auction, children's games with prizes, special YL and XYL events. Bring your lunch — coffee free! Tickets $1.00.

**DAKOTAS** — June 12th, at Island Park, Mayville, N. D. Hamborpe-picnic, good fellowship, free ice cream and drinks. Bring your family or YL and a picnic lunch. In event of inclement weather affair will be held in the Municipal Auditorium.

**GEORGIA** — June 5th, at Grant Park, Atlanta. Auspices Atlanta Radio Club. Barbecue, noted speakers, contests, all-around good time scheduled. Reservations, $2.50, to Gus Barron, W4EFS, 425 Peachtree St., N. E., Atlanta, Ga., or by June 1st.

**IOWA** — July 17th, at Fairmont Park, Council Bluffs. Auspices Council Bluffs Radio Operators Club. Two-meter treasure hunt, featuring big prize, starts at 2 p.m. Registration, $1.50, includes all the food and whistle-wetter you can hold. Tickets available in advance from Secy. O. W. Miller, W8SEE, 2928 A. V. C. Council Bluffs, Iowa.


**SASKATCHEWAN** — July 1st, at Regina. Plans for a gala time now being formulated — be sure to attend. Contact SCM J. H. Goodridge, VE5DW, % Canadian Pacific Air Lines, Prince Albert, Sask., for reservations or particulars.

June 1949 57
Still More on the “Super-Selective C.W. Receiver”

The April issue of QST, with its “Technical Topic” on the W9AEH receiver, was out only a few days when several letters came in with tips on the transformers and on the receiver. Here is a summary of the information.

George Goldstone, W8MGQ, wrote to tell us that the CFI unit from an ART-13 transmitter has some coils that might be used in sharp low-frequency transformers. The little unit marked “Z-2201” (there are two in a CFI) contains a 50- and a 200-kc. tuned circuit. Both inductors are slug-tuned in powdered-iron pots, and they are mounted side by side in a bakelite housing inside a shield can. By removing the 200-kc. coil and substituting the 50-kc. coil from another unit, it should be possible to make a fair transformer. On the Q-meter, the 50-kc. coil shows a Q of 80 at 85 kc., just twice that of the coils in the 85-kc. transformers used in the BC-453. Some stores have the Z-2201 units for 25 cents—a CFI unit for about $1.50 has two Z-2201 units. We haven’t tried these as transformers in a low-frequency i.f. strip, but we can vouch for the Q figure.

From Canada, A. E. Pugh, VE5AP, writes to say that the Bendix MN-26 radio-compass receiver, available in surplus, contains a total of 22 powdered-iron pots and cores, with various coils mounted in the pots. Many of them tune to around 110 kc., so they are in the range and might be useful. The receiver has a wealth of condensers and resistors, a 5-gang tuning condenser and a 24-volt dynamotor. We don’t know how useful the coils would be in i.f. transformer applications, and the receivers go for about $25 in the current market, so we may never know, unless the QRM gets real bad.

But apparently you have to hear the W9AEH receiver before you really wake up to this selectivity business. Harold Leighton, W9LM, writes to tell what he did after listening to the receiver on several occasions. He was so impressed that he wanted something like it. He had a McLaughlin Selectable-Sideband Adapter1 on the tail end of his HQ-129, but it wasn’t good enough on e.w., so he added a little additional selectivity. He took six Hammarlund SS-50 transformers (special low-frequency transformers available for the McLaughlin system) and increased the separation between pots by ½ inches, to loosen the coupling. He then built an i.f. amplifier using two of these transformers between each stage, and patterned the detector circuit after the McLaughlin design. For a 50-kc. b.f.o. he used the coil from a BC-453 surplus unit, padded with micas and tuned by a 100-µfd. variable.

To give him the various degrees of selectivity he wants, a 4-position switch is used. The first gives straight audio output from the HQ-129, with the crystal filter in Position 4. In the second position, the headphone output is taken from the selectable-sideband adapter. Position No. 3 gives the receiver selectivity plus the selectable-sideband adapter selectivity plus the six loose-coupled SS-50s selectivity, and No. 4 uses all this plus an audio filter! A beat note of about 375 kc. is generally used, and in Positions 3 and 4, no signal has ever been heard on the other side of zero beat, and practically all signals are gone by the time the beat reaches 800 cycles on the high side. Plates have been removed from the bandspread condenser in the 129, and only 150 kc. is covered on 14 and 28 Mc., and on 3.5 and 7 Mc., only 30 kc. The main bandset condenser is reset to cover the band. On 40 and 80 meters, all of the selectivity can be used practically all of the time.

The most trouble with drift comes from the HQ-129 b.f.o., which is used only in Position 1 and so is of little importance. Fine tuning is available on the 50-kc. b.f.o., however, and a handy gimmick is the pair of pencil marks on the panel that permits flipping the b.f.o. from one spot to another that gives exactly the same beat note on the other side of the signal.

Selectivity? It looks like we’re just beginning to scratch the surface. With selectivity comes the requirement for more stability, and with both comes more enjoyable operating. Who said everything had been done in amateur radio?

— B.G.

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Sweepstakes Scores Next Month

The unusually tight space situation this issue, imposed by the need for bringing to the attention of members the full text of the new proposed FCC rule-making (pages 20 through 23), has made it necessary for us to hold over until July QST publication of the official results of the 15th ARRL Sweepstakes.
1949 ARRL Field Day Rules

Annual Test for Emergency-Powered Stations, June 18th-19th

BY F. E. HANDY, * WIBDI

This year's Field Day provides for (1) club-and-group portable station participation like that of last year, except no battery multiplier, (2) unit or individual portable-station participation, just as last year, including the 1.5 multiplier when everything is on batteries, and (3) mobile-rig participation, a new department of listings distinct from either of the above for any amateur stations that qualify for such separate listing.

Mobile entries, invited this year, must be under one call throughout the FD, that of the amateur having legal control of the particular mobile installation. Each mobile-entry call signal must be different from that of any other FD station participating. Only one mobile can be entered under the one call. ARRL will classify mobile entries for listing by 1, 2, etc. transmitter classes, depending on the number of transmitters used at the same time. Most, of course, will be "1 transmitter." "Mobile" reports must show individual control (call signal), list operators handling key or mike, give antenna type and length, power supply, and may credit or identify this entry with one club, if a member, and if desired to contribute to some club's "aggregate mobile" score. Mobiles can claim 1.5 multiplier credit, where all equipment runs from batteries. (4) Home-station participation. This is the customary listing of work reported by fixed amateur stations with those afield.

Signal reports and ARRL section or specific location must be exchanged in proof of QSO. All station operation must be in compliance with government regulations to be accepted for FD credit. The rules include the usual liberal multiplier credits for contacts made independently of commercial mains. The credits for correct radio relaying of FD messages only are 1 for receiving, 1 for sending onward by radio and 25 for a single radio-origination. Instead of sending the special Field Day messages out of the section, they should be given to stations in the same state or section where your SCM or SEC will get them by radio, or later mail delivery. Avoid errors in form or "check" that will deduct points from your score. Mobiles can cross a time-zone line but not receive credit for more than 24 hours operation if they do so. Antennas so long as to take external support (impractical for vehicle in normal motion) cannot be used for any contacts

ALL LICENSED AMATEURS, RADIO CLUBS & GROUPS:

Test mobile as well as portable stations in the 1949 ARRL Field Day - June 18th-19th.


Locations, Band-Mode Transmitter Groupings, Scoring Plan, Definitions and Examples

Locations: For participation in classes (1) or (2) all control locations for equipment operating under one call and responsibility-to-FCC (or Canadian government) must be not more than 500 feet from a given spot for points to count toward one score. Only portables in the field, away from fixed-station power and conveniences, are eligible for such listing. For class (3) or mobile participation a single identifying call used through the entire FD and differing from any other station taking part must be used, but there are no restrictions as to location. Reports must show point(s) of operation. Class (4) home stations must be at government-recorded addresses.

Hands: One transmitter may be changed from band to band at will for a 1-transmitter entry. The number of units in simultaneous operation at any one time determines our classification of the entry. It is regarded as improper, unethical, and grounds for disqualification to use more than one transmitter at one time in the same band. (Such as one on 3510 and 3800 kc., or 14.1 and 14.35 Mc., for example.) This is not construed to bar two transmitters, one on 75 fone and one on 80 e.w., or one on 7-Mc. and one on 3.5-Mc. e.w. at the same time, for a 2-transmitter-class entry.

*Communications Manager, ARRL.

1 Not Daylight Time.
Each phone and c.w. band or band-made sector is regarded as a separate band. A.m. and n.f.m. are considered the same mode for FD purposes. (Eleven meters will be regarded as one band using voice, another when using c.w., as distinct from similar 10-meter considerations.)

The following 13 bands (and additional u.h.f.-s.h.f. bands if you choose) constitute separate bands on which simultaneous operation may be arranged if desired: A1: 3500-4000, 7000-7300, 14,000-14,400, 27,160-27,430, 28,000-28,700 kc.; 50-54 and 144-148 Mc. A2: 3550-4000 kc.; 142-143, 285-297 Mc.; 27,160-27,430 kc.; 50-54 and 144-148 Mc. (In Canada VE phone bands apply.)

Points: Each amateur station worked by an FD station counts 1 point toward the score. The same station contacted again counts only if the FD transmitter credit reported is on a different amateur frequency band. A.m. and n.f.m. hands if you choose) constitute voice, another when using c.w., as distinct from arranged if desired:

Message Credits: The text of Field Day messages to SEC or SCM will include (a) the number of operators, (b) location or QTH, and (c) the number of AEIC members at the FD station. Each such message originated by radio counts 25 points before multiplier (there will be a deduction of ten points for omission of handling data and ten for defects in form or procedure), if the text is submitted with a worked list by bands showing on-off times for each transmitter. Relays: 2 added points before multiplier (1 for receiving, 1 for sending on) may be claimed by FD handling station. Delivery to addressee is required on all FD messages in transit at end of the test as prerequisite to credit, of course. (Home stations: 1 point for each message received and mailed to Hq., 2 points for relays, 1 when received, 1 when forwarded by radio.)

Multipliers: Multipliers are not applicable to home stations. The scores of all FD stations in the Northwestern, Pacific, Rocky Mt., Southwestern, and West Gulf Divisions will be multiplied by 1.5. FD credits: Powers up to and including 30 watts input to the final take a multiplier of 3 for the points earned. Power limits between 30 and 100 watts, inclusive, similarly take a multiplier of 2 for the points earned when so operating.

Independence-from-Mains Multiplier: Multiply points by 3 when obtained operating with all radio equipment independent of commercial power source.

Battery-Credit Multiplier for Mobile, or Unit-Individual Entries: (Not applicable to club-and-group or home-station entries). Score of class (2) and (3) entrants is subject to additional multiplier of 1.5 for points made while using battery power source on all equipment. Charging batteries from commercial mains while said batteries are connected to transmitter or receiver voids the "independence-from-mains" multiplier.

Regarding battery power, the battery capacity or size should in all cases be adequate to make station operative for at least one hour of continuous operation to justify use of a 1.5 multiplier, applicable only for entries in class 2 or 3. Like other multipliers, this will apply only to those QSOs and message points earned at times when station is completely operated from a battery primary source.

Club Aggregate-Mobile Scores. In addition to each unit mobile entry by the controlling licensee, a club claim may be submitted in the form of separate letter-tabulation of all mobile scores of bona fide resident members. All club mobile credits will be separate from and not combined in any way with club-and-group scores derived from work at club or group location. It will be required that the club identity be noted on mobile logs of the individual reporters as well as that the club secretary submit a claimed aggregate-mobile score for any club mobile credit. Credits to the degree supported by the logs of the individuals will be allowed. Only club members residing in a club territory, belonging to and attending meetings of a club, may contribute to an aggregate-mobile club listing.

Definitions

Mobile stations (Class 3) are defined as complete installations including power source and antenna, mounted in or on vehicles and capable of being used while in normal motion. (A boat, car, trailer, etc. station installation may qualify... but the antenna used must be proper for actual mobile use, not a long wire or beam that could not be utilized without earthbound support apart from the vehicle itself. If they utilize antenna supports not normal or suitable for use during vehicular motion of the vehicle in which installed, boat, car, etc., installations must be classified as portable instead of mobile, and either under class (1) or (2) instead of (3). Likewise, a car installation that has to plug in on a commercial source is "earthbound" and must be classified as portable. Such may be capable of small movement but is not mobile in fact. (Contacts may be made in motion or from any location(s) without prejudice to entry, however.)

Portable stations are those established at sites away from customary fixed-station locations for FD purposes. All units, including antenna, must be transported, erected and reassembled for the Field Day except where transported as one ready-to-work unit. Portable equipment or units will be placed under one call and the control of one licensee, for one-score group or entry.

Club and group participation (Class 1) is that portable-station work accomplished away from home site sub—
mitted by three or more licensed operators. Home stations (Class 4) are those fixed amateur stations not operating portable or mobile but reporting contacts they make with portable or mobile stations active in the FD.

Scoring

Example 1 (may be either of the Mobile, or Unit-Individual Classes):
Assume a 25-watt rig wholly on batteries, not originating or relaying any messages, and not having more than two operators.
40 points (40 stations)
\[ \times 3 \text{ (power below 30 watts)} \]
120
\[ \times 3 \text{ (all power must be independent of commercial mains)} \]
360
\[ \times 1.5 \text{ (Class 2 or 3 and everything on batteries)} \]
540
\[ \times 0.8 \text{ claimed score} \]

Example 2
Same as Example 1 but one required message origination is duly sent and receipted for, and reported. We have:
25 + 40 = 65 pts.
\[ \times 9 \text{ (3 \times 3)} \]
585
\[ \times 1.5 \text{ (batteries and Class 2)} \]
877.5 claimed score

Example 3
Assume a club, the Emergency Radio Club of Floodcrest, Wis. (or alternatively a group of 3 ops.), runs a portable with 85 watts input to final, using batteries or gas generator. One message started in good form (25 points); 1 received and relayed onward (2 points), both reported to ARRL.
230 points (230 QSO) + 25 + 2 257
\[ \text{ (power between 30 and 100 \times 2 watts)} \]
514
\[ \times 0.8 \text{ claimed score} \]
1542 claimed score

No battery multiplier for either clubs or groups.

Reports

Mail individual and group reports on or before July 11th, eliminating duplicate contacts. Show contact time, band used, attach traffic for claims. Messages must show handling data, watts power and sources of power. Entrants must use the ARRL forms or follow the form to be given in June, '49, QST. Mimeographed FD forms are available on request.

June 1949

Strays

"Dear Editor: I have followed with great interest your articles and correspondence on underground antennas.

"I tried several directive beams buried in four feet of moist earth. After several reports from various hams I found I had no more power than with the old skywires. I dug deeper — even tried rhombics — but reports were still the same ('Nice sig, OM, but some guy in California has 10 kw. right on you.')!!! I consulted the old faithful ARRL Handbook and decided to try a multiple-wavelength vertical on ten meters.

"I did not have to look far for a suitable antenna site. We have a 200-foot well right in our basement. I hooked a variometer to the final tank and from same connected a No. 6 stranded wire to a pipe running into the well.

"I was delighted to raise a C2 in Hankow, China, on my first QO. Chinese stations were heard that pinned the S-meter on the receiver.

"I soon discovered that all I could work were (Chinese amateurs. Now wouldn't this bear out the Handbook theory that the more wavelengths an antenna has, the more it tends to radiate straight off the end?" — W7LLE

WØHQW was walking along the street of a Northern Minnesota mining town, wearing his new radium-dial wrist watch, when he noticed several chaps following him, wearing earphones and carrying little black boxes — which turned out to be Geiger counters! — WØKYE

A notable QRP WAC performance has been turned in by W2GX. Using 3 watts input on 11-meter 'phone, Huss successfully completed the all-continent feat in one day! Some of W2GX's contacts were crossband to ten meters.

W7LLE

Tales of the "good old days" were swapped freely when approximately 200 venerables of ham radio turned out for the Fifth Old Timers' Night of the Delaware Valley Radio Association, on April 9th. Among those in attendance were Irving Vermilya, WIZE, Lloyd Espenfeld, C. D. Tuska, first editor of QST, A. L. Budlong, present editor, and Major C. F. Welch, USMCR, ex-W6BBK. Ed Raser, WZZI, was general chairman and Les Allen, W2QOK, acted as toastmaster.
Correspondence From Members-

The Publishers of QST assume no responsibility for statements made herein by correspondents.

160 METERS

1109 S. Country Club Dr., Schenectady, N. Y.

Editor, QST:

I have just received the “flash” that 160 meters was opened as of April 7th.

The return of this nearly-lost ham band is double evidence that the League has again successfully defended amateur radio rights. I am fully confident that the League will handle successfully any similar situations which may arise in the future.

— George H. Floyd, Jr., WERYT

W. Palm Beach, Fla.

Editor, QST:

Although I am not primarily a ‘phone man nor do I nurture such aspirations, I cannot but feel profoundly grieved about the return of 160. Not only does it reestablish the Government’s confidence in the amateur but, for my money, it will put the lid on the coffin of the “anti-ARRL” clique of leftists. This, I think, is peachy!

— Gene Sikes, W4BRB

MEMBERSHIP DUES

University of Pennsylvania, Philadelphia 4, Pa.

Editor, QST:

Congratulations on the April editorial. Many of us do not appreciate the extra services rendered by the ARRL and what these services mean to amateur radio. I, for one, feel that the services are worth the full price of the $4.00 a year and look upon QST as a bonus.

— Henry L. Pemberton, W3PN

1033 North 20th St., Lafayette, Ind.

Editor, QST:

The little story on membership dues certainly made me see the light. . . . My renewal will be forthcoming as soon as I pay my spring taxes.

— John W. Miles, W3ZES

St. Raphael’s Church, Dubois, Ind.

Editor, QST:

As a radio magazine QST alone is worth every cent of four dollars for twelve issues if one reads it carefully and not cursorily.

— Rev. Joseph Tersa, W9LQE

4818 Greenspring Ave., Baltimore, Md.

Editor, QST:

I’ve been reading various letters in QST from members who are kicking or resigning because of increased dues. Frankly, they don’t deserve to belong. I think that membership in ARRL is the most reasonable value on today’s superinflated market and why anyone should not think the same is beyond me. A subscription to QST alone (aside from membership privileges) is worth double its present cost from what I know of magazines. Where else could one find such a broad collection of technical data, etc.?

— Marx S. Kaufman, W3IUC

105 E. Mistletos, San Antonio 1, Texas

Editor, QST:

I am inclined somewhat to be sympathetic with those who think the price too high. Take the April issue, for instance. It contains 112 pages but there are only 28 pages of technical information. That is just 25 per cent of the magazine. Advertising occupies 40 per cent. From this viewpoint $4.00 is a little high for about 300 pages of so-called technical information.

— Vernon S. Wizel, M.D.

536 Merchants Road, Rochester 9, N. Y.

Editor, QST:

It is only with much hesitation that I enclose my four dollars for another year of QST. I have not overlooked your first notice, because I was considering the reasons for the increase in dues as given in QST.

True, your costs of operation have increased, and it is only fair that your income should increase also. The dues in the ARRL have increased in the past two years over one hundred percent.

I would like to know how your advertising rates have increased in the same period of time. I do know that your classified advertisements in QST have not increased at all.

— Robert W. Kester

[Editor’s Note: Wrong. O.M. Classified-ad rates have doubled since the war; only the special member rate, less than production cost and thereby operated as a membership service, remains the same. Display-advertising rates were increased proportionately to the rise in circulation back in 1946, two years before the first rise in dues.]

Box 55, Dix, Nebraska

Editor, QST:

Congratulations to you for printing the very good article on the 222. I, for one, would like to see many, many more such articles in future issues of QST.

As to the price of QST as mentioned in the April issue, I find that there are several articles appearing each year that are worth more to me than the subscription price.

— Raymond H. Johnson, W9WUV

1184 College Ave., Elmira, N. Y.

Editor, QST:

The DX cards which I receive thru the QSL Bureau are well worth the four bucks to me. Just do the best you can for the “average ham” and let the chips fall where they may.

— Joseph W. Meyer, W9YV

60th and Broadway, Galveston, Texas

Editor, QST:

I refer to the wails about the upage in membership dues to the League.

Being in the broadcasting business, with many years of experience in same, I would like to point out to these disgruntled lads that we broadcasters would be ecstatically happy to be a member of any organization which would give us legal, technical, and research services, and, give us an exceedingly valuable periodical, all for the sum of, let us say, ONE THOUSAND DOLLARS A YEAR! If we broadcasters could obtain such representation as the ARRL and its committees give to the amateur fraternity as a whole, we would be indeed swed at the prospect!

In small words, what I am trying to say is this: For the services involved with the privilege of voting upon every important issue that arises . . . with the power of electing our own representatives for our particular area, plus an excellent magazine which in itself constitutes a rather concise study course in radio, we are indeed fortunate to get by with as little a fee as $4.00 annually!

— L. D. Clough, W5GQV

(Continued on page 118)
SPEEDING UP "PROP-PITCH" BEAM ROTATORS

Those who complain that they can grow long white beards while waiting for their beams to turn around toward a choice piece of DX can heave a sigh of relief. No, you don't do it with external step-up gears, V belts, or by speeding up the motor until it burns out! Here's how it is done. Remove:
1) the bevel gear;
2) its thrust bearing plate;
3) the upper case of the speed reduction unit housing;
4) the large ring gear with the spline on it.

This last item is the first thing you will see upon removing Item 3, and is illustrated in Fig. 1, where it is resting to the right of the assembly, in front of the upper gear case.

Grind the teeth off the hardened, splined ring gear. (Not off the splined portion, but off the inside of the ring!) Next drill and tap four holes in the gear carrier over which the ring gear was placed. Line the holes up with the holes that already exist in the face of the ring gear, and bolt the two together. Reassemble the whole thing and refill it with oil. You can now turn your beam at 4 or 5 r.p.m. if you want to. To reduce this to a more-comfortable 2 r.p.m. it is only necessary to reduce the voltage applied to the motor. Don't worry about the slight reduction in power caused by "short-circuiting" one of the several planetary gear sets. It will still have enough steam to "rotate the house should the beam get stuck."
— David G. Vanderhoek, W8YLL

A SAFETY REMINDER

The popularity of that excellent power-supply circuit that uses, in addition to the usual rectifier-and-filter set-up, a reverse-connected half-wave rectifier to supply a negative bias voltage, prompts this word of warning:

Fig. 2 — Most of us have used this convenient arrangement at one time or another to obtain both plate voltage and bias voltage from a common transformer. If you use such a supply, do you recognize the dangers that you encounter if you put the on-off switch in the center-tap of the secondary?

The circuit, shown in Fig. 2, is a bridge rectifier with an output voltage equal to approximately half the transformer secondary voltage. This voltage appears from the positive output terminal to ground, and also from the negative output terminal to ground.

Obviously, a d.c. potential equal to approximately the total effective transformer secondary voltage appears between the two output terminals when the supply is operating. If we follow the common practice of turning the power supply off merely by lifting the center-tap of the high-voltage secondary off ground, the d.c. potential continues to appear between the positive and negative output terminals of the supply even after we have, supposedly, turned the thing off! Thus, if we go probing around inside the rig where such a supply is used, we are exposing ourselves to the full secondary voltage of the transformer.

The moral of the story: Don't place your on-off switch in the center-tap of a supply that is used for both plate and bias voltages. It is a lot safer to put the switch in the primary, and all it costs is a separate filament transformer, not your life.
— Ben Roberts, W9IEU

(Continued on page 180)
Overmodulation Difficulty! The following actual exchange was reported to ARRL recently by an official observer.

W1 --: "Turn up the modulation, Bob. Maybe we can carry on in spite of 50-mile skip. You are kinda weak here...."

W9 --/1: "Sorry, but I have this thing up to about 50 per cent as it is, and I guess that isn't helping very much."

FCC's Section 12.133 requires that in the case of A-3 emission, one's transmitter shall not be modulated to the extent that interfering spurious radiation occurs, and in no case shall the emitted carrier wave be amplitude-modulated in excess of 100 per cent. Spurious modulation products and transient effects (also mentioned in the FCC section) are generated under adjustments that cause overmodulation. It seems to happen at increasing frequency that operators so frankly ignoring the regulations and requirements of good amateur operating are getting FCC notices, many of which have also been sent for unnecessary testing and failure to identify by giving the call at proper intervals.

A Plea to DX Stations. W2SF A wants QST to emphasize the following two things to all DX operators for their work in the DX Contest or at other times:

1) Use short CQs.
2) Specify the tuning range (within 100 kc. on 10 meters).

Mr. Tonny's letter suggests that this would eliminate a large amount of QRM from so many Ws calling DX all over the band, thus giving weak DX stations a chance to get out instead of being covered up by the Ws, and this should improve dispositions all around as well as improve the efficiency with which stations in this region would be worked. While his suggestions were intended only to be applicable to 10-meter 'phone, the basic ideas are sound wherever applied.

W-VE Note. There's little sense in running a calling marathon on our end, either, trying to make yours the longest call, when the DX amateur, to save his time, is working 'em as fast as he can. The short call with listening pauses, and resumption of call if appropriate, with due regard to choice of a little different frequency than the pile-up, may bring the desired result.

ARRL Field Day—June 18th-19th. To set up and try out one's emergency transmitter fulfills the meaning behind our ARRL FD. Every amateur can prove his ability to maintain communications when the chips are down by completing as much as one emergency-powered QSO. This is the time of year in which the FD has been arranged to give even more point to just such testing.

For FD rules see the full announcement elsewhere in this issue of QST. Recognizing the need for car-installed equipment, both h.f. and v.h.f., this year's rules have added a new classification for mobile rig entries. We hope many hundreds of amateurs will report a brief or full-fledged test of mobile or portable work in the Field Day using their own completely-transportable facilities.

If you haven't such a mobile rig as described yet, you may incline to interest in planning a suitcase portable. Equipment suitable for vacation work or emergency also can be kept ready for quick action and operation from emergency power whenever called for. Many amateurs also habitually use such small transmitters as regular station adjuncts, for keeping schedules or reporting into nets. This is one way to have enjoyable local QSOOR in a hurry when not inclined to fire up one's higher-powered and more-elaborate equipment. Report your unit or individual portable station work in this FD for comparison with similar set-ups away from home sites. Scores for all such entries are confined to the work accomplished by one or two licensed amateur operators, additional operators requiring other classifications.

As usual there will be club and group portable station entries, these to be compared with those of other clubs and groups operating with the same number of simultaneously-operated portable transmitters. In the urban locations having such club-arranged or coördinator-inspired group availabilities, join your operations to some of these. If you do this, you will be assured of a top experience shared with a lot of other amateurs. The FD club plans provide for a workout of both the capabilities of the equipment and develop operating know-how for a great many types of installations and operations involved. Best of luck and fun in the FD!

-- F.E.H.
CODE-PROFICIENCY AWARDS

Have you received an ARRL Code Proficiency Certificate yet? Twice each month special transmissions are made to enable you to qualify for the award. The next qualifying run from W1AW/W0TQD will be made on June 15th at 2200 EST. Identical texts will be sent simultaneously by automatic transmitters. Frequencies of transmission from W1AW will be 3555, 7215, 14,100, 28,000, 52,000 and 114,000 kc., from W0TQD 3534 kc. The next qualifying run from W60WP only will be transmitted on June 3rd at 2100 PST on 3590 and 7248 kc. For additional dates, see the ARRL Activities Calendar elsewhere in these pages. These W60WP-only runs will have different text from the runs sent by W1AW and W0TQD, but copy will be handled in exactly the same way as the transmission from W1AW and W0TQD.

Send copies of all qualifying runs to ARRL for grading, stating the call of the station you copied. If you qualify at one of the five speeds transmitted, 15 through 35 w.p.m., you will receive a certificate. If your initial qualification is for a speed below 35 w.p.m., you may try later for endorsement stickers.

Code-practice transmissions are made from W1AW each evening, Monday through Friday, at 10:00 P.M. EST. References to texts used on several of the transmissions are given below. These make it possible to check your copy.

DX CENTURY CLUB AWARDS

DXCC Certificates based on postwar contacts with 100 or more countries have been issued to the amateurs listed below. The countries worked and totals indicated have been certified by examination of written evidence under the award rules as published in March, 1947, QST.

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<thead>
<tr>
<th>HONOR ROLL</th>
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<tr>
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<td>W8VFR</td>
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<tr>
<td>W8G0W</td>
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<tr>
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<td>W6DI</td>
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<tr>
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<td>Q2PL</td>
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Date Subject of Practice Text from April QST
June 1st: Getting Back on "150," p. 11
June 3rd: Qualifying Run, 2100 PST, from W60WP only
June 6th: Pointers on Harmonic Reduction, p. 14
June 7th: Better Results with the 848, p. 23
June 9th: Grounded Folded Dipoles, p. 28
June 13th: Surplus Corner, p. 31
June 15th: Qualifying Run, 2200 EST, from W1AW and W0TQD

June 17th: Deep Freeze, p. 35
June 21st: A New Approach to Antenna Design, p. 42
June 23rd: Technical Topics, p. 44
June 27th: The 1949 Governors-to-President Relay, p. 49
June 29th: The World Above 50 Mc., p. 51

From March 15 to April 15, 1949, DXCC certificates and endorsements based on postwar contacts with 100 or more countries have been issued to the amateurs listed below.

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<thead>
<tr>
<th>NEW MEMBERS</th>
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<tr>
<td>W5MIS</td>
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<tr>
<td>V3SGD</td>
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<td>V3BAW</td>
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<td>G2HFO</td>
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<td>W8BF</td>
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<tr>
<td>W1FJN</td>
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June 1949 65
A.R.R.L. ACTIVITIES CALENDAR

June 3rd: CP Qualifying Run - W6OWP
June 4th-5th: V.H.F. Contest
June 11th: CP Qualifying Run - W1AW, W0TQD
July 2nd: CP Qualifying Run - W6OWP
July 19th: CP Qualifying Run - W1AW, W0TQD
July 23rd-24th: CD QSO Party
Aug. 1st: CP Qualifying Run - W6OWP
Aug. 19th: CP Qualifying Run - W1AW, W0TQD
Aug. 21st: Frequency-Measuring Test
Sept. 6th: CP Qualifying Run - W6OWP
Sept. 16th: Frequency-Measuring Test
Sept. 19th: CP Qualifying Run - W1AW, W0TQD
Sept. 24th-25th: V.H.F. Contest
Oct. 7th: CP Qualifying Run - W6OWP
Oct. 14th: CP Qualifying Run - W1AW, W0TQD
Oct. 15th-16th: Simulated-Emergency Test

TRAFFIC TOPICS

The denizens of the BPL change from month to month, but close perusal will show that certain stations are consistently among that select group, while others, like Vesuvius, flare into violent action only occasionally, such occasions interspersed with long periods of silence. It has long been our feeling that, while great credit is due anyone who makes BPL, certainly a great deal more credit is due those who make it consistently, month after month; yet our traffic-handlers get credit only on their monthly performances.

Pursuing this theme a bit, we decided to engage in a bit of research in the BPL. If we were

officially to crown a “Traffic Champ” each year, who would be he? Who would be the leading traffic man in each call area, in each ARRL division or section? We decided to find the answer at least to the first question, and then, having become deeply engrossed in the subject, to select the outstanding traffic man for 1948 from each call area; and having done this, we discovered that other significant trends made themselves known.

Two trafficiers made BPL ten times in 1948: W7CKT and W0HMM. Of these two, W7CKT rolled up the higher BPL traffic total, 14,408 points! Even without adding his traffic totals for the two months he did not make BPL, this is an average of well over 1000 per month. This amazing total was amassed partly during the summer months; for example, in August, while most of us were basking in the summer sunshine, CKT racked up the incredible traffic total of 3008 points, the highest postwar total and the only one over 3000. W0HMM, the runner-up in number of BPLs, also made it ten times for a BPL traffic total of 8921. W6REB, Mr. Traffic himself on the West Coast, made BPL nine times for a total of 10,054 points. We believe that such consistent over-all performance deserves some special recognition! W7CKT was the “champ” in 1948. W6REB and W0HMM shared the runner-up spot. Who is gunning for the 1949 “championship”?

In 1948, the boys on the West Coast really showed us how to handle traffic. The tabulation which follows shows how W6-land led the way by a wide margin, and gives the leader in each call area with the number of times he made BPL shown in parentheses. It is not hard to see that some of the call areas would have fared far worse had it not been for the performance of one outstanding traffic man!

<table>
<thead>
<tr>
<th>Call Area</th>
<th>No. BPL Outstanding Listings Station</th>
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</thead>
<tbody>
<tr>
<td>W6</td>
<td>41       W6REB (9)</td>
</tr>
<tr>
<td>W7</td>
<td>25       W7CKT (10)</td>
</tr>
<tr>
<td>W2</td>
<td>21       W2RUF (3)</td>
</tr>
<tr>
<td>W5</td>
<td>18       W5LEW (4)</td>
</tr>
<tr>
<td>W9</td>
<td>18       W9HMM (10)</td>
</tr>
<tr>
<td>W1</td>
<td>17       W1QM1/INF (4)</td>
</tr>
<tr>
<td>W3</td>
<td>15       W3TRE (4)</td>
</tr>
<tr>
<td>W9</td>
<td>12       W9STZ (5)</td>
</tr>
<tr>
<td>W3</td>
<td>11       W3SCP (6)</td>
</tr>
<tr>
<td>W4</td>
<td>8        W4PL (4)</td>
</tr>
<tr>
<td>VE4</td>
<td>4        V5ATR (3)</td>
</tr>
</tbody>
</table>

The faces of some of the CD personnel here at Headquarters took on a fiery crimson color when it was realized that some of the examples of word count in messages given on page 521 of the 1949 Radio Amateur’s Handbook are erroneous. We spotted this shortly after the new Handbook came out, and now that W8LOT has pinned us down we must blushingly admit: some of the examples in the Handbook are wrong, especially in the examples for counting figures. The information in our booklet Operating an Amateur Radio Station is correct, and steps have been taken to see that there is no recurrence of the Handbook faux pas.

An annual get-together of all the traffic men of a section to discuss the section’s traffic problems is one of the best ways of ironing out difficulties and making plans for future activities, to say nothing of the good-fellowship to be derived from meeting personally the fellows you handle traffic with on the section net. Several sections we know of sponsor such a meeting every year, some-
times twice a year. They can take the form of a simple discussion get-together with coffee and sinkers served by the host, or of a more elaborate affair complete with banquet, speakers and assessment to pay for the former. Many sections whose traffic fortunes are at a low ebb would do well to adopt this means of forming esprit de corps. A case in point: the New York City-Long Island Section is sponsoring a dinner to be held at the Franklin Hotel, Jamaica, N. Y., on June 11th at 1930. RM W20BU invites all traffic-handlers to attend. Tickets are $3.00.

Some sections are too extensive in area to make personal meetings practicable. In that case, a good alternative is a section net news bulletin. True, it costs money to put out a bulletin, and it costs someone some time. Assuming that the SCM or RM has sufficient enthusiasm to get such a project rolling, the bulletin can be financed by donations thereafter. It is worth a try. The "Washington State Net News," edited by W7FIX, is one of the best we have seen. It is complete with general news notes by the SCM, monthly traffic totals, pertinent traffic topics that net operation indicates need comment, net information, net attendance rosters, miscellaneous notes from here and there about the section, Jotters, light-veined commentary, and many other little bits of info of interest to the section traffic handlers, all rolled into eleven legal-sized pages. It shows what can be done when the interest is high, but even when the interest is low a well-designed bulletin will go far toward stirring up interest; and once it is stirred up, continuance and expansion is almost assured.

**COUNTRIES-LIST CHANGES**

Since the adoption of the ARRL Postwar Countries List, the official standard used in connection with the annual DX Competition and the DX Century Club, several changes have been reported in this department. See page 40 of March, 1949, *QST* for the latest revised list. We are pleased to announce the addition of one more country to the list: Israel., 4X4. DXCC credit will be given those who submit evidence of having worked Israel (including both 4X4 and ZC6) since May 14, 1948, the date on which the independent State was set up. Make this change on your list and watch the Operating News department for further changes and additions.

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**BRASS POUNDERS LEAGUE**

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<th>Call</th>
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<th>Rel.</th>
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The following made the BPL for deliveries:

- W9FAM 210
- W2YNJ 161
- W5UXJ 115
- W4ETN 192
- W2YM 190
- W5VS 117
- W6T 187
- W2UE 182
- W5IR 116
- W9HC 187
- W2EHJ 129
- W5QXU 115
- W2RB 185
- W5NY 129
- W2ECP 114
- W7FIX 181
- W1HD 124
- W5NL 104
- W9QXO 179
- W2PGT 123
- W8UKY 104
- W8T3 168
- W7Y8C 198

A message total of 500 or more or 100 "deliveries plus extra delivery credits" will put you in line for a place in the BPL. The Brass Pounders League listing is open to all operators who qualify for this monthly "honor roll."

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A neat, quiet-looking station, this W0QXO, is it not? A glance at page 38 of April, '49, *QST* will remind you, however, that this was the scene of one of the greatest demonstrations of amateur radio's ability to handle record traffic in time of emergency that has been seen in years. Paul holds ORS and RM appointments, and we'll bet he did not look this calm and collected during the "Deep Freeze."

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**June 1949**
WITH THE A.E.C.

At 5:45 A.M., Sunday, March 21, 1949, the La Crescenta, Calif., EC, W6BTA, was called by Deputy Sheriff J. Reith and informed that a party of 18 Boy Scouts and three men was lost in the Big Tujunga and Little Tujunga Canyon area and that communications aid was requested.

The Local Mountain Rescue Plan was immediately put into action, net control for 10, 15 and 2 meters falling to W6YKB and W6UBY. A H1-meter mobile unit, W6FKW, was dispatched to the Montrose sheriff's substation to act as liaison for them with the rescue units. W6HMC, mobile, W6VRK, mobile, W6BTA, 2-meter pack unit, and W6SVU, mobile, were dispatched to the base of operations. From there W6BTA went into the search area on foot with the pack transceiver to relay the needs of the rescue units. In spite of the extremely rugged mountainous terrain, constant contact with W6VRK at the base of operations was maintained on schedule every 15 minutes. All requests from the search parties were relayed by W6HMC to W6UBY who then fed traffic into the local organized net for delivery to its destination. The search came to a successful end about 2:30 P.M. when all nets were closed.

The following other amateurs were of material assistance to the success of this venture: W6YGT, W6QDW, W6LCY, W6KQS, W6FMJ, W6ZWS and W0LKP.

At 4:05 A.M., Monday, March 28, 1949, the EC, W6BTA, was called by Deputy Sheriff Sgt. Jack Garvin and informed that a sixteen-year-old boy and three dogs on a hike in Big Tujunga Canyon and a climb to Condor Peak had been lost since late Sunday, and that communications assistance was needed again.

The Local Mountain Rescue Plan was once more put into action. Net control for 10 and 75 was W6UBY, W6VRK on 2- and 10-meter mobile, W6SVU on 10-meter mobile, and W6BTA with the two-meter pack set, went with the sheriff's detail to search the area to set up a base of operations with W6HMC handling outgoing traffic on 75 'phone. The search came to an end before a base set up was in operation. The boy and dogs were found on the road on the way out, "old, wet and hungry. The net and the sheriff's office were advised of developments and the AEC net was cleared and closed at 7 A.M.

At 4:30 A.M. on the morning of March 30th the local highway patrol officer called SEC W5HGC on the 'phone and advised that a tornado had just struck Blackwell, Oklahoma. He requested that W5HGC notify headquarters and stand by for information from him as he was going into the area. W5HGC then contacted W5PA at Tulsa by long-distance 'phone and was able to get a line into Blackwell to W5HFW. He was unaware of the storm, although his home was only a few blocks outside of the area. W5HFW then furnished information to all agencies unable to get through by commercial lines which were intact from the north. No communications emergency existed; however, W5MFW and W5HXC at Blackwell handled considerable traffic during the remainder of the day.

It was about 6:15 A.M. this same morning that W5JKQ at Canton, Oklahoma, called the Oklahoma 'Phone Net (on c.w.) and advised that Canton had also been hard hit and that a town to the North of them, Longdale, was gone completely. This was the first word from these areas. Through W5JKQ and W5WQ information was passed to all relief agencies.

SEC Cartwright, W8UPB, is trying to determine how many AEC groups have their control stations located in Red Cross premises, with a possible view toward some type of on-the-air liaison between them in time of emergency. If your group is set up in the Red Cross headquarters, please drop Carty a line.

W2WIB and W2UXZ, in collaboration with the New York City headquarters of the Red Cross, are calling "CQ RC TFC" at 4:00 P.M. daily on 3550 kc., to provide a traffic route for those AEC groups in the Northeastern Area of Red Cross who may wish to operate a message service for their RC groups.

SOUTH DAKOTA ICE EMERGENCY

On Wednesday, March 30th, it started raining in the morning and toward evening it had turned to a very wet and heavy snow that was starting to build up on the wires. At 10:30 P.M. the power failed in the entire city of Mitchell, a community of 16,000 population. At that time, local hams, W6GCP, W6DBE, and W6HDO, were notified by the local broadcast station,
KMHK, that their tower lights had failed and that they were off the air and were unable to notify the CAA of this failure as there were no wire services out of the city.

We—W0GCP, W0DBE and W0HDO,—surveyed our own stations and found that the antennas were down and that we were without power. It was decided that W0GCP's antenna would be the easiest to repair, so we hauled W0HDO's battery-operated gear to that location and set up a BC-654 on 80 c.w.

Several calls were made but we didn't raise anyone due to the heavy QRN. About 1:00 A.M. Thursday, we were able to contact W0SRR in Grundy Center, Iowa, who was on 75 'phone and informed him of our situation here. He took the message for CAA and we had no further need for an outlet so closed down for the night.

About 8:00 A.M. Thursday, W0HDO had calls from the Northwestern Bell Telephone, Western Union and Milwaukee Railroad, all wanting to get information to their respective headquarters as to the extent of their wire damage. It wasn't until then that we realized the seriousness of the situation. We were completely isolated, no power in a large portion of the city, no water pressure in the city mains because of power failure at the pumping stations. Thousands of poles were down, and there were thousands of wire breaks in the Bell and WU lines. Again we surveyed our stations and found that W0DBE was the only one with power and an antenna that could be used if we could clean off some of the snow and sleet that had formed on the feeders.

We tuned up on the South Dakota c.w. net frequency and made contact with K0NRU, the Naval Reserve Station in Sioux Falls, and asked them to stand by to handle traffic. About 10:00 A.M. power was restored to W0GCP and it was decided to make it the headquarters station as Bill the operator, is the EC and also the RM; he also has a higher-power station and ready access to a telephone. From that time on W0GCP was in constant contact with K0NRU, W0SRX in Yankton and, later, W0ILL in Huron.

Thursday afternoon W0ZXX erected a temporary antenna and contacted W0DOP in Sioux Falls, who was in contact with the Iowa 'phone Net and was able to handle several Milwaukee train orders and Western Union messages.

From 10:30 P.M. Wednesday, until 4:00 P.M. Saturday, when the last message left the hook, amateur radio was our only contact with the outside.

Amateurs outside the immediate storm area who were of material assistance included: W0HIZ, W0CRI, W0D2J, W0EFJ, W0GWJ, W0IBP, W0KSS, W0MPQ, W0OVD, W0PHR, W0RGN, W0ZIQ and W0ZRA.

--- W0HDO, Section Emergency Coordinator

STOCKTON, MISSOURI, "RADIO-LIFT"

It was a cold, ice-dominated night when a frantic "CQ Springfield" went out from W0WRQ, Stockton, Mo., on 3640 kc. Stockton had never dreamed that there would be a time when the only communications outlet would be amateur radio. A terrific ice storm a week earlier had flattened its only long-distance lines and had left only four local telephones, out of five hundred, in contact with the central telephone office.

W0WRQ had replaced its full-wave 7-Mc. antenna and, with emergency power connections restored, had tried in vain to establish contact with Springfield, the regular relay distribution point for commercial communications to Stockton. It was soon evident that for short-haul emergency traffic 7 Mc. was very poor compared with 3.5 Mc. With bell wire the only thing at hand, coils for 3.5 Mc. were hurriedly wound and served very well. W0BRN, Butler, and W0HVW, Pleasant Hill, were worked and agreed to monitor the Stockton frequency, 3640 kc., until contact could be made with Springfield.

Calls on 3640 kc. didn't seem to be getting much result but gobs of Springfield stations could be heard on 3960 'phone. Only one crystal in the 'phone band was available, 3910 kc. W0CZR, Joplin, was heard on 3910 kc. and asked if he would use his VOI to QSY to 3960 kc. and ask the Springfield gang to look for W0WRQ on 3640 kc. with traffic for Springfield. In two minutes time W0WRQ was QSO W0CXP and W0EBE, emergency coordinator for Springfield.

For several days during the emergency W0EBE and W0HUT were compelled to lock their businesses to meet schedules at 0900, 1100, 1200, 1500, 1615, 1700 and 1800. Later, K0NRS, at the Naval Reserve Training Center, relieved them of some of the schedules that conflicted with business, and did a swell job. Southwest Missouri Amateur Radio Club "Field Day" operations really paid off in this emergency and many of the 40 active members took assignments on the "Radio-Lift." Stations participating by handling traffic or keeping schedules were W0EBE, W0HUT, W0QUIZ, W0CGZ, W0CGJ, W0BH3, W0UEH, W0ERU, W0ADL and K0NRS, all in Springfield, Mo.; W0DEA, W0GZR, Joplin, Mo.; W0DEQ, Bolivar, Mo.; W0CKK, W0NNH, Marionville, Mo.; W0BRN, W0XX, Butler, Mo.; W0CXP, Fort Scott, Kansas; W0AIA, Independence, Kansas; W0MJX, Kansas City, Mo.; W0BKJ, Fort Wayne, Ind.; and W4BAQ, Memphis, Tenn.

Through April 15th 277 messages had been handled on the Stockton "Radio-Lift," with 138 sent, 139 received and 136 delivered. The emergency operation is still being carried on because cable and other equipment for Stockton's new telephone system will not be delivered before midsummer. — H. C. King, W0WRQ

June 1949 69
OPERATION MOSQUITO
The Small Group Breaks Into Field Day Operation
By the FD Gang at WBDFK/8

Field Day is one of the big ARRL activities of the year. For several years, we attended the FD set-ups of several of the radio clubs with which we were associated, but we were always disappointed, since most of our time was spent in watching other guys doing the operating. After the war, a group of five of us (W8s MMZ, TLQ, TNA, ZEP and ZTA) began to bend our efforts toward FD operation.

As a result, Field Day 1947 found us set up in a goat barn. The operation was just a feeler — an attempt to familiarize ourselves with FD operation technique and to determine what equipment is necessary for successful operation. We used our home-station equipment, operated from commercial power mains. The gear worked very well, but it was apparent that lighter, more flexible equipment was required. Our own portable “shack” and power supply were a must.

A major source of trouble that year was antenna erection. Jim, W8TLQ, our chief sky-wire hanger, climbed umpteen trees umpty-two times. He also rode a chimney that broke off under him and crashed to the ground. Thus by the time the starting gun sounded, his efficiency as an operator was below par.

We had a lot of fun that year, enough to make us want to do a real job the next year, and when our score appeared in QST, we didn’t think we had done too badly for a bunch of novices.

Our second FD operation was a real safari. We located a lightly-wooded knoll way back on a friend’s farm, so we really needed our tents and generator. We loaded the gear on the Friday before FD operations began and set off for camp. This gave us time to get the camp established and get a good night’s rest, so that we were ready to go to work on the radio end early in the morning. After a nice hot meal (cooked on a gasoline stove), we sprayed the tent with a gallon of DDT, hit the sack, and dreamed about high scores.

Now the big day was at hand. After a hearty breakfast of bacon and eggs, we got to work. There were three principal jobs to be done: arranging the operating positions, getting the generator set up and running, and putting up the antennas. Since there were only four of us this year, we split up into teams of two. The first team took care of the first two jobs, and the second put up the antennas. The operating positions were set up on card tables placed along one side of the 8 x 12-foot wall-type tent. The generator was set up about one hundred feet from the operations tent, and power was run up through RG-8/U cable. The shielding effect of the outer conductor is very helpful, especially when grounded, and the cable at present available on the surplus market has the additional virtue of being inexpensive.

Jim hit upon a rather novel method for erecting the antennas. He is an avid archer, so he tied a piece of light twine to an arrow, and then shot the arrow over a convenient branch. The light twine was then tied to somewhat heavier cord (parcel-post cord) which was in turn tied to the antenna insulator. The antenna was pulled up to the desired height, and then the cord was tied to some convenient low branch or bush. For wire, we used No. 18 enameled copper, which the past two years have proved most satisfactory. All antennas were end fed. In two hours, two men put up four half-wave antennas, two for eighty, one for forty, and one for twenty.

By 3:00 P.M. we were ready to go. The generator (a 1.5-kw. 110-volt 60-cycle gasoline-engine-driven job) was perking away. The rigs were a converted BC-457 for eighty, a BC-459 for forty, and a BC-459 plus doubler for twenty. The receivers were BC-348s and a BC-224. All this equipment is ideal for FD operation, being simple and similar. All very fine — but then came the trouble. Thunder and lightning and rain, rain, rain. We were happy that the tent didn’t leak! When the starting time came, the QRN was terrific, but signals could be heard on forty, so we opened up on that band. Eighty began to calm down by about 10 P.M., and it got pretty hot during the night. Unfortunately, the doubler for twenty had a mishap, so we were stuck with two-band operation. We really went to town on those two, though. There was no generator hash, thanks to a filter, and the antennas worked well. Just as an example, we worked a KH6 on forty, and the rig was running at less than thirty watts input. By morning the rain had stopped, and the sun was starting to dry things off, thanks to our hilltop location. Gil’s cover cartoon had been strangely prophetic!

Operation for the rest of the day was routine, including the fact that eighty went dead. When closedown time came, it didn’t take us too long to break camp and get started toward home.

After considering the matter, we decided it was about time we had our own call (we used W8TLQ/8 in 1947, and W8ZEP/8 in 1948). So we formed ourselves into the Brass and Java League, and have been assigned WBDFK.
Our second year's operation had taught us a few things, and we'll list them here, hoping that they may give you some helpful hints:

1) Keep equipment simple, and small in quantity.
2) Be prepared for bad weather.
3) Plan to have hot food for most of the meals.
4) Have a comfortable sleeping place arranged.
5) Have the antenna locations planned beforehand.
6) Test all the c.w. rigs for clicks beforehand, and if any exist, get rid of 'em. Remember you're going to be a couple of hundred feet at most from your buddy's receiver.
7) Try to have at least two operators for each rig, so that each can get some rest.

Well, we'll see you from WSDFK/8... if you get in on this FD operation... and you're missing a lot of fun if you don't.

WIAW OPERATING SCHEDULE
(All times given are Eastern Standard Time)

Operating-Visiting Hours:
Monday through Friday: 1130-0600 (next day).
Saturday: 1900-0230 (Sunday).
Sunday: 1000-2200

A mimeographed local map showing how to get from main state highways (or from Hq. office) to WIAW will be sent to amateurs advising their intention to visit the station.

General Operation: Refer to page 65, March OSt, for a chart showing WIAW general operation. This schedule is still in effect and is not reproduced here for space considerations. Mimeographed complete master schedules of all WIAW operation in EST, CST, MST or PST are available upon request.

Official Bulletin Schedule: Bulletins containing the latest information on matters of general interest to amateurs are transmitted on regular schedules:

Frequencies:
C.W. — 8555, 7215, 14,100, 28,000, 52,000, 146,000 kc.
Phone — 3950, 14,280, 29,000, 52,000, 146,000 kc.

Times:
Sunday through Tuesday, 2000 by c.w., 2100 by phone.
Monday through Saturday, 2330 by phone, 2400 by c.w.

Code-Proficiency Program: Practice transmissions at 15, 20, 25, 30 and 35 w.p.m. are made on Tuesdays and Thursdays on the above-listed frequencies starting at 2200, and on Monday, Wednesday and Friday at 9, 12, 18, 25 and 35 w.p.m. Approximately ten minutes of practice is given at each speed. Next certificate qualifying run is scheduled for Wednesday, June 15th.

WIAW will be closed from 2200 May 29th until 1130 May 31st. Similar provisions will be made for July 4th. The station participates in all official ARRL operating activities, omitting some weekend general operating periods for this purpose (see Activities Calendar).

ELECTION NOTICE
(To all ARRL Members residing in the Sections listed below)

You are hereby notified that an election for Section Communications Manager is about to be held in your respective Sections. This notice supersedes previous notices.

Nominating petitions are solicited. The signatures of five or more ARRL full members of the Section concerned, in good standing, are required on each petition. No member shall sign more than one petition.

Each candidate for Section Communications Manager must have been a licensed amateur for at least two years and similarly a full member of the League for at least one continuous year immediately prior to his nomination.

Petitions must be in West Hartford, Conn., on or before noon on the closing dates specified. In cases where no valid nominating petitions were received in response to previous notices, the closing dates are set ahead to the dates given herewith. The complete name, address, and station call of the candidate should be included with the petition. It is advisable that eight or ten full-member signatures be obtained, since on checking names against Headquarters files, with no time to return invalid petitions for additions, a petition may be found invalid by reason of expired memberships, individual signers uncertain or ignorant of their membership status, etc.

The following nomination form is suggested:

Communications Manager, ARRL [Place and date]
38 La Salle Road, West Hartford, Conn.
We, the undersigned full members of the
Division, hereby nominate........................ ARRL Section of the...

as candidate for Section Communications Manager for this Section for the next two-year term of office.

Elections will take place immediately after the closing dates specified of nominating petitions. The ballots mailed from Headquarters to full members will list in alphabetical sequence the names of all eligible candidates. You are urged to take the initiative and file nominating petitions immediately. This is your opportunity to put the man of your choice in office.

F. E. Handy, Communications Manager
Atlantic division

Eastern Pennsylvania — SCM, Jerry Mathis, W3HES — VMP has resigned as k for his E. PA. Net. QEW is acting as RM meanwhile. LZF is enthusiastic about his new VFO, which enabled him to get his WAS certificate. The Harbison VFO Club is preparing for Field Day. Nominations for an EC for the Harbison area should be forwarded to Bxe. AER is on the Penn Harris Emergency Radio Net. DL is airborne, using less than 1 kw over Towson, Md., and worked MTE, mobile, with 144 Mc. Also, of Maryland meets the first Monday of each month at 8:00 P.M., Wednesdays and Fridays.

The Washington Mobile Club held an outing at the rear of 120 W. Penna. Ave., Towson, Md., on the last Tuesday of each month considering she was off two weeks in March. OWP is on the Penn Harris Emergency Radio Net. BBV has a new call at Rehoboth Beach, Del., on Mar. 27th with eleven members present. Many stations were worked including a new call at Lehighton. OP, AVM, JPR, BYF, and ATI attended the Old Timers Nite banquet in Trenton, N. J. MAC worked his 100th country on 28-Mc. phone with a pair of 6L6s in about two years. The Delaware-Lehigh Amateur Radio Club of Easton had a very successful exhibition on Window Shopping Holiday Night, having a pair of transmitters in a large department store in the center square. He handled more than 100 messages to all parts of the world. The DXL is waitin' for the 21-Mc. band to open in order to get away for the JJO. November meeting was highlighted by ARRL films on “Infrared image tube, 1220-Mc. equipment, grid-dippers” and “Triode Amplification.” Application for a new call has been made for use at club headquarters, York. BFL, airborne, has less than 1 kw while over Towson, Md., he worked MTE, mobile, with 144 Mc. (no V.E.I.I), and building mobile 28-Mc. LFF has a new station.

The York Road Club is to divide into small groups for Field Day. The local brothers are much interested as to measures to combat T.V.I. and its associated problems. Traffic: WSDZ 325, KIT 210, QGW 147, NHQ 106, OAQ 91, VMF 99, ADR 94, WTS 31, OML 29, AQN 21, AGM 19, CUA 5.

Maryland-Delaware-District of Columbia — SCM, Leppa W. Greene, W3HWT — The Chesapeake Amateur Radio Club, organized Dec. 14, 1948, meets in the halls of the Agricultural Annex, Ave. Towson, Md., on the first and third Tuesdays of each month. Officers are: LZF, pres.; FLG, vice-pres.; MTE, secy.; MIB, treas.; KOU, alt. treas.; and BBU, recording secretary. Electron tubes, grid-dip-meter, and “Souping up HBO by APM.” Thirteen are registered for code class. 144-Mc. activity has been resumed, with activity guaranteed at 8:00 P.M. Wednesdays and Fridays.

Mobiles include MZA and LMC on 28 Mc. and KJF and MTE on 144 Mc. DL is airborne. The Washington Mobile Radio Club’s newly-elected officers are IZL, pres.; K4YT, secy.; and EN6, treas. The club held an outing at Old Saybrook, Ct., on Mar. 27th with eleven members present. Many stations were worked including a 220 Mc. and a GM on 28 Mc. At its first March meeting the Washington Radio Club ran its stock of spare gear brought in by the members. A Code class was started at the second regular monthly meeting with HIN as chairman. At the first March meeting of the Baltimore Amateur Radio Communications Society, a talk was given on the Civilian Mobile Radio Service of the telephone company by AFR. The second March meeting was highlighted by ARLR Ema on “Inductance” and “Transformers.” Application for a club call has been made for use at club headquarters. 4 West Mc., DLM, will handle traffic for visitors. To prove to himself that he wasn’t undermanned Mr. HIN joined the gang on 144 Mc. (no V.E.I.I), and building mobile 28-Mc. OWP is on the Penn Harris Emergency Radio Net. BBV has a new station.
In view of the recent Federal Communications Commission authorization allowing amateur operation in sections of the 160 meter band, subject to certain qualifications and restrictions*, it appears appropriate and timely to devote space on this page to give 160-meter band calibration and bandspread data to users of existing National Communication Receivers. The table shown below provides this information. It will be noted that on the receivers employing two dials, such as NC-33, NC-57, NC-173 and NC-183, the setting of the main dial for each of the 25 Kc. sections occurs at a point where there is a division mark on the dial, making it easy to set and reset. It is also evident, from the chart, that the NC-33 and NC-57 provide more than 1 division per kc., the NC-173 and NC-183 provide more than 2 divisions per kc. and the HRO provides about 3 large divisions for every 10 Kc. in each of the 25 Kc. sections.

J. H. Ivers, W1HSV

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<th>NATIONAL CO. RECEIVER TYPE</th>
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* For more detailed and complete information on regulations, see QST, March 1949, page 28.
INDIANA—SCM, Charles H. Conway, W0FG—BKJ, Fort Wayne, has new NC-183 receiver. The Tri State Amateur Radio Club reports the winner of the June DX contest was WFO. The contest was run on DX with QLW, BBC, and GFO running ahead. HUV, Stillwell, worked ZC4A for a new country. AFO, Ft. Wayne, worked K7ABB, Los Angeles, California, and now more he is getting out. Spokane, Wash., is his best DX. Fort Wayne area hams are invited to join the Maumee Valley Amateur Radio Club. There will be DX contests and traffic at the W9EVA. W9EVA, who has been operating in conjunction with the Ohio Valley Amateur Radio Club, is ready to go. The first drill is set for June 12th. Following reports: AYV, GEG, LIW, LOD, MKJ, NJC, USM, VXR, and XOG. New members of the club are LKZ, Metamora, and QSP has a new folded dipole and from reports received it looks good. HAU has a new car. NGG is doing some readying for 3.85-Mc. phone. QLZ is QRL remodeling house. ZPC put up a new antenna. OZB visited SYZ. GME is a new YL operator in Indiana. W9NH, our new SEC, for his splendid work and cooperation while in the service, tells us that Headquarters can count on him for more accurate reports as he is getting out. Spokane, Wash., is his best DX.

CENTRAL DIVISION

CENTRAL DIVISION

ILLINOIS—SCM, Lloyd E. Hopkins, W9EVJ—ERX is making the last repairs on his antenna. AIVC is building a 110-ft. tower. Six members of the IRL are assisting with an emergency. W9OOG is 144-Mc. phone. The Illinois Village Radio Club was host to Illinois's Central Amateur Radio Club at La Salle. W9OOG is the only active ham in his county. KQJ/D14 reports a new rig from Germany and expects to be home in July. IRL can't find time to help out. W9LW has just been licensed and has his first QTH for phone. WW9OOG is trying to get a new tower up and into his antenna. DLO had trouble with his new tower. W9LW is having trouble with his new tower. W9USM is cutting records of the Pole Cat Net. LFK says that with V26Z on 7 Mc., he has over 24 Gs on 14 Mc. TPA is announcing a new net at WILA. KQL reports the Sangamon County Amateur Radio Club is having a DX contest. KQL reports that the midwest VHF Club picnic will be held on June 26th. BIN is now a timer at 'WILA. Further information can be had on the announcement of the Dakota Hamboree in the Hamfest Calendar elsewhere in this issue. See you June 12th! Traffic: W2RUF 851, WZQ 580, PGT 287, QHH 166, YGW 138, SJV 55, WFU 50, YRF 47, PZC 40, FCG 39, WIC 30, QLL 28, HQ 28, VQ 27, BLP 14, GZ 11, BJL 4. WESTERN PENNSYLVANIA—Karl J. Hilley, W3KWL—Our new SEC is Robert J. Mack, W3KWL. Let us all extend our sincerest gratitude to W3KWL, our former SEC, for his splendid work and cooperation while in the service. We are proud of a new member who has come to the club and to the hobby. W3KWL has a new receiver and it is a great honor to have you all again. The ATA Net reports that OB did a swell speaking job on propagation and DX procedures. He also reported on DX news and it looks as if conditions are improving. SGL has been organized in conjunction with the Ohio Valley Amateur Radio Club. KSH is now 28-Mc. phone. GQY is on 144 Mc. QSH wants to try 144 Mc. KSR piled up 11,686 points in the DX Contest. USM is cutting reports of the Pole Cat Net. LFK says that with new tower and KSP he has over 24 Gs on 14 Mc. TPA is announcing a new net at WILA. KQL reports the Sangamon County Amateur Radio Club is having a DX contest. KQL reports that the midwest VHF Club picnic will be held on June 26th. BIN is now a timer at WILA. Further information can be had on the announcement of the Dakota Hamboree in the Hamfest Calendar elsewhere in this issue. See you June 12th! Traffic: W2RUF 851, WZQ 580, PGT 287, QHH 166, YGW 138, SJV 55, WFU 50, YRF 47, PZC 40, FCG 39, WIC 30, QLL 28, HQ 28, VQ 27, BLP 14, GZ 11, BJL 4.
Custom Made Technical Ceramics

FOR ELECTRONIC AND ELECTRICAL USES

SOLD ONLY TO MANUFACTURERS

AMERICAN LAVA CORPORATION
*48TH YEAR OF CERAMIC LEADERSHIP*
CHATTANOOGA 5, TENNESSEE
MINNESOTA — SCM, John B. Morgan, W5RA — Asst. SCM, John E. Walter, KYE. RM: RJF. SEC: BOL. REE decided to acquire a building to house the 3 kw. rigs given by Corps members. Send a card to BOL for an application form. RFV has classes.

Gates.

28 Mc. with antennas for each. HTD installed his 3.85-Mc. rig. and adder! 28.5 Mc. mobile and 144 Mc. CW and HCP. JMY is giving as.s.e.c. a try. LNN is new 00. NPS, ex-LBIV, is new ORS and OPS. Other recent appointments include FDF as SEC; NNH as ORS; and FDF and ECL as MRO.

MISSISSIPPI—SCM, Ward Bulhman, W4QT — Special session of the Mississippi section Field Day Contest. The club president reports that they recently have been incorporated, and a dozen or more new members have joined. VDI and JQV have been issued OBS. BPL cards have been reported in as a regular. FBV says OXC is a new call, having worked a good amount of QSOs. Traffic: W5BRG 117, MXW 88, EDE 80, OAD 39, MWX 75-A which replaces an RME-99 aud a BC-610. AAM also has an impressive list of DX on 7 Mc. YMO, as NOS, has been invited to give talks at the 1954-55 meeting of the National Emergency Coordinator and the Delta Division Director. At the Nashville meeting last winter, CRI was installed as a high-office member. The Delta Division Director.

GREAT LAKES DIVISION

KENTUCKY — SCM, W. C. Alcock, W4CDA — Activity still is booming in Kentucky. Eighteen stations came through with reports. Mississippi section Field Day Contest. The club president reports that they recently have been incorporated, and a dozen or more new members have joined. VDI and JQV have been issued OBS. BPL cards have been reported in as a regular. FBV says OXC is a new call, having worked a good amount of QSOs. Traffic: W5BRG 117, MXW 88, EDE 80, OAD 39, MWX 75-A which replaces an RME-99 aud a BC-610. AAM also has an impressive list of DX on 7 Mc. YMO, as NOS, has been invited to give talks at the 1954-55 meeting of the National Emergency Coordinator and the Delta Division Director. At the Nashville meeting last winter, CRI was installed as a high-office member. The Delta Division Director.
We all like to experiment with new circuits, and designs on our gear, but I wonder if you know how many of the parts you need are included in the Mallory line. Learning this has saved me lots of time and trouble in the design and construction of my new rig. I found that the Mallory distributor was only too glad to help, too. He has a wealth of information at his fingertips, in all the books and catalogues that Mallory has published to help amateurs like you and me.

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Maybe you’re thinking of a new low voltage DC for relay control circuits in your transmitter. Now you know where to get the rectifiers—Mallory, of course! They have a full line of MAGNESIUM-COPPER SULFIDE DRY DISC RECTIFIERS, and BATTERY CHARGERS.

You can depend on Mallory for everything I’ve mentioned as well as phone plugs, jacks, dial plates, knobs, soldering iron tips. And, of course, for those highly special items such as the Mallory INDUCTUNER*, GRID BIAS CELLS and VIDEOCOUPLERS.

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*Registered trademark of P. R. Mallory & Co., Inc. for inductance tuning devices covered by Mallory-Ware patents.
and TYO are alternates. With the Alban.v gang, AWF and on :3.85 Mc. with f.m., ILI is building a super-small half.

City and Northern New Jersey on 144 Mc. GYV even 78.

E - wvP. 'l'he Schenectady gang had big antenna-raising 144 Mc. Respective NOS are PFU, NHY, and GYV. CAZ partyputtingup CRE's new 144-Mc. beam. It was originally

HOS are having a T.V.I., SUL is building for 144. Mc., DSK is operator, Paul Joseph, on Feb. 17th. Fellows, let's have time March 21st. QUS is NCS. ACE, ENH, CEA, ZQU,

CQ, TX, and IVO the preceding evening. The Westpark Radios of Cleveland is newly-affiliated with ARRL. Our Communications Manager, H.01, visited Ohio and passed out the latest information on the 160-meter band, license extension, 11- and 21-Mc. bands, a.s.s., portable-licensing, T.V.I. Our

Club's letterhead. ENS -·wvP. EYE, chairman, ENH, vice-chairman, EQN, secy. NDN, treas. F'JN had the highest score for the Columbus area in contacts on :1.85-Mc. 'phone during the first three months trouble and will be back when he gets those traps working.

20 watts VFO and NC-183. RIG is off the air for the time :1.85-Mc. mobile is really working out on Long Island. It is very popular. New members have visited new 24-Mc. mobile, say the gang. QBS is using "half" of ten-element beam on 144 Mc. RT74 handles traffic for one fair another. Hope joins to get to NLI Banding. TYC says he will be back June 26th.

AOP is experimenting with kite-supported antennas. From the GCCA, Greater Cincinnati Amateur Radio Club, the following officers were elected:

1600 kc. Wednesdays at 2000. ZNM was "exceptionally" QRM this month in connection with T.V.A., but says he knows how to cure the trouble. His new call BO will take G.I. traffic for Japan or Europe via regular schedules. YDG hit low operating level in March but will improve or give it up, says Jack. DBK hopes to give NLI more of his time soon. VNJ now is manager of SBN and handled traffic direct from Chicago. CHU discussed the conversion of the Command Set 274 series at the March meeting. Field Day location is to be near Marysville. From the Dayton C. W. Net of Dayton, the Dayton C. W. Club; IVDQ has a new three-watt with simple 8000 final. WCF now is operating on 14 and

November 14th. 3.82. TYC 224, WIK 165, EQU 140, PHO 96, QGH 44, YBK 15. 1N 10, SQW 10, BSH 7, NJF 5.

The State Dental Society May 2nd-4th, PTQ says she's was reelected NCS of the Iowa 75 Net, with SQQ, CPU, and AT A was holding there. LAC has an ARC-4 on 144 Mc. PP Waterloo, TWX reported a swell vacation in Florida, HMM

of the North Iowa Radio Club are WLY, pres.; QZP, secre-tary, WLY, CG, FPL, KUS is building new high-power final and QEC for Greene County

the fine work he is accomplishing as QSL Manager. The

the Dayton C. W. Net met for the first

of the Springfield Amateur Radio Club: HB9GV is conducting theory classes for would-be

. Class II-CLL; EC for Greene County

Here's a tube that can really take a beating.

For over a decade the Eimac 100TH has proven its superiority in many thousands of transmitters. Regardless of how you make a comparison... it is the TOP triode in its power class.

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March 9th. The Mamilla Hamfest will be held the last Sunday of March. The first Sunday in April the annual 144-Mc. transmitter hunt will be held Sunday, July 17th. Bill Copeland is making the rounds again. The Council Bluffs Spokes and the Spokes-platter are both published weekly.

A good source of news for the SCM. Traffic: W$HMM 581, FP 521, W5VU 151, SCA 98, SCH 62, CIH 44, ALU 38, THF 37, UYB 36, OIF 33, KGZ 31, SGV 31, YAO 29, AY 21, KYX 10, LK 9, ATT 0.

KANSAS — SCM. Earl N. Johnston, W0ICV — The May issue is in the mails and it is looking good. SAE has a new 50-Mc. rig, and LMK are on 144 Mc. The Manchester Club is conducting a junior radio class with QJ in charge. KU5 finally fixed his V. F. oscillator and is building it up. Members of the KVRC, Topeka, are engaging in volunteer work with Winter Veteran Hospital, holding code and theory classes for the patients and giving them a new lease on life. NEJ is battling a wild pair of fleas and jumps about in Eureka Springs, Ark. BPL got in on 50-Mc. opening in Kansas Springs. JLD rebuilt a 6L6-807 rig with two power supplies in the final. OUD is trying various types of anode. AHA 80, CXF 27, IYR 26, F$R 27, SKZ 21, SQY 19, KNO 18, THF 17, KYX 10, LK 9, ATT 6.

NEW ENGLAND DIVISION

CONNECTICUT — SCM. Walter L. Glover, W1VB — The SCM wishes to acknowledge the various monthly reports received. Exceptionally good work is being done on all fronts. We are making a good job with very little publicity. QIX and EJ1 are celebrating the arrival of Jr. operators. SAG is a new ham in Manhattan who organized with YEC, pres.; and ONL, secretary. Charter members are YEC, ONL, HZV, HLV, YCK, MCR, and IKE. The Club is located in the basement of the YMCA building on Ninth street and is operating at 217 Gs into a four-element beam. KWA, vice-president, is building the clubhouse. NWC is building a 28-Mc. beam over supplies in Stonington. The new transmitter is built into a 100-watt mobile to EAQ. UPY added 14.4-Mc. beam over the old station. THF can switch his NC-46, Sonar 9AVX. WKP, VOI, and NWC were elected trustees of the local Traffic Net, plus a power supply talk by ex•oscillator and is building pp. 813 final. From GJM we hear c.w. HARC bought a Micro-Match for club use. the HARO, UMOZ are new ORS appointees. FAM renewed ORS appointments, and is particularly interested in frequency measuring. LKF, our SEC, is visiting various clubs in the section to acquaint and to establish a more frequent Emergency Corps. Your cooperation will be appreciated. The Nutmeg Net is going strong, but could use a few more stations around the State. If interested, get in touch with ORP, your SCM, and LKF has new Collins receiver. NEK is vacationing in Florida with a portable rig. RRQ is on 28-Mc. w.t. Traffic: WIRR 230, CTI 222, I1N 196, VE 166, NHM 159. WNM 157, 107, DAV 98, KYX 92, RUP 98, BD1 36, KY 34, IEF 22, BB 21, JTD 19, JTD 8, NCY 6, AH 1.

MAINE — SCM. F. Norman Davis, W1GJX — QE< is doing a fine job as editor of the bimonthly Eastern Maine Amateur Radio Club. 144-Mc. activity is continuing to increase in the State. Each member is keeping his file moving on the Hit and Bounce Net, QXO is keeping his file moving on the Jnd Bounce Net, and the Diode Tube," plus a power supply talk by ex•oscillator and is building pp. 813 final. From GJM we hear c.w. HARC bought a Micro-Match for club use. the HARO, UMOZ are new ORS appointees. FAM renewed ORS appointments, and is particularly interested in frequency measuring. LKF, our SEC, is visiting various clubs in the section to acquaint and to establish a more frequent Emergency Corps. Your cooperation will be appreciated. The Nutmeg Net is going strong, but could use a few more stations around the State. If interested, get in touch with ORP, your SCM, and LKF has new Collins receiver. NEK is vacationing in Florida with a portable rig. RRQ is on 28-Mc. w.t. Traffic: WIRR 230, CTI 222, I1N 196, VE 166, NHM 159. WNM 157, 107, DAV 98, KYX 92, RUP 98, BD1 36, KY 34, IEF 22, BB 21, JTD 19, JTD 8, NCY 6, AH 1.

EASTERN MASSACHUSETTS — SCM. Frank L. Baker, jr., W1AFL — The following renewed their appointments: As ORS—PLQ, QN1. As OPS—DHX, IN, ERH, MRE, As ORA—QXR, PCH, As OBS—MHO, XLY, As ORS—PLQ, Q1I. As OPS—DHX, IN, ERH, MRE, As ORA—QXR, PCH, As OBS—MHO, XLY.
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K6RAM. K6V has the kw. rig ready. MDU is in MARS.

KJ9 handled traffic for MPP with her OM, P6. QJ has 61 countries on 7 Mc. EMG has c.e.o. in the h.t. band. PU is on 28 Mc.


WESTERN MASSACHUSETTS — SCM. Prentis M. Bailey, in the executive chairmanship of the club, which is near the end of its club year. New officers are selected. BFB's claimed score in the DX Contest is the highest ever recorded by a Rhode Island contestant. A tribute to international ham radio is due, for several of the personnel of the club have handled traffic for many years on the high frequencies. KTL and EG Rare new members. BFB's claimed score in the DX Contest is the highest ever recorded by a Rhode Island contestant. A tribute to international ham radio is due, for several of the personnel of the club have handled traffic for many years on the high frequencies. KTL and EG Rare new members.

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THE VARIAC — the original continuously adjustable auto-transformer — is designed to give years of trouble-free service. The Type V-10 (illustrated) will handle up to 1.725 kva... meeting the total voltage-control needs of most amateur stations. It can be used for either behind-the-panel or table mounting. Unique unit brush construction makes brush replacement simple without tools; new molded terminal plate with barriers to prevent short-circuits; both solder and screw terminals provided; wiring diagram on terminal plate shows normal voltage between terminals; large, easy-to-grasp knob with extra large voltage calibration figures easy to read at a distance... these are only some of the many features found only in the VARIAC.

The Type V-10 has a rated current capacity of 10 amperes and a maximum of 15. Its no-load loss is only seventeen watts, compared to the usual high loss in a rheostat type of control. Output voltages are essentially independent of load with the VARIAC. VARIACS are correctly designed to provide the ideal method of varying a-c voltage... and to give output voltages 17% higher than that of the line.

TYPE V-10 VARIAC . . . . . . . $33.00
WRITE FOR "VARIAC BULLETIN"
The JOHNSON Rotomatic has been designed and built expressly for those who want the very finest. High gain and excellent front to back ratio are easily achieved without endless hours of adjustment. The most flexible beam ever offered the ham, the JOHNSON Rotomatic is available with two, three and four element parasitic arrays for 10, 14 or 20 meters as well as dual beams for any two of these bands. Also available are two and three element phased arrays, all elements powered. Hardware is offered for mounting additional VHF or television antennas.
ALL WEATHER CONSTRUCTION

Rotator assembly is housed in a sturdy, lightweight aluminum casting, will safely handle arrays weighing 125 pounds. Beam is instantly reversible, turns at 1 1/2 RPM, has foolproof locking, large safety factor on wind loads. Drive motor causes no radio interference. Starting torque will turn beam during lowest temperatures. Design is truly all weather.

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Uniform, efficient performance is achieved on several bands by method of coupling transmission line to antenna. Slip rings and relay box have no large value of capacity or inductance which have complicated beam tuning in the past.

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May be used as a dual beam assembly requiring but one transmission line. RF relay housed in a weatherproof box. Elements for two frequencies mounted on the same boom. Interaction minimized.

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Accurately follows antenna rotation. Controls: power switch, motor reversing switch and antenna relay switch. Dial illumination indicates when power is on.

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Tuning of both parasitic and driven arrays is simple. In fact, driven elements can be preset on the ground and used without further adjustment, being less affected by proximity of surrounding objects and height above ground.

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"T" match adjustable to permit use of any type transmission line from 50 ohm coax to 600 ohm open wire line. May be used over the entire 10-meter band without seriously changing low standing wave ratio. All holes located, drilled and tapped. U bolt element clamping permits easy adjustment of spacing.

Interior of rotator showing worm gear, selsyn, oiling chain and terminal board.

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The purpose in furnishing antennas with all elements driven (phased arrays) as well as conventional parasitic arrays is two-fold. First, tuning the phased array is very much simpler. Further, it offers unlimited possibilities for experimentation. Many hams will want to use components which they already have. For that reason the ROTOMATIC is available as a complete unit or all parts are available separately.

See the new JOHNSON Rotomatic at your JOHNSON jobber. You’ll agree, its miles ahead of any beam in the field. Or write your jobber for Rotomatic brochure.

New Johnson Phased Array employing driven elements.

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87
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$59.40

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PACIFIC DIVISION

SANTA CLARA VALLEY — SCM, Roy E. Pinkham, W6BP - ZRJ is handling traffic on Mission Trail, Southern California, and Pioneer Nets. Doe was elected secretary of SCCARA. ZBY has just returned from a trip to Europe as a ship radio officer. Jack is busy working DX and contacting his brother, BAX. ONL is on 14 Mc. chasing bugs in a 500-瓦 rig. DNG reports using 650-B mobile on 28 Mc. Hary uses an ARB/7 as receiver installed in '49 Chevrolet. ZTQ's XYL made a fast trip to Iowa and return, bringing back a new daughter Linda. DAE has been listening to DX tuning up on 3.5-Mc. e.w. HC gave a talk before the Monterey Bay Radio Club on April 19th. His subject was Class C amplifiers. TRW has moved back to San Francisco, where he and his XYL spent their honeymoon. RY is in Japan with military reserve work. LJJ has been on 14 Mc. lately working DX. ZTL is on a trip to Los Angeles so you may check into the Mission Trail Net. SCCARA wishes to thank the members of the Mission Trail Net for the invitation to attend their hamfest to be held at JTE's ranch the first week in July. Traffic: W6BPT - ZRJ is handling traffic on Mission Trail, with scores of 116,523 and 253,890.

EAST BAY — SCM, Horace R. Grover, W6TI - Asst. SCM, Charles P. Henry, 66FA, SEC: OJU. ECs: AKB, BSC, DMS, ITH, JJK, QDE, WGM, Ass't EC u.h.f.: OJU. RMa: F'DR, ZM. I'QK is the second 'phone postwar DXCC man in these parts. Considering the limited time Phil can spend on the air, this is an FB job. Under the guidance of I'KX, the Hayward gang really have a swell club and on April 9th they celebrated their first anniversary with a big party. Traffic: (Mar.) W7CZY 2828, CKT won on the East Bay section, with scores of 116,523 and 253,890.

ARRL Contest won on 'phone and RM won on c.w. for the Oakland Radio Club on April 1st and it was well attended. UPV is getting ready to rebuild beam. In the DX contest, SCCARA wishes to thank the members of the Mission Trail Net for the invitation to attend their hamfest to be held at JTE's ranch the first week in July. Traffic: W62RJ 167, WJ 95, WGO 80, WZE 18.

(Continued from page 88)

(Continued on page 90)
Now you can monitor your modulation percentage and speech quality with a fine instrument available at low cost. Percentage modulation can be read directly on the meter. Headphone jack, conveniently provided, also permits monitoring your signal quality to check for hum or audible distortion.

Compactly designed to fit the most cramped operating table, this precise Modulation Meter will be of great assistance in complying with FCC regulations on overmodulation. It will also help keep your average modulation percentage up in the effective region between 60% and 90%. Indicates carrier shift.

Take advantage of this new low price! See Sylvania's Modulation Meter Type X-7018 at your distributor today! Sylvania Electric Products Inc., Radio Division, Emporium, Pa.
Compact, laboratory styled, "Precision" Circuit Tester 20,000 Ohms per Volt

APPLICATION ENGINEERED

"PRECISION"

375 transmitter. CWV is working c.w. for the present. SLX is handling emergency stuff and building up the emergency network. RAQ is installing new radio gear. ZHE is remodeling surplus gear. FCL is building a jobs site. NAD is trying to find out who used his call and got QSL cards from him. RAQ is working on new W3AI and building gear. EQQ is building up code speed. BOT is rebuilding new building. DQY is devoting all his time to 27 Mc. using 522 B and is plenty consistent with his old pals back home in W2. YME recently worked a DL4 in Hedeborg, who gave the usual QSL report. On the next transmission DL4 about to station up and is going out of the speaker with a wire recording of his signal, so Bob knew he had "arrived." VFG is working on a new "killer diffy" after perfecting the one-tube phone transmitter. EAX has moved to a new location high on the side of Mt. Baldy with a line of sight shot at most of the Bay Area. KAJAA, formerly from Hamilton, has left Manhattan and will be back in the air in Marin County. We haven't heard a squeak out of BVO since he opened up at Harvey's. ZUB is getting the fever to give 160 a whirl. WBE is working a new Class C ticket and giving 3.85 and 14 Mc. a whirl. DQX lost his beam. Tower recently and says when it gets back up it will have the proportions of a 14-Mc. job. He's already worked 111 countries, made WAC on 14 and 28 Mc., WAVE on 7, 14, and 28 Mc., and WAVE, W4F, and W6E. OE is going strong on 28 and 144 Mc. He's using a twelve-element beam on 144 Mc. TEL still is up in the air over T.V. YDI is waiting for some good weather to work his beam. YDI is back from Mosses Lake and should be heard on 3.5 Mc. soon. I2R now has an antenna for 3.5 Mc. and can be heard for 3.5 and 7 Mc. This has a super efficient limiter gadget working his a.m.r. rig on 28 Mc. FZG, after giving 28, 30, and 144 Mc. a thorough workout, can now be heard on 28 Mc. and on 144 Mc. JD is working some nice 7-Mc. European DX in the wee hours of the morning with his new kw. rig. JD is working East Coast schedules on 7160 kc. VKT worked all stations but North Dakota. Field Day should furnish plenty of competition, as many clubs are on the hunt for good locations early and plans are well under way for the event. I am indeed happy to be able to report that our Pacific Coast Director, Mr. William A. Ladley, is improving as fast as possible from his illness. Bill is a hard worker and he works each and every problem with his usual personal vigor. His past record has been one of continuous activity in business and for the betterment of ham radio. The entire Pacific Division and the thousands of other amateur friends join in wishing you a complete and speedy recovery. Best regards, Bill. Traffic: W6REB 2185, W6LBD 1502.

SACRAMENTO VALLEY — SCM, Ronald G. Martin, W6ZP — Asst. SCM. Northern Area, Ray Jensen, GEB; Central Area, Willie Van denkamp, RCB; SEC: RM, EC; Metropolitan Sacramento Area, BVK; Walnut Grove, AYZ, RM, REB; OBY: PTV, PTV replaced pentodes with 28's in 522 A/C, and mixer, claims less noise and more sensitivity. Northern Area: 3DN has HRF, EWG, ADR, CVQ, CFU, JDQ in AEC says emergency plans for Shasta. Dunsmuir has new Plemont gear. WRG is in a new location high on the side of Mt. Lassen. CJG built 7728 converter for 28 Mc., RAQ is on 28 Mc. with three-element beam. KO1 works AJF over the mountains in Sonoma on 144 consistently. Southern Area: MDW, SDU, and LKZ. putting up new 3.5-Mc. skywire. Traffic: W6REB 2185, W6F'KL — Asst. SCM. James F. Wakefield, 6PSQ. SEC: PHL, VTF, W6Z, EXH, VDK, BHI, YGZ.

(Continued on page 24)
"LITTLE DEVIL" RESISTORS
For quick, easy identification, resistance and wattage are clearly marked on every one of these tiny, rugged insulated composition resistors. In three sizes — 1/2, 1, and 2-watt and all RMA resistances. Tolerance ±5% and ±10%.

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(Continued on page 90)

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**MODEL 129**—Extremely compact size (4 1/2 x 5 1/2 inches) for easy under-deck mounting in your car. Delivers 8 watts A-3 emission on 27-29.7 Mc. Uses 7 or 9 Mc. crystal. Power requirements are 6.3 volts AC/DC @ 2 amps and 350 volts DC @ 110 Ma. Uses three type 6AG7 tubes for oscillator, amplifier and modulator. Antenna termination for 50 ohm coaxial line is 150 volts DC. Maximum output frequency is 1500 kc. Tube complement: 6AK5—RF amplifier, 1002—mixer, 9002—oscillator, 6B9—modulator. Power requirements are 150 volts DC maximum @ 20 Ma., 6.3 volts AC/DC @ 75 amp. Has antenna transfer switch. Less tubes, your cost. Model 119 for 20 meter band and model 175 for 75 meter band. All available! 23.95

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Bevery Hills, GFI; Long Beach, AOT; Oxnard Valley, LHI; San Fernando Valley, KEI; San Bernardino, KSD; San Luis Obispo, KLF; Venice-Culver City, TSN; Santa Barbara, TVw. Venture Company. During this month's meeting the units under CEC BTA were called into active service on emergency missions to provide communication service. In addition, a number of parties in the Southern Border Net on Monday. The San Diego YLRL had a National 1-10 receiver at a price at March meeting but we have no report on get it! VUK and AW, plus their harmonics, were mobiling with VQJ and YX1 via a trailer. KI6QI, formerly W6YIY, is back in San Diego to stay. YTH and his XYL have a new baby girl. PNU now is signing HZIAB. The Imperial Valley Club reports that CNZ gave a nice talk on telepyle. CQW pre- continued on page 10)

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SAN DIEGO—SCM, Dale's, Boc, W6BWB—Asst. SCM, Gordon W. Brown, 8AG, and Shelley E. Trotter, 8BM. RM: BGF, SEC: DUF. Congratulations to GC for a job well done as SCM for the last two years. DBZ reports antenna trouble; also lots of recruits and trainees at Training Center going up for tickets. Ex-4K,JT now is 6FIJ at Wickenberg. The Radio Club of Arizona is awarding a Cup for the highest club Field Day score. UPR has its new kw. on 14- and 28 mc, 'phone. Both LVV and HKY have continued to do good work. HJX has organized a traffic net. CRIN was a visitor in Santa Barbara. YTH and his XYL have a new baby girl. PNU now is signing HZIAB. The Imperial Valley Club reports that CNZ gave a nice talk on telepyle. CQW pre-
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WEST GULF DIVISION

NORTHERN TEXAS — SCM, Joe C. Buch, W8CDU — PRN is the latest call in Commerce and is on the air with a Measnger Signal Shifter and 8-40A receiver. LGY again is active on 50 and 9 M. NFF is operating on 20 while after vacationing in Houston, W. H. Propst, SKGC, of Cleveland, Ohio, new is in Lubbock. HJX, the new 75W, net, is a ham, and postmaster with the death of FMX, of Swenson. JHX has completed a three-month GCA and surveillance radar course in Oklahoma City. The last Sunday after his return, an extra meeting of the Dallas Club resulted in a fine display of mobile equipment by club members and late-type portable gear with the pleasure of witnessing M. F. Swenson, new 827 Collins, LSN and GZU again make PBL; it's getting to be a habit with these big league traffic handlers. HCE won the CQ Contest held by the DAR and proved he is to be most proficient in the art of left-foot keying, ENB was a close second and MA rates third. A8A has raised power input to 290 watts. ARX is now 2C for the Ft. Worth area. FD is on 3.5-Mc, c.w. JDZ is ready to go on 160 meters. NFT visited friends in Dallas and took his Class A exam. 144-Mc, interest appears to be on the up. A power supply failure caused considerable damage to components and wiring in NRE's 1610 rig. Traffics: W8LON 1026, G7U 745, LRZ 740, CDU 59, BKH 99, ANF 89, ASC 23, LGY 1.

OKLAHOMA — SCM, Frank E. Fisher, W5AHT/AST — SEC: HGC, NMM spent some time in New York on TV business. He welcomed a new daughter, Jenn Marie, on his return. LGI has a job in Washington, D.C. C. AGM recognized SEC appointment because of increased demands of his job. GCN has a new 28-Mc beam. GCK moved to Oklahoma City from Texas. ERC built a modulation meter. BCL is installing a color filter on a test set in Okmulgee. KXJC activity and other Oklahoma amateurs may be interested. JIII is operating on 40 M. c.w. JOB, DUD, MEL, and ODD, OP, and LEI are among Tulsa amateurs active on 50 Mc. with the cubical quad a favorite antenna array. H7Z, IOW, TXK, and APG also are doing new work on extended ground wave. ORE, SEC, George Bird, was guest speaker at Pawhuska Rotary and Ada Kiwanis clubs. His subject was "Amateur Radio and Emergency Communications." JKQ is active on 144-Mc. c.w. and postwar member with the death of FMX. Music is flawless, noise-free — every instrument sounds true ... speech is clear, with astonishing presence." Tuning is precise and drift-free.

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BQ is active from Cooksville. BHS is QRL with the Air Force rotator, and VH have 144-Mc. mobile rigs. PY is very active with 3.5-Mc. c.w. exclusively and have had over 600 contacts during the past year running 60 watts to an 804. LO continues with PQN and reports AAF is now in Drummondville, running 28 Mc. Litho is QRL with the Quebec 'Phone Net. TR also is on 146.8 Mc. VE and VH have 144-Mc. mobile rigs. PV is very active with n.f.m., ZG appears to be the backbone of 144 Mc. in the St. Maurice Valley district, having converted ten 522s to 144 Mc. for the gang. It is suggested that those who are operating VFOs on 160 meters double to 80 check carefully for third harmonics of VFO falling in the 5250-6000-Mc. band.

ONTARIO DIVISION

ONTARIO—SCM, Thomas Hunter, Jr., VE3CP—VX is working FB DX with an indoor antenna. Traffic: VE3IA 31, QU18, IJ 8, LZ 15.

QUEBEC DIVISION

QUEBEC—SCM, Gordon A. Lyon, VE2GL—GM reports increasing activity on both PQN and QEN. A total of 18 VE2s report into PQN. On the QEN, 9 stations are now battery-equipped for emergency operation. B3 has an A-1 Operator certificate. He continues traffic schedules as far as shift work allows. AAK is new in Montreal and his executive. HM and his XYL are visiting England. BG is constructing new rigs for 50 Mc. VS has converters on 3.75 Mc. for the gang. It is suggested that those who are operating VFOs on 160 meters double to 80 check carefully for third harmonics of VFO falling in the 5250-6000-Mc. band to eliminate the possibility of interference on airline frequencies.

VANALTA DIVISION

ALBERTA—SCM, Sydney T. Jones, VE6MJ—Final plans for a real bang-up hamfest in Edmonton July 30th and 31st are about complete. Hotel reservations should be made well in advance. VE5's are busy building converters to 14 Mc. IC is running 100 watts to 800s, BX is assisting local prospective hams, NA and YD are building handy-talkie rigs for 50 Mc. RA's station on 3.5 to 29 Mc. BC is assisting local operators portable on 3.8 Mc. FP reports exceptional DX on 28 Mc. late at night. The NARC annual banquet was a real success. WA seems to be a real ham to his friends and his executive. HM and his XYL are visiting England. EF has returned from a business trip to the U.S.A. and reports seeing some outstanding stations. BQ has left the game, and his position of Government QSLs now is available, thanks to LG. RU pounds brass on his new call and AHL is his son. They are on 7- and 3.5-Mc. c.w. exclusively and have had over 900 contacts during the past year. A total of 18 VE2s report into PQN. On the QEN, 9 stations are now battery-equipped for emergency operation. B3 has an A-1 Operator certificate. He continues traffic schedules as far as shift work allows. AAK is new in Montreal and his executive. HM and his XYL are visiting England. BG is constructing new rigs for 50 Mc. VS has converters on 3.75 Mc. for the gang. It is suggested that those who are operating VFOs on 160 meters double to 80 check carefully for third harmonics of VFO falling in the 5250-6000-Mc. band to eliminate the possibility of interference on airline frequencies.

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PRAIRIE DIVISION

MANITOBA — SCM, A. W. Morley, VE4AM — Congratula­
tions to DU on the birth of a daughter. DP joined the
ranks of the benefactors and is leaving for VE7 land. BG
followed suit and spent his honeymoon in VE7 land. A W
is next. The WARC reflected Tj, pres.; LC, treas.; and L
Young, secy. New vice-president is G. Williams. Several
new-comeers were heard. Please drop me a line, fellows.
them are OS, in Carman, who runs 100 watts on 7 Mc.,
and IA, in St. Vital with crystal oscillator to a 316 D and
uses a 407 t a dipole and an RME-84. GI is moving to
VE5 land. LF joined the Manitoba Phone Net on 3775
kc. LS, in RMH, has beam up and is working DX. His
brother HS prefers to stay on 3.5 and 3.8 Mc. LC has VFO
and has extended his OVB to cover 27 Mc. XO is settled in
new QTH. Green Wood, who became interested in amateur
radio while on a course with the Army through VE3BON,
has applied for a call and will sign VS6 from Shilo. QC
has 84 running on 3.5 and 7 Mc. after a tough spell with
parasites. TM is building new receiver. EN has left Rivers.
The ARRL Field Day will be held shortly after you read
this. How about getting on during the Test and getting
Manitoba represented for a change? Traffic: VE6AM 32,
JO 19, GY 14, DN 3.

SASKATCHEWAN — SCM, J. H. Goodridge, VE5DW
— GC worked Japan at about 5 o’clock in the morning on
3.5-Mc. ‘phone. MA is active on 3.5-Mc. ‘phone. AB now
has 28-Mc. Hammond beam and works DX. AW has new
155-watt bandswitching rig and worked 7HJ, ex-SAX, LC,
PA, and VE6GA makes plans for portable operation. Let’s
see more of this. FY dismantled mobile rig and is construct­
ing another with bandswitching. KJ is on T1 “1” and cleared
traffic from the West Coast direct. HB reports the ex­3.5 is
coming along fine indicating a bang-up season beginning
next fall. If interested, contact HF. JV now has 98 coun­
ctries. GC is working DX on 27 Mc. and ‘phone. MC has
retumed to the air at Cudworth after four months of silence
and reports he is being heard in the telephones. RA. now in
the USAF, was home on leave. The Saskatchewan Phone
Net has 20 registered members. HR hopes to run 300 watts
next fall. 6PP plans to make a journey by boat along the
North Saskatchewan River from Edmonton to Prince
Albert during July using mobile equipment. Listen for him.
There will be special QSL cards for the occasion. VB works
7XV, ex-5XU, frequently on 14-Mc. ‘phone at noon. Traffic:
VE5HR 36, KJ 23.

BOOK REVIEW

Basic Mathematics for Radio, by George F. Magdel. Published 1948 by Prentice-Hall, Inc.,
New York, N, Y. 339 pages + viii pages. 203 figures, 6 x 9½ inches. Price $4.75.

The book covers the following topics, which the author
states are necessary for the technician to be able to under­
stand the radio textbooks and literature necessary to im­
prove his knowledge and keep him abreast of his subject:
solution of algebraic equations; rules of variation; geometric
representation of machine elements and assemblies and the
characteristics of electrical circuits; trigonometric functions
of sine, cosine and tangent; solutions of the right triangle;
use of tables of functions; use of slide rule and logarithms;
complex-number notation.

The beginner will find that the questions which naturally
arise are deftly anticipated and answered in the text. There
are many illustrative examples with adequate instructions.
Mathematical proofs are present only where absolutely
necessary; the author feels that some proofs are not essen­
tial to practical application of mathematics in radio and elec­
tricity and has omitted them. The written material is easier
to follow and less formal in style than in the usual mathe­
matics book. While the text is kept practical by basic prob­
lems in electricity and radio, additional problems of this
sort would enhance the text from the aspect of interest as
well as learning. About three-fourths of the problems given
are pure mathematics and the remainder deal with radio
and allied to radio. — John Merrill, WICOS, Radio Engineering
& Maintenance School, U. S. Coast Guard Training Station,
Groton, Conn.

This book would make a good guide for study by a group
of amateurs under the guidance of one versed in mathematics
allied to radio. — John Merrill, WICOS, Radio Engineering
& Maintenance School, U. S. Coast Guard Training Station,
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1/32" $ .08

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5 x 10 x 9 $ 1.35
10 x 13 x 9 $ 1.38

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Unshielded type A-3000 $ 1.18
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VERTICAL OUTPUT turns ratio pri.; to sec. 10:1.
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Type 946 6.3 VCT @ 3 Amps. 2500V Ins. $ .39
Type 947 6.3 VCT @ 4 Amps. 2500V Ins. $ .42
Type 960 7.5 VCT @ 10 Amps. 2500V Ins. $ .79
Type 143 7.5 VCT @ 8 Amps. 2500V Ins. $ .12
Type 961 Dual 6.3 VCT @ 3 Amps. 2500V Ins. $ .38
Type 951 5 VCT @ 10 Amps. 2500V Ins. $ .18

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Smooth efficient voltage control. 0 to 135V. output from 115V. AC.
Type 400 (illustrated 3 amps) $ 1.25
116 for table mg 7.5 amps. $ 1.09
1104 for panel mg 15 amp $ 4.00
1106 for panel mg 15 amp. $ 4.00
1156 45 amps. $ 1.15

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100 Ma. D.C. $ 4.50
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200 watts $ 5.10
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VR-6112 60 8 $24.00
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Apply by Writing to C-3, P.O. Box 3552 Philadelphia 22, Pa.

Men qualified in RADAR, COMMUNICATIONS or SONAR give complete history. Interviews will be arranged for successful applicants.

What! No Antenna?
(Continued from page 17)

Conclusions
Although the sample is small, it still seems valid to draw several conclusions from the different indoor antennas just described. It is apparent that you don't require anything approaching an ideal location for satisfactory low-frequency results with an indoor antenna. Far more important are a little ingenuity and some time to prune the antenna. Because the entire system is indoors, it is not difficult to adjust the antenna length until the system is exactly resonant or provides a good match for your feedline (if you use one). This careful adjustment pays off in results.

So, if you're a one-hand man because you "don't have room for an antenna"—forget it! Look over the antennas in this article, then put up your own "improved" version, and meet an entirely new gang of fellows and conditions on some of our other bands.

— B.G.

Teletype Reception
(Continued from page 24)
dips the peaks as shown in Fig. 3. When the carrier is "on," the limiter operates and the locally-generated noise of the blocking oscillator is squelched. The carrier "on" condition thus becomes the teletype "space" position. The carrier "off" condition permits the blocking oscillator and any received noise to make the "mark" signal.

The system will operate successfully until the signal drops below the level of limiting or until local noise becomes so continuous that it keeps the receiver squelched all the time. The random nature of most received noise makes this an extremely unlikely occurrence.

Multiple-Circuit Tuner
(Continued from page 28)
harmonics. A rectifier-type wavemeter using a 200-μa. meter as the indicator was link-coupled to the antenna coupler for this test.

Miscellaneous Data
The amplifier-antenna coupler has been laboratory tested while coupled to loads of 75, 500, 2400 and 6000 ohms impedance. Series tuning was used for the 75-ohm load at 3.5 and 7 Mc. Parallel tuning was used on all six bands when working with the three loads of higher impedance. In order to give the antenna coupler a reasonable test, the dummy loads were shunted with both capacitance and inductance to simulate the effects of capacitive and inductive reactance that would be present with a feeder system having a fairly high standing-wave ratio. The coupler passed the test with flying colors—with

(Continued on page 110)
Hallicrafters S-38
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Hallicrafters model S-38 has four wave bands, continuous frequency range from 540 kc. to 32 mc. Precision quality, long range exciting performance. In addition to splendid regular broadcast reception and police calls you can listen in on all sorts of land, sea, and air communications from the most distant points of the globe. The whole world's your neighbor! Now, a new low in price!

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one exception. If the reactance was highly capacitive at 28 Mc., it could not be completely compensated for by the tuner and the final-amplifier tank circuit was affected to the point where it would not tune the entire 28-Mc. band. Just as an experiment we removed a turn from each of the plate coils, L6 and L7, to see if the band could be covered under the above conditions. This did allow the full band to be covered, but we can't say that the stunt should be duplicated because the mismatch between coupler and feeders certainly is not corrected by operating on the final amplifier!

Several hours of operation will convince most operators that multiple-circuit tuners provide one of the neatest and most rapid methods of getting from band to band. But, like nearly everything else, the system isn't foolproof. One must remember that the tuners will resonate at frequencies in between the amateur bands. Get the idea? Well, be sure and keep it in mind for although the tuners won't mind being tuned to an out-of-the-band harmonic, the FCC might not like it. Come to think about it, we're going to color code our tuning controls in terms of ham bands right away.

50 Mc.

points keep him in mind when conditions are good.

Hamilton, Calif. — Participating in the 2-meter mileage contest of the V.H.F. Institute of New York, April 23rd and 24th, W6ZOE (Hamilton Field Radio Club station, operated by Jack Drummond, W6YHI) worked 47 different stations, for a total of 2368 miles. Average distance was 50.3 miles, and the greatest was 118 miles, to W6IFE, Reedley, Calif.

Brockton, Mass. — Whether it was aurora, the eclipse, or an overrunning warm air mass, a number of W2s were coming in nicely at W1JMU on the night of the 12th. Notable was W2NGA, who was seeing what he could do with low power that night. With 5 watts input to his 1120 final he was solidly readable, at 83, for some time.

The distance is about 175 miles.

Council Bluffs, Iowa — The Council Bluffs Radio Operators Club will have 144-Mc. equipment in this year's Field Day activities, with W0CCY providing 4-channel operation on 144.1, 144.9, 146 and 147.96 Mc. with two 522s, which are also available for emergency use or hidden-transmitter hunts. A hunt is scheduled for the summer hamfest on July 17th, and another for the Midwest Division ARRL Convention, to be held at Omaha, Neb., Oct. 8th and 9th. W6CCY is now using vertical polarization on 2, to facilitate work with mobile stations. His antenna system is two 5-element arrays mounted side by side, a half wave apart.

Doings on 220 and 420 Mc.

Burton, Ohio — With a new home just about ready for occupancy, and a 100-foot steel tower (Continued on page 118)
YOUR DOLLAR IS WORTH MORE AT WRL!
Deal With “The World’s Most Personalized Radio Supply House”

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Above tubing will telescope into the next size

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just about ready for antennas, W8UKS is getting set to go places on 220 Mc., as well as 144 this summer. Knowing something of Sam's past efforts in the antenna field, we have little doubt that something colossal will be appearing above the Burton horizon before long.

**London, England** — A group of amateurs in the Suburban London area works out on 420 Mc. each Wednesday, beginning at 1930 GCT, according to information received from G3AHB. Those usually active include 5PY, 2WS, 3CU, 2FKZ, 4CG, 2RD, 61ID and 3A11B. A similar group operates in Birmingham and the Midlands, and the two coordinate their activities, just in case conditions should permit the spanning of the 150 miles between them. From results obtained on 145 Mc. in England, we'd say that this is not being overoptimistic. Vertical polarization has been used, but they expect to change to horizontal, as TV and other services in England are vertically polarized. G3AHB cautions anyone working with coaxial-line-fed arrays not to omit the balun to balance between the line and antenna. In a check with G2FKZ over a 15-mile path, installation of the balun was found to improve signals by several S units.

**Woodhaven, N. Y.** — A junk-box wavemeter for the 420-Mc. band is suggested by W2WML. Wes uses a 100-µfd. variable, a piece of Twin-Lead, and a 60-ma. pilot lamp and socket, bayonet-base type, to make up a low-cost wavemeter. The Twin-Lead is 11½ inches long, with ¼ inch cleaned of its insulation for soldering to the condenser terminals. A short is soldered across the other end. The center lug of the pilot-lamp socket is soldered to the other stator terminal and the other socket terminal is left floating. The condenser should be mounted on a piece of insulating material. Its tuning range will just about cover the 420-Mc. band. Queens County 420-Mc. activity now includes W2s EK, DKH, MWB and KDB. Polarization is vertical.

**How's DX?**

(Continued from page 49)

What price DXCC or, go away, mother, you bother me, seems to be the hue and cry. Stuff he's been hearing lately has Bob thinking, at long last, in terms of remotely-controlled rotaries. M13LZ (W4FGJ) tells W8BNU that the use of 16 and MI6 prefixes for Eritrea has been discontinued. Seven MI3s and one MD3 are currently licensed. Stealing some of W1DX's thunder, we hear that VR5PL is contemplating a Hessian with single-sideband soon. Noel is presently employing c.w. and a bit of n.f.m. MD2AC (W4LQQ) is giving 20 a big play lately. Milt's set-up includes a BC-4601 rig, a 3-decibel wide-spaced beam plus SX-28 and Super-Pro receivers. Gosh, the fancy equipment some of the modern rare-DX gang show up with is a far cry from the old days when bloopers and Hartleys were the rule.

Lots of action on the Q8LL front. The following gents announce they'll positively put out the

(Continued on page 114)
Mobile Transmitter

Here's your best mobile transmitter! Compact size (only 4½" x 5½" x 6½" deep) permits mounting in glove compartment or under dash - for finger-tip tuning, metering, and QSY'ing - while you drive. Built-in relay for complete PUSH-TO-TALK control. Stable, crystal controlled oscillator. 2E26 RF amplifier (not a doubler!) can be loaded to 30 watts input, with high output efficiency. Covers 10 and 11 meter bands. Class B Audio for 100% modulation and real battery economy. Ultra-modern in appearance, too! Chrome embossed panel - direct meter illumination - dark green, slide-in cabinet. (And with an AC pack, it makes an FB fixed station or portable rig!)

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Palestboards 100% as soon as practicable: VS2CH, ex-D4AEQ, ZC6UNJ, ZL1GE/P, ex-VP4TY and OX3RG. These stations believe they've completed whipping the backlog and will furnish refills for strays: W6PJS/KG6 (QSL to Box 855, Los Angeles 53, Calif.), VP2GF (% W1FTX), ZD4AH, MD4JG (QSL to P.O. Box 1313, Nairobi, Kenya), VP7NG, MD1E (QSL to 4 Deer Park Way, Axwell Park, Blaydon-on-Tyne, Co. Durham, England), TA3GUV and MT2E. . . . . . . . VK9NR, ZP3AW and ZC8PM cards are being distributed and C1DH/C3 has been passing out $100 bills—QSLs impressed upon Formosan currency, of course.

In the your-guess-is-as-good-as-mine category, we hear that W4MR has been bumping into various PX1As with regularity. The PX1A that W2SHZ has been working claims to be a legit F8. [Say, maybe that's a club station, huh? —Jeeves] As if this were not enough puzzlement for W4MR, along trots one AC5C8. After the latter QSO, Alva talked the fellow over with W8NBK and W5QL, the consensus being that the fellow was a playboy. Then who shoves his 2c in but the "AC5," hollering "I am too legit," or words to that effect. Zooks! never a dull moment on 14 Mc. . . . . . . The YM4AW that sent W0BNU a card states that practically all the prewar Danzig hams are Silent Keys now . . . . . . We could list a few more weirdies but it would only smack of alphabetical mayhem.

Seeking elimination of the stupendous QRN by-product of the standard type of DX contest, Jeeves is now plugging a new idea, the "QRJ Test." Stated simply, stations with the average weakest reports throughout the affair emerge victorious. Obviously (he says), with everyone continually cutting the soup to be weaker than the next guy, 20 will ultimately be dead as a doornail.

I.A.R.U. News
(Continued from page 60)

AUSTRALIA

Australian amateurs are now permitted to use n.f.m. on the 3.5-, 7-, 14- and 28-Mc. bands. Single-sideband emission is also to be allowed on these same bands. The 1215-1300 Mc. band replaces the 1345-1445 Mc. band. These changes became effective May 1st.

FRANCE

Robert Larcher, F8BU, honorary president of the Réseau des Émetteurs Français, is compiling a history of international amateur radio. He is very desirous of obtaining all sorts of documents, anecdotes, photographs, texts of regulations, and all else pertaining to the work of amateurs prior to the year 1914. Please address all correspondence direct to Robert Larcher, F58BU, 1 rue des Tanneries, Paris 13, France.

HONG KONG

The past year has seen considerable activity by VS6 stations, and despite the confined area...
Asiatic Microphones remain the top preference of amateurs. A recently completed survey of that locality—neither instigated nor conducted by Asiatic—provides interesting evidence of Asiatic Mike popularity. Among 352 Hams, 101 own and operate Asiatic Microphones. The figures are still more significant due to the fact that 85 of the 352 include owners of War Surplus units and miscellaneous types. The remaining 166 divide their choice of mikes among six other better known makes. No other make has half the representation in Essex County as that enjoyed by Asiatic units. No test of product quality is more conclusive than that of actual use. The continued preference of amateurs for Asiatic Mikes is their greatest endorsement.

Asiatic Crystal Devices manufactured under Brush Development Co. patents

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Due to Transmission Line Pick-Up!

A major advance in television technique! Developed by Federal ...offered only by Federal. Now manufacturers can obtain a lead-in that protects the quality performance they build into their receivers. Antenna kit makers can greatly improve their products. And servicemen can call a halt to many of the customer complaints that take the profit out of service policies. For information, write to Dept. D-157.

Patent Pending

Federal Telephone and Radio Corporation
900 Passaic Avenue, East Newark, N. J.

In Canada—Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors:—International Standard Electric Corp., 67 Broad St., N.Y.C.
excellent cooperation between neighboring stations has reduced to a minimum the amount of interference experienced. A number of stations have had their licenses modified from the 25-watt c.w.-only permit to 150-watt phone/c.w. permits. The Hong Kong society lost a keen supporter when V86AS, and his wife, were killed in the Macao air piracy disaster.

**BELGIUM**

The Union Belge des Amateurs-Emetteurs is now issuing the certificate WABP (Worked All Belgian Provinces). The requirement is that the applicant submit written proof of having contacted each of the nine provinces on each of two bands. (The *Call Book* at present lists the province after each call.) Applications for this award should be addressed to the U.B.A., Box 694, Brusselles.

**CZECHOSLOVAKIA**

The following v.h.f. and u.h.f. bands are currently available for use by amateurs in Czechoslovakia: 50-54 Mc., 144-150 Mc., 220-235 Mc., 420-460 Mc., 1215-1300 Mc., 2300-2450 Mc., 3300-3500 Mc., 5650-5850 Mc., 10,000-10,500 Mc., and 21,000-22,000 Mc. Class A operators are allowed 100 watts input, Class B operators 50 watts, and Class C operators 10 watts.

---

**HRO**

(Continued from page 68)

**Antenna Shorting Relay**

An additional refinement of particular interest to those who use relatively high-power transmitters is the use of a small, low-current relay for protecting the receiver by disconnecting and shorting the antenna coil during transmissions. A Potter-Brumfield d.p.d.t. relay, Type LM-11, with 10,000-ohm coil, is mounted under the chassis directly below the antenna input terminals and connected as shown in Fig. 4. The relay opens the antenna leads and shorts and grounds the antenna coil of the receiver. If desired, the relay can be wired so that removing the plate voltage from the receiver during transmission periods automatically switches the relay to the protective condition. But with the relay wired as shown, and controlled by S1, the receiver can

---

(Continued on page 118)
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CHARACTERISTICS
Heater . . . . . . . . . . . . . . . . . 6.3 Volts 0.6 Amps
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The opening of the antenna leads and shorting and grounding the coil is far more effective than shorting the antenna leads, especially for 28-Mc. operation.

[The receiver send-receive switch is rewired to leave voltage on the h.f. oscillator and the b.f.o., it will keep the power to these oscillators at a constant value and reduce any tendency to drift when the receiver is switched off during "transmit" periods. — Ed.]

Correspondence

(Continued from page 68)

314 W. Lakewood, Peoria 5, Ill.
Editor, QST:
The critics of ARRL's dues increase are living in the past—with the ten-cent loaf of bread. Things cost more today because people earn more. It's ridiculous to expect ARRL or any other organization to render a service at a prewar price. Why should some hams be so dumb about economics? I respect the fellow who says that Junior's shoes come first, but the guy who says the price is too high must be kidding.

And as for the ARRL services, we need them all—unimpaired. Even those of us who disagree with ARRL on minor issues will agree on the need for a strong organization to represent the amateur fraternity. I would certainly hate to see a forty-dollar-a-week man representing the amateurs at, for instance, a frequency-allocation conference where the big corporations send their $10,000-per-year men.

— Gorus Rohrer, Jr., W2EKL

Wilmington, Ohio
Editor, QST:
YOUR ARTICLE ON MEMBERSHIP DUES WAS VERY INTERESTING STOP SOME DOGS BITE THE HAND THAT FEEDS THEM BECAUSE THEY DO NOT KNOW ANY BETTER STOP MORE POWER TO YOU COMMA IF NECESSARY INCREASE THE DUES TO KEEP OUR AMATEUR ORGANIZATION STRONG.

— H. M. Robinson, W3HOX

[Many thanks also to W1HWZ, W1POL, W3C6D, W22SK, W3ZOZ, W4KOB, W4MVM, W5NEQ, W6GFX, W9ZS, KP4GV, V66HM, V66LQ, Harold McKay, Mike Schmitz, James Swanson, Robert Del Cielo and others for their comments on the April editorial. — Ed.]

PAGING MR. RAPP . . .
WHO GETS AROUND

Eatons Park, Colo.
Editor, QST:
Reference is made, to "A New Approach to Antenna Design," by Larson E. Rapp, April, 1949, QST.
I think that a little explanation regarding his findings on standing-wave ratio should be made. The "indefinite impedance" to which he refers actually approaches zero as the antenna is tuned through permeability. This can easily be proven mathematically, thus substantiating his acquired results.

Since
\[
\frac{BC}{AD} \times \frac{1}{73} = \frac{Apr}{1049} \times 1 \\
\text{for } 73 \text{ ohms}
\]
and
\[
\frac{BC}{AD} \times \frac{1}{300} = \frac{Apr}{1949} \times 1 \\
\text{for } 300 \text{ ohms},
\]
where Apr is the prospective rate to the antenna, it is readily seen that the mere substitution of a 300-ohm line for a 73-ohm coaxial would not affect the standing-wave ratio.

— F. K. Mateika, W4ADD

Floundering-on-the-Hudson, N. Y.
Editor, QST:
I must call to the attention of Mr. Rapp some oversights which nullify his constructive efforts. In the first place,
Amateurs—the new Alliance Tenna-Rotor will rotate most antennas from 50 m.c. upwards.

Tenna-Rotor is a “beaming” device to give you positive control of rotation—select the exact spot for “peaked” reception. Operates in any weather—is quick and easy to install—consists of a fully enclosed, electrically driven rotor, connected to plastic control box which plugs into any 110 volt, 60-cycle house circuit. A simple two-way selector switch rotates your antenna clockwise or counter-clockwise through 365° and stops it at any desired point on the compass! Rotor unit resists corrosion. 

Ask your dealer for Tenna-Rotor!

Another Walter Ashe SURPLUS Exclusive!

HARVEY WELLS ATR-3 Transmitter/Receiver
JUST THE THING FOR THAT 75 METER MOBILE INSTALLATION!

Regular price: $159.95
Walter Ashe's original low bargain price: $49.95
NOW—marked down to...ONLY $39.50

F.O.B. St. Louis, Mo.  

Walter Ashe Radio Co.  
1125 Pine St., St. Louis 1, Mo.

WALTER ASHE  
1125 PINE ST. • ST. LOUIS 1, MO.
he has not indicated whether the antenna was 142.2 cm.
before or after cooling. This would tend to confuse calcula-
tions. I am working on a much simpler derivation which will
show that since the resistance in a conductor is inversely
proportional to $K \sqrt{\tau}$, the ideal radiator would be all thick-
ness and no length. I shall further pursue my studies and
divulge them in a work entitled, "Life Among the Neutrinos
of West Betatron."

Scientifically yours,
Upson Downs, WOOPS
—by S. Leibholz, WBDT 

171 Kensington St., Brooklyn 29, N. Y.

Editor, QST:
I implore Mr. Rapp to submit another paper dealing with
the practical constructional features of his antenna as soon
as he thaws out.

— Joel Porte, W8YIR

47-47 39th Place, Long Island City 5, N. Y.

Editor, QST:
It is with regret that the three undersigned tried and true
members of the ARRL advise that they are seriously con-
sidering resigning from your organization.

For some time we have had a devil of a time operating
through the interference from galactic noise, and the League
does not seem to be doing anything about the situation.

The fact that this galactic noise is variable does not, in our
opinion, constitute an excuse for the negligence of your
members of the ARRL advise that they are seriously con-
sidevng resigning from your organization.

Note too, the free use of the word "free" in the above
proposal. What do we get free from your League? Free
Handbooks? Free liquor? Bell, no!

— Adrian B. Clark, Jr., W8PDH
— Murray Ater, W8UX
— Irwin Ater, W8YRP

(We deplore our inability to pass along these ideas to Mr.
Rapp who, at last account, had secluded himself at his
summer home at Eeling-on-the-Thames for further re-
search. — Ed.)
Quality Performance
TURNER MODEL 77

TRU-CARDIOID
Tru-Cardioid pickup pattern and smooth, wide range response make the Turner Model 77 a truly outstanding microphone. Built-in switch gives instant selection of 50, 200, 500 ohms or high impedance. Recommended for highest quality recording, public address and broadcast work.

MODEL 77 • Level: 62 db below 1 volt/dyne/sq. cm. Response: Substantially flat from 70 to 10,000 c.p.s. List price ......................... $77.00

Write for Complete Microphone Literature

IN CANADA: Canadian Marconi Co., Ltd., Montreal, P. Q., and branches
EXPORT: Ad. Auriema, 89 Broad Street, New York 4, New York

THE TURNER COMPANY
917 17th Street, N. E. Cedar Rapids, Iowa

Microphones by TURNER

on the receiver by the scratches you hear as the crystal is being ground. You can then follow the scratching noise along the dial as you grind. When nearing the frequency you desire, the regular methods of crystal checking must be used, but up to this point the scratches will tell you what you want to know. It saves the time usually taken to wash and dry the crystal, replace it in a holder, and fire up the oscillator each time you want a rough check to show just how far you still have to go.

— Elmer A. Gunther, W9ACC

SOLDERING-IRON CLEANER

Shown in Fig. 3 is a handy tip cleaner for your soldering iron. It is made from an empty solder spool, forming two "cups" by sawing it in half through the barrel of the spool. The cups are then filled with steel wool, and are fastened to the work bench by two screws that pass through the large flange. Just a poke and a twist of the iron into one of the cups will insure a clean, bright iron and greatly simplify the soldering job. In my own shop I found the vertical back of the bench the most useful spot for mounting these gadgets. — Leon Baldwin, VE2TM

A SIMPLIFIED ELECTRONIC KEYER

The idea at this station was to make a keyer as simple and compact as possible and still retain the qualities that make the electronic key a desirable "gadget." The result is shown in Fig. 4. No attempt was made to devise anything radically new but rather to redesign existing circuits for the sake of simplicity. A most necessary feature was that the keyer must be "self-operating" and the key lever was to act only as a trigger. It was found that the timing circuit, once set, needed no further adjustment over the entire speed range, so fixed resistance was used rather than a larger variable control to set the timing circuit. Not only is less space necessary but there is no chance of the control being bumped out of adjustment.

Tests proved that with a little patience in the initial adjustment of the relay arm and contacts plus the proper resistance and capacity in the timing and bias circuit, the intraletter spacing of one unit length can be achieved. This made it

(Continued on page 124)
(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.

(2) No stranger character will be accepted, nor any typographical arrangement, such as all or part capitals letters be used which would tend to make one advertise.

(3) The Ham-Ad rate is 30¢ per word, except as noted in the table below. No commission will be allowed.

(4) Remittance in full must accompany copy. No cash allowed.

(5) A special rate of 7¢ per word will apply to advertising with 50 or more words, subject to the approval of the editor. This approval will be granted only when the advertising is of interest to the radio amateur.

(6) A specimen rate of 30¢ will be furnished to any individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League takes the 7¢ rate. An attempt to deal in apparatus in quantity for profit, even if individual, is commercial and all advertising by him takes the 30¢ rate. Provision for N HFM. Best offer over $250.00. All inquiries answered. Jack Cramer, 13222 High Point, N. C.

(7) Because error is more easily avoided, it is requested that signatures and address be printed plainly.

(8) No advertiser may use more than 100 words in any one insertion. No more than 1 insertion per issue.

Please note the 7¢ rate on ham ads is available to ARRL members only.


ARN-7, AN/ARC-1, AN/ARC-3, BC-188-B, L-122, MN-26. Test acts with 5- or 10-watt Dynamotors, control boxes, transmitters, receivers, parts, etc. Different conditions and be press, first letter. Hi-M Electronics, Box 105, New Haven, Conn. X54907.

PERSONAL BOOK ENTRIES. Send letters or name and address. Samples with prices. Miss Amanda Martin, Box 1123, Rochester, N. Y.


SUBSCRIPTIONS, Radio publications a specialty. Earl Mead, Maywood, Ill. 

JON’S QSL’s. "The finest!" Samples. 2106 South Sixteenth Avenue, Maywood, Illinois. X54909.

CRYSTALS: Precise low drift units. Type 100A in 40, 40C, 40 and 20 meter bands. Other types. QSL Quality cards priced right. Samples. Ferris, W9UTL, 1768 Mornua, Calif. X54910.

FOR Sale: HRO, jr. receiver, $75.00, with 40–20–10 coils and power supply. One power supply is 600 volts, $20.00 and one power supply 400 volts, $25.00. All inquiries answered. Jack Cramer, 13222 High Point, N. C.

FOR Sale: HRF 152A, $50.00. Panadapter, $30.00; Abbott TR4 transceiver, $25.00. All inquiries answered. Jack Cramer, 13222 High Point, N. C.

FOR Sale: BC-610B, 25SX recvr and RME 142A converter, perfect condition, for $75.00. Send your orders to Monarch Electric Co., 411 Wood Street, Pittsburgh 2, Penna.

WANTED: for sale or sale by trade with speaker, complete beam rotor with indicator or 20 meter beam. Write WS5IY, Monroe, Louisiana. X54911.

FOR Sale: HFO, jr. receiver, $75.00, with 40–20–10 coils and power supply. One power supply is 600 volts, $20.00 and one power supply 400 volts, $25.00. All inquiries answered. Jack Cramer, 13222 High Point, N. C.


SOLD: VHF 152A, $50.00. Panadapter, $30.00; Abbott TR4 transceiver, $25.00. All inquiries answered. Jack Cramer, 13222 High Point, N. C.

FOR Sale: BC-610B, 25SX recvr and RME 142A converter, perfect condition, for $75.00. Send your orders to Monarch Electric Co., 411 Wood Street, Pittsburgh 2, Penna.

WANTED: for sale or sale by trade with speaker, complete beam rotor with indicator or 20 meter beam. Write WS5IY, Monroe, Louisiana. X54911.

FOR Sale: BC-610, 25SX recvr and RME 142A converter, perfect condition, for $75.00. Send your orders to Monarch Electric Co., 411 Wood Street, Pittsburgh 2, Penna.

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FOR Sale: BC-610B, 25SX recvr and RME 142A converter, perfect condition, for $75.00. Send your orders to Monarch Electric Co., 411 Wood Street, Pittsburgh 2, Penna.
unnecessary to provide a tube and relay for this. It was decided that the one tube necessary to control the keying relay should be a dual-purpose tube so that the power necessary for the circuit would also be supplied at a minimum of space. A 117N7 answered the purpose nicely and did away with transformer or resistor worries so far as the filament was concerned.

**PATRAN Adoption wanted, type RBU preferably. Longley, W2ANB, Slingerlands, N. Y.**

FOR Sale: RC4601 modulation transformer, $20.00; R035, $5.00 pair, W096, 1000 volt regulator transformer input and 50 watt output, $10.00, WB9DS, Buc, 1224 Orchard Drive, Ames, Iowa.

FOR Sale: New: JSTG, "scope pwr supply kit, 3AP1 tube, four 1200 Mc cavity osc. assemblies for 2C40 and 2C44 tubes, type 17177 parabolic antenna, needed, new: UTC-S-22, 219 modulation transformers, H & W coils: 10BV, 40BV1, BVL base. Make an offer for any or all of these pieces. WTG, Knipe, R.R. 3, Nampa, Idaho.

**ELECTION One revision complete, Elements Five and Six newly released questions only, with answers for radio-telegraph exams.**

**SLEVERGLEN manual AN/ART-13 Autotune transmitters removed from unused aircraft. Complete with dynamotor, tube, plug, control box, dynamic mike, manual. $195.00, Fargo Engineere Service, 385 7th Avenue, So. Fargo, N. Dakota.**


COMPLETE Navy TCS Collins 32V-1 for sale. No time to operate, $400.00. Complete with mods. (12) PEP-103 dynamotor, Vibropack for above receiver, ideal for 10-meter amateur transceiver. W8DEO, Holland, 109 Liberty St., N. Y.

FOR Sale: SX-24 Hallcrafters receiver, $55.00, S22 receiver unloaded, $10.00. Workshop, 10-meter beam, $15.00. IS-B converted $775.00. WB9TS, 205 E. State, Rockford, Ill.

MEISSNER signal shifters in kit form at $49.75 are regular stock items at your local Redfield Engineer radio store.

**COMPLETE Navy TCS Collins 180-3 160-80-40 meter station for sale, including transmitter, receiver, instruction book, remote cables.**

**FOR Sale: HRO-7, power box, speaker, coils, original crate, 245.00.**

**FOR Sale: SX-25, Box 286, Haase, Fergus Falls, Minn.**

**FOR Sale: 400-watt fore/cw transmitter P.P. 812's, modulators & 51-050 watt. Complete in good condition. With Miller exciter unit, 30-1, 50-4 high panel, rack-mounted. Practically new, $300.00, WSKWA, H. Bartlett, 2605 Broadway, Beaumont, Texas.**

**FOR Sale: 655.00; Scott midget SCR F superhet, tunes 50-550 Mc, 1200-3000 kHz, five bands, RF stage, built-in AC power supply, Trade for BC221 or LM freq. meter with original calibration or SCR-522 complete as above. Hand-built HC-10 transmitter receiver sets are not for sale. F. R. Madan, W2CUD, Irvington, New York.**

**FOR Sale: BC-348-P added stage audio, noise-limiter, S-meter. Separate power supply, $315.00, plus shipping. W8I, O'-main St., Lima, O.**

**FOR Sale: Supreme AF100 transmitter, $375.00, Hallicrafters S-29 Sky Transmitter, $40.00, Scott SE-216 receiver, 80 mc band, converted for BC, $125.00. A. Adams, W5OKO, P.O. Box 1729, Middletown, Mass.**


---

**Fig. 4 — Circuit diagram of a simplified electronic key.**

- $c_v$: -0.04-µfd. 600-volt paper.
- $c_2$: 0.1-µfd. 600-volt paper.
- $r_2$: 0.05-µfd. 600-volt paper.
- $r_1$: 500 ohms, 1/4 watt.
- $r_3$: 1-megohm potentiometer.
- $r_4$: 10,000 ohms, 1/2 watt.
- $r_5$: 27 megohm, 1/4 watt.
- $r_6$: 47 megohm, 1/2 watt.
- $r_7$: 22 megohms, 1/2 watt.
- $r_8$: 2200 ohms, 1/4 watt.
- $r_9$: 7200 ohms, 1/4 watt.
- $s_t$: Sensitive d.p.d.t. relay.
- $s_{p.s.t.}$: S.p.s.t. toggle switch.

Any good relay with the coil resistance suitable for vacuum-tube operation will suffice. The relay used here is a conventional telephone-type relay purchased through a QST ad for 49 cents. It has a coil resistance of 12,500 ohms and is equipped with d.p.d.t. wiping contacts.

The speed control used gives a variable range from 12 to 40 w.p.m. Use of a higher-resistance control will allow slower speeds.

It will be noticed that when the "rig" is being keyed the plate-supply voltage is being applied to an "open" contact on the relay. The voltage may be used to operate an audio oscillator used as a monitor and will key the oscillator exactly as the transmitter is keyed.
For Sale or trade; one Zettel "Trusty Osc" portable receiver (150 watts output, 300 watts maximum); complete with "QST" instructions, BC-486; or $65.00 cash. Also one Sonor VFX-890 NFM exciter in excellent condition, complete with "QST" instructions and T-125 tubes and many transformers, chokes and miscellaneous equipment. Will sell, trade or buy. Albert K. Hayes, Jr., c/o ARRL Hq, West Hartford 7, Conn.

AMPLIFIER ACA-100AD by Amplifier Corp. of America. Like new, complete, no phone inputs. Guaranteed. L. Atwood, Box 1155, Nogales, Ariz.

SELL; 600 watt phone transmitter made of standard parts, RME-69, KI32, HM2s, VT155s, Treble and Bass, 900 tubes, 400 meters, and T-125 tubes and many transformers, chokes and miscellaneous equipment. Will sell, trade or buy. Albert K. Hayes, Jr., c/o ARRL Hq, West Hartford 7, Conn.


SELL; Resonator Co. µretuned J-element 10-meter wideband transmitters, HAMMARLUND, 1-l.ME, MILLEN, SONAR, MEISSNER, etc. Speech amplifier $25.00. Triplett 426 type O-1 M.A., $5.00. SONAR ST., Richmond, Va.

FOR SALE: One new RCA 155-C J-in. oscilloscope. $85.00; one voltmeter, $69.00; RME45, $99.00; NC57, $69.00; NC18, $199.00; TEMCO VHF-152A, HF-10-20, DB22A. Bargains. Very lightly used. Mounted $.15000; Two ART 129's, make offer. Receivers NC240-D. Earthquake and AC powereri broadband converter. Super KW power amplifier, 250 watts. like new. $150.00. James Geras, W2MVR, 7805 N. Damen Ave., Chicago, 25, Ill.

FOR SALE: Four new LIMAC 450TH tubes, best offer or will trade for LIMAC 540TH, 450TH and 125 tubes and many transformers, chokes and miscellaneous equipment. Will sell, trade or buy. Original owner. W8CCJ, 26889 Lyndon, Detroit 23, Mich.

ENTIRE: Morrow 100TH new; one 160TH new; one 20 meters new. Over $200.00. Write or phone for details. Bill Whiting, 1417 North Orchard St., Eau Claire, Wis.

FOR SALE: NEW: Collins J29B rebuilt final TZ:40's, Milwaukee, Wis.; Weil Co. 152A, $299.00; new 150 watt phone transmitter $199.00; 60 watt phone transmitter $99.00; Gigawatt, tetrode, for 600 watt output, $25.00; TR-4, $10.95; HT-9, $295.00; MB-0111 $45.00; silver 701, 801, 802, $90.00. SELL HALLCRAFTERS BC-610E, 500 watts phone, 750 watts c.w. all tubes; 450 watts exciter. 10-20 meter exciter, 30-60 meter exciter. $350.00. Lucey exciter, c.k., e.o. operation. $75.00. Will accept HT-9 trade, W2B1G, 715 Pacifie Ave., Atlantic City, N.J.

FOR SALE: One RCA 155-C J-in. oscilloscope. $85.00; one voltmeter, $69.00; RME45, $99.00; NC57, $69.00; NC18, $199.00; TEMCO VHF-152A, HF-10-20, DB22A. Bargains. Very lightly used. Mounted $.15000; Two ART 129's, make offer. Receivers NC240-D. Earthquake and AC powereri broadband converter. Super KW power amplifier, 250 watts. like new. $150.00. James Geras, W2MVR, 7805 N. Damen Ave., Chicago, 25, Ill.

FOR SALE: Three new National 300 W. modulator with multi-match Q5'er, $195; RBM complete, $150.00. LM-7 Taylor 4-125-A final, etc., used 2 hours (not surplus). Make offers. W3OXI, D. Wilkes, 1218 S. 60th St., Beautiful 900-watter AM-CW signal shifter. 813-304TL FOR Sale: One new RCA 155-C J-in. oscilloscope. $85.00; one voltmeter, $69.00; RME45, $99.00; NC57, $69.00; NC18, $199.00; TEMCO VHF-152A, HF-10-20, DB22A. Bargains. Very lightly used. Mounted $.15000; Two ART 129's, make offer. Receivers NC240-D. Earthquake and AC powereri broadband converter. Super KW power amplifier, 250 watts. like new. $150.00. James Geras, W2MVR, 7805 N. Damen Ave., Chicago, 25, Ill.

FOR SALE: One new RCA 155-C J-in. oscilloscope. $85.00; one voltmeter, $69.00; RME45, $99.00; NC57, $69.00; NC18, $199.00; TEMCO VHF-152A, HF-10-20, DB22A. Bargains. Very lightly used. Mounted $.15000; Two ART 129's, make offer. Receivers NC240-D. Earthquake and AC powereri broadband converter. Super KW power amplifier, 250 watts. like new. $150.00. James Geras, W2MVR, 7805 N. Damen Ave., Chicago, 25, Ill.
The No. 90651
GRID DIP METER

The No. 90651 MILLEN GRID DIP METER is compact and completely self contained. The AC power supply is of the "transformer" type. The drum dial has seven calibrated uniform length scales from 1.5 MC to 270 MC with generous overlaps plus an arbitrary scale for use with special application inductors. Internal terminal strip permits battery operation for antenna measurement.
NOW EVERY HAM CAN
OWN A BEAM

STURDY • LIGHTWEIGHT
ALL ALUMINUM • FULLY
ADJUSTABLE ELEMENTS
AND SPACING • 300 OHM
FEED LINE RECOMMENDED
• WILL MATCH ANY FEED
LINE FROM 50 TO 600 OHMS

Hy-Lite—ever mindful of the high cost of materials and labor—has again put their designers to
work to give the ham best for the least; this fine, sturdy, all-aluminum, all-grounded 3 element beam
—the Sky-Lite. The Sky-Lite is the result of much experimentation and study. It was subjected
to the rigors of last winter’s storms and winds and has performed handsomely. It is now ready for
you—the ham. We know it will “stand-up” and serve you faithfully, both physically and electronically.
Combining all the many fine features of the “all-grounded” type array, the Sky-Lite is built with
the utmost simplicity and is easily adjusted. The Sky-Lite weighs under 11 pounds, and is made of
dural aluminum throughout. Mast included. Enjoy many hours of DX.

Remember HY-LITE for the finest in antennas

WRITE FOR CATALOG Q-6

HY-LITE Antennae Inc.
Makers of Fine Antennas for AMATEUR • FM • TELEVISION
528 TIFFANY ST., BRONX 59, N.Y.
Make Your Hobby Into a Good Paying Job

Do you know over 50% of Broadcast Station Engineers started as hams? You can become a Broadcast Engineer easily if you hold an FCC 1st class Commercial operator’s license. Many other new jobs now open to FCC Commercial license holders. I can train you to pass your FCC Commercial License Exams in a few short weeks. My time-proven plan can help put you, too, on the road to success. I’ll send you the entire story free of charge. Mail coupon for full information today.

Edw. H. Guilford, Vice-President

Add Technical Training to Your Ham Experience and

Get Your FCC Commercial Radio Operator License in a Few Short Weeks

It’s easy if you use CIRE Simplified Training and Coaching At Home in Spare Time

Thousands of new jobs are opening up — FM, Television, Mobile Communication Systems. These include a few of the radio fields which require licensed radio technicians and operators. Get your license without delay. Let Cleveland Institute prepare you to pass FCC License examinations, and hold the jobs which a license entitles you to. With CIRE streamlined, post-war methods of coaching and training, your FCC ticket is always recognized in all radio fields as proof of your technical ability.

Look what Broadcast Engineers earn

(Average Pay Reported by FCC Nationwide Survey)

<table>
<thead>
<tr>
<th>Position</th>
<th>Big Stations</th>
<th>Little Stations</th>
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</thead>
<tbody>
<tr>
<td>Transmitter Engineer</td>
<td>$4800</td>
<td>$3000</td>
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<tr>
<td>Studio Engineer</td>
<td>5000</td>
<td>3650</td>
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<tr>
<td>Chief Engineer</td>
<td>7700</td>
<td>4800</td>
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Cleveland Institute of Radio Electronics
Desk OT-4 4900 Euclid Building, Cleveland 3, Ohio

I want to know how I can get my FCC Commercial ticket in a few short weeks by training at home in spare time. Send me your FREE booklet “Money Making FCC License Information,” as well as a sample FCC-type exam and FREE booklet, “How to Pass FCC License Examinations” (does not cover exams for Amateur License.)

Name: ____________________________
Address: __________________________
City: __________________ Zone: ______ State: ______
I am a Veteran: [ ]

NO OBLIGATION — NO SALESMEN

Get All 3 FREE

APPROVED FOR VETERAN TRAINING
UNDER "G.I. BILL OF RIGHTS"
In service... in re-sale value

Why do National receivers still establish DX records after 10 or 15 years of service? Why — when you’re ready to buy a new National — does your old one bring a higher re-sale price? Because National receivers are National-built (not just assembled), using National components specifically designed to out-perform and out-last commercially available substitutes. This tuning condenser — from the NC-183 — is a typical example.

NC-183 FEATURES


$268

less speaker

(slightly higher west of the Rockies)
In plate-modulated finals it's **safety factor** that counts ... and RCA tubes have it

A **FINAL AMPLIFIER TUBE** in plate-modulated service is subjected to plate voltage peaks approximately *four times* the dc plate supply voltage. Plate voltage and plate current peaks are *double* those encountered in unmodulated service, and input power peaks *four times* as high. No wonder, then, that in plate-modulated finals it's **safety factor** that counts.

RCA power tubes have the extra safety factor required for the most rigorous service ... ample reserve of cathode emission to satisfy modulation peaks ... husky grid structures that permit ample drive without causing grid emission ... high-voltage insulation.

High safety factor is one of the reasons why experienced phone men ... and cw men, too ... use RCA power tubes where the going is tough. To get all the tube power, performance, and life you pay for—buy genuine RCA tubes in the familiar red-black-and-white cartons from your local RCA tube supplier.

---

**RADIO CORPORATION of AMERICA**

**ELECTRON TUBES**

HARRISON, N.J.