QST — devoted entirely to amateur radio

In this issue —
A New Series on Modern Television
Improved Diversity Reception
It is customary to think of a hundred watts as being rather high power at ultra-high frequencies, and a full kilowatt was not dreamed of a few years ago.

The special 201FU Transmitter illustrated is an engineering project recently completed for Farnsworth Television Incorporated of Penna. It is of real interest, not so much as a curiosity, but as an example of how a new development can be taken out of the “hay-wire,” laboratory stage and be made neat, business-like and commercially usable.

The 201FU design is adapted to frequencies between 35mc. and 70mc. This particular transmitter delivers an output of 1000 watts fully modulated at 66 mc. The water-cooled tubes in the output stage are mounted in water jackets which themselves form the output transmission line tank circuit. Parallel and concentric lines are used elsewhere as tank circuits, impedance transformers and as by-passing elements.

An interesting fact is that with these components properly proportioned the entire equipment is as stable, neutralizes as completely, and functions as efficiently as if it were a conventional transmitter on much lower frequencies.

The 201FU is advertised, not as a piece of apparatus which you may want to buy, because there are few applications at present for such sets, but as an illustration of the ability of Collins Radio Company to handle difficult engineering commissions.
Here's Why We Endorse the New 1938 SUPER SKYRIDER

First—We've tried it out—tested it on the air, under every condition—on every band—we've verified the Hallicrafters claims before we offered it to you.

Second—From our experience, we know that the Hallicrafters stand behind every receiver they build, that each and every one is thoroughly tested and inspected before shipment.

Third—Because every receiver we sell undergoes a second inspection in our own laboratory—to make sure that your receiver is in first class operating condition before you get it.

That's why we can unconditionally endorse the New 1938 Super Skyrider, why we can guarantee absolute satisfaction, and why you'll find Radio Shack offers a real service to its customers. Come in to see the New Super Skyrider, try it, compare it! We can arrange remarkably liberal time payment terms that make it easy for you to own a New Super Skyrider.

MODEL S16
1938
Super Skyrider
$99.00

MODEL SX16
Same as above but with crystal
$111.00

MATCHED SPEAKER
(P M Dynamic)
$12.00

All receivers complete with tubes, and all sold on easy time payments. Orders shipped anywhere in the United States.

THE RADIO SHACK
46 Brattle Street
BOSTON MASS.

New England's Oldest Amateur Supply House

Say You Saw It in QST — It Identifies You and Helps QST
YOU CAN BUY with DOUBLE ASSURANCE from

First with assurance before you buy that you will be satisfied. You need send but a $5.00 deposit to Bob Henry and any receiver will be shipped to you on 10 day trial. Your $5.00 deposit will be refunded if you return the receiver.

Second with assurance that after you buy you will be kept satisfied. Bob Henry stands behind every receiver. Bob Henry guarantees to service every new set he sells for a year with no cost to you except for parts and transportation. The new receiver will be shipped promptly from the factory or from Henry Radio Shop as you prefer. It will be shipped in factory sealed carton or if you wish Bob Henry will test and OK it before shipment to you.

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<th>CHECK</th>
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Trade In Your Present Receiver on a new Hallicrafters receiver. Write me today with complete description and I will give you an approximate trade-in allowance.

Buy on Bob Henry's Liberal Time Payment Terms. Don't put off the satisfaction that comes from the operation of a new Hallicrafters receiver because you haven't the full purchase price. Get complete information on my 6% TIME PAYMENT PLAN and enjoy better reception while you are paying for it with easy monthly payments you'll hardly miss. I finance my own paper and my terms are simple and economical.

Satisfaction Guaranteed. Your dealings are all with Bob Henry, W9ARA, personally — an M.I.T. Graduate EE and an active amateur for 12 years, and, as for service, I am on the job nearly 24 hours a day, seven days a week. Write, wire or phone and you'll get my prompt, personal attention.

**HENRY RADIO SHOP**
211-215 NORTH MAIN STREET
BUTLER, MISSOURI

**the hallicrafters inc.**

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All appointments in the League’s field organization are made by the proper S.C.M., elected by members in each Section listed. Mail your S.C.M. a postal covering your radio activities for the previous 30 days, tell him or other appointments he can tell you about them, too. Mail your S.C.M. on the 16th of each month.

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<th>Section</th>
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<tr>
<td>W3JP</td>
<td>John Buck Morgan 8527 Germantown Ave.</td>
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<td>W3BAK</td>
<td>Edgar L. Hudson 247 E. Atlantic Ave.</td>
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<tr>
<td>W3BEI</td>
<td>W. W. Filson 310 E. Wautz St.</td>
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<td>W3BOO</td>
<td>Charles Smith Kendall Scee, Jr.</td>
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**CENTRAL DIVISION**

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<tr>
<td>L. J. Horton 327 Brandon Ave.</td>
<td>Glen Ellyn, Illinois</td>
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<tr>
<td>W3GRC</td>
<td>Noble E. Buffett R. 8, Box 1 Box 177</td>
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<tr>
<td>W3UHJ</td>
<td>G. W. Moosbarger R. F. D. 2 405 Broadway St.</td>
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<tr>
<td>W6QV</td>
<td>Harold O. Bird 405 E. 40th St.</td>
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<tr>
<td>W6AQ</td>
<td>E. H. Gibbs 2200 Winnebago St.</td>
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**DAKOTA DIVISION**

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<tr>
<td>Ernest Bloch Box 202</td>
<td>Thompson</td>
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<tr>
<td>W2RA</td>
<td>Andrew J. Kijewski 221 West Prospect Ave.</td>
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<tr>
<td>W2SA</td>
<td>Edwin L. Wicklund R.F.D. 3</td>
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<tr>
<td>W2HJ</td>
<td>Webster E. Soules 3549 46th Ave., So.</td>
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**SOUTHEASTERN DIVISION**

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<tr>
<td>R. H. Vivian 4415 West 12th St.</td>
<td>Little Rock, Arkansas</td>
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<tr>
<td>W3AHT</td>
<td>Eugene H. Treadaway P. O. Box 244</td>
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<tr>
<td>W3HJ</td>
<td>J. R. Weema, Jr. 6131 Pleasant St.</td>
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<tr>
<td>W3JH</td>
<td>J. B. Lowrey Smith</td>
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<tr>
<td>W2LJ</td>
<td>E. L. Bausman</td>
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<tr>
<td>W2ZV</td>
<td>Fred C. Read 511 South Holmes St.</td>
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<td>W2GMN</td>
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**MIDWEST DIVISION**

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<tr>
<td>Owen Williams 108 No. Johnson St.</td>
<td>Iowa City</td>
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<tr>
<td>W2NA</td>
<td>John C. Lewis 304 Main St.</td>
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<tr>
<td>W3GD</td>
<td>Miss Letha Allendorf 1015 W. 3rd St.</td>
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<tr>
<td>W4R4</td>
<td>Samuel E. Wallace 102 Central St.</td>
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**NEW ENGLAND DIVISION**

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<td>Frederick E. Truesdell 1868 Washington Ave.</td>
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<tr>
<td>W3FC</td>
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<tr>
<td>W1HC</td>
<td>Sam Gross</td>
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<tr>
<td>W3JH</td>
<td>William J. Barrett 2200 10th Ave.</td>
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<tr>
<td>W1HI</td>
<td>Carl B. Evans 197 Washington Ave.</td>
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<td>W1RC</td>
<td>Clayton C. Gordon</td>
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<td>W1GF</td>
<td>Alvin H. Smithton 1 Central St.</td>
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**NORTHEASTERN DIVISION**

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<td>Richard J. Fox 2010 North 26th St.</td>
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<tr>
<td>W3EO</td>
<td>Carl Eichelberger 5013 N. E. Cackamas</td>
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<tr>
<td>W3RH</td>
<td>Russell T. Richardson</td>
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<td>W2MV</td>
<td>Eugene E. Lovelace</td>
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<td>W3WV</td>
<td>Robert H. Voraw</td>
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**PACIFIC DIVISION**

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<tr>
<td>Osa Hill Box 982</td>
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<tr>
<td>W2HJ</td>
<td>Edward W. Holm 569 Claremont St.</td>
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<tr>
<td>W6KU</td>
<td>Elbert Amarantes 454 Washington St.</td>
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<tr>
<td>W6BG</td>
<td>Harold J. Burchfield 2200 10th Ave.</td>
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<td>W6SK</td>
<td>Ann D. Whittaker, Jr. 79 Elinor Ave.</td>
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<td>W6CZ</td>
<td>J. L. C. Beckett 7311-24th St.</td>
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<td>W6GR</td>
<td>George L. Reckard 2240 W. 8th St.</td>
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<td>W6LF</td>
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<td>W6MF</td>
<td>Chartes Smith 729 Safford</td>
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<td>W2JO</td>
<td>H. S. Carter</td>
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<tr>
<td>W4BE</td>
<td>Ted Ferguson 1213 College St.</td>
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<tr>
<td>W2GQ</td>
<td>Charles M. Woff, Jr.</td>
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<td>W2ED</td>
<td>C. S. Hoffmann, Jr. 715 W. 4th St.</td>
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<td>W2EA</td>
<td>Glen Glassock 2164 So. Corona St.</td>
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<td>W2CH</td>
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**SOUTHEASTERN DIVISION**

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<td>James F. Thompson 102 Narrow Lane Rd.</td>
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<td>W4DS</td>
<td>L. A. Connolly 114 S. Edison Ave.</td>
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<td>W4WJ</td>
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<td>W4MY</td>
<td>2135 N. E. Boulevard Dr.</td>
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**SOUTHWESTERN DIVISION**

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<td>Don M. Driver</td>
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<tr>
<td>W4TO</td>
<td>Victor L. Ogden 247 E. Polk St.</td>
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<tr>
<td>W2AM</td>
<td>Harry A. Ambler 731 York St.</td>
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<td>W6BBV</td>
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<td>W6CQ</td>
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<td>W8EE</td>
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<tr>
<td>W6PZ</td>
<td>Van Allen, Jr. 611 First Ave., N. W.</td>
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<td>D. R. Vaughan-Smith 1231 Barnaby St.</td>
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**MARITIME DIVISION**

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**ONTARIO DIVISION**

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**PRAIRIE DIVISION**

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<td>W4BO</td>
<td>A. J. R. Simpson 635 Garfield St.</td>
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<tr>
<td>W4DL</td>
<td>Willard Smith 9090 McManus St.</td>
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Kandid Ken-O-Talk, No. 1

THE Kenyon Transformer Co., Inc., takes pleasure in presenting to the users of its products a few of the inside details and manufacturing processes that assure them of the best product obtainable.

Let us first consider how and why our T-Line, and better grade units, are sealed and supported in their housings.

All units which develop heat of their own accord, such as plate and filament transformers, are supported on heavy cold rolled steel brackets. These brackets support the transformer rigidly so it cannot move in the case due to the cold flow characteristics of all pouring compounds. This precaution eliminates the most common causes of failure in potted transformers. When a transformer is supported in this way, it makes it impossible to shift and ground to the case, put tension on and snap leads, or settle on and short circuit leads. This detail of construction is one of the results of our thirteen years' experience in transformer manufacturing.

This feature has brought immediate acceptance from many of the leading commercial builders of complete equipment which must not fail due to the transformers shifting in cases, regardless of the position in which they are mounted or the degree of heat encountered.

All leads are brought through a false terminal board directly under the main terminal board to eliminate shorts between leads and to insure a neat wiring job.

Now the transformer and case are baked several hours in temperature controlled ovens. (This is after a thorough impregnation in varnish under alternate pressure and vacuum cycles.) This baking drives out all moisture which might otherwise turn into steam when the hot compound hits it, and subsequently condense as water inside the unit.

After the baking process is finished the case is filled one third full of compound and the transformer is set in it. Then compound is poured in until it flows over the top of the false terminal board.

The pouring compound used is a special type possessing excellent heat transfer characteristics to prevent "hot spots" in the winding. It also has chemically inert and non-hygrosopic properties. Thus the coil is completely sealed to make it impervious to moisture and adverse climatic conditions.

These manufacturing processes are a few of the many rigidly followed by the Kenyon Transformer Co., Inc., to give the user the best products for all round use.

F. P. KENYON
President
The American Radio Relay League, Inc., is a non-commercial 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 non-commercial 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; ownership of a transmitting station and knowledge of the code are not prerequisite. Correspondence should be addressed to the Secretary.

Hiram Percy Maxim, First President

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State College, Pa.

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Weston, Mass.

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West Hartford, Connecticut

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West Hartford, Connecticut

Communications Mgr.....F. EDWARD HANDY, W1BDI
West Hartford, Connecticut

General Counsel........PAUL M. SEGAL
1010 Shoreham Building, Washington, D. C.

Address all general correspondence to the administrative headquarters at West Hartford, Connecticut.
THE big news of the moment is about the ultra-high frequencies. As we write, the Federal Communications Commission has just issued its orders announcing the long-awaited service allocations of the frequencies from 30 to 300 Mc. Amateurs will remember the extensive hearings of June of last year which called into being our famous "Presentation for the Amateur Service." The intervening months have largely been filled with interdepartment government conferences designed to reconcile the conflicting demands for frequencies. The present result, two orders and a new text for Rule 229, makes radio history, for much of the future of our art is going to be written in the u.h.f.

What you fellows want to know, of course, is how amateur radio came out in the new deal. The news is all good. Our 56-60 Mc. (5-meter) band is reaffirmed as exclusively amateur. Our neighbor on the low-frequency side is to be the television service while, on the high-frequency side, it is government services. Then we have two new exclusive bands, from 112 to 118 Mc. (2½ meters) and from 224 to 230 Mc. (1¼ meters), our neighbors on both sides of both of these bands being government services. Thus in the new deal we have gained for ourselves two new bands of ultra-highs, each of 6 Mc. width, continuing our harmonic family as far up into the spectrum as allocation has been carried.

These new allocations are not yet effective. It will first be necessary for the F.C.C. to amend our Rule 374 and it hasn't got around to that yet. When it does, we shall probably also obtain a joint right to continue experimental work on all frequencies above 300 Mc. Meanwhile we may operate at will anywhere above 110 Mc.

The great hue and cry about u.h.f. of course has been on behalf of the impending arrival of television, still around several corners but getting closer. The new order assigns for this service seven main channels, not all contiguous, between 44 and 108 Mc., and twelve additional channels above 156 Mc., although at this stage there isn't much interest in the latter. The seven main channels, each of 6-Mc. width, are as follows, the figures being in megacycles: 44–50, 50–56, 66–72, 78–84, 84–90, 96–102, 102–108. The Commission's press release contains the interesting comment that "The investigations and determinations of the Commission justify the statement that there does not appear to be an immediate outlook for the recognition of television service on a commercial basis. The Commission believes that the general public is entitled to this information for its own protection. The Commission will inform the public from time to time with respect to further developments in television."

There was a time when amateur radio had plenty of reason to worry about television's effect on our 56-Mc. band. It threatened to surround and squeeze it. With eventual pressure from the public, who would resent "one tooth out" of their tuning range in the shape of our band, it threatened in the long run to engulf our band. But now the fact that it is not to have a continuous assignment, that it is broken into four ranges, that our neighbors are chiefly government services—these things dissipate the fear of the old squeeze. "Five" now sits just as pretty as possible. With one exception that we'll mention below.

We have mentioned before that u.h.f. allocation proved an exceedingly arduous task. There weren't nearly so many channels as folks had imagined, and allotments were asked by every service, present and postulated, that man's mind could conceive. The end result seems to us to be about as good a job as anybody could expect. We did not receive the full width of bands to which we aspired, but neither did any other service, and the result ought to be generally satisfying to us.

So now all God's chillun's got megacycles, and the one remaining job is to equip them with radio gear and commence going places. You hams who have not yet investigated the u.h.f. are passing by one of the most fascinating fields in this grand old game. Two new bands, fellows—deserving more ham occupancy than they now enjoy!

We intimated above that there was one cloud on our 5-meter horizon. (Neat, wot?) There is. It's out-of-band operation and how we'll get-it-in-the-neck unless. It has constantly been the history of amateur radio that, following our pioneering in new territory, commercial users come in and occupy frequencies adjoining ours, and we go through a period of grief from interference complaints until we finally learn how to keep ourselves inside our new fences. That was notably true of 7, of 14 and of 28 Mc. For the last several years it hasn't been tremendously important whether we stayed between 56 and 60 or

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not; there wasn't much of anybody else there.

Now repeating history is bringing us neighbors in that band, people who also have the right to operate there and who are entitled to do it without QRM from us. The time has been reached in the progress of the new art when we must clean up this band. Two examples will illustrate: (1) Experimental television service is under way. Columbia Broadcast System in New York has the 50-56 channel immediately below our band and they've been surveying. During the past summer, listening only briefly during daylight hours, they logged scores of amateurs between 54 and 56 Mc., pretty good W2 stations for the most part. You can imagine what it must be like on a typical winter evening. (2) Some of the government services are putting in gear to use frequencies just above our band for keying circuits, to control transmitters on lower frequencies. Won't some ham identify himself unfavorably in high quarters when he overrides the control signal and takes over the keying of a high-powered government transmitter!

In other words, boys and gals, the day is upon us when we must immediately clean house, take steps to insure that our signals stay between 56 and 60, and generally apply to that band the same scrupulous care that we necessarily devote to staying on-frequency in the lower bands. QST's technical staff is preparing practical helpful information on the subject. Let's take this to heart right now, people, and govern our 5-meter operation in such a way as to avoid complaints from our important new neighbors.

K. B. W.

Radio Amateurs in the Television Picture

Announcing a Planned Program of Technical Cooperation

By James J. Lamb*

Radio history repeats itself. The experimental activities of licensed amateurs in radiotelephony supplied the initial impetus and acceleration for sound broadcasting in the early 1920's. Now, over 15 years later, we radio amateurs have immediately before us the same opportunity to aid the progress of modern television development and perform an important public service in traditional amateur fashion. That this should come about was inevitable. Amateur radio provides the logical experimental proving ground for new developments between their laboratory stage and their attainment of widespread practical utility. In performing this service we have not only benefited ourselves as amateurs, but we have also earned recognition for experimental contributions no less important than the appreciation amateur radio has merited for emergency and other communication activities. For a time, it appeared that those concerned with the technical and economic problems of television development would do without experimental amateur aid. According to plan, television would come out of the laboratory, pass through a period of field trials conducted by a few restricted groups, and then be presented as a fully standardized and "perfected" public service—all under strictly commercial auspices. Participation of independent amateur experimenters in the intermediate stage of this program was contemplated. Of course not everyone engaged in the commercial development of television thought that this would actually work out. And neither did we. Behind this lies a story.

THE AMATEUR BACKGROUND

One responsibility of A.R.R.L. headquarters is to be on the alert for technical trends which may affect amateur radio; to judge, to the best of our ability, the possibilities of new developments as aids or hindrances to the progress of amateur radio; and on the basis of this judgment to do our best, by practical action, not only to adapt developments to our own needs but also to cooperate in their evolution so that progress may be maintained.

We have actively followed this policy with regard to television since the time of those early experiments with mechanical systems some ten years ago. For television is pretty much an old story in amateur radio. This magazine devoted considerable space to experimental television systems during 1928. In fact, there were more articles on television listed in the index for that year than articles on radiotelephony, the score being 6 for television to 4 for 'phone. General Electric, in Schenectady, and the late Dr. C. Francis Jenkins, in Washington, D. C., were the principal sponsors of transmissions on the medium high-frequency bands with pictures of 24 and 48 lines—exceedingly crude by present-day standards and even too crude to do more than demonstrate

*Technical Editor.
principles at that time. The television content of QST tapered off to three articles in 1929 (and telephony scored four). Two of these three articles were distinctly of a debunking nature—in the January issue, "Rotten Television," by The Old Man, whom we now know to have been our late president, Hiram Percy Maxim; and, in the March issue, "What Price Television," by M. B. Sleeper. These two stories pretty definitely wrote "finis" to the amateur's further expenditure of money and effort on experimental reception with mechanical systems.

But this did not mean that the prospect of experimental television was hopelessly ended for us. In one of the 1928 articles, "Radiovision," in the September issue, Thornton P. Dewhirst had pointed the way and outlined the basis of what has become the modern technique in television reception. He said:

"The use of the cathode-ray tube for the receiver is worthy of consideration since it opens up the possibility of real radiovision. In this tube, a stream of electrons may be moved in two directions at right angles to each other by means of either an electric field or a magnetic field. The window of the tube is covered with a fluorescent material and the electrons upon striking it cause it to glow. By means of proper values of current or voltage and frequency, the small spot of light can be made to cover completely the window. For radiovision work, the use of a material for coating the window that was not only fluorescent (emits light when exposed to certain rays) but also continued to glow for a short period after the ray has been removed would be of material assistance. This will help in causing the vision to persist and thus give the effect of greater illumination as far as this characteristic is concerned."

In this same article, the author also outlined general requirements for satisfactory picture reproduction which still apply—and which are not yet completely solved. Quoting his words:

"... When the elementary area used to build up our picture bears the same proportion to the whole picture that the individual particle of the (film) emulsion of the moving picture bears to the total number of particles in the exposure, and (when) some method of transmitting each of the individual parts with ease and the problem of synchronism have been completely and simply solved, radiovision will be ready for the public."

Now we must remember that in 1928 the cathode-ray tube was not the familiarly-known tool for routine amateur use that it is today. It was then a relatively rare, expensive and somewhat temperamental device restricted to the realm of the laboratory of the advanced physicist. But it soon became our conviction that television reception ultimately would employ the cathode-ray tube, and that until the c.r. tube technique was sufficiently developed, further amateur activity in experimental television would be practically futile.

We continued to keep an eye on the ball, but could not discern anything sufficiently significant to warrant further QST space until 1931. But in the middle months of that year the television pot began to boil sufficiently to give off some steam and evidence of the beginning of the cathode-ray era became visible. In the early fall of 1931 Associate Editor Ross Hull and this writer made an inspection trip to several of the representative television camps to learn first-hand just how much fire there might be under the pot. The results of this survey were reported by Hull in the article, "Television—What About It?" in the Nov., 1931, issue of QST. The sum and substance was that the cathode-ray technique promised results, that higher definition was in sight with "perhaps 240 lines to the picture," that transmission on ultra-high frequencies above 40,000 kc. was proposed—but that television still was in the laboratory stage.

THE PRESENT SITUATION

It was not until about a year ago, in the Fall of 1936, that television had reached a stage where we became convinced that our active experimental participation would not be much longer delayed. Technique in the art had reached the state where refinement rather than new basic developments had become the ruling order. Experimental field tests with fairly high-power trans-
mitters were started. Under the auspices of the Radio Manufacturers Association, a set of proposed standards was promulgated. So we started to look for a way into the modern television picture.

But several questions of utmost importance had to be answered first. Was there reasonable assurance that transmission would, in general, conform to the proposed standards and that such changes as might be made would be in detail rather than drastically sweeping? Even though there were no transmitters using these standards operating on anything like fixed daily schedules, would there be at least sufficiently frequent transmissions suitable for experimental purposes in several centers with large amateur populations? (It was our aim then, as it is our firm purpose now, to encourage the building of receivers by people solely interested in being entertained by television shows, but rather to present practical technical information to encourage experimenting amateurs to attack the problems of television in a constructive way.) Could we secure adequate technical information, with design data and constructional dope on practical television receivers of proved performance which would be suitable for amateur experimental work? Would the operators of the experimental television transmitting stations cooperate in keeping us posted on their current activities and, possibly, their future plans? Would the necessary special cathode-ray tubes and other essential components be made available? And, finally, did a sufficient number of amateurs want QST articles on television?

Throughout the past year we have worked to get the answers to these questions. And we report here and now that the answer to every one of them is a resounding, "Yes!"

Taking the last question first, a decidedly positive answer was given by A.R.R.L. members returning the questionnaire sent out with membership certificates and cards. An average of the replies for six months shows that over one-third (37%), to be exact, of the membership want articles on the theory and practice of television.

The answer to the question of design data and constructional dope on practical television receivers was given by Marshall P. Wilder, W2KJL, who is not only a real amateur but also one of the most experienced and competent workers in the cathode-ray television field that we know of. We were fortunate to have secured the promise of his cooperation nearly a year ago, when, while he was doing independent research on television tubes, we worked out a plan for just such a series of articles as he begins in this issue. He also has been instrumental in cooperating with us to have made available to amateurs essential components, especially tubes, for construction of experimental receivers.

Promises from several manufacturers assure diversified sources of essential television components, including several types of cathode-ray tubes and their associated components. An encouraging feature with respect to the c.r. tube situation is that the prices are to be considerably less than ordinary oscilloscope types of the same screen sizes—even though the construction of the television tubes is more expensive.

Conferences with executives of leading experimental television transmitting stations have brought promises of full cooperation in keeping us advised on times and types of transmission so that we can pass this information along to interested experimenters. We also have been informed that more frequent transmissions are contemplated after the first of the year. No changes in standards are contemplated, other than the variations in polarity of modulation and method of transmitting the brightness component described in W2KJL's article elsewhere in this issue—which the receiver, to be presented subsequently in QST, is designed to accommodate.

THE PROSPECT

One tangible result of all the cumulative effort that has gone into this planning is the inauguration of the series of articles on practical television reception by Marshall P. Wilder, W2KJL, in this issue. These articles will progress in logical order through the design, construction and adjustment of a cathode-ray type receiver incorporating the latest circuit developments. It will be capable of delivering a good picture. But its construction just should not be attempted by anyone less capable than the amateur who is well grounded in the fundamentals of circuit operation, who has had experience with the building and successful adjustment of fairly complicated equipment such as a multi-stage transmitter or superheterodyne receiver. He also should be familiar with the operating principles of cathode-ray tubes. In fact, he must have a cathode-ray oscilloscope available for the adjustment of the television receiver circuits before any attempt to operate the complete set is made. Experience with ultra-high-frequency apparatus and familiarity with the peculiarities of u.h.f. communication, while not so necessary, will stand him in good stead. The television receiver is not a simple thing to get going. But there are hundreds of amateurs who have the required ability and who will find it just the kind of venture to satisfy their desire for a good technical job to take on.

It must be distinctly understood that the construction of a television receiver is not to be undertaken by the non-technical "home set builder" who doesn't know a saw-tooth wave from a megacycle, no matter how alluring a kit advertisement may seem and no matter how simple a "picture diagram" may make the job look. Most of the real work (and it's head work) is in

(Continued on page 68)
Introduction to Modern Cathode-Ray Television Reception

Fundamentals of Scanning and the Make-Up of the Television Signal

By Marshall P. Wilder,* W2KJL

It is timely that we take a serious interest in modern television as a certain future activity in amateur radio. In this, the first of a series of technical articles on practical television, the general background will be presented.

The purpose of this series is not just to present purely theoretical television receiver design. On the contrary, straightforward practical data will be given, dope that can be used not only to give an understanding of the principles but also to make possible the construction and adjustment of a cathode-ray television receiver that works. But before tackling the working circuits it is necessary that a great deal concerning the make-up of the television signal and what goes on in television reception must be thoroughly understood, so that when the images (or beginnings of images) appear on the screen, it will be possible, by looking at the tube, to tell what adjustments need be made and where further effort should be expended to improve the quality. Only by a thorough understanding of the fundamentals, coupled with actual experience with a working television receiver, will it be possible for the amateur to participate usefully in the development of this new art.

Scanning

No picture or scene is properly intelligible to the human eye unless it can be perceived instantaneously as a complete whole. Unfortunately, no practical electrical communication system is capable of handling more than one element of information at any instant. The inability of electrical communication systems to transmit a picture as a whole makes it necessary to dissect the picture into a large number of small elemental areas—to transmit them one by one, and to reassemble them in their appropriate positions at the receiver, in order that the observer may view the scene as a whole. If this process of dissection and reconstruction is performed a sufficient number of times per second, the eye receives the impression of a complete picture as a result of the phenomenon of "persistence of vision." This dissection of the picture into small elemental areas is known as scanning.

Although scanning may be performed in several ways, it is usual to scan the picture in lines from left to right and to proceed line by line from top to bottom, in much the same way as one's eye scans in reading the pages of this magazine. This system, with a modification known as interlacing, has been adopted in modern practice.

Interlaced scanning requires that one line of the subject be scanned, then a line skipped, then another line scanned, and so on, until the whole scene has been covered, in alternate lines, from top to bottom. Then the scene is scanned again, getting those intervening lines that were not scanned previously. Interlaced scanning has the distinct advantage that the number of views per second presented to the eye is double the number with straight scanning; and, although the number of picture elements transmitted is no greater

* National Union Radio Corp., 57 State St., Newark, N. J.

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taking place. If, as in Fig. 1, a nozzle were set up before a screen and then moved from left to right it would draw a line of a width equal to the diameter of the stream. If we jerk this stream back to the left very many times faster than we moved it over from left to right, only a comparatively few drops of water will strike the screen during the return trip; and if we return from right to left in a slightly downward direction, the jet of wetness; and if the valve were controlled in some proper sequence, a picture might be produced.

Of course it would not be possible to make such a piece of apparatus work as a television receiver because of the inertia of its moving parts. But, in a cathode-ray tube the stream is an inertialess electron beam. Since electrons are invisible, only the effect of their impact on the screen can be seen. This impact is visible when electrons strike certain salts, notably zinc and cadmium sulphide or their silicates. A coating of one of these materials is applied to the inside of the bulb in a thin, even layer so that the beam striking any part will show up at the point where it impinges as a more or less bright spot of light.

The intensity of this light can be controlled by varying the density of the electron beam. This control action is similar to that employed in an amplifying vacuum tube, the flow of electrons from the cathode being controlled or modulated by varying the voltage on a grid in familiar fashion. After this control or modulation, the emitted electrons getting past the grid are assembled by a focusing field which bundles them into a narrow beam and urges them in a forward direction between two deflecting fields, one horizontal and the other vertical. The two fields may be either electro-static or electro-magnetic.

The strength of these crossed fields is varied in the proper sequence by local oscillators controlled by synchronizing impulses derived from the received television signal. Thus the modulated beam is made to move across the fluorescent screen horizontally in practically straight lines, and vertically from line to line, in a manner similar to that outlined in the water analogy, so that a picture of varying light intensity can be obtained.

Before considering further the actual details of how a television picture is produced in a modern cathode-ray receiver, it is well to summarize the six essential requirements which must be satisfied.

First, a beam of electrons of very small cross-section must be produced and made to strike a screen of special material which will reveal the beam's incidence at the point of contact as a spot of light.
Second, the beam must be made to scan a given area in a proper sequence.

Third, the density of the beam must be capable of variation by the received impulses from the television transmitter.

Fourth, the speed of travel of the beam on the receiving tube screen must be the same as that of the scanning beam at the transmitter. This is accomplished by setting the oscillator which generates the deflecting field to run at approximately the correct rate and then applying correcting impulses at the completion of each line and at the completion of each half-frame or field. These correcting impulses are extracted from the signal received from the transmitter and are known as synchronizing impulses.

Fifth, blanking impulses, also from the transmitter, must be extracted from the received signal and applied to the beam during the retrace of each line and during the fly-back to the top of each half-frame, so the beam will not have sufficient intensity to show up as light during the return trace.

Sixth, and finally, the average brightness of the picture must be transcribed from the incoming signal. Since the average brightness is of a relatively fixed nature, only varying occasionally as when the scene shifts from a dimly lighted room into a bright one, the average brightness variation must be considered as of very low frequency—or practically d.c.

There is now nearly general agreement on the technicalities for meeting these six requirements in practice—except on the method of transmitting the average brightness level and on the polarity of modulation which should be employed. With regard to transmission of information giving the average brightness or background, two methods are being used experimentally at the present time. One method employs modulation of the transmitted r.f. signal by d.c. which varies in accordance with the average brightness of the scene televised. The other method utilizes the variation in the amplitude of what is known as the pedestal component of the complete signal to control the average brightness of the received picture, as will be described later. The second unsettled point is whether the polarity of modulation should be negative or positive. With modulation of negative polarity, maximum amplitude of the modulated wave corresponds to black and minimum amplitude to white; while with positive modulation, maximum amplitude of the wave corresponds to white and minimum amplitude to black. The differences between television waves of positive and negative polarity, with and without d.c. modulation, are illustrated in Figs. 2, 3, 4 and 5, which will be discussed later.

While these two technicalities affect the design of the television receiver, an experimental receiver employing electronic scanning can be readily adapted to receive any one of the types of transmission now in use.

The current American system employs 441 lines. These 441 lines are broken up into two half-frames of 220½ lines each. Approximately 20½ lines of each half-frame are employed for transmitting the field-frequency synchronizing impulse, as well as for blocking out the frame return trace. At the end of each line is a synchronizing impulse consisting of a pulse riding on a pedestal. The pedestal voltage is rectified and the resulting d.c. voltage determines the average brightness of the received image in accordance with that of the scene transmitted. These pedestals are used also to block the grid of the cathode ray tube to remove the return trace during the fly-back of the spot at the end of each line. To do this, the pedestal component is separated from the signal and rectified. The resulting d.c. voltage is automatically applied to bias the grid of the cathode-ray tube during each line, the video-frequency voltage being superimposed on this bias.

Meanwhile, the grid, under control of the video

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1 Reproduced by permission of the author and publishers from the article, "Standards in Television," by H. M. Lewis (Hazeltine Service Corp.), Electronics, July, 1937.
(picture element) modulation portion of the signal, determines the instantaneous brightness of the spot. In other words, the pedestal at the end of each line sets the d.c. grid bias and the video signal in between pedestals changes the intensity along each line. This is continued line by line to make up one half-frame. There are two half-frames interlaced to form one frame or picture. Thirty such completed pictures are transmitted in one second; that is, the frame or picture frequency is 30 per second, and the half-frame or field frequency is 60 per second.

In Fig. 2, a typical signal with negative modulation is represented. With the signal of Fig. 2-W a black bar on a white background would appear. The second picture, Fig. 2-G, corresponds to a white bar and a black vertical bar on a gray background, and Fig. 2-B to a white vertical bar on a black background. Figs. 3, 4 and 5 are for the same patterns with other types of modulation, which will be discussed later.

ANALYZING A TELEVISION SIGNAL

Fig. 6 represents a part of two half-frames with their line- and frame-synchronizing pulses, for a television signal wave with negative modulation. The pulses appear on the leading edge at the top of a pedestal. The width of the pedestal is equal to 1/10th of a line length. The pedestal voltage is used to bias the grid of the cathode-ray tube beyond cut-off during the retrace of the spot and to transmit the background brightness component, as previously explained. The drawing shows where the video signal stops and the synchronizing and blanking signal begins. Note that the video signal amplitude extends only part way up to the maximum amplitude of the complex signal. All signals in the region above this limit will automatically bias the grid of the picture receiving tube black. This region is therefore known as the "blacker-than-black" region, and in it all synchronizing impulses can be transmitted without appearing in the pattern of the received picture.

With negative polarity and no d.c. modulation, the average voltage of the video modulation is constant, but the height of the pedestal varies. As previously discussed, this changing pedestal amplitude conveys the average picture brightness. In Fig. 2-W the height of the pedestal is a maximum, and the picture background is white. In Fig. 2-G the pedestal is one-half the height it was in Fig. 2-W and, in this case, the background is gray; that is, half-way between black and white. In Fig. 2-B, where the pedestal height is zero, the background is black. Thus, we find our transmitted signal consisting of three major parts--
video signal, synchronizing pulse and pedestal.

If we return now to Fig. 6, and study the line and frame synchronizing pulses, we see the line pulse occurring in proper phase relation at the end of each line. A frame-frequency pulse occurs during a 20½-line interval every sixtieth of a second and consists of a group of serrations, from "X" to "X" on the diagram. Now it might appear simpler to transmit one long 60-cycle impulse for frame synchronization; but during such a long pulse, the line-frequency sweep generator would get out of synchronization. Therefore, it is necessary to transmit the line impulses during the frame impulse to keep the line-sweep generator constantly in step.

In the section called the frame or vertical synchronizing impulse region, extra impulses of a frequency which is a multiple of the line pulse frequency are inserted. These pulses will not disturb the line synchronization but will make the synchronizing impulses identical in phase and number in the region "Y-Y." Hence, integration of the frame impulse "Z-Z" can be accomplished in an RC circuit with less critical adjustment of the line- and frame-impulse separation circuit, allowing the low-frequency sweep generator to return the spot to the top of the screen ready to start the second half-frame without interrupting the line synchronization.

Interlacing of the lines of each frame is controlled by the phasing of the line-synchronizing impulse. These impulses are evenly spaced during the half-frame. They begin one-half line earlier on the first half-frame, as at "E" in Fig. 6. They begin a little later on the second half-frame, as at "L" in Fig. 6. Each time a half-frame of 220½ lines is drawn, the line placement will shift (up or down) a line-width on the cathode-ray tube screen. During the second half-frame, for instance, as the first impulse "F" is purposely delayed a half-line, the top line will be just one line-width lower down. This second half-frame of lines will fill in between the lines drawn during the first half-frame to complete one complete frame or picture.

The system which has been described in detail is that employing negative polarity without d.c. modulation to correspond with changes in average brightness. Although this system has been principally used for experimental transmission in this country up to the present time, it must be emphasized that there is no definite assurance that it will be the one used ultimately by the broadcasting stations. As previously mentioned, at least three other combinations are possible. That represented by the wave diagrams of Fig. 5, employing positive polarity with d.c. modulation, is preferred by a considerable number of engineers, for instance. This is the type of signal transmitted by England's television station. Both systems have certain desirable characteristics for the particular service in which they are employed.

All four systems can be received on the same experimental television receiver, provided a suitable circuit is incorporated to restore the d.c. component and provision is made for reception of signals with either positive or negative modulation. A special circuit will restore the d.c. regardless of the manner in which it is transmitted, while a simple switching arrangement can be used to change the detected signal polarity to accommodate either position or negative modulation.

It has been decided recently that a series of tests will be run by television broadcasters to determine which of these methods will be the most acceptable under actual operating conditions and will make the manufacture of television receivers the easiest. A receiver designed to be instantly adaptable to any one of the four types of signals will place the amateur in an especially effective position, since he will then be able to cooperate in the tests and furnish valuable information as to which method gives the best signal-to-noise ratio, which method causes the least difficulty in synchronization, and produces the best picture.

The receiver which will be described in subsequent issues of QST has been designed to have this desirable adaptability.

A WORD ABOUT STANDARDS

The tentative standards which are in use by the experimental transmitters on the air at the time of this writing, are as follows:

1. Frequency allocation, 42 megacycles to 90 megacycles, excepting the amateur 56- to 60-Mc. band; also an experimental band starting at 120 megacycles.

(Continued on page 68)
ABILITY to copy code accurately and exactly is the special pride of the earnest amateur, the mark of technique that sets him apart and makes him an amateur. This is the annual opportunity to have an interesting hour checking up on ourselves to note our progress above the mere license requirement. The winner or as many as submit perfect copies will receive a striking bronze medallion award from A.R.R.L. Like the previous Bees this will give hams a chance to try copying some unusual word combinations, figure groups, and simple punctuation. There may be trick words, or misspelled words and plain language groups sent in no particular sequence. It’s an excellent opportunity to check up on our personal operating ability. Are we as good at the basic business of knowing our code stuff as we think we are? A feature of genuine interest to every participant: The League will return all papers (except winners) with a copy of the transmitted texts to each participant with a confidential rating. This report on standings will be made as soon as feasible after the closing date for mailing of copies. Transmissions will all be 60 words in length. The sending will be by tape at about 25 words per minute. It will be a test to copy what you hear.

The following stations, all using “automatic” equipment, have been selected in the different time zones. Care will be taken to make all messages equally difficult by different words, word order, errors, etc. It will be worse than useless to try to correct or compare messages. However we urge everybody that knows the code at all to take part. Send in whatever you get, however little that may be. Check on your own proficiency and have some good fun at the same time.

In addition to the confidential rating you will receive you have a chance to win, and all participants will be mentioned in the report in QST. The schedule of transmissions for Friday night, December 10th is shown below:

The rules for taking part in the copying bee:

1. Any amateur operator, not having access to the tape or transmission copies, and copying wholly by ear, is eligible.
2. Mark one copy as your “best”; only this one copy shall count, but report all the above stations that you can hear to us. Keep copies other than your “best” to check yourself when we mail out the official texts to you.
3. Print your name, call signal, and address plainly on each entry.
4. Send in original copies. Re-copying messages invariably introduces errors and detracts from credits.
5. Copies must be mailed bearing a postmark in the year 1937 to be counted. Mail at once or within five days to make sure.
6. Every contestant must certify he has not been employed as a commercial or government radio, Morse or cable operator in the last year. This is strictly an amateur contest. The following exceptions, however, shall be eligible: (a) Holders of commercial licenses without experience under same. (b) Such holders ('phone licensees or technical attendants) whose duties have not been telegraph operating within one year.

The transmitting stations will each send V’s and identify themselves for ten minutes before scheduled times above. All amateurs are requested to note the frequencies listed and try to cooperate by keeping silence on these channels during copying bee transmissions, which start at the time indicated. Here’s luck in the copying bee, and remember, write down just what you hear. If the transmission or what you can get is fragmentary, send it in just the same, so you receive credit, and we can send you the official texts for your examination.

—F. E. H.

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<tr>
<th>Station</th>
<th>Frequency</th>
<th>E.S.T.</th>
<th>C.S.T.</th>
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<th>P.S.T.</th>
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<tr>
<td>W1AW (W, Hartford)</td>
<td>3825/7150 kcs.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
<td>7:15 P.M.</td>
<td>6:15 P.M.</td>
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<td>W2AYN (New York)</td>
<td>7200 kcs.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
<td>7:15 P.M.</td>
<td>6:15 P.M.</td>
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<td>W9UZ (Chicago)</td>
<td>7000 kcs.</td>
<td>10:15 P.M.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
<td>7:15 P.M.</td>
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<tr>
<td>W9BAZ (Louisville)</td>
<td>3810 kcs.</td>
<td>10:15 P.M.</td>
<td>9:15 P.M.</td>
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<td>7:15 P.M.</td>
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<tr>
<td>W6AM (Long Beach)</td>
<td>7250 kcs.</td>
<td>11:15 P.M.</td>
<td>10:15 P.M.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
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An Improved Dual-Diversity Receiver for High-Quality 'Phone Reception

By J. L. A. McLaughlin* and Karl W. Miles*

The original single-control dual-diversity receiver, employing the automatic synchronizing circuit devised by J. J. Lamb and built by the first of the authors of the present article, has been in operation for nearly two years at XELG, the station of Dr. James M. B. Hard, at Cuernavaca, Morelos, Mexico, and has satisfactorily completed over 5000 hours of trouble-free service. It has conclusively demonstrated the practicability and the desirability of diversity reception for amateur and experimental communications work. Even with two antennas spaced but 50 feet apart, good diversity action has been obtained, especially on the 14-Mc. band. Dr. Hard reports that many times when fading conditions and heterodyne interference become so bad as to make his other single receivers useless, the dual-diversity still brings in an intelligible signal. From the experience gained in the building of Dr. Hard's receiver, plus additional work through the past spring and summer, the new design described in this article has been completed.

Improvements have been mainly in simplifying the mechanical design and improving the i.f. amplifier, with the consequence that the new model is more compact, with an improved layout. The infinite-rejection i.f. system has been incorporated, giving improved selectivity characteristics with means for the elimination of adjacent-channel interference. A simpler and more rapid coil-switching system is employed. The frequency range is from 36 megacycles to 545 kilocycles, divided into five bands. (We have included the standard broadcast band, not because any large improvement in broadcast reception is obtained by using diversity, but because we like to listen to the programs once in a while.) Electro-mechanical band spread is used so that the band-spread dial can be calibrated for each of the four amateur high-frequency bands (28, 14, 7 and 3.5 Mc.). A pointer above each dial indicates the proper scale for each setting of the band-change switch.

PRINCIPLES OF DIVERSITY RECEPTION

Before describing this new receiver in more detail, it might be well to digress for a moment and review briefly the principles of diversity reception and the benefits as compared to the best single-receiver methods. The principal improvement is, of course, in the reduction of fading...

The coil assemblies for the h.f. stages are separately shielded.

effects. Fading is the result of several waves from the same transmitter arriving at the receiver over different paths. The signal delivered at the output of the receiver is the resultant of these several waves, which arrive over paths differing in direction and length, and which are of varying amplitude and phase. The most vicious fading at high frequencies is experienced when two or more of these waves are of approximately equal amplitude. The phase angle between the waves arriving over varying paths is continuously rotating and when the amplitude is the same in two waves and the signs are opposite, the resultant is zero or "no signal." This is what may take place when a good signal suddenly takes a dive below the noise level. For a pretty good picture of just what diversity offers, let us refer to the original article in May 1936 QST, particularly the following:

"The lead to a method of solution (of fading) lies in the happy fact that a signal does not fade identically in two antenna locations at the same instant, even when the two antennas are spaced only a relatively small distance apart, or when they are near to each other and in different planes of polarization. In other words, there is considerable diversification in the fading of a radio signal, not only as regards space but also as regards polarization. Diversity reception is the method which takes advantage of this vulnerable spot in fading's armor.

"The basic idea is to pick up the signal waves on two or more different antenna systems and then combine the signals in a common receiver circuit. While it might seem possible to accomplish the result by coupling the several antennas to a single receiver in such fashion that the signal amplitudes are added at r.f., this simple method is impracticable. An input coupling arrangement for several antennas might be phased to give addition of the r.f. amplitudes under constant signal phase conditions; but constant r.f. phase

conditions just do not exist. Variation in phase conditions is inevitable in the phenomenon of fading. The combining operation must take place in some part of the receiver circuit where unpredictable radio-frequency phase differences are no longer of consequence. It is only in the output of the final detector, where we have the rectified envelope of the signal to work with, that the combining operation becomes practicable."

The latest commercial space-diversity receiving system uses three antennas spaced about 1000 feet apart and generally located at the corners of either a right-angle or an isosceles triangle. Three separate and individually tuned receivers are used, each connected to one of the three antennas. Detector outputs of the three receivers are tied together across a common load. Combining the signals after rectification results in audio output which will be the average of the several signals. By virtue of common a.v.c., the receiver with greater signal input takes control of the gain of all three receivers and supplies practically the total output. The gain of the other receivers, at that instant of time, is so reduced that the noise they would otherwise contribute is made negligible. This gives a signal-to-noise ratio approaching that of the particular receiver in control at this instant and results in a considerably higher average signal-to-noise ratio than can be obtained with the single-receiver method of reception.

While the type of system with separate tuning of each receiver is ideal for commercial communication work, where a diversity unit is used to receive from only one or but a few transmitting stations and on one frequency for hours at a time, it is, nevertheless, hardly adaptable for use in amateur communication work. As was pointed out in the previous QST article,1 separate tuning still left the operation complicated and too time-consuming for practical amateur work. (Just tune in a signal on the crowded 4-Mc. 'phone band some busy evening on one receiver, and then try to tune a second receiver to the same signal—and find out how much time it takes. And as for simultaneously tuning both receivers across the band looking for the answer to a CQ—!)

The single-control dual-diversity system differs from the commercial diversity system in that instead of using separately tuned receivers with individual high-frequency oscillators, a common

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oscillator is used which feeds the first detectors of two receivers. The tuning condensers of the r.f. circuits of the two receivers and the common oscillator are ganged together. Besides the virtue of simpler tuning, the dual-diversity method with its common oscillator is, we believe, an improvement over the commercial practice of using separate oscillators with each receiver. Ignoring the tuning complications of operating two or more receivers on the same signal, the common oscillator system eliminates the need of the expensive precautions found necessary in the commercial type to prevent the high-frequency heterodyne oscillator of one receiver from feeding into one of the other antennas or input circuits. With separate oscillators it is, of course, practically impossible to obtain perfect synchronism for any appreciable length of time. Hence, in the commercial system, it has been found necessary to keep stray oscillator leakage from one receiver as much as 140 db below the signal level in the input circuits of the other receivers.²

CIRCUIT ARRANGEMENT

The single-control dual-diversity receiving system consists of two complete r.f., i.f. and second-detector circuits with a common r.f. heterodyne oscillator, common a.v.c. and one audio amplifier. Two stages of r.f. are used ahead of the mixer stage of each channel. The five coils for each stage, together with the necessary trimmer and padding condensers, are housed in a separate shielded box. Referring to the top view, the first box toward the back of the set is the first r.f. stage for receiver “A.” The second box is the first r.f. stage for receiver “B.” The third box is the second r.f. stage for receiver “A,” the fourth box is the second r.f. stage for receiver “B,” and so on to the last box (larger than the others) which contains the coil assembly of the common r.f. heterodyne oscillator. A seven-gang variable condenser with double rotors (one for band-set dial the other for band-spread) is mounted below the coil boxes in a separate shielded compartment.

Each box contains the necessary switches to shift from one band to another, a long shaft through all the boxes shifting the switches together in proper sequence.

A shield will be noted between the tubes in the r.f. section. This is employed not so much to keep down coupling between tubes of the same receiver circuit but rather to reduce cross coupling between tubes of the two receiver circuits, “A” and “B.” Fairly good isolation between the two circuits must be maintained to prevent cross-talk from impairing good diversity action. In the present setup the isolation between circuits “A” and “B” is approximately 40 db, which proves to be sufficient, and most of the residual coupling is between the 6L7 mixers in the injection circuit.

The i.f. amplifier for each channel uses three stages with iron-core transformers tuned to 465 ke. in the infinite rejection system described in November QST.² This is a radical departure from previous systems in that two of the i.f. coupling circuits of each receiver are in themselves infinitely selective in rejecting off-frequency interference at a particular frequency. As used in this receiver, the first rejector in circuit “A” is fixed at 5 kc. off-resonance on the high-frequency side and the second (variable) rejector is normally set at minus 5 kc. In circuit “B” the first rejector is fixed at 5 kc. off-resonance on the low-frequency side and the second (variable) rejector is normally at plus 5 kc. The variable rejectors can be swung 5 kc. either side of resonance for the purpose of wiping out a particular interfering signal.

It has been found in practice that when the rejectors are set close to the resonance frequency (within 1 kc., for instance), the power-factor corrector resistor (R₁ of Fig. 2 in the Nov. QST article) becomes quite critical for infinite rejection; so a variable 1000-ohm resistor in series with the proper fixed resistor is used in each circuit as a vernier to permit close adjustment for maximum rejection under such conditions.

FIG. 1—SIMPLIFIED FUNCTIONAL DIAGRAM OF THE IMPROVED DUAL-DIVERSITY RECEIVER CIRCUIT

To avoid confusion, the seven-gang band-spread tuning condenser is not indicated in this schematic. Each of its seven sections is simply connected in parallel with the corresponding section of the seven-gang band-set condenser shown. For the same reason, the full complement of 35 coils is not indicated, but one coil set being shown in each stage. Note that adjustable series condensers as well as parallel trimmers are used in the r.f. circuits for better full-range tracking. The output of the common h.f. oscillator, which is the feature insuring automatic synchronous tuning of the two receivers, is applied to the injection grids of the two 6L7 first detectors. The oscillator is the high-mutual triode type 6J5G, chosen because of its good output and reliability at very high frequencies.

There is little mutual coupling between the first detectors because of the good screening which isolates the injection grids from the signal input circuits. The i.f. amplifier system of each receiver is a duplicate of the infinite-rejection unit described in Nov. QST. Receiver "A" throughout. The meter connected in the bridge circuit, near the center of the diagram, indicates the gain balance of the two receivers. Immediately above this meter is SW1, the three-position diversity switch which cuts in either receiver alone, or both in diversity. Decimal capacitance values are µfd., whole-number values are µfd. Resistance values are indicated in ohms. "M" meaning thousands.
CONSTRUCTIONAL FEATURES

The mechanical construction is quite unique. A conventional chassis is not used. A heavy steel frame of U-shaped angle construction is the main support of the various units. This frame is mounted between two larger frames of similar construction which form the sides of the cabinet. Another U-shaped angle frame with reinforced corners is bolted to the bottom. The cover, instead of being just a flat piece of sheet metal, is a solid box-shaped unit. The front panel follows the same general design of reinforced construction. The two side pieces are box-shaped and give good support for the main center panel. The whole makes for a very rigid assembly, strictly functional in design and pleasing in appearance.

The front panels are aluminum finished with “alumilite.” (A heavy aluminum oxide is deposited on the surface of the aluminum by electrolysis, which gives it a tough permanent finish.) The main dials are similarly treated. To insure good frequency stability, excessive heat is kept out of the receiver by building the power supply and power audio amplifier in separate boxes of similar construction to that of the receiver. These units are placed at the sides of the main receiver and conform to give unified appearance.

A few words about the mechanics of the tuning mechanism. Both rotors of the 7-gang variable condenser are fitted with split worm-gear drives. Both of the large 6-inch dials are direct reading in frequency, a separate scale being used for each range. This is a great help in tuning, in setting and re-setting the different frequency ranges without reference to calibration charts or tables. The band-set dial calibrations hold true providing the band-spread dial is set to zero. The band-spread dial calibrations for each of the ham bands are effective when the band-set dial is set to the high-frequency end of the particular ham band being used. This dial is directly connected to the worm shaft and requires 35 complete revolutions for one complete span of its associated main dial.

The outer rim of each of the main dials carries a scale having 35 equal divisions. One revolution of the micrometer dial (behind the panel) moves the main dial one division. Since the micrometer dial on the worm shaft is calibrated with 100 divisions, the dial setting can be read with an accuracy of one part in 3500. This auxiliary micrometer calibration is for use when greater calibration accuracy is needed than that supplied by the direct frequency calibrations on the particular scale being used. This micrometer calibration arrangement allows a scale length equivalent to approximately 35 feet. The scheme is not entirely original with us, as it has been used for some time by several of the well-known laboratory instrument manufacturers for applications in which precise calibration is highly desirable.

Low-Power Contest Results

The August Low-Power Contest (for stations using 25 watts or less) turned out in some respects to be a miniature Field Day. Some 60 per cent of the 137 operators participating did so from portable stations “in the field.” 54 operators manned 46 stations at home locations, 83 operators manned 26 field stations. Comments from participants bring out the fact that low power gets results. The fellows to whom low power was a new experience, marveled at the results obtained even though the meters were not banging over onto the pins. The regular low power men justly demand, “Chalk up one for our side!”

Scoring was simplified as much as possible. Each contact counted one point. An extra credit of 10 points could be claimed for sending a message to A.R.R.L. HQ’s reporting transmitter tube line-up and power supply equipment. The sum of claimed points were multiplied by 1.5, if either the receiver or transmitter was self-powered, and by 2, if both transmitter and receiver were supplied from a source independent of the public mains; 25 watts input to the final stage of the transmitter could not be exceeded in any case. But one transmitter and one receiver were permitted to be used at any one time at any station.

The leader in this first exclusively low power contest was W2DKJ-2, operated in the tower at 40 Wall Street, New York City, by Arthur H. Lynch, W2DKJ, A. J. Haynes, W2JHV, and P. A. Denonn, W2IGK. These men worked 107 different stations for a score of 234. And now for the surprise—all work was with about 8 watts input on 56-Mc! W2DKJ has always been an enthusiastic participant in field day operations, making a new record for 56-Mc F.D. work in the June affair. The experience gained in previous doings certainly paid dividends! FB, DKJ, JHV and IGK!!

The three-man crew of the Central Colorado Radio Association’s entry, W9PWU-9, came in second with 172 points. . . 76 QSO’s, self-power being used throughout. Operation was from Flagstaff Mountain, Colo., ‘phone and c.w. being used on 1.75, 14 and 56 Mc. Power was obtained from a gas driven generator.

Third in line was W8IFD-8 at Camp Aharoh (Y.M.C.A. camp), about 140 miles north of Kalamazoo, Mich. The three operators here (W8OBP, W8QYE and W8IFD) emerged from the battle with 160 points from 70 QSO’s. 3.5, 7- and 14-Mc. c.w. and 3.9-Mc. ‘phone were used. Storage battery and “B” batteries for the receiver, storage battery and generator for the transmitters, constituted the power source.

So close behind W8IFD-8 that you can hardly notice the difference is VE3GT . . . 159 points.
Conferences Preparations for the American regional conference at Habana and for the world conference at Cairo are substantially complete at this writing. In fact, by the time these words appear in print the Habana conference will be about over. Our aims at the latter conference are to see all the amateur bands confirmed as exclusively amateur within the American region, to prevent the overrunning of the 7-Mc. band by 'phone, to obtain region-wide authority for the handling of third-party friendly messages by amateurs, and to effect amateur participation in the Pan-American Radio Technical Union. We should have some preliminary reports on the outcome in next QST.

At Cairo the United States will stand for the preservation of all of our bands. She believes that the 1.7- and 3.5-Mc. bands should continue in their present status, shared with fixed and mobile in the international table, so that their whole widths may be available on this side of the water as now, and so that European nations may continue to give their amateurs as much of these bands as they need. Rejecting both the proposals to widen and to narrow our 7-Mc. band, the U.S. will support our present width. The 14-Mc. band will be similarly defended against the proposals to reduce it, and the 28- and 56-Mc. bands sponsored as exclusively amateur. Our government wants each nation to continue free to set the power of amateur stations, opposing the Japanese proposal to cut us to 50 watts in the antenna. Similarly favorable decisions have been reached on numerous minor points which are not of great interest at this stage.

Even the ultra-high frequencies will come in for some consideration at these international conferences. Further information on developments in this field will be found in this month's editorial.

R.M.A. The A.R.R.L. Board at its last meeting petitioned the Radio Manufacturers Association to establish higher standards in the design of midget broadcast receivers to preclude the pick-up of interference from other services operating in accordance with good engineering practices. The R.M.A. seems to have pitched right into the subject and have been to see us to obtain data on the exact nature of the interference and on the damages suffered by amateur radio as a result thereof. Our technical editor has given them extensive data on the principal types of interference experienced and on the technical deficiencies of the affected receivers which are responsible for the trouble. There is room to hope for some real progress in this matter, certainly for a much clearer realization of the deficiencies of these cheap sets.

New On October 1st Colonel Joseph O. C.S.O. Mauborgne became Chief Signal Officer of the Army with the rank of Major General, succeeding Major General James B. Allison, who has retired. Because the Signal Corps deals with many forms of communication, it is interesting to know that General Mauborgne is primarily a radio man. In 1912, as a lieutenant at Fort Riley, Kansas, he installed a quenched-spark radio set of his own devising in an airplane and provided the first air-to-ground radio communication in history, and two years later accomplished two-way radio communication between plane and ground for the first time. In his long career he has of course had many important assignments. His last previous one was as director of the aircraft laboratory at Wright Field, Dayton, before which he was Signal Officer at the Presidio of San Francisco. During the 1927 Washington conference General Mauborgne, then a lieutenant-colonel, was a warm defender of amateur radio and worked actively in our behalf, as was reported in QST at the time. In fact is interesting to note the recent promotions of the two service men who were most instrumental in our aid at that time: Lieutenant-Commander T. A. M. Craven, U.S.N., retired, has recently been appointed an F.C.C. commissioner; while General Mauborgne now heads his branch. Indicative of the latter's continued interest in us is the following letter he recently wrote to the Editor:

Dear Warner:

I was delighted to receive your letter of October 6, 1937, extending the congratulations of yourself and the American Radio Relay League upon my appointment as Chief Signal Officer. May I extend my most sincere thanks to both yourself and the League for your congratulation and good wishes?

Having started as a "ham" many, many years ago, it is but natural that my sympathies for the American radio amateur should always be of the warmest nature, as I believe you personally have witnessed during my many contacts with you in connection with the work of radio conferences in the past. You may be assured that I shall continue to have a very strong interest in the operations of the American Radio Relay League. 73.

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Applying Inverse Feedback to the Universal Speech Amplifier

Modifications to Improve Frequency Response and Increase Power Output

By George Grammer*

Most 'phone operators are distinctly "quality-conscious," to judge by the important place the word occupies in most air conversations. Yet few seem to have taken advantage of one of the easiest methods of improving speech-equipment frequency response and reducing distortion, the two most important ingredients of "quality." Although the advantages to be gained by the use of inverse feedback have been dwelt upon several times in QST, it may be that any sort of feedback is an anathema to builders of speech equipment and consequently is left severely alone by those who stand to gain a good deal from its use. Actually, it's not such a formidable thing to apply.

It is well known that the transmission of intelligible speech does not impose very rigorous demands on the frequency characteristic of the speech system. For all practical purposes, a frequency characteristic fairly uniform between about 200 and 3000 cycles is adequate for good reproduction of speech; the addition of lower and higher frequencies does not add materially to the intelligibility. For amateur communication, more than good intelligibility is not required, but there is no dodging the fact that practically every amateur who takes pride in his equipment wants that extra something which makes for good speech quality, even though the additional trouble and expense may not be justified from the purely utilitarian standpoint. Therefore, any reasonably simple and inexpensive means of increasing frequency response should be of interest.

Simply to see what could be done by such methods, we decided to "operate" on the speech amplifier described in October QST. As originally built, this unit incorporated components and circuit constants designed for speech reproduction, with cut-offs near 100 and 5000 cycles.

The transformer-coupled stages were naturally suspected of introducing most of the frequency discrimination at the low and high ends; however, the constants of the first two stages, the 6J7 and 6C5, had been selected for 100-cycle cut-off, so the first step was actually to measure the performance of these two stages from the frequency standpoint. To do this the first transformer, T1, was disconnected from the 6C5 plate circuit and an oscilloscope connected through C4. With variable-frequency constant-amplitude input to the 6J7 grid, the output of the two stages was down perceptibly at 100 cycles, although perfectly flat from about 200 cycles up to 15,000, the limit of the audio signal generator range.

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* Assistant Technical Editor.


Now it is generally possible to use feedback over two stages without running into oscillation difficulties but somewhat dangerous over three, especially when some of the stages are transformer-coupled, because phase shifts in the transformers can cause oscillation at the high or low ends. Therefore we had decided to confine the feedback to the last two stages only, thereby including all the transformers. Negative feedback, however, cannot correct for frequency discrimination in stages preceding those treated unless special frequency-correcting measures are taken in the feedback circuit itself. We felt that it would be simpler to straighten out the front end insofar as possible, and thus avoid the special equipment needed for accurate frequency correction in the feedback circuit.

The low end of a resistance-coupled amplifier can be boosted readily by the use of sufficiently large by-pass and coupling condensers. Trial of several condenser values at various points resulted in flattening out these two stages to the extent that the amplification was uniform from 70 cycles up to 15,000, the low-frequency drop becoming perceptible at about 50 cycles. The new condenser values are given in Fig. 1, the resistors remaining unchanged. The changes, in brief, consisted of making $C_4$ a 15-µfd. instead of 5 (a 10-µfd. electrolytic shunted across the original 5-µfd. unit), and $C$ a 4-µfd. electrolytic instead of the 0.1-µfd. paper originally specified. Increasing other condenser values made no noticeable difference in performance, hence these were left alone. A recheck of the frequency characteristic of the entire amplifier after the changes were made showed no difference in the final output, thus confirming the original suspicion that most of the discrimination was in the last two stages.

**ADDING NEGATIVE FEEDBACK**

Several methods are available for applying feedback. Many of these use resistance-capacity combinations, which, however, are not always suitable in the case of transformer-coupled amplifiers. In this case we wanted to introduce the feedback in the primary of $T_1$ and thus compensate for all the transformers in the speech amplifier. Introduction of feedback in the secondary circuit would not correct for frequency discrimination in the primary, and besides would have been difficult to apply to a push-pull transformer without separate secondary windings or without special taps.

The first scheme tried used a resistance-capacity network from the plate of one 2A3 to the primary of $T_1$, the feedback voltage being developed across a resistor of a few thousand ohms connected between the lower end of the primary and ground. This was fairly satisfactory at the high-frequency end, but did not give any particular improvement at the low, although the values of $R$ and $C$ were varied over quite a wide range. This was probably the result of different orders of phase shifts in the transformer and feedback network. A better arrangement—the one finally adopted—used transformer coupling in the feedback circuit. The means for introducing feedback were right at hand, since the output transformer, $T_3$, was provided with a speaker voice-coil winding. Taking some of the voltage developed across this winding and inserting it in series with the primary of $T_1$ gave much better performance and required not a single extra component. The method of connection is shown in Fig. 1. The voice-coil winding is tapped for 4, 8 and 15 ohms; in our case proper phasing and about the right feedback voltage were secured when the 8-ohm tap was grounded and the 4-ohm tap connected in series with the primary of $T_1$. Reversing the voice-coil winding connections (Continued on page 84)
A Rotary Spider-Web Loop Antenna
With Reflector

An Inexpensive Horizontal Array of Good Directivity

By Charles W. Lugar,* W8MRR

I

t has not only been the desire of the writer to find a solution for the problem of present congestion of our allotted amateur bands but also find a means for hearing and working DX. Quite naturally the above sounds like a large order to undertake; but, nevertheless, it is a task which is growing in importance by virtue of the fact that our ranks continue to increase.

Briefly, let us state that more power does not solve the problem. Granted, our percentage of stations worked may increase in the face of QRM; but it is also granted that, as first one of us and then many add watts to the final, the conclusion is bedlam! The situation is certainly not improved by such a trend.

Where, then, can we start to find a solution? At least one trail seems worth following; namely, the antenna. Many are on the way and the results achieved to date are well worth additional study and experimentation. Let's pause a moment and size up the antenna situation from a general viewpoint. We can divide the various systems into two classes, generally speaking, from the standpoint of mechanical construction; those capable of mechanical change of their orientation at the will of the operator, and those maintained in a fixed position. Each class has its advantages and disadvantages over the other—gain, size, ease of construction, space required, labor, cost, frequency flexibility. All these factors should be given consideration if we are to design an antenna that can be utilized by the majority and that, consequently, will be a step forward in the solution of our problem. We may not all have a forty-acre field or even a complete kit of tools, not to mention the size of the proverbial pocket book. This latter sometimes supplies a certain amount of braking action to our enthusiasm.

In view of all the above, just where do we get off? It has been our experience not to get excited over working in any one particular direction. Rather, we like to communicate with the boys whether they be east, west, north, or south. Likewise, when we are carrying on a QSO to the east, for instance, we do not like competition from other directions. Therefore, in answering the above we decided that some form of rotary antenna with the greatest possible pick-up and transmission in one direction was desired, plus the fact that ease of construction and low cost were to be given every consideration.

All our thoughts and schemes seemed to be rather complicated affairs; lattice-work masts, electric rotating drive mechanisms, thrust bearings, remote control, and various designs of complicated arrays. All of these ideas were very fine and possibly of value—but not altogether necessary. At any rate, they can be added at any time if desired. But this was not even the start; how about the antenna itself? We noticed that others had obtained a gain in one direction by twisting a half-wave dipole in the form of a circle, thereby getting with one stone the two birds, small space and good directivity. Then the idea took the form of a new question. How about adding a reflector to this

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A rigid tower equipped with a rotating mechanism supports the web assembly at W8MM.

Design? From there we were off in a cloud of dust. (Although it happened to be wet at the time!) Copper tubing was a little heavy, as we had decided to utilize a couple of poles already in position. We would make a framework of bamboo and hoist it into place, as we would any other antenna, between said poles. Ordinary wire, No. 14 or No. 12 copper, seemed logical from this angle. However, we realized that a circle could not be formed with such material; therefore, the octagonal shape was decided on, since we could get this with five 20-foot bamboo or cane fishing poles.

After looking around we located the poles and proceeded to bring five of them home. They were laid out in the backyard and lashed together, as shown schematically in the accompanying diagram of Fig. 1. Next, a piece of string was made fast to the center or pole intersection and a length of 5 feet 8 inches was measured off on the string. Using this as a radius, each pole was marked this distance from the center. Next a length of 11 feet 6 inches was measured off and this was also marked off near each end of the double cross pole (A-A') and the small ends of the other three center poles (B'-C'-D'). This distance finally became 11 feet 2 inches after some work with a signal strength meter.

Ordinary porcelain cleats or insulators were made fast to the poles, as suggested by the detail in Fig. 1, and the radiator and reflector wires were fastened to the other ends of the cleats. Airplane-type strain insulators, large size, can also be used here. A few feet of sash cord served for making a bridle and the entire array was secured to rope halyards from each of the two masts. It was then a simple matter to hoist it in place approximately one-half wave off ground. It is interesting to note that we did the hoisting in less than two hours after assembling the necessary materials—and most of them came from the junk box, at that.

By adjustment of the bridle ropes any tilt angle desired can be obtained. Two other ropes were attached, one toward the front and the other near the rear. By proper manipulation the array can then be rotated for orientation in any direction. Other schemes for rotation can undoubtedly be thought up that would be superior to this means. In fact, several such rotation designs have already been presented in QST. The above method of rotation, although having distinct disadvantages, can be made to work and happens to be very inexpensive.

In Fig. 1, showing the schematic plan view of the array, A-A' consists of two 20-foot bamboo fishing poles, so lapped that a total length of 24 feet is obtained, the poles being lashed together large ends out. B-B', C-C', and D-D' are 20-foot single bamboo fishing poles with their small ends trimmed off slightly after the array has been assembled.

Ordinary porcelain insulators or cleats can also be used here to locate the wires for the radiator and reflector. The octagonal shape is shown in Fig. 1. A-A' consists of two 20-foot bamboo poles with the small ends out. B-B', C-C', and D-D' are 20-foot single bamboo fishing poles trimmed off slightly after the array has been assembled. Ordinary porcelain insulators or cleats can also be used here to locate the wires for the radiator and reflector.

Fig. 1—Schematic plan of the antenna and reflector assembly for 14-Mc. operation.

(Continued on page 90)
Contact with far-flung expeditions has always been a fascinating part of amateur radio. Since 1923, when Don Mix operated WNP on 220 meters, amateurs have provided communication for explorers at all corners of the earth. Amateurs followed Byrd on the Chantier, KEGK, to Spitzbergen and later to Little America. Adventurers in the Brazilian jungle, Central America, Africa and Tibet have found amateurs of inestimable help. Capt. Bob Bartlett and his Morrissey rely on amateur operators on each trip to the northern latitudes. Now we find Capt. C. J. MacGregor and his followers frozen in for the winter at Reindeer Point, northern Greenland. Gerry Sayre, W2QY, operates OX2QY and puts a remarkable signal into the States at all times of the day on both 'phone and c.w. The following story was taken at WIEH in about 45 minutes with Gerry doing the talking and one of the Hq. stenos doing the work.—EDITOR

THRILLS, adventure, exploration, research, vacation, hard work—these may all be the fruits of the radio operator’s job on many present-day expeditions. Thrills? Yes! When a bowsprit carries away in a storm . . . when a fire breaks out immediately below decks with several thousands of gallons of gasoline forward . . . when someone is overcome by fumes from an exhaust-pipe leak: those are the moments. Hard work? Yes! Schedules at odd hours often calling for all hands to turn to and try to start the cussed engine, stiff with cold oil and grease . . . and then, when you get all fired up, ready to go, moisture condensed on radio-frequency gear is so heavy that there are flare-ups and you have to get going in easy stages. . . . Troubles arising just as you are about to go on an N.B.C. program . . . signals dropping out in the middle due to magnetic storms and everybody putting you on the spot because of it . . . All in all, it makes you wonder if things will ever get back on an even keel.

Adventure, exploration, research? Yes—all of these, too. The various things which come up at a moment’s notice—unexpected, exciting, demanding all of one’s fund of knowledge to cope with changing conditions—really invite one to enter upon such a trip as this. Put yourself in my shoes and figure out just how much of a kick you’d get out of it. Yes, indeed, there is never a dull moment on such a venture. I’m mighty glad I had the opportunity to go.

Seven weeks before sailing date of the MacGregor Arctic Expedition I was notified that the radio job was mine. Manufacturers were immediately contacted, but I found they would not meet our sailing date. So it was up to me to obtain the parts for the complete transmitter.

This resulted in fourteen-hour days as a routine job in preparation. I first contacted several amateurs who had operated on other expeditions to get their opinions as to what I should expect and what preparations I should make. With their suggestions I came to the following conclusions: the transmitter should have approximately 500 watts input to the final stage; all material should be the best available and worked within their ratings; it must be very sturdily constructed to withstand the rigorous usage it had to go through; it must be able to cover a broad range of frequencies from 6 Mc. to 15 Mc. and possibly more; it must be capable of full one hundred percent modulation on any of these frequencies and should rely on plug-in coils instead of band switching. All materials used for insulation must be as near non-hygrosopic as possible, and the transformers be very well impregnated and filled with suitable compounds thereby keeping moisture out of the windings. The rig would need to allow easy servicing and be constructed with the idea of taking it ashore upon our arrival at our base camp. From all these ideas a layout was decided upon and work started.

December, 1937
On such a trip spare parts of every kind must be carried, for one never knows when some accident will destroy some part of your rig. By spare parts I refer to every little detail down to lock washers, solder, lugs, hook-up wire, sockets, condensers, resistors, transformers, tubes, bolts and nuts, bakelite and aluminum for construction work; insulators and wire for the antenna, feed wire as well as spare parts for the engine, such as plenty of plugs, condensers, points, fanbelts, bearings, pistons, rings, relays, etc.

The engine will run more in radio service as we are using it than your car engine will run in about two years of hard usage, so you can all understand why I mention the bag of parts. Too much emphasis cannot be made on these spare parts, for otherwise we might find ourselves off the air because of lack of suitable essential spares. It entails more than just throwing together a few essential things and trusting to good luck that you maintain your broadcast, ship and amateur schedules.

At this point I want to say that I have always greatly appreciated the amateur spirit of cooperation. But the Newburgh radio amateurs really helped in countless ways with their aid and their suggestions. John Smith, W2BCR, helped me at all times. He worked his regular job during the daytime and then would come over and work a good share of the night assisting me until late. He left work for four days at the end to assist me. To him and to all the others I have a huge "Thanks a million" for their untiring efforts. This spirit I find daily in contacts over the air assisting us in relaying traffic and getting schedules arranged from up here in the Arctic. It was just the same at Lunenburg, Nova Scotia, and Sydney, which were ports of call. At those ports I was certainly glad I was an amateur. The other hands of the expedition found it hard to understand why these strangers should so suddenly become interested in my problems and could not understand how I seemingly had located a long lost friend when meeting a new amateur. I greatly appreciate all you boys did for me up there. To VE1GH, VE1CD, VE1GC and VE1CR goes another huge vote of thanks for their hospitality and assistance. I assure you it was greatly appreciated.

Ship antennas supposedly work out well. Our ship is a three-masted schooner rig and with plenty of steel cable. We found it very hard to get up a stable antenna. A Marconi antenna partly vertical and partly horizontal was tried. But the first time the sails were hoisted it was carried away by the main sheet gaff. Finally a doublet fed with Bassett cable was installed between the

A. G. (GERRY) SAYRE

CAPT. C. J. MACGREGOR
forward and main masts and worked out very well. Another vertical antenna running up outside of the shrouds mizzen top was tried and found to work well. We had installed a large copper plate on the hull to get a good ground. The antennas were completely remodeled in Nova Scotia during other repairs to the ship. Pyrex insulation was used throughout.

Antennas ashore are always a major problem on expeditions of this type. No timber being present, we were forced to bring our own masts, and all equipment that is needed for antenna supports. Work is extremely hard due to the rough, rocky, steep slopes. We do not have suitable room for separate antennas for such frequency coverage. So we had to fall back on the antenna that could be operated covering more than a two-to-one frequency range and which was not in harmonic relationship. Finally we decided upon a diamond or rhombic antenna as large and high as possible. We found one spot that was 500 by 200 feet where we could get a line approximately two degrees west of true south, aiming at New York, with the north end about 50 feet or more above the lower end of the antenna off the beach, or south, end. A high cliff arose 1000 feet immediately in back, to the north. To the south, fortunately, we have an open way about one and one-half miles wide before it comes to the steep banks of the shore. Across the fjord this bank rises about 1000 feet also. On the eastern leg the pole had to be set on the further side of a ravine with rocks piled around it to keep washouts from bringing it down during freshets.

All this makes the ground appear very irregular when viewed from the antenna. This may distort the calculated radiation pattern of a good rhombic. Reports indicate that this is true, for we get similar reports from most parts of the States. The antenna is 275 feet on each leg, with side angles of about 62½ degrees. The height is about 35 feet, making the 580-ohm feed line about 350 feet long. We installed an 800-ohm Ward Leonard plaque resistor.

A little cut and try on the best side angle has been done to get the best signal into New York City to maintain our NBC and other commercial schedules, also to get our best signal on the higher frequencies. Enough contacts have not been made to formulate any real conclusions except to let us know that it has a good coverage and ample for our needs. We also use it on standard broadcast receiver, boosting those signals perceptibly.

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**THE DRIVER AND MODULATOR**

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![Diagram of an antenna system](image)

**PRE-AMPLIFIER**

- **C1**: 0.006 µfd. (Cornell Dubilier).
- **C2, C7**: 1 µfd. (Cornell Dubilier).
- **C3, C9**: 0.005 µfd. (Cornell Dubilier).
- **C4, C6, C8**: 0.5 µfd. (Cornell Dubilier).
- **C5**: type PE-4688.
- **R1, R2, R3**: 250,000-ohm, 1-watt (IRC).
- **R4**: 8000-ohm, 1-watt (IRC).
- **R5**: 250,000-ohm, 1-watt (IRC).
- **R6**: 4000-ohm, 1-watt (IRC).
- **R7**: 1000-ohm, 2-watt (IRC).
- **R8**: 50,000-ohm, 2-watt (IRC).
- **R9**: 2500-ohm, 2-watt (IRC).
- **C10**: type PE-4688.
- **B+**: 120 VDC.
- **R1, R9**: 250,000-ohm, 1-watt (IRC).
- **R10**: 50,000-ohm, 2-watt (IRC).
- **CH1**: 156 (Kenyon).
- **R11**: 250,000-ohm, 1-watt (IRC).
- **R12**: 2500-ohm, 2-watt (IRC).
- **T1**: Type T-156 (Kenyon).
- **C1**: type PE-4688.
- **R13**: 50,000-ohm, 2-watt (IRC).
- **R14**: 2500-ohm, 2-watt (IRC).
- **R15**: 6FG (Sylvania).
- **R16**: 6CSG (Sylvania).
- **R17**: 6CSG (Sylvania).

*All chassis, panels, and racks are Par-Metal products.*
THE FINAL AMPLIFIER AT OX2QY

Standard units were used throughout. The high-power final shows compact, neat construction. The grid circuit and neutralizing condensers are on the level of the tube sockets. The plate circuit is overhead as the plates of the tubes are brought out at the top.

Possibly a little discussion of the hardest job we encountered on the whole trip would be of interest to some of you fellows. It was the erection of the antenna. Poles about 40 feet long and 6 to 8 inches in diameter were stowed aboard in Nova Scotia. These were thrown over the side of the ship, towed ashore at high tide by use of row boats. Four members of the expedition now shouldered a single pole and carried it up a steep butte about 30 feet high, then about 500 to 1000 feet from their first position. If you can visualize one man standing up over a rock, another over a hole between rocks and possibly slipping down helping the others to carry their share, you will then understand the two solid days we spent at this work. Then came the blasting of holes with dynamite, placing guy wires, cutting holes for the dead-man anchors which we made of 2 by 8's, four feet long, buried. The poles were finally hoisted and stood on end in their holes. Securing the guys to the dead-man anchors and piling stones about four feet high around the base of each pole was the next operation. The leaning back brace is one-quarter inch cable wire; the other two are No. 10 wire split up with insulators. Three 2 by 4 braces were also installed about fifteen feet above the ground to check any slipping of the pole. We used No. 10 copper clad steel wire for all antenna, feed line and guy wires. The antenna is one piece from the south end up to the north end, down the feed line and into the shack, thereby doing away with corrosion joints which sea water makes worse. The feed line is mounted on seven pieces of 2 by 4 stuck up in the rocks and stones piled around them. Cross beams are nailed on these and pyrex insulators are used to keep the feed line uniformly placed between poles.

Ice, sleet and snow have all been encountered to date and the antenna seems to be able to take it. You may doubt that we have high winds up here so I will just mention one little instance to show you what happens. Our schooner was

MODULATOR

AMPLIFIER

FIG. 2—AUDIO DRIVER AND MODULATOR

QST for
anchored here in harbor with two anchors out and a ten-inch hawser ashore. We had not been ashore when this occurred and fortunately for us. One of these gales came up and snapped the hawser, broke one anchor chain, and we started to drift rapidly on to the beach. It was necessary for us to put out to sea for our motors would not hold us against the breeze. When it subsided in thirty-six hours we were able to get back in again. These winds seem to come up very rapidly and reach about 75 miles an hour gale force.

Power is obtained from a U. S. Motors four-cylinder four-cycle gasoline engine which is directly coupled to a 5-kw. 110-volt a.c. generator. It uses nearly a gallon of gasoline per hour to operate the complete rig and receiver. Suitable by-passing on the generator cut out was imperative. By-passing on the generator armature and field exciter armature and field were found absolutely essential to good receiver operation.

The engine and generator were too heavy to move ashore in one unit as they were too bulky. They were lowered separately overboard into smaller boats and hauled ashore. Here all hands had to use 2 by 4 pieces over their shoulders to lift them out of the boat and up the ledge to the deserted Eskimo igloo which we use for our shack and power house. All of this was much more hard work than you may think, down there where everything is provided for human ease. The essential extra gear included a battery stand-by receiver—radio analyzer, signal generator, spares of all kinds, code practice oscillators for the crew, thereby getting practice for their work of exploration next spring when the sunlight returns to us. I find that they are very much interested in learning the code, which will come in handy when they get out on the trail. To date the only failures have been composition feed-through insulators, condensers and tubes. Moisture and temperature changes have accounted for most of these.

Other things I brought with good reason were a torch of the alcohol variety, materials for grinding crystals from blanks and wire of all varieties. I had thought I had enough wire to last indefinitely but the supply is getting low already.

There is no dull or idle moment to date on this trip so far as I am concerned. There are always any number of things still to be done before a complete darkness sets in on us for the winter. Then we will need preparations for the trail parties such as camp duties to which all of us are subject, of course.

To date most all of my listening and work has been on frequencies between 18 and 8 Mc., mainly commercial broadcast and ship's band work and news which is handled by the New York Times. I wish we had more time and found it possible to use enough gasoline to work more amateurs during some of the evenings. Those we have had have been very pleasant and fine contacts. So far no

(Continued on page 94)

![FIG. 3—DRIVER AND FINAL AMPLIFIER](image-url)
ARMY-AMATEUR RADIO SYSTEM ACTIVITIES

Code Speed Contest

On Monday, December 6, 1937, WLM/W3CXL will broadcast a speed contest. All amateurs, whether A.A.R.S. members or not, are invited to participate. The contest will start at 10:00 P.M. E.S.T. WLM/W3CXL will use automatic equipment and sufficient power to reach most states. The frequencies 6990 and 3497.5 kc. will be keyed simultaneously.

Speeds will vary from 20 to 60 w.p.m. in jumps of five words per minute. Clear text will be transmitted for five minutes at each speed. Each speed will have different text, and words will be counted on the basis of five letters to the word. The contest will be run according to the following rules:

1. Anyone having a valid amateur license is eligible.
2. Only one report can be turned in by each participant. Pick out the speed which you are sure is correct.
3. Holiday copy for one minute anywhere in the five-minute transmission will determine qualification.
4. A.A.R.S. members should send their copies to their Corps Area Signal Officer.
5. Non-members should send their copies to the nearest Corps Area Signal Officer. List of addresses and states comprising each Corps Area was published in November QST.

A.R.R.L. will give letters of commendation to League Members who stand highest in each Corps Area.

A.A.R.S. MESSAGE FORM

The following description gives the message form used by the A.A.R.S., and hints for copying the same on a typewriter:

43 WLMA V
STATECOLLEGE PENNA 400P OCT 23 1937
MISS LUCILLE MOORE
EIGHT NEWCUMBERLAND PLACE
NEW YORK NY
LETTER RECEIVED FROM MARY WHO IS IN NEW YORK STOP FAMILY JOIN WITH ME IN WISHING
YOU A HAPPY BIRTHDAY
FRANCES

First line: write the number, station of origin, operator's sign and check.
Third line: place of origin, filing time (if any), and date.
Fifth line: the name of the addressee.
Seventh line: one space after the last word of the addressee's name, the address, giving number and street.

Eighth line: name of the city immediately under street and number.

The body of the message starts at the left on the tenth line. Copy ten words to the line. At the end of the fifth, fifteenth, twenty-fifth, etc., word, a double space should be left to aid in counting the check. New York is written NEW YORK, as are all names of places, and counted one word.

Two lines under the last word of the body appears the signature. If the last word of the body is too far to the right, start the signature two lines down and in the center of the blank. The message is serviced by the receiving operator by placing the call letters of the transmitting station two lines under the signature, followed by the time of receipt and day of the month.

As the message is being copied between the fifth and tenth lines, a new blank may be placed in the typewriter so that upon the removal of the completed message the new blank appears in approximately the right position for the next message. If carbon copies are made, considerable practice is required to get the new blanks in at the proper time.

A service message is shown below. It does not have a check and the place of origin and date are shown after the signature. Service messages should contain only data relating to traffic schedules or operation.

64 WLM SVC
WLMA STATECOLLEGE PENNA
YOUR FORTY THREE OCTOBER TWENTY SECOND
PLEASE REPEAT ADDRESS

WLM WASHINGTON DC OCT 23

ZCB CONTEST RESULTS

Final scores of ZCB (QSO) Contest held September 13, 1937, are shown below. The contest lasted from 5:00 P.M. to 1:00 A.M. local standard time. Five minutes were required to elapse from the beginning of one contact to the beginning of the next. Stations exchanged their locations. Each contact counted one point.

The scores, by Corps Areas, and the scores of the individual stations having high score follow:

<table>
<thead>
<tr>
<th>C.A.</th>
<th>Points</th>
<th>Handicap</th>
<th>Total</th>
<th>High</th>
<th>Station</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>118</td>
<td>2.4</td>
<td>283.2</td>
<td>W1JMY</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>390</td>
<td>1.2</td>
<td>469.0</td>
<td>W2DBQ</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>1085</td>
<td>1.9</td>
<td>2061.4</td>
<td>W9OMZ</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>145</td>
<td>3.4</td>
<td>493.0</td>
<td>W4AWO</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>366</td>
<td>2.1</td>
<td>798.6</td>
<td>W5LII</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>211</td>
<td>1.5</td>
<td>393.4</td>
<td>W8ONX</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>VII</td>
<td>715</td>
<td>1.9</td>
<td>1388.5</td>
<td>W6BNT</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>VIII</td>
<td>416</td>
<td>3.4</td>
<td>1314.2</td>
<td>W9KPC</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>IX</td>
<td>2267</td>
<td>1.0</td>
<td>2267.0</td>
<td>W6CVL</td>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>

(Continued on page 98)

QST for
Designing the First Stage of the Speech Amplifier
A Pentode Circuit for Low Hum and R.F. Pickup

By Thomas A. Gross,* W1JZM, VE1IN

The input stage of a speech amplifier largely determines the performance of the whole amplifier. So much can be done by intelligent design of this stage to reduce r.f. pickup, "motor-boating" and hum that it is worth while to study their design.

Most amateurs start out with two strikes against them in their efforts to obtain good amplifier performance by using a triode in the input stage. The pentode embodies many advantages which greatly outweigh their slightly increased cost. Changing a triode over to the pentode circuit will result in extended high frequency response, higher gain, and greatly reduced r.f. pickup.

The increased gain may be expected, but many are not aware of the other two advantages made possible by the pentode. The reduction of radio frequency is a result of the improved isolation afforded by the pentode circuit. The shielding of the screen grid has a similar effect to the neutralization of a triode speech amplifier tube. Indeed, triode speech amplifiers in broadcasting stations are usually neutralized.

The high frequency response can be extended when using a pentode because of its lower capacities. The pentode can work into a higher load impedance for a given high frequency attenuation than is possible with a triode. When a triode is used with a high loading resistance, as is necessary with the high-mu tubes, the higher speech frequencies suffer attenuation. On the other hand, pentode amplifiers can give reasonable gain even at frequencies used in television amplifiers.

In the accompanying diagram of Fig. 1 is the circuit of a simple but very effective speech input amplifier, combined with the coupling network to the following stage. It is not intended that the circuit be copied exactly as shown. The amateur should make changes necessary to accommodate his requirements for frequency response, available supply voltages, etc.

Most of the pentode tubes can be used in this circuit without changing the circuit constants. The 6J7 tube is suggested because it is small, self-shielded and is of the sharp cut-off type. Sharp cut-off tubes have higher gain and lower plate current than the variable-mu tubes. The last point is important because lower values must be used for the decoupling resistor $R_5$ and the plate loading resistor $R_6$. Representative of the sharp cut-off types are the 57, 6C6, 6J7, and the 954. The last tube, one of the acorn types, can be used to advantage in very small amplifiers.

Many prefer to use a bias cell in place of the cathode-resistor bias system shown in the diagram. This practice is desirable when a large condenser for $C_2$ cannot be obtained. The bias battery might cause trouble, however, when strong r.f. fields are present and there is grid rectification of the r.f. voltage.

The recommended values for the circuit con-

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*Bowdoin College, Brunswick, Maine.
volumes. However, chokes should not be used except under special conditions because they tend toward hum and frequency distortion.

The combination of the gain control, $R_7$, and the grid leak for the second stage, together with the coupling condenser, $C_5$, is capable of frequency discrimination. An increase in either $C_5$ or $R_7$, or both, will bring up the bass response. With the values indicated in the diagram cut-off will begin at approximately 150 cycles, which is satisfactory for most amateur applications. If it is desired to attenuate the low frequencies further, to improve intelligibility or reduce hum, the condenser $C_5$ can be reduced in size. This practice is limited because of the phase distortion which develops when very great attenuation is attempted. The dialogue equalizer or the more complicated high-pass filter provide splendid means to attenuate the bass response of the amplifier. The high-pass filter has the advantage of a very sharp cut-off characteristic while in other equalizers the attenuation obtained bears a fixed relation to the frequency.

It is important that the condenser $C_5$ and the resistor $R_7$ be adjusted not to pass more of the low frequencies than actually needed. If this rule is not followed the possibilities of "motor-boating" and high hum level is increased. The flat response required of program amplifiers in broadcasting stations is actually undesirable for amateur service. The frequencies below 200 cycles are practically useless from the standpoint of intelligibility, yet it is these frequencies which contain the bulk of the speech energy. A high-pass filter designed to cut off at 250 cycles will eliminate all of the hum (up to a fourth harmonic at 240 cycles) developed in the previous stages and, at the same time, add greatly to the effectiveness of the signal.

When selecting condenser $C_5$ choose only one of the very best quality. If the resistance of the condenser is below 500 megohms, the bias on the following tube will be affected. Use a mica condenser if possible.

The cathode resistor by-pass condenser should be as large as is consistent with cost. It has been a practice to use a condenser as small as is needed for satisfactory bass response. It may seem logical to attenuate the low frequencies by reducing its value and thus cause degeneration at those frequencies. However, if this condenser is smaller than 10 $\mu$fd. the hum level will increase. A very pronounced hum will result if the heater leads are not balanced to ground with a center-tapped resistor or filament transformer secondary. I have noticed that this hum will develop even when d.c. is used on the filament unless the leads are center-tapped or at least one side connected to ground.

A very common mistake that is made, even in many published circuits, is to use decoupling in the grid circuit of any resistance- or impedance-coupled amplifier. Do not attempt to isolate the "cold" end of either $R_1$ or $R_7$ with a decoupling resistor. A decoupling network at $R_1$ will place the case of the microphone above ground, which will encourage hum pickup. If decoupling is used at $R_7$ the cathode resistor will not be by-passed and degeneration will result. However, should a transformer be used in either grid circuit, decoupling is then very desirable.

The decoupling network consisting of $R_6$ and $C_4$ should always be used, providing that the supply voltage is adequate. The network will cause a drop in the d.c. voltage on the plate of the tube but will reduce the tendency toward "motor-boating" and will iron out the ripple of the supply voltage. To function properly, the resistance of $R_6$ should be at least 25 times the capacitative reactance of $C_4$ at the lowest frequency which must be filtered.

It is desirable to locate the gain control $R_7$ at least one stage from the input circuit. It is then able to reduce hum and other noise which has developed in the preceding stages. Only when the magnitude of the signal voltage is great enough to overload the input tube should the volume control be situated in the input circuit.

The hum level will increase if multiple grounds are used to ground the metal braid on shielded leads. If shielded wire is used it is important that the braid have a good ground—but at only one place.

The two best tubes to use in the following stage are the 6J5 and the 6C5. The former has a lower plate impedance than the 6C5 and it is the more desirable of the two when the second stage is called upon to deliver small amounts to power. The 6C5, however, has better insulation and should be used when only voltage amplification

(Continued on page 98)
Cathode-Coupled Driver for Class-B Modulators

By R. B. Shimer*

WITH the exception of negative feedback, which has been described in these pages recently, the fundamental design of audio power systems has experienced little improvement beyond the usual absorption of the newer tubes. Of course, new innovations or circuit designs which do not lower cost or materially improve the overall frequency response, while often interesting to the amateur or experimenter, do not find favor and are obviously soon forgotten. However, when a circuit appears which is really an actual improvement over existing designs and which, furthermore, lowers the cost, then it is at least worthy of consideration.

Recently there has come to the audio field a new innovation in the way of drivers. These are called "cathode drivers," since the driver transformer, instead of being in the plate circuit of the driver tube or tubes, is in the cathode circuit. This is a degenerative type of amplifier, and possesses inherently better characteristics than the plate-coupled type for certain applications. In the circuit here discussed, it permits driving a 250-watt audio output stage with only a single receiving-type tube. Moreover, the driver tube operates Class-A, and thus may be fed directly from a comparatively low-level stage.

This method of driving a Class-B output stage is highly recommended whenever it is necessary to obtain maximum efficiency with lower distortion. One of the inherent faults with existing plate drivers is that often the tube is operated Class-AB or Class-B, which necessitates the use of a driver transformer for the grids of these tubes. Aside from this, tubes that draw considerable grid current usually are characterized by inherent distortion, and when fed into the Class-B final output stage are often responsible for the poor quality so often encountered in inefficiently designed Class-B audio amplifiers or modulators.

While the above advantages of cathode drive are highly desirable, the main advantage is its ease of operation. This particular modulator will deliver full output with an input to the driver tube of only +14 db—the output of a typical (Continued on page 100)

FIG. 1—CIRCUIT OF THE 250-WATT CLASS-B MODULATOR WITH CATHODE DRIVER

C1—2µfd. 450-v. electrolytic.
C2—25µfd. 500-v. electrolytic.
C3—2µfd. 2000-v. paper.
C4, C5, C6—8µfd. 450-v. paper.
R1—50,000-ohm 2-watt.
R2—1000-ohm pst. 5-watt (wire wound).
T1—Input transformer (Kenyon Type T-2).
T2—Driver transformer (Kenyon Type T-264).
J1—Single-circuit shorting jack.

*Kenyon Transformer Company, 840 Barry St., New York City.
A Complete Oscilloscope with I.F. Input Amplifier

By Earl I. Anderson, W8UD

Unfortunately a cathode-ray tube is a comparatively insensitive device. Little or no power is necessary for deflection, but the voltages required are fairly high. In the case but it is inexpensive and will serve for some purposes. Even so, this simplest type of unit is well worth while and should be a part of every 'phone station’s equipment.

However, as one becomes familiar with the capabilities of the cathode-ray tube and the multitude of interesting and useful purposes it will serve, it is extremely doubtful that the user will long be satisfied with the 'scope in its simplest form. He will almost certainly desire to connect the oscilloscope to his receiver and observe incoming signals, as well as to make observations at lower amplification levels in tracing and eliminating distortion in his speech input equipment.

The foregoing considerations were the factors which resulted in the development of the unit now in use at WSUD. The completed job contains all the necessary features available in expensive commercial jobs and in addition contains an I.F. amplifier, thus making connection to the superhet receiver simple and effective. Usually such amplifiers are built separately and are not as convenient to use for that reason.

The total cost of the unit at amateur prices will be about $30.00, including all tubes and the cabinet. However, if that cost is high enough to be prohibitive at the moment, a most excellent start can be made for $15 to $16 by purchasing the of the 913 tube about 100 to 150 volts must be applied to the deflection plates if the picture is to be as large as possible. Because the 913 screen is quite small it is necessary that full or almost full deflection be obtained or the pattern will be difficult to read. This means that unless the oscilloscope is equipped with amplifiers it may be used for observing voltages which are comparatively high but that it will not be usable for low voltages. Most units which have been described for amateur construction and those which are offered to amateurs at a low price are of this type. If no linear sweep is included their use from an amateur application standpoint is limited almost entirely to the trapezoidal pattern for observing final r.f. amplifier and modulator performance. The 60-cycle sweep usually incorporated is less usable than a linear sweep

* Douglas, Michigan.
may be used to obtain the trapezoidal pattern. As finances permit, the additional parts may be added, beginning with the other power supply, 885 linear sweep circuit and horizontal amplifier. Either or both of the vertical amplifiers, i.f. and low-frequency, may be added next—and the unit will be complete.

The cabinet is a standard unit measuring 8 by 14 by 7 inches and is designed to accommodate the chassis, which measures 7 by 13 by 2 inches. There is plenty of room for all of the components and no difficulty should be experienced in getting them all in. The exact layout is not particularly important but the one shown has proven entirely satisfactory and should be followed as closely as possible. The power transformers are placed as far from the 913 tube as possible. Placed as shown, their fields do not influence the operation of the tube. Several different 913 tubes were tried and with each of them the beam centered properly so apparently no beam centering controls are necessary with this tube and none are shown. Originally ordinary

midget receiver transformers were used for $T_1$ and $T_2$. Their operation was satisfactory except that the heat developed was excessive and the voltage on the 913 was too high using the entire secondary for the half-wave rectifier and too low using half the secondary. The entire secondary was used with a series resistor to reduce the voltage across the voltage divider network to 550 volts. Price is perhaps the most important factor in the design of midget receiver transformers and accordingly they operate at extremely high copper and steel densities. Because of this it was impossible to operate the scope in the cabinet for any length of time without developing excessive heat which resulted in the failure of several condensers, despite the fact that large holes were cut in the bottom and top of the back with a socket-hole punch. The Standard Transformer Corporation offered to develop the special and more conservatively designed units which

(Continued on page 108)
A Compact 56-Mc. Portable-Mobile Transmitter-Receiver

By Howard C. Lawrence, Jr.,* W2IUP

A rig was wanted that could be used for portable and portable-mobile work. Since this rig would not be installed in any one location for more than a short period of time, the complete station had to be as compact as possible, with a minimum of extras to be carted along when setting up. A summer's work with a transceiver showed that a separate transmitter and receiver were desirable, and that duplex operation is a convenience. The power consumption had to be low so that the battery drain would not be too great when operating off a storage battery and so that the power supply used for mobile work would not be too expensive.

Convenience in operation dictated that there be no vernier dials, so that the band could be covered rapidly; that the transmitter be tuned by a single control so that it would be easy to QSY to avoid QRM or to find a frequency suitable for duplex work; that the change from send to receive be made with a single switch; and that the rig be provided with a small bulb to illuminate the control panel and provide sufficient light to write up the log at night. All wires and controls...
were brought out on the control panel so that the rig could be easily shoved against the wall or into a corner where it would not take up too much space. To keep the rig dry when operating in an open boat or in an unexpected rain storm, a box with no openings in it was needed. With all these requirements in mind the rig described in this article was designed and built.

The transmitter is a 76 Hartley oscillator modulated by a 41. The receiver is a 76 “Minute-Man” super-regenerative detector, transformer-coupled to a 76 first audio.

For simplex operation the 41 modulator acts as a second stage of audio driving a loud speaker. Only the first stage of audio is used for duplex operation.

The entire transmitter and receiver are built in a black crackle-finished box 9 inches long by 6 inches high by 5 inches deep. The panel and chassis are ¼-inch aluminum while the shield partitions are ½-inch aluminum. The aluminum work was given a dull finish by dipping it in a solution of lye and water for a few minutes (and then rinsing in clean water) after all drilling and cutting was finished. The small bowl-shaped dent in the top front of the shield was hammered out with a ball-peen hammer to make room for one of the transmitting antenna feed-through insulators. All bolts were equipped with lock-washers to keep them from shaking loose.

Starting in the upper left-hand corner of the front panel, and reading to the right, are the two transmitting antenna feed-through insulators, the panel light, and the receiving antenna feed-through insulator. Fahnestock clips were installed on the antenna insulators. At the left end of the second row is the transmitter tuning control, followed by the switch which turns the whole rig on and off when working from a storage battery and turns just the microphone battery on when working from an a.c. supply; the rotary send-receive switch which turns off the receiver, turns on the transmitter, and connects the 41 as a modulator when going from receive to send; the duplex switch which turns the receiver back on for duplex; and, on the far right, the receiver tuning control.

On the left-hand end of the bottom row are four binding posts. The 50-ma. 250-volt Generator input is connected to the upper two terminals and the storage battery to the lower two terminals. When working from the a.c. power supply a microphone battery of three dry cells is connected to the lower two terminals and the upper two are not used. The plus side of the battery and Generator are grounded to the chassis. It is important that this polarity should not be mixed, since the Generator will not run and the electrolytic condenser in the microphone circuit filter will burn out if the polarity is backwards. For this reason different type binding posts were used for plus and minus connections; one post takes a forked lug and the other a straight end of wire.

On the right of these binding posts is the receiver audio volume control. Next come two red tip-jacks for the microphone, two black jacks for

(Continued on page 112)
How Would You Do It?

Suggestion for Weather-Proof Lead-Ins

ALTHOUGH responses to Problem Number Ten did not reveal anything startling or revolutionary in schemes for bringing the antenna or transmission line into the station (we hardly expected they would), nevertheless, the solutions submitted do give a good idea of the various means employed under different circumstances. A brief summary of these should be of assistance not only to those confronted by the problem for the first time, but also probably to many who find their present arrangements unsatisfactory for one reason or another.

It is realized, of course, that it is difficult to label any single type of installation “best,” because few schemes can be made to serve to complete satisfaction under all circumstances. Therefore, more weight than heretofore has been given to quality of write-up in selecting prize-winners.

Several made suggestions which included cutting holes directly through the walls of the building. When the property is one’s own, or where a special “shack” is provided for the rig, this is undoubtedly the best solution, for the job can be done without great difficulty and can provide greater mechanical permanence than other schemes. It involves no interference to screening or storm windows. Probably the best place to go through the walls, from the standpoint of appearance, is at the trimming board at the top or bottom of the window frame as suggested by W1ALJ and Alexander Marshall of Kearny, N. J. The trimming boards inside and outside provide flat surfaces for tightening lead-in insulators. Cement or rubber gaskets may be used to weather-proof the exposed joints.

Unfortunately for many amateurs, such extensive surgical operations will not be tolerated and, for these, the window usually offers the best opportunity. If necessary, the window itself may be altered considerably without permanent injury to the property because it may be replaced at little expense. The chief problems encountered in bringing the transmission line through the window are those of weather-proofing and arriving at an arrangement which will interfere as little as possible with the normal functioning of the window. We have seen no scheme which solves these difficulties better than a sufficient number of holes drilled in the glass near the top of the upper pane. The only restriction which this imposes is that the lower sash cannot be raised to its full limit, but this is of minor importance. Stops should be provided at the proper heights to prevent accidental damage by raising the lower sash too far.

W1AUN offers the advice that much trouble will be saved if the entire upper pane is replaced (Continued on page 118)
THERE are two ways this piece might begin:

A glance in the Call Book will show you that the only way you can add the country of Reunion Island to your list is by working FR8VX, for he is the only ham there.

That’s the DX angle—and it may be all that matters. But if you, too, like to go behind the signals you hear and learn of the personalities back of them, then harken to a brief page from history.

In the year 1428, following a series of long and sanguinary wars extending back to the third century B.C. when the Kingdom of Annam became subject to Chinese control, that country, which then comprised most of what is now French Indo-China, became autonomous under Chinese suzerainty. In 1789, with the aid of the French government, it freed itself entirely from Chinese control.

But it was not long before France, the erstwhile ally, became an aggressor. In 1858 Napoleon III attacked Annam, acquiring successively Cochín China and Tongking, and in 1886 what remained of the Kingdom of Annam became a French protectorate. Although technically a monarchy, ruled by the King with the aid of the Secret Council of six, it is actually governed by the French Resident-Superior and his staff.

What has all this to do with ham radio? These are the historical moves underlying the creation of a most unusual ham. But first, a little more background.

When the French took over the Kingdom of Annam they deposed the existing ruler and, in 1889, placed 13-year-old Prince Bun Lan on the throne as King Than Thai. As he grew older they found they didn’t like him very well, however, and in 1907 he was forced to abdicate.

Now Than Thai had two sons, the eldest named Vinh San and the second Duy Tan. In selecting his successor the French authorities overlooked the claims of the eldest son and placed Duy Tan on the throne at the age of 7. Vinh San continued to live in Huế, the capital of Annam until 1916, however. In that year a further upset occurred, and Khai Dinh succeeded to the throne.

At the same time Vinh San was exiled to Reunion Island.

There’s not much fun in the life of an exiled prince, but Vinh San was the sort to make the best of his predicament. Naturally of a scientific bent, he took up electricity and wireless as his primary interests in life. In 1917 he erected the first antenna on Reunion, using a galena crystal detector, to make weather and storm observations. During three years of operation this equipment—entirely home-made, for shipments from outside are very difficult owing to the remoteness of Reunion’s rockbound coast from world waterways—enabled the observance of much interesting natural phenomena. In 1919 the Prince undertook the study of earth currents, in connection with Reunion’s living volcano, Piton de la Fournaise. His other more abstruse scientific activities include the correlation of radio conditions with cyclone formation, succeeding in 1930 in the “determination of cyclonic centers and their translation.”

It was in 1920 that Prince Vinh San started in the transmitting end of radio, with a Rhumkorff coil which covered 18 miles, the first wireless transmission on Reunion. In 1924 he graduated to vacuum tubes, acquiring a small triode.

Two years later saw the start of a long agitation by him in the local press for the erection of a radio broadcasting station. From 1926 to 1930 he busied himself with a 40-watt broadcaster on 180 meters. In its early days he even built up a hundred or more receivers himself for his friends, to popularize the innovation. The station was
heard as far away as Mauritius, the call used being OXV. Finally an official station was installed, and this activity necessarily ceased.

It was 1933 when the Prince's ham career actually began. On October 12th he had his first QSO on 40 meters, with ZS2A. The call then was FB5VX, which he used until November, 1935, when he changed to the present FR5VX. In short order he worked all continents, using both 7 and 14 Mc.

In December, 1935, he had the idea of observing radio conditions at the top of Piton des Neiges, an extinct volcano which is the highest point on the island (3069 meters high). Together with Paul Bundewoet, formerly a radio officer with the French commercial navy, he camped for 12 days in a natural cavern near the top. With a portable transmitter using flashlight cells and operating with less than 2 watts many QSO's were made with Australia and South Africa. A commentary on the normal climate of Reunion is the Prince's emphasis on the weather conditions at the peak, where there was "such a cold that wooden fire was needed from sunset to next morning."

Now FR5VX—as no real DX man needs to be told—works regularly on 14,340 or 14,430 (approximately) kc. or the 28-Mc. harmonics of these frequencies. His first W contact was W8MAH. The first in each of the other U.S.A. call-letter areas were W1FOZ, W2HPL, W3CHG, W4EF, W5EDT, W6CNX, and W9NBM. He has no W7 yet!

The normal power is 20 watts, with no more than 40 at any time. The Prince finds W's hard to work, the only good time being 2300 G.T., but then static and QRM are both bad. He often hears five or six W's on the same channel—so when he reports QRM you can be sure he really means it.

His regular operating periods are from 1800 to 2200 G.T. (10 P.M. to 2 A.M. his time). The first two hours are usually spent on 14,340, while during the last two he moves to the edge of the band to avoid W QRM.

All in all, FR5VX is still another remarkable example of the inscrutable ways of Fate. But it is an interesting reflection to note that one who might have been the ruler of five million peuple has no W7 yet!

The Northwestern Division Convention

WHEN, in spite of a registration fee of only $1.00, 233 hams and their wives vote the resulting convention just about the most enjoyable affair they ever attended, that is news! That, however, is precisely what happened this year on the occasion of the Northwestern Division's convention August 28th and 29th at Sunrise Park, on the slopes of Mt. Rainier and the reaction can be attributed to three things: First, intelligent planning by a thoroughly competent committee; second, a convention site of unsurpassed beauty, affording numerous opportunities for hiking, fishing and photography, and third, the unusual amount of visiting and friendly hamming directly attributable to the "cabin life" of the gang during their stay.

The gang started assembling anywhere from several days to—in at least one case—a whole week before the convention (and it may be said that those who didn't, wished they had!). Accommodations at Sunrise are provided by cabins and this was responsible for an unusually friendly atmosphere. Many of the gang brought along their wives, and housekeeping on a small scale was started up all over the place. Not only housekeeping was started, however—so was ham radio! We won't say there's never been a convention with as many portable rigs in active operation but we will say that if there has, we don't know about it. From the moment the gang settled in their respective cabins hams were crawling all over the place putting up temporary masts and stringing antennas. Long before the evening of the first day rigs were operating in e.w. and 'phone on every band except 160 (and only the loss of a couple of tubes prevented at least one rig being on that band!). And what conditions!... signals rolled in from everywhere and, judging by reports, rollout similarly.

If the reactions of most of those attending mean anything, the affair would have been just as successful whether there'd been a program or not. In justice to the committee and guest speakers, however, it is to be recorded that there was an excellent program, just right in length, comprising two technical sessions on Saturday and Sunday, a League meeting, a hugely successful dance in the big Park lodge on Saturday night (music thanks to W7MD) and a final picnic on Sunday afternoon where various merchandise prizes were distributed in addition to three cash prizes of $30, $20 and $10 donated from the surplus funds of the convention (we still don't know how it was all done for $1.00! W1JFN). In between all this, the convention committee had wisely left plenty of time for mountain climbing, hiking on the many splendid trails nearby, fishing, photography (we've come to the conclusion that most hams are also pretty keen about photography), and plain hamming. There was plenty of each.

Speaking for ourselves (W1JFN), anytime the NW Division gang holds another convention at Mt. Rainier, we'll break both legs as many times as may be necessary to get there. However, we'll do three things we didn't do this time: first, we'll
The 1937 West Gulf Division Convention

The Eleventh Annual West Gulf Division Convention was held in Houston, August 20th and 21st. It was a huge success, having a larger attendance than any previous West Gulf Division convention—265 hams. Numerous prizes were donated by the manufacturers, and nearly everyone went home with one. Among the distinguished guests present were President E. C. Woodruff, representing A.R.R.L., Dr. J. S. Waters of Rice Institute and Mr. and Mrs. John L. Reinartz.

Every item on the convention program went off exactly on schedule, and a great deal of credit is due the Houston Amateur Radio Club for their excellent management. Through the sale of advertising space they were able to provide $4.50 worth of entertainment for each $3.50 registration.

Next year's convention is scheduled to be held in Carlsbad, New Mexico.

—W6BKW

Strays

"Have you ever mounted a shield can on a metal chassis and found it hard to mark the holes for drilling?" asks W8KQZ. He supplies a kink to make it easy. Place a small piece of adhesive tape on the chassis at the approximate location of each hole, place the shield can in exact position, and with a long pencil mark on the tape where the holes are to be drilled. Remove the shield, and twist a sharp knife point through the marks and tape into the metal. Drill through the tape; it will prevent the drill from creeping sideways.

What the League Is Doing

(Continued from page 38)

No More A-2

Type A-2 emission, even of a nature not involving frequency modulation, is no longer permitted in our 28- to 30-Mc. band. On October 5th, the F.C.C. amended our Rule 375, stating the frequency bands on which A-2 may be used so as to limit it to the frequencies above 56 Mc. Thus the 28- to 30-band is now governed by precisely the same regulations applying to our lower-frequency bands as concerns the quality and types of output.
HINTS and KINKS
for the Experimenter

Combining the Frequency Meter, 'Phone Monitor, and Keying Oscillator

By Stan Comach, VE2EE

One of the most indispensable items of the well-dressed and operated ham station is the monitor, and no law-abiding amateur should think of doing without one even in these days of extensive crystal control. The best of crystals act up at times and the best of transmitters cannot always, therefore, be depended upon to perk merrily along right where it belongs; the only safe thing to do is consistently to check its operation to make sure that the signal is all in one lump, all in one place. The writer speaks from experience, remembering very vividly the expenditure of a brand-new five spot for a crystal guaranteed to hold the signal of VE2EE on a frequency of 14,398 kc.; the itch to ride the edge was upon me. Two A.R.R.L. Official Observers checked the signal at 14,403 kc. and sent me QSL's. Was my face red! At that time the station sported a monitor of the single tube type which up to that time had been considered sufficiently reliable, but with trouble sneaking up on me so unsuspectingly I decided to build something that could be trusted.

A search through QST brought to light an article entitled “Combining the Frequency Meter and Monitor,” and working along these lines I started in to build a reliable piece of equipment. The question of stability is naturally of prime importance and after talking the matter over with some of the boys the 2A7 was chosen for the oscillator with the 56 to function as the detector. The unit was constructed and its performance exceeded all my expectations. The 2A7, after being allowed to settle, held the calibration error on the 14-Mc. band down to close to 1 kc., which is tolerable good. Along about April, 1934, someone brought out an improvement which, while not affecting the oscillator, afforded a cleaner keying signal; this was the tuned grid circuit on the detector.

Quite recently another article appeared in QST entitled “Audio Oscillator Keying Monitor Without Relays.” Upon reading this an idea was born and is here presented as an improvement for the shack, with apologies to the fellows who provided the basic ideas.

It seemed to me that the 56, while doing a mighty fine job as a detector, could still be called upon to perform another duty, so by rearranging the grid circuit it is made to function as an audio oscillator which provides a beautiful signal for listening to that bug. For those who already have built the oscillator already referred to the changes, shown in Fig. 1, are simple and inexpensive. A d.p.d.t. switch, an old audio transformer, a volume control, couple of resistors and the change is completed. Following through the d.p.d.t. switch it will be seen that on one side the cathode resistor is grounded while the grid is connected to L2. The coil L2 consists of 5 turns of No. 20 on a tube base, and without any tuning condenser resonates at around 14 Mc., well enough to provide an S9 'phone signal with the switch in the oscillator plate in the “Off” position; Voila, the Phone Monitor!

With the oscillator plate switch closed, the carrier or keyed transmitter signal can be tuned

FIG. 1—COMBINED FREQUENCY, MONITOR, AUDIO OSCILLATOR

C1-25-µfd, variable (bandspread).
C2-50-µfd, variable.
C3-0.002 µfd.
C4-0.1 µfd.
C5-0.5 µfd.
C6-0.01 µfd.
C7-250 µfd.
C8-0.5 µfd.
C9-0.1 µfd.
C10-0.004 µfd.
C11, C12-0.004 µfd.

C1-250 µfd.
C2-50 µfd.
C3-0.002 µfd.
C4-0.1 µfd.
C5-0.5 µfd.
C6-0.01 µfd.
C7-250 µfd.
C8-0.5 µfd.
C9-0.1 µfd.
C10-0.004 µfd.
C11, C12-0.004 µfd.

R1-40,000-ohm.
R2-100,000-ohm.
R3-10,000-ohm.
R4, R5-0.5-megohm.
R6-100,000-ohm variable.
R7-15,000-ohm.
R8-0.25-megohm.
R9-100,000-ohm.
R10-10,000-ohm.
R11-40,000-ohm.
R12-100,000-ohm.
R13-0.5-megohm.

L1—Inductance adjusted for frequency band desired.
T—Audio transformer.
in, by means of $C_1$, $I_{ci}$ ... the Frequency Meter! With the d.p.d.t. switch in the other direction the grid of the 56 is connected through the grid leak and condenser, $R_6C_7$, and the audio transformer secondary to ground, while the cathode is connected through one wire to the center-tap of the keyed stage on the transmitter, above ground until the key or keying relay contacts are closed. The audio oscillator is thus keyed simultaneously with the transmitter. $R_6$ is front panel control of audio tone, and the pitch of the note can be varied for different ears between 100 and 5000 cycles. The volume control $R_s$ provides a means of controlling the volume of the oscillator without affecting the frequency; this is an essential as the level of the audio oscillator is up about 15 db over the output of the frequency meter. The toggle switch in the plate circuit of the 2A7 is necessary to prevent the r.f. oscillator signal from killing the audio oscillator, since $C_6$ is always in the circuit.

The 2A7 functions as a negative-resistance oscillator of the retarding-field type, with electron coupling to the output circuit. Its use was suggested to the writer by J. C. E. Mitchell, VE2LO. In the circuit shown, the No. 2 grid functions as a screen, the Nos. 3 and 5 grids together as a plate, and the No. 4 grid as a suppressor. The screen and suppressor are at the same r.f. potential, and when the potentials of both vary together, increasing screen potential will be accompanied by decreasing screen current and vice versa, thus giving the negative-resistance effect. 1

The No. 1 grid is connected to the cathode. The circuit is simple to use, since no feedback tap or coil is needed.

Another Harmonic-Reducing Circuit

NOTICED much discussion in QST lately re harmonic radiation—or rather its elimination—and would like to chip in a few cents' worth as per the diagram of Fig. 2. Have found this circuit very effective with either self-excited or oscillator-amplifier rigs.

Circuit $L_1C_1$ is the regular tank circuit. $L_2C_2$ is tuned to the second harmonic, placed in lead from plate to $L_1C_1$. It is essential that the coupling between $L_1$ and $L_2$ can be varied.

The rig is cranked up on the regular frequency and $L_2$ coupled fairly closely. $C_2$ is varied while listening to the second harmonic of the signal in the receiver. When the point of minimum signal is observed, leave $C_2$ at that setting and vary the coupling between $L_1$ and $L_2$. This should still further reduce the strength of the harmonic when the proper degree of coupling is obtained. The antenna may be coupled by any of the usual methods; if an antenna tank is used, it should be coupled to the side of the tank circuit opposite $L_2$. $L_2$, incidentally, probably works best coupled to the plate end of $L_1$. I have reduced an S9 second harmonic to S3 by this method with no trouble to speak of. $L_2$ could be left fixed over a band once the optimum setting is found, but it would of course be necessary to retune $C_2$ for each change of frequency as its adjustment is quite critical.

—Fred C. Allen, VE3SA

Inexpensive Stage Switching

THE idea shown in Fig. 3 comes from Dr. W. R. Jaffrey, VE3DC, of Hamilton, Ont. Applied to the exciter unit described in October QST, it substitutes a 6-prong tube socket for the switch, and utilizes old tube bases with appropriate jumpers between the pins to make the proper connections between stages for output on various bands. The socket may be mounted on the front of the unit, in case relay-rack construction is used, so that it is readily accessible. Other pin

1 "A New Type of Two-Terminal Oscillator Circuit," QST, April, 1935.
Connection arrangements can of course be used provided the necessary interconnections are made with the three plugs.

With the 6-prong socket shown, the grids of the idle stages are not grounded as in the original switching arrangement. Grounds can readily be provided, however, by using a 7-prong socket and plugs, using the seventh prong as a ground with appropriate connections in the plugs.

VE3DC also recommends using a 0.01-µfd, 600-volt condenser connected between oscillator cathode and ground if the oscillator is keyed in the cathode circuit. A choke between key and ground is also helpful in preventing chirp with oscillator keying.

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Replacing Magnetic Speaker with D.C. Dynamic

**FIG. 4** shows a simple method of replacing the old magnetic speaker with a dynamic without adding a field supply or without modifying the receiver in any way. The field is simply connected in series with the primary of the output transformer and by-passed with a 4-µfd. condenser, thus using the plate current to the output tube of the receiver to excite the field.

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Regenerative Doubler

The output of the 46 doubler in the 47-46-10 low-power transmitter, shown in August, 1936, *QST* and the Fourteenth Edition of the *Handbook*, can be materially increased by the use of the regenerative circuit shown in **Fig. 5**. All that is required is a trimmer condenser and a few turns of small wire. The use of a separate neutralizing coil connected as shown permits the use of a cheap trimmer condenser instead of a more expensive variable which would be necessary if the plate voltage appeared across it. In some cases an increase of 100% has been obtained in the grid current of the 10 when used as a doubler. At the same time the plate current of the 46 was lowered by one third. The addition of the neutralizing coil requires no changes in any existing connections. *L₂* has the same number of turns as *L₁*, and is wound one-eighth inch away from the low-potential end of *L₂*. No. 30 wire is plenty large enough. The circuit is neutralized in the usual way.

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Mounting Trimmer Condensers

While rebuilding recently, I decided to mount the grid tuning condensers inside the coil forms (link-coupled circuits) to save space. To eliminate loose wires inside the coils I ran across this very helpful kink which saves plenty of time and trouble.

Instead of using the usual 4- or 5-prong coil form, I purchased the six-prong type (some of

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**FIG. 5**—Adding regeneration (neutralization) to a doubler stage

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**FIG. 6**—Wiring arrangement for easy removal of trimmer condensers mounted in coil form

these have a mounting shoulder for mica or air trimmers). Hook the twisted pair for the link to the large terminals, and the ends of the grid coil winding to plate and cathode prongs. This leaves the two top prongs free for connection to the tuning condenser. The connections may be pulled tight and cut off, as indicated in **Fig. 6**. This permits easy removal or installation of the tuning condenser. Connections between the condenser and the two sides of the grid coil are made on socket. Don't forget these!

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R. N. "Bob" Eubank, W3WS (W3AAJ)
Amateur Radio

STATIONS

W6HG, Inglewood, Calif.

Not all West Coasters employ "California kilowatts." In twelve years' operation George Dery, W6HG, ex-6OHT, has used single-210 transmitters. (Before the 210 it was a single 202.) The photo of W6HG shows how ultra-simple an amateur station can be, yet it can be just as effective as it is simple. With the 210 Hartley, running only 40 watts input, WAC has been made on 14 Mc., and all continents except Europe have been worked on 7 Mc. The receiver is an SW-3. Crystal control was used for a period of about a year, but eventually was discarded in favor of the greater flexibility of the self-excited rig. Favorite antennas are a 67-foot horizontal Zepp for 7 Mc. and a 31-foot vertical for 14 Mc.

The operator, an ex-seagoing brass-pounder, gets his fun working DX and handling traffic with foreign stations. Despite the low power, W6HG is a member of the Trans-Pacific Traffic Association.

W5FIY, Okemah, Okla.

W5FIY, John F. Stanbery, of Okemah, Okla., specializes in low-power 'phone DX, the 14-Mc. band being his principal hunting ground. After an eight-months' wait to get Africa WAC was finally made in June, all contacts being made with a pair of 841's running only 60 watts input. Since then the 841's have been replaced by T-20's.

The tube line-up in the transmitter consists of a 6L6 crystal oscillator, doubling, an RK-39 buffer and second-doubler, and the aforementioned T-20's. The input has now been increased to 90 watts. The final is modulated by a pair of Class-B 46's. The microphone is a Shure 708 crystal. A three-halves wave antenna, fed through "Q" bars, is used. It is 55 feet high.

A Lincoln R-9 communications-type receiver is used. Other equipment on the operating table includes a Peak pre-selector, control panel and speech amplifier, monitor, and a frequency-meter.

W5FIY was formerly W 4DPI in Tennessee, where he secured his first license in 1935. At the present location, nearly all operation has been on 20-meter 'phone, although 75 is used occasionally.

K5AA, Fort Amador, Canal Zone

The inhabitants of the c.w. portion of the 14-Mc. band between 14,250 and 14,400 kc. can recognize after a dot or two that signal near 14,300. There's something about the note and the operating which makes K5AA one of the most easily-spotted stations on the band.

The photograph shows most of the equipment that is visible from the operating position. Everything is behind a series of plywood panels, totalling 8 by 10 feet, from which a shelf extends out to serve as the operating desk. Even the receivers are
set flush, as the photograph shows. A small shelf under the table holds the log and callbook. The transmitter is operated on 14,310 kc. only. Starting out from an 80-meter crystal, the tube line-up includes a 59 Tri-tet oscillator, a pair of 10's, a 211 doubler-buffer, and push-pull 860's in the final amplifier. Grid keying is used, with 42's as the keyer tubes. Power switches are on the control panel at the right in the photograph.

For ham work, the receiver used is an RME-69. The receiver to the left of the 69 is a late-model army set, while a second army receiver of older vintage is mounted up above.

There are seven operators at K5AA: Turcotte (Eddie); Templin (Dick); Laird; Winters (Ed); Atwill (Bill); Weir (Chas.), and Klami. Schedules are maintained with several W stations, and the whole gang likes rag-chewing. And they have a signal with which they can put it over.

K7EVM, Fort Yukon, Alaska

When you're out in the far-away places, amateur radio assumes greater importance than simply a hobby, important though our hobbies may be to us. In such a case, a little thing like lack of power may be an annoyance, but it is not a major obstacle.

K7EVM, owned by Ray Randall, Deputy U. S. Marshal and Deputy Collector of Customs at Fort Yukon, Alaska, is such a station. First take a look at the picture which shows the location, and then read the following letter:

"The shelves which hold the transmitters are mounted on the outside wall, which is of logs. This is fairly solid. In the upper right-hand corner there is a single 42 crystal transmitter connected Tri-tet. I usually use this on 80 meters, though have tried it out on 40 and 20. The greatest DX on 20 with this rig has been a contact with F8EO.

"On the upper shelf along with this rig there is also a Collins type pi-filter. Notwithstanding all the adverse criticism of the filters I find it very satisfactory and so far have had no ticket for harmonic interference, nor any heard cards on 10 meters!"

"Below, the 47-46-p.p. 46's are spread out, and on the bottom shelf are the power supplies. There are three, 300 volts for the oscillator, 400 volts for the doubler and 550 volts for the final. Condenser input on the low supply and choke input on the others. Rectifiers are an 80, 5Z3 and an 83.

"The receiver at the left of the crystal Comet Pro is a home-built t.r.f. using 2-volt tubes. The frame and some of the parts are from an old Pilot Wasp. The coils are an old set of Nationals from a converter. The Comet is a 6-volt job with four Edison batteries for filament supply. These are located in a small lean-to addition at the rear of the house with a pair of wires running around the outside to the receiver.

"The stack of 'B' batteries to the right are for the 42 transmitter and are mostly old ones that have been used on the Comet until the voltage drops to about 35. The current drain on the 42 is low so I get long life from them. The neighbors give me their old batteries, which helps out a lot.

"I have a single-cylinder air-cooled engine which drives a 32-volt generator to recharge the Edisons, charging in series and discharging in parallel. The engine also drives an a.c. generator made from an old Dodge generator. The generators are arranged so that either can be used. The engine is mounted on heavy timbers set on the ground, which is not very solid in the summer but in the winter I pour a little water around and it stays frozen all winter with the rigidity of con-

(Continued on page 116)
Conducted by Byron Goodman

Regulations:
The right to use 'phone on 14 Mc. has at last been granted ZL stations, according to information received from ZL4AO through W6ITF.

The new regulations provide for a band from 14,150 to 14,250 kc. for 'phone, to be used between midnight and 7 A.M. New Zealand time. Crystal control must be used, with a buffer stage between oscillator and final. Equipment to indicate overmodulation, a monitor and a frequency meter must be included. All testing must be done with a dummy antenna. Applications for the use of 14-Mc. 'phone must be passed by both the N.Z.A.R.T. and the Postmaster General's office.

In Australia a circular letter has been sent to all licensed "experimenters" (i.e., amateurs), notifying them that because of abuses in operating practices, especially on 'phone and notabiy in connection with music testing, regulations were being placed in effect which (1) prohibit music transmission on 7 and 14 Mc., except during daylight hours, (2) impose technical requirements concerning oscillator stability and modulation efficiency on the operation of 'phone stations, (3) limit 'phone transmitters to 25 watts input power, (4) institute a probationary period of six months in which c.w. operation with power under 25 watts only is permitted, and (5) announce that vigilance committees are being appointed in each state to assist in securing enforcement of regulations.

QSL:
As most readers will have realized, the Australian QSL Bureau listing in the October issue was in error. The address given applies to Austria. The Australian address is: W.I.A., QSL Bureau, Ray Jones, 23 Landale St., Boxhill, Victoria.

WAC:
The following WAC certificates were issued during the period from January 1 through June 30, 1937:

Dorothy D. Hall, W2IXY ('phone); Francois Peret, F8II ('phone); S. C. Pleass, ZT6K; Perce Cronin, ZL2Q; J. M. Mavis, ZEIJE; J. P. R. Friedenthal, ZS6AJ; Kristian Mathiesen, LASH; Ernst Schamann, DJCFH; R. T. Dealey, G6DT; Harushige Nakano, JSJT; Erling Karlsen Klevfos, LS6E; Andreas Giiske, LA5O; Wilh. Ingart, LAMR; F. E. A. Koopmans, PA0T8K; Frank A. Robb, GI0TK; D. H. Wijkman, W6CDX; Wladimir de Carvalho, PY2BX; E. R. Roderick, W3MLW; E. V. Carpenter, W5KSF; Dr. H. G. Wyer, W11CI; W. L. King, W7ETK; Fred J. Welton, WTNS; H. M. Grant, W9HHQ; Maury Kingman, W3FGF; Wm. L. Opdyke, W3VB; R. C. H. Taylor, ZT6T; L. Adalberto Brito, R, CB4AD; Arthur B. Smyly, W9CIZ; C. M. Fockler, V3SF; Wenceslao Sere, CX1AA; San Jose State Radio Club, Harry Pangwietch, Trustee, W6YL; Donald J. Simpson, W3EYF; Walter J. Smith, Jr., W2DXX; Norman P. Jessup, W5EHR; Richard F. Barrett, W6CFK; Roy W. McCarty, W9BA; Mrs. Mary Roth, WT6SV; Murray J. Douglas, W6CUG; Theodore J. Zuki, WI1UL; David B. Stout, W3UX; George D. Heitzman, W7AHX; Kiyoshi Yamachika, W6NGO; Raymond C. Lowery, W1AFB; Elmer Rahmes, W8JFC; Andrew C.
For A.R.R.L.'s Tenth International DX Competition tentative dates are announced: Radiotelegraph contest, March 5th to 13th. Radiotelephone contest, March 19th to 27th.

Any changes in our DX Contest rules? But two out of many suggestions seem to meet general approval. (1) "Operating time" recorded as the summation of the difference between "time on" and "time off" will probably be required reported in units of full hours covering full quarter-hour segments rather than making up total time as the sum of many shorter periods. Five minutes' work or fifty-five minutes' or sixty minutes' work will all count as an hour. Work may be planned to permit periods on and off the air to suit vocational schedules, but dipping in and out of the fray for just quarter-hour periods may prove unprofitable. (2) A group of radiotelephone amateurs request change in 'phone rules to bar counting any contacts by 'phone with telegraph stations . . . requiring all work reported to be "voice to voice." That's OK with us if the gang really want it that way, and unless strong opposition is voiced at an early date that's the way the rules will appear. It may limit scores slightly, but, like all rules, they are equally fair to all comers. There are a few foreign countries where telegraph stations can be worked, but few or no voice stations. It was our idea to give everybody a crack at these—but the factor is unimportant as long as the rules are the same for everybody. So expect it to be a 100% voice-only telephone competition. (3) Remember the disqualifications made last March for off-frequency operation, improperly modulated notes, and the like? Violations of government regulations will again be penalized. There must be no repercussions about poor amateur operating at Cairo! Official Observers will be asked to note the line, reporting all violations to the contest committee. Special cooperation is being requested of the F.C.C. itself. We shall ask the monitoring stations to give the DX bands redoubled attention. Any stations known to have been logged in violations by the F.C.C. during the contest will also be disqualified automatically. The interest of all amateurs requires strict observance of frequencies, d.c. power supply regulations, etc.

A.R.R.L. Member Party Coming!! A number of A.R.R.L. activities are open to all radio amateurs, whether members of the League or not. Appointments by S.C.M.s are, in accordance with the League's By-Laws, open only to bona fide members of the League. Appointees have special tests at regular intervals. January 8th—9th week-end has been proposed for a special activity, A QSO PARTY FOR A.R.R.L. MEMBERS ONLY. For maximum enjoyment for our members, rules will be of the simplest—no restrictions to certain bands—nor to 'phone or telegraphy. Either or both may be used. A worthwhile prize will be given by A.R.R.L. to the MEMBER in each Section who can chat with most other members in the allotted hours. It will be something designed for the individual member himself. Details next month. Set aside the dates. Polish up the station. Any persons who are League Members on January 15th will be eligible to the fun and benefits—but not other amateurs.

Friday, December 10th—A.R.R.L. Copying Bee. Let us check your copy and return to you for your confidential information. See announcement on page 16.

—F. E. H.

Official 'Phone Station and Official Relay Station appointees have entered on another all-season competition which runs to May 15, 1938. In each group, amateur work performed between the dates of the quarterly station tests that keep these stations and operators at peak efficiency, will count an important part in the results of all the stations. This season not only national standings but section comparisons will net points to participants. Experimental and constructional activity is emphasized in the radiotelephone group, and traffic handling in the O.R.S. group. These key appointments stand for the best in amateur operating. The submitted performance records will enable the judges to select the best all-around O.P.S. and O.R.S. for the seven-month period ending next May. Ten awards will be made in each group.

Regular Headquarters bulletins to these organized 'phone and telegraph groups convey full details on rules and prizes. Any League member-amateur who can qualify by consistent activity, proper procedure and operating ethics, a good
station and monthly proof of doing things with it, is eligible for appointment as O.R.S. or O.P.S. Drop Hq. a line stating whether you are interested in voice or telegraph appointment and let us send you information about the qualifications. The appointments are not made by Headquarters but by the Section Communications Manager elected by League members in each Section. Your S.C.M. is listed on page 4 of this issue and he will send ORS/OPS application blanks on request.

The exclusive DX Century Club membership is growing. 75-country men are in a scramble to secure the elusive written proof and make the full membership. Others are working for 75 countries! It would be trite to say that DX is "popular as ever" this year. DX tales have acquired about the reputation of "fish stories." Now we have a club with certified members, all of whom successfully meet the dual challenge of the I.A.R.U. country list, and the hurdle that comes in getting the written confirmations which is a legitimate requirement. Our membership list is no empty list of fishermen who say what they have done, but a list of those who have proved their right! Hats off to the "centurions."

The A.R.R.L. Trunk Lines (each of the fourteen lines supervised by one of its members) set our pace in organization performance this year. Functioning with snap and precision these lines have outlets and inlets for handling traffic to and from an increasing number of A.R.R.L. Section Nets. Official appointment to posts of responsibility in the system arranged above is effected by certificate. The certificates are striking and to the point. The definite performance for amateur radio is likewise much in point. We want to say that every amateur, whether he takes part in this worthwhile relaying work or not can be proud of the work Official Relay Stations and nets are doing. The men who hold certificates have earned them well. They invite all amateurs (and others) to route traffic over their routes. To reach the friend who is beyond immediate range of transmitter, or unavailable at convenient hours, to schedule us the intelligent way is to use amateur message facilities.

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BY JOSEPH A. HOFFMANN

Effective Use of CQ

CQ calls are an important part of amateur operating, and probably the most misused part. It is essential that every amateur acquaint himself with and make use of the correct CQ practices in order to obtain more and better QSO's.

Many operators having only a little time to spend on the air will turn on the rig, and after a quick tune-up and check-up on the meters while the key is "locked" will turn on the receiver and proceed with a CQ, continuing it long enough for the receiver to get thoroughly warmed up. When they start listening for an answer they will be surprised at the number of CQ's and other QRM on the band. Such foolish operation just adds to the QRM and not your reputation of "fish stories.

Before calling CQ we should tune over the band thoroughly to see if any QSO's are being sent, and if there are, why not answer one of them. Our own CQ will probably be answered by one of those same stations anyway. While listening over the band we may run across some good DX. If no DX is heard and conditions seem unfavorable for DX, there is no reason for calling CQ DX as is often heard called at the most inopportune times. During our listening periods prior to calling CQ we may hear only "locals," and if we are looking for QSO's with stations somewhat remote, it is useless to call CQ at this time as is also the case when skip prevents us from hearing "locals," when we want such QSO's. Better results are usually obtained by tuning over the band and calling for certain places than by calling directional CQ's. A good listener can sometimes distinguish DX and certain sections of the country by the tone of the signals and the type of sending. If we still persist in CQing after doing those things, we should first listen on our own frequency to ascertain whether it is free from CQ's and also wait for QRM to abate somewhat to insure being heard.

At times we will notice several stations on the band all calling the same fellow. A good time to CQ is right after they stop calling that fellow, as probably all of them except the lucky one will be back listening for more CQ's. Many times a fellow calling CQ is answered by several stations, but due to an obsolete or faulty receiver he hears not one of them and calls CQ a second and third time with the same lack of results. Not giving his receiver a thought he tries returning the rig for the next few minutes causing awful QRN. He then tries CQing again with no luck, decides conditions are against him and QRT's. If your receiver is N.G., refrain from CQing, and call only those you are able to hear.

CQ. CQ, 21, 22, 23, and we turn our dial to another frequency in disgust. It is nothing unusual to hear twenty or more consecutive CQ's before an interruption is made by slurring in the call letters once or twice, and then this whole procedure repeated a few times before the CQ is finished up with almost anything but K to indicate that the operator is ready to listen over the band. Incidentally it has been men-

PRIZES FOR BEST ARTICLES

The article by Mr. Joseph A. Hoffmann, W2DJ, wins the C.D. article contest prize this month. Each month we print the most interesting and valuable article received marked "for the C.D. contest." Contributions may be on any phase of amateur operating or communication activity (DX, phone, traffic, rag-chewing, clubs, fraternalism, etc.) which adds constructively to amateur organization work. Prize winners may select a 1938 bound Handbook, QST Binder and League Emblem, six logs, eight pads, radiogram blanks, DX Map and three pads, or any other combination of A.R.R.L. supplies of equivalent value. Try your hand. Send your contribution to-day!

Brief

In regard to the letter in the correspondence section of October QST concerning special telephone directory listings for amateur radio stations, additional information has been received. Directory listings are not determined by the A.T. & T., but rather by the local telephone company which furnishes the service and publishes the directory. Most local companies charge a nominal sum (usually 25¢ or 50¢) for additional directory listings. The West Virginia company mentioned in October QST is an exception, offering free listings for amateur stations. If you desire your station to be listed in your directory, get in touch with your local telephone office for information on the cost, etc.

*15 Grandview Ave., White Plains, N. Y.
tioned numerous times that three CQ's followed by the call letters once or twice, and this procedure repeated three to five times followed by the signing of the call letters several times and then sending K is sufficient for obtaining excellent results. It is of extreme importance to sign the call letters several times at the end before signing K, as the CQer is probably looking over the band now and then while operating will suffice. Some fellows make the mistake of calling stations the same length of time in the daytime as in the evening when the band is very crowded. It takes quite a while longer to tune over a crowded band, so make the call according to conditions, and of course they will vary in length dependent upon the part of the band the CQer is tuning from. Stations located on the edge of the band should give a short call, sign, and then listen, and if the CQers fail to answer, continue with a longer call now as the CQer is probably looking over the second transmission, and the answerer is greatly disappointed.

When answering a CQ it is necessary to know the condition of the band regarding QRM. A quick look over the band now and then while operating will suffice. Some fellows make the mistake of calling stations the same length of time in the daytime as in the evening when the band is very crowded. It takes quite a while longer to tune over a crowded band, so make the call according to conditions, and of course they will vary in length dependent upon the part of the band the CQer is tuning from. Stations located on the edge of the band should give a short call, sign, and then listen, and if the CQers fail to answer, continue with a longer call now as the CQer is probably looking over the band for other calls, one of which he will pick out for a QSO. Break-In should also be used when answering CQ's.

A fellow with a good note is heard CQing, it is our immediate duty to call him and tell him to change it or keep it off the air until it is fixed. The same thing applies when we are called by a bad note. It is hoped that the practices suggested in this article will be conspicuous by their greater and constant use on the air rather than by the space they take up on this page.

Let’s improve our operating by the effective use of CQ.

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**56-Mc. International Contest**

The Radio Society of Great Britain announces a 56-Mc. International Contest. The rules are as follows:

2. The Contest is open to any radio amateur licensed to operate in the 56–60 Mc. band.
3. The winner will be the operator of the station scoring the most points based on the following system:
   - 1 Point for each contact over a distance between 200 and 999 Miles; 5 Points between 1001 and 2000 Miles; 10 Points between 2001 and 3000 Miles; 15 Points between 3001 and 4000 Miles; 20 Points between 4001 and 5000 Miles; and so on, at the rate of 5 extra points for each additional 1000 Miles or part thereof.
4. Only one contact with a specific station may count for points in any 7 Day period.
5. Final entries must be received by R.S.G.B., 53 Victoria Street, S.W. 1, not later than February 28, 1939. (W and VE entrants may send their entries via A.R.R.L.)
6. The decision of the Council of the R.S.G.B. shall be final in all matters relating to the Contest.

Attention is called to the cup award being offered by the Milwaukee Radio Amateurs' Club to the first licensed United States amateur to work 56-Mc. two-way between continents, properly certified by documentary evidence. Complete details of this offer appeared on page 35, July 1937 QST.

The Wireless Institute of Australia reports that 56-Mc. transmissions are conducted by V6A's each Sunday at 0000 G.T. and at 0900 G.T. on the last Sunday of each month.

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**56-Mc. Reception Contest**

In conjunction with the International 56-Mc. Transmitting Contest, and in order to encourage non-transmitting amateurs to collect and tabulate phenomena relative to the 56-Mc. amateur band, the R.S.G.B. has decided, provided sufficient entries are received, to offer a suitable trophy to the non-transmitter whose log covering the period January 1 to December 31, 1938, is considered by the Council of

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**BRASS POUNDERS’ LEAGUE**

(September 16th–October 1st)

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**MORE-THAN-ONE-OPERATOR STATIONS**

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**A.A.R.S.**

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A total of 500 or more, or 100 deliveries Ex. D. Cr. will put you in line for a place in the B.P.L.

*All traffic handled by two-way radiotelephone.*

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December, 1937

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that body to contain the most valuable information. Certificates of merit will be awarded to those submitting the most valuable information at the conclusion of the Contest, irrespective of the number of entries received. Logs must be received by R.S.G.B. not later than February 28, 1939.

For the purpose of this Contest a non-transmitter shall be regarded as a person who did not hold a radiating permit on January 1, 1939.

**DX Century Club**

TWO more operators have attained membership in the DX Century Club since the November listing—G2ZQ and W1SZ. The total membership is now seven at this writing. Several operators have increased their standing, and we find some new faces in the 75-or-over ranks. That these listings represent real accomplishment is proven by the fact that body to contain the most valuable information. Certificates of merit will be awarded to those submitting the most valuable information at the conclusion of the Contest, irrespective of the number of entries received. Logs must be received by R.S.G.B. not later than February 28, 1939.

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**THE "ULTRA ULTRA" IN PORTABLE POWER SUPPLIES**

Benton White, W4PL, inspects the outfit that supplied power for W4CDC-4, Chattanooga Amateur Radio Club, in the June Field Day. The generator is mounted on a power lawn mower, direct-connected to a 1-h.p. gas engine. This "animal" pulls itself to the field, cuts the grass around the tent, and then contentedly furnishes juice as long as desired.

**THE 1.75-Mc Code Practice Stations**

Code practice transmissions for the benefit of beginning amateurs have been announced by the following stations:

- W18SD, Hartford, Conn., 1825 kc., Tues., Wed., Fri., 7:30-8:30 P.M. EST...
- W1ASZ, Pawtucket, R. I., 1925 kc., intermittently, 6:30-7:00 P.M. EST...
- W1GIX, East Windsor, Conn., 1825 kc., Mondays, 7:30-8:30 P.M., Thursdays, 9:00-10:00 P.M. EST...
- W2DSI, Arlington, S. L., N. Y., 1835 kc., Thursdays (exc. holidays), 7:00-8:00 P.M. EST...
- W2FYW, New York City, 1920 kc., Mondays, 7:00-7:45 A.M. EST, Fridays, 8:00-8:45 P.M. EST...
- W2SHZ, Utley, N. J., 1927 kc., Mon., Thurs., Sat., 8:30-10:00 P.M. EST...
- W3GYR, Philadelphia, Pa., 1950 kc., Fridays, 6:00 P.M. EST...
- W5CFQ, Paris, Ark., 1840 kc., Mon., Wed., Fri...
- W6CAG, Fort Smith, Ark., 1910 kc., Tues., Thurs...
- W7DHY, Seattle, Wash., 1915 kc., Fridays, 10:30-11:00 P.M. EST...
- W8JYO, Cridersville, Ohio, 1874 kc., Tues., Fri...
- W8QJH, Shreveport, La., 1965 kc., Tues., Thurs., 7:00-7:45 P.M. EST...
- W8PBX, Cincinnati, Ohio, 1865 kc., Mon., Thurs., 6:45-7:15 P.M. EST...
- W9BSP/W9UA, Olathe, Kansas, 1903 kc., Daily, 7:30-8:30 P.M. EST...
- W9OPG, Cedar Rapids, Iowa, Tues., Thurs., 7:30-8:30 P.M. EST...
- W9BSP, West Hartford, Conn., and we will send you some hints on how to conduct code lessons by radio.

- **O.B.S.**

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 50): W1ASI, W3CDQ, W4ASR, W4CXY, W6LZJ, W7FPN, W8DFD, W8ECY, W6VTC, W6SPL, W6NLI.

- **Briefs**

W2KJY inquires, "Did you hear about the fellow who worked for a condenser company and got discharged?"

- **Field Day Reports**

A report on participation of the Elmira Radio Amateur Asn. in the June Field Day was received too late for the report in November QST. W6C11-S was the call used with W6CQJ, W6CHU, W6AYD, W8DZC and Lew Roy as operators. Score was 582... 69 QSO's. The score of W6KXJ-9 was erroneously listed in November QST. The correct score is 711... The score of 323 credited to W9IXJ-8 should have been credited to W9IXJ-8 with W9LHI, W9ECL and W2IJJ as operators.

W7GEQ, who started in radio in 1907, suggests that we end our sign-offs with the year we started hamming, viz., '07, '12, etc., etc. This might prove interesting, especially in the case of 20-Year Club members.
How's DX?

The 28-Mc. band is again in full swing at the time of this writing. If you want to add to your list of counties worked on 28 Mc., now is the time to do it. You'll stand a good chance of working some new ones too.

W8MAH, Williamsport, Penna., sends in some very interesting general information on conditions on 28 Mc.:

"There are a few generalities which can be mentioned at this time about 28 Mc., that may be helpful to many of the gang. These are based upon general normal conditions. "European stations come through in the mornings and stay with a weak period around noon (E.S.T.), until 3 P.M. The South African stations come through rather poorly from 10 A.M. until noon, when they start to become very much stronger, reaching a peak between 1 and 3 P.M. with fade-out shortly thereafter. South Americans seem to be best from noon until 5 P.M., with their best signals from 6 to 8 P.M. Australia comes through as early as 3 P.M. and stays until an average of 8 P.M. This is also true of ZL's and K6's. The signals from Japan, based mostly upon JNJ's harmonic, start coming in around 4 P.M. and build up for a short while, but have a very weak to fade-out spell between 6:30 and 6:00 P.M., after which they are much stronger, but gradually fade out to stay about 7:30 or 8:00 P.M. Signals from India and the East Indies seem to be best between 10 and 11 A.M.

"The following frequency list was carefully made: ZSIAH 29050, ZTEJ 29050 29060, ZTY8 29050 29060, ZTEU 29180, ZTSG 29170, ZT60 29170, ZUSP 29150, ZSIAJ 29080 29090, ZS6T 29120, ZEJII 29250, ZEDH 29140 29150, ZEDH-Jenna 29180 29190, LU6AX 29180, OAJ8 29300, FY18C 29120, FY2CY 29180, K6AY 29050, K6AG 29170, T2RRC 29115, HR4AF 29135, CNAY 29250 29260, FQAA 29140, LK5N 29280, GTRH 29110, YL2CD 29170, O2NNM 29200, O2NB 29075 29080, LAM5 29120, YR5C 29150, YM4AA 29000, DB5BP 29180 29190, D4FND 29075, OK2YM 29125, OK1JF 29300, FR9R 29200, FBS8 29130, FGQG 29075, FSWC 29290, GMSK 29090, ZTAQ 29190, ZLIMR 29100, ZL1IDV 29125, VK5K 29060, 3FJS 29170, VU2CQ 29320."

W3EXB worked ZBIC 29010 which, he believes, is the first ZB-W contact on 28 Mc. He also reports TFCG 29560. W3GJV worked V8SFAA 29140 for a hour around 10 A.M. E.S.T. WIEPRD reports U9ML 29150, and SVIRX 29075, 29080, 29135, OK1FF 29040, FR8R 29200, FBS8 29130, FGQG 29075, FSWC 29290, GMSK 29090, ZTAQ 29190, ZLIMR 29100, ZL1IDV 29125, VK5K 29060, 3FJS 29170, VU2CQ 29320."

W8MAH QSP's the need that VKSKO needs only Vt., R. I. and Md. for 28-Mc. WAS. He is daily on from 2300 to 0100 G.T.

On 14 Mc., WSC7Z reports recent QSO's as follows: PKIBO 14160, PKIR1 14300, PK1MF 14130, PKIVX 14340, XUBRL 14350, KAIAN 14598, VU2FV 14070, VU2PI 14170, FQA8 14060, FPRPX 14350, K7GIE 14014, KDT7 14010, USID 14430, XZIS 14260, XUSHM 14015, J6OY 14070, VQAS 14130 and F18AC 14100. His claimed counties now totals 104.

W9AXX works them with an 807 final. Some of his more recent contacts are: MX2B, PK3LC, V8ST, V8IAL, SM7QD, J9CA and XUS8T. R.X.B, who gives his QTH as Gold Coast, Africa, was worked recently by W2CYS. His frequency is 14.9. Whether he's a shore station we do not know. W2CYS, by the way, does some nice work with an attic antenna. Look them over—PK1MF 14230, KAIAN 14405, XUSH 14250, K6JG (Guam) 14270, FR8VK 14140, FQAB 14110, OFC7 14030, C2XZ 14070, J2DI 14225, J6DZ 14075 (5 P.M., E.S.T.), VR4CD 14300, V8FAP 14040 and V64CS 14290.

W9ALV reports V8S6, V8AS, V8AF, F18AC, V8NL, and a few V8USB, V8RR, U87XX, C8NWA and K9JL. CM2A0 has worked VR4AD on 14085. UP8OF is still active according to W8PMB who worked him at 11 P.M. E.S.T. His frequency is 13995.

W9EVB reports a new one, AAGCN 14450, who gives his QTH as Tangiers, Morocco. North Africans have bootlegged. He is receiving several cards from W stations although VQ8MSN has been out of operation for a considerable time.

When it comes to fax DX, it takes an SWL to haul them in. We are much indebted to W. Mayes of Maywood, Ill., for the following list of 14-Mc. fax frequencies: V82A0 14590, V82AK 14560, V8ZL 14100, V8SLA 14040, V81AB 14250, ZAIIM 14100, KAIIME 14150, KAIIMM 14090, KPK3 14030, PK1MX 14320, PK1GL 14260, PK3G 14020, PK4VR 14375, PK3ST 14310, PKIR1 14375, PK6C 14060, VK0WS 14145, V6ICU 14140, V6USA 14000, SU1SG 14375, TG1AX 14105, LA1G 14130, CNSAM 14100, CNSA 14940. W1HHK reports the following 14-Mc. faxes: F38HC

December, 1937
14300, ZU6F 14120, EASA 14000, EASA 14010, HAAA 14140, HABN 14120, PADMQ 14100. 

W6EHO reports to listen for South African and Asian fones around 8 A.M., P.S.T. and Europe around 11 P.M. He has recently worked ZS1AV 14272, VR2AK 14256, G2PU 14130, G6LZK 14100, F900 14140, ZSSM 14314 and ON4VK 14230 c.w. He furnishes the QTH for FI8AC whom he has worked on fone as R. R. Lebon, P.O. Box 13, Hanoi, French Indo-China.

W6JPE is travelling through the western section of the country this month. He should be able to give some interesting slants on DX from the West Coast next month.

From W2BYX via W2GMN: The National Broadcasting Company operates two ultra-high-frequency transmitters daily from 8:00 a.m. to 11:00 p.m. W2XDG operates on 38.65 Mc., transmitting the programs of the Red Network; W2XHGI on 41 Mc. carries the Blue Network programs. Each station is of 100-watt carrier power. The N.B.C. is glad to have reports of reception.

U. S. Chicago Works Amateurs

An exercise between N.C.R. members in the 12th Naval District and the U.S.S. Chicago was part of the radio program for Navy Day. October 27, 1937. The Chicago, NAGM, used 3475 kc. and listened for N.C.R. members between 3500 and 3800 kc. Two receivers were used on the cruiser to facilitate finding the N.C.R. stations. All transmissions were in proper Naval procedure and the messages consisted either of greetings to the Navy generally, or to some individual with whom the N.C.R. member was acquainted. A QSL card was sent to every station worked. During the NPG Navy Day broadcast the Chicago circuit was secured so that all hands could copy the message from the Secretary of the Navy: 103 stations were worked by NAGM during the period 4:40 to 10:00 P.M. This was the third annual contact between the N.C.R. and a Naval vessel anchored in San Francisco Bay. In 1935 there were 77 contacts; in 1936, 91 contacts. The drill was under the supervision of Lt. Sydney J. Foss, U.S.N.R., W6NZ, who recently served in the special car attached to the train for that purpose (and other rigs to be used at the destination). The exact date and place of the exercise will be announced in proper Naval procedure and the messages consisted either of greetings to the Navy generally, or to some individual with whom the N.C.R. member was acquainted.

The ham program from W2WICP: W2DO BXC CNF W7GHN W8PI JHH FUB W9ABH IID BYF PXQ ex-KDMEG W2CCG W2FFR W9EL. These fellow work on the transmitters made for the Army, Navy, Coast Guard, Fireboats, Police and many other services.

From W2BYX via W2GMN: The National Broadcasting Company operates two ultra-high-frequency transmitters daily from 8:00 a.m. to 11:00 p.m. W2XDG operates on 38.65 Mc., transmitting the programs of the Red Network; W2XHGI on 41 Mc. carries the Blue Network programs. Each station is of 100-watt carrier power. The N.B.C. is glad to have reports of reception.

The Oakland Radio Club is holding its annual 56-Mc. contest, starting the first Friday in December. The rules are practically the same as last year. Two loving cups are offered; one for the highest scoring mobile transmitter, one for the leading fixed station. Points will be awarded on mileage. For further information contact W6NOE, the W6MC, secretary of the Oakland Radio Club.

The following is quoted from the U. S. Coast Guard Communication Bulletin, October, 1937: "On 14 August, 1937, the Spencer's Plane V-144 was dispatched on an assistance case which involved the transporting of an injured man from Port Hobron, Kodiak Island, Alaska, to Seward, Alaska, for hospitalization. Through the cooperation of Army Signal Corps Station (WXE) at Anchorage, Alaska, the Spencer contacted amateur station K7BYA at Port Hobron, the destination of the flight. Direct contact was established with K7BYA, the Spencer using 4000 kc. and K7BYA using 7200 kc. Through this contact, progress of the flight and developments at the scene of the accident were rapidly dispatched between the Spencer, the plane and Port Hobron, the station maintained a continuous watch from 2000, 14 August, to 0800, 15 August. The operator at K7BYA, Mr. H. L. Reish, performed commendable service.

20-Year Club

NEW 20-Year Club members: W1DMP W2BYW W2DNI W2DYT W2GOU W2ECO W2IXC W5JG W5NT W6AM W6KTQ W6MNN W6NPD W8APD W8CNX W8ND W8ZY W9A A W9CZ W9CX. Members in this group of old timers have held a license (amateur operator or station) 20-or-more years ago and holds a ham call t.o-day.

Merrill E. Gregory, W5JL: "1910 used call MG—Ford spark coil somewhere between 400 and 1500 meters. Crystal detector receiver coil somewhere around 14 inches long. Later a 1/4-kw. Acme with Murderock rotary gap. Closed down during World War. After war was declared as 3JL and came on with a 1-kw. Thor. and rotary gap. Used Audiotrons for receiving with honycomb coils on 200 meters, finally changing to two 5 watt tubes self-rectified. Hold
oldest ticket in Morris County and the 2nd one issued. Been off the air less than a month during said period. Using the call MG, or as I used to like it... (9)-Boy, those were off the air less than a month during said period. Using the oldest ticket in Morris County and the 2nd one issued. Been in code in 1914, started out with a one-inch spark coil home made glass condensers, and tuning inductance as the transmitter. For receiving I made use of a Clapp-Eastman tuner and variable condenser, crystal detectors, such as silicon and amber. I recall having a note from the nearest operator's license issued to me was an Amateur, Second Class, received through the mail. At the same time I was issued the call letters 30V. The following year, 1915, I took a personal examination at the Navy Yard, Philadelphia, Pa., and received an Amateur First Class Operators License. The same year I also constructed a 3½ kw. spark transmitter, with a non-synchronous rotary spark gap. This equipment was used with moderate success until this country entered the World War when I was notified to dismantle the station.

In June 1916, I entered the employment of the Marconi Wireless Telegraph Co. of America and subsequently the R.C.A. I remained with them for a period of four and one-half years, and then obtained a local position. All amateur activities were discontinued with until I was induced to sign up with the Naval Communication Reserve in 1932. In May 1933 I again took the Amateur examination and, having passed the same, was issued my present call letters W9VV. I am absolutely sure that my first license was issued to me was an Amateur, Second Class, the days!

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from Headquarters will list in alphabetical sequence the names of members nominated for the position by members residing in the Sections concerned. Ballots will be mailed to members as soon as the election procedures specified above, for receipt of nominating petitions.

3. Nominations for the Section Manager are hereby solicited. Five or more A.R.R.L. members residing in any Section have the privilege of nominating any member of the League for the position of Section Manager. The following form for nomination is suggested:

(Place and date)

Communications Manager, A.R.R.L.
SS
West Hartford, Conn.

We, the undersigned members of the A.R.R.L., residing in the section of the above, hereby nominate -- as candidate for Section Communications Manager for this Section for the next two-year term of office.

(Please sign)

(Five or more signatures of A.R.R.L. members are required.)

The candidates and five or more signatures must be League members in good standing or the petition will be thrown out as invalid. Each candidate must have been a licensed amateur operator for at least two years, and similarly, a member of the League for at least one continuous year. Immediately prior to his nomination or the petition will likewise be invalidated. The complete name, address, and station call of the candidate should be included. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon of the closing date given for receipt of nominating petitions. There is no limit to the number of petitions that may be filed, but no member shall sign more than one.

4. Members are urged to take immediate initiative, filling petitions for the offices for the Section listed above. This is your opportunity to put the man of your choice in office. Call to the attention of persons in your Section.

W. S. Handy, Communications Manager

ELECTION RESULTS

Valid petitions nominating a single candidate as Section Manager were filed in a number of Sections; as provided in our Constitution. Portions of the list of the following officials, the term of office starting on the date given.

Eastern Florida

L. A. Connolly, W4DVO
Oct. 15, 1937

We, the undersigned members of the Eastern Florida Division, hereby nominate: Miss Allendorf, WSOUD; Mr. Henry J. Eschrich, WUSRE; and Mr. Fred M. Kamp, W9KI, for the office of Section Manager for the Eastern Florida Division for the next two-year term of office.

Miss Allendorf received 57 votes. Mr. Eschrich received 56 votes and Mr. Kamp received 53 votes. Miss Allendorf’s term of office began October 19, 1937.

Station Activities

CANADA

MARITIME--SCM, A. M. Crowell, VE1ID--FO has been appointed P.A.M. and is lining up a “phone net. JA and GR, together with W1IIM, handled a death message to resident of Glace Bay visiting the States. Thanks also to W1AUI, W1FBJ and W1AXE who assisted in QSP. GK has an ACR-138. JZ has finished his nine-tube super. At a recent meeting of the H.A.C. the following officers were elected: pres., WA; vice-pres., EK; secy.-treas., FB; asst. secy.-treas., FO. BV snagged his first VK phone--using only about 15 watts and an indoor ant. too!!! EA has a new RME 16. Motonet notes via EY: LP’s new rig will use 5W, 45W, pair 40B’s. CX has a new exciter completed--59 and 58. XL, IL has annexed a new Sky-Buddy. JJ is rebuilding to 59, pair 46D. DC has new band-switching rig nearly completed. EV changed QTH to help out the C.L.C. QRM. New officers for the M.A.R.C.: IJ, pres.; CX, vice-pres.; EV, secy.-treas. St. John news via EE/EZ, press rep. for L.C.A.R.C. At the opening meeting of the season the L.C.A.R.C. members fully discussed the L.C.L. interference problem and the various steps which may be taken to eliminate this trouble. GP has moved in from his summer home after a successful summer on 14 Mc. IF operates on 28 and 3.5 Mc. "phone. FL gets FB quality reports from everywhere. EV has been on again. GQ sounds nice. EI is on 14-Mc. "phone. JN has new new exciter. EZ is heard over for the first time since he put up his double again. EF is making a small hand-by-transmitter. KQ is back on 7 and 3.5 Mc. ‘46 and T20. JP is rebuilding with P.P. T20’s. ‘04A schedules ON and AB 58. (August--September: VE8AID 6 QB 2 MB 1 VE9AL 12.)

ONTARIO DIVISION

ONTARIO--SCM, Fred H. B. Saxton, VE8SG--R.M.: SABW, SDU, 3GT, S3E, 3QK, 3TJM, 3WJ. DH has a new second transmitter. VKL has put last got hydro and is using 41 crystal osc., 6L6 amplifier with 40 watts input. PL is now in Toronto and is on the U. of T. staff. MB has visited GA, YC, ACF, AIB and OO. QK joined the Michigan net on occasion. A large flock of visitors this fall. ABW has new antennas up. VC sold his FB-7 and now has a t.r.f. SG is lone VE in traffic net with six W’s; each op is O.R.S., R.M. or S.C.M. ABC, up beyond Kenora, has a 2A5 crystal osc, and 6L8 doing nicely. ZE2 has his rig working nicely on 3.5 Mc. VE6 has taken over at T.L. "I" in Ontario. WK is picking up his old schedules. Watch next month’s report for the announcement of a SECTION QSO PARTY. The North Toronto Club had a splendid meeting at the home of E0. LGJ is now back at work. OP is working 3.5, 7 and 14 Mc. AU worked 8 hours in the VK-ZL contest, scoring 2530. The Ottawa Club is away to a good start for the season. RK, SX, XL and PD, all from Ottawa, are at Queen’s this year. S8 is studying for 2nd Class Commercial ticket. HY is contemplating a swing to ‘phone. HY has a new Collins 45A. ADZ is in with an 80A. OI needs Nevada for W.A.S. DH is keeping traffic schedules with temporary rig while rebuilding and has a new antenna. RV has back in with an FB phone. After a season of hard work on the line, the W’s; and the YF’s are back to their old haunts—the shack. BY has 6L6, RK23 and T55 with 125 watts and is contemplating O.R.S. ZQ, late of Ottawa, asks me to let the gang know that he is now back at work in the Kenora Division at Regina, Sask., and will be glad to hear from the eastern fellows. Let’s have more news next month, gang. 73.

Traffic: VE8RZ 144 SG 72 AU 65 GT 41 DH 32 AJB 34 VA 29 NM 22 PE 12 OB-10 MB 9 SS 8 AA 7 ABC 5 AND 4 WK 3 ZB 2 VE9AL 16. (August--September: VE8AID 6 QB 2 MB 1 VE9AL 12.)

QUEBEC DIVISION

QUEBEC--SCM, Stan Comarch, VESME--Thanks to those who so kindly wrote the S.C.M. DF deserves credit for being the highest Canadian ‘phone scorer in the recent DX tests. PT is rebuilding. KN has a schedule with Ottawa three nights a week. We regret to learn that HH has been confined to bed for some time. We hope for an early recovery. John, NX would like it mentioned that she is a YL; Miss Varey operates on 7170 kc. DP is planning a new transmitter with a pair of T-20’s in final. HO has received his W.A.C. ‘phone certificate; the Prof. handled a message from VP3BG for Lachine and had a reply back to BG in 20 minutes. JK is now located at Northwest River, Labrador, and is using the call VE9L. JJ is the new treasurer and secretary of the M.A.R.C. W9K1Z, is a visitor from VE9AL, and along with the gang, took part in the Army maneuvers. BU is back on the air keeping his old schedules, Hartford and Toronto, daily. KM has half of his new rig perking. FF is an old sea-going op and met your S.C.M. when he was on the S.S. Canadian. Vancouver, running for the West Indies. AB, LP, AP and EO were on a fishing and hunting trip end of Sept. and were the guests of NI and his YF. EM paid a short visit to AB in Quebec. Your S.C.M. had the pleasure of a month’s stay in Quebec, meeting the gang; a special debt of gratitude is owed to W9OUD, Mr. Henry J. F.,achrlch, W9KEF, and Mr. Fred M. Kamp, W9K1. Miss Allendorf, VE9AL, Fred V9AOD, Mr. Henry J. F.,achrlch, W9KEF, and Mr. Fred M. Kamp, W9K1, were nominated. Miss Allendorf received 57 votes. Mr. Eschrich received 56 votes and Mr. Kamp received 53 votes. Miss Allendorf’s term of office began October 19, 1937.

(Continued on page 108)
The Facts on RST

Editor, QST:

In reference to the editorial in the October, 1937, issue of QST, dealing with signal strength reporting, I should like to explain a few points which may not be familiar to some of us. Considerable time has elapsed since the original article on RST appeared (October, 1934, QST), and some may have forgotten the underlying reasons for advancing a new system. I should like particularly to bring out certain phases of RST which have not been stressed before.

The new system was devised with the idea of correcting certain evils which had grown upon amateur reporting practice. In the first place, I felt that our reporting procedure should be systematized. Where previously there had been no system whatever, just the indiscriminate use of the three separate scales, I attempted to substitute an orderly system which would both standardize and facilitate the exchanging of reports. In the second place, I wanted to rationalize the scales themselves. The existing codes of so-called “readability,” audibility, and tone, which were contradictory and inconsistent among themselves, were replaced by three scales, (R)eadability, signal (S)trength, and (T)one, which could be used singly or together without any conflict or change in meanings.

Referring now to the signal strength scale, it embraces a certain range of strength. This range is the same whether we divide it up into 5, 9, or any number of gradations. Since the new signal strength (S) scale and the old audibility (R) scale each have nine steps, if we should strip them of their definitions, they should be identical, theoretically. In each scale, any given step should be in the same ratio to the corresponding adjacent step. That is to say, if S7 is twice as strong as S6 (assuming received signal intensities to be measured in voltage), then R7 should be twice as strong as R6. Practically, however, this is not true, because, unfortunately, this simplicity in the audibility (R) scale was destroyed by an unwise choice of definitions. Take a look at the old R scale. Besides an illogical arrangement of the wording describing successive steps, such as going from “moderately strong” to “good,” and then to “good strong,” irrelevant terms on readability, interference, and audio strength were injected into them. It was a case of trying to make one code cover too many things, and not doing a good job on any one of them. The same thing also happened in the old tone code. It was these qualifying terms that ruined the chances of the R code ever being used to correctly rate signal strengths. It is human nature to follow the definitions, and if a signal is not capable of overriding bad QRM it is pretty hard for the conscientious operator to call it R7, even though its actual strength in the absence of the QRM would make it so. This is true also for the other gradations containing readability or audio-strength terms. The practical result is that a given step does not always describe a signal a given strength above the preceding step. From the foregoing it is evident that in the interest of accuracy the old audibility code should be forgotten as soon as possible, both in ‘phone and c.w. work.

It was with the view of correcting these difficulties that the S scale was devised. It was desired that this scale should describe signal strength, and signal strength only. In it will be found no definitions whose meanings can be influenced by extraneous factors, such as readability, interference, etc. S7 should refer to a signal a definite amount stronger than S6 under any possible condition. Actually, of course, the wordings of the definitions have no quantitative meaning, and it is this very quality which gives the scale its great advantage. It should be remembered that in the strength scale the numbers are the steps; the definitions are given merely as an aid in distinguishing between steps. It will be noted that a logical progression in definitions was adhered to; for instance, a “fairly good” signal is lower than a “good” signal, but higher than a “fair” one. Similarly, “moderately strong” comes below, but next to, “strong.” This should explain any discrepancies between the S and old R scales.

Examination will reveal that the same plan of assigning definitions was followed in the readability and tone scales, always as smooth as possible a progression of increasing values. In the case of the tone scale this was naturally not quite so simple, but, as pointed out in the editorial, the limits were fixed, and all types of notes had to come between them. So we have in the middle the musically modulated note, which is the point where a.c. and d.c. meet. Toward either end of the scale the a.c. or d.c. component becomes increasingly predominant. It will be remembered

December, 1937
radiation of the harmonics in beating oscillators of other stations on the b.c. band receivers. This does not mean that S1 is the weakest signal we can perceive on a two-tube set with 'phone and 20 kc. apart, since signal we can stand out of a loudspeaker system. The original scales were devised when receivers consisted of a detector and one or two stages of audio, plus headphones. Estimates of signal intensities to be done with any degree of accuracy by ear should be made only at headphone levels. The loudspeaker is "out," because above headphone levels the ear is no longer accurate as a measuring device.

It has been found, through the researches of various investigators, that the average difference in signal intensity between successive steps is roughly in the order of 6 db. This corresponds to a change in strength of two to one (four to one in power), and this is about the minimum difference that can be distinguished over a radio circuit. It is true that for a perfectly steady, pure tone an instantaneous change of as little as 1 db can be detected. However, in a space circuit, where fading ratios are important, and it is surprising how much a seemingly steady signal actually fluctuates in strength, this is not possible. The situation is further complicated in the case of a keyed or modulated signal.

Since each step represents an increase of about 6 db, the total range of signal intensities from 1 to 9 is seen to embrace approximately 48 db. It is rather fortunate that this is true, since 6-db steps are very convenient to use in making calibrations. In the future, time permitting, I hope to prepare a short article dealing with the measurements on which these conclusions are based. In the meantime it is hoped that this discussion may serve to satisfactorily clear up any misunderstandings which some may have concerning the aims and purposes of RST.

More on Planned Use

Editor, QST:
612 Atlantic Ave., Morris, Minn.

I have been planning on writing the League for some time. The new "Sub-division Plan" by D. A. Griffin in October QST is the spark that has set me off.

... I have yet to see our radio misanthropes offer any plan which promises to do anything really constructive. It is this I am venturing to undertake.

I have an ACR 175, and when I tune over the broadcast band I marvel at the sharp tuning and lack of interference. The reason for this is that "it was planned that way." All stations on the b.c. band must use a frequency which is a multiple of 10 kc. This is because a receiver when heterodyning stations 10 kc. apart makes only one audible, since 10 kc. is too high a frequency to hear. Thus the b.c. band is swamped with whistles and gibberish, which shows that there are plenty of those who would like to use the band if it could be made usable.

There is another advantage, too. Since amateurs generally answer those on or near their frequency, there would be many times when QSO's would take place on one channel, instead of occupying two, as is usual. This would be more and more the case as time wore on, and amateurs acquired more than one crystal.

Now about the interference caused to the tune of 67 per cent. by 160-meter 'phone. C.w. causes a more annoying interference than 'phone in the estimation of everyone I have talked to. Moreover, there is a way of reducing c.w. interference and harmonics as well. As the electric field is shielded in coaxial cable, radiation from the feeders is greatly reduced or practically eliminated. I know such cable is quite expensive. But WJDO reports that b.c.l. QRMI was greatly reduced, presumably for the same reason, i.e. feed radiation is greatly reduced, by the installation of EO-1 cable. He also reports that harmonic trouble with Grand Island was also eliminated.

It seems more practical to require coaxial feeders by law, for 160, rather than give up the 160-meter band entirely. The amateur would want his shack improved in value by more than the cost of the coaxial cable.

—Arthur M. Braaten, W6BBR

Equalizing Voting Power

713 St. Louis Ave., East St. Louis, Ill.

Editor, QST:

The A.R.R.L. was primarily intended to be a democratic organization, controlled by its members through a Board of Directors elected by the membership. In theory this is a good set-up for placing control of the League in the hands of the members, But in theory only, in fact the members have very little to do with controlling and deciding the policies of the League.

The unreasonable part of the present arrangement is in the apparently democratic organization is the unequal distribution of voting power among the directors. To make this statement clearer, let me point out that the professor of the Central Division who represents over 4000 members (Continued on page 68)
Once every few years we make a futile attempt to use the broadcast receiver type of construction somewhere in a National Receiver. We should have learned our lesson by now, but broadcast receiver parts cost so much less than ours that we have to reassure ourselves, now and then, that we really are on the right track. For example, a "good" broadcast tuning condenser sells for about a third as much as the labor and materials alone in a PW condenser.

In the NC-80X and 81X we have tried to give as much performance per dollar as possible, and it struck us that the economy would be well worth while if we could use a commercial tuning condenser. We shopped around. One of the best manufacturers in the field agreed to build us a special job with low-loss insulation and other refinements, and we purchased a number of units.

But when the production sets came through it became apparent that these condensers would not do. The ganging was not good enough and backlash was perceptible when using the high selectivity of the crystal on the bandspread amateur bands. We found that by careful refitting these were satisfactory for the NC-80X (which has general coverage ranges) but not for the NC-81X (which has extreme bandspread on the amateur bands.) But this refitting brought the cost up as high as a PW, so what the heck.

This unfortunate discovery was made in October, just when we were starting deliveries. This is why these receivers are so late. NC-81X Receivers (with PW condensers) will be delivered about the time this page is published. In the meantime, we are filling orders for the 80X by using the refitted condensers described above. Later production will employ PW units exclusively. Of course, substituting the more expensive condenser means that the NC-81 is no longer an $88.00 receiver. However, we have never built a poor receiver and we would rather take a licking than do so. So for the present there will be no price increase.

This account of our troubles is by way of explaining why the deliveries are late. It is not a criticism of the broadcast parts manufacturers, who know exactly what they are doing. The condensers are fine for a set with a maximum selectivity of about 5 KC, but a communication receiver with a maximum selectivity of 320 cycles is something else again, to name just one of the more obvious differences.

It is too bad, though, that broadcast methods will not do. One very clever economy is the way they adjust coils. The coils are wound oversize, and while the impregnating wax is hot, are squeezed with special pliers until the inductance is exactly right. When the wax sets, the inductance remains fixed, — for a while. If you have ever operated a pseudo-communications receiver over a period of months you have probably noticed the steady sliding out of alignment and calibration as the cold flow of the wax allowed the coils to regain their normal shape. It works out very well in broadcast receivers, however, and we only wish it would in ours. It is such a lot cheaper than the exceedingly laborious method that we use, which is to adjust the number of turns with no internal stresses. It is too bad that broadcast methods will not do.

JAMES MILLEN
Play Safe—with YAXLEY Pilot Lights

DON'T run down batteries or run up light bills by leaving equipment turned on!

Don't try to change that final tank coil when it's "hot".

Use Yaxley Pilot Lights to tell you at a glance the condition of your rig. Your distributor has Yaxley Pilot Lights, at 30c list (less bulb) in four colors of jewels:

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<th>Screw Base</th>
<th>Bayonet Base</th>
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<td>Red</td>
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Correspondence Dept.
(Continued from page 60)

of the A.R.R.L. and has one vote at the board meetings. The director of the Delta Division represents about 400 members of the League and also has one vote.

Here is a case where 400 men have the same voice in governing the League as 4000. Nothing much democratic about that. I believe a majority of League members would like to see this condition changed and have a more equal voting power created by either redistricting the present divisions of the League or giving each director one vote for each hundred members he represents.

This change can be brought about in one way only and that is through the directors themselves. It will accomplish nothing bombarding Warner with letters blaming him and all Headquarters for the present set-up. The proper man to spill your ideas on the subject to, is your director. If a majority of the members in your division wish this change made and your director votes contrary to your wishes there is then only one thing to do. Kick that director out by electing a man who will vote the way a majority of the members in your division wish him to.

You League members who would like to see the A.R.R.L. really controlled by the men who pay the dues and make the organization possible get busy and write your director demanding him to vote for this long overdue and much needed change in the League's Constitution.

—Earl R. Linder, W9DZG

EDITOR'S NOTE: File No. 129 in the Secretary's File at the Headquarters office is an inch-thick collection of data on the subject of "Reapportionment of A.R.R.L. Divisions." The question is one that has received much attention in the past. The last official actions occurred in 1931 and 1932. The A.R.R.L. Board, at its 1931 meeting, acting upon the suggestion of the Executive Committee, instructed the Committee to draw up a detailed plan for such reapportionment. This was done in the following year and the plan submitted to the Board at its 1932 meeting. At that time it was voted to lay the question on the table, and there it has remained.

Ham Helpfulness

Koch Hospital, Koch, Missouri

Editor, QST:

About a year and a half ago I wrote you a letter asking you if you could help me get some kind of a job that I could do in the hospital in order to get enough money to get together a transmitting outfit. You did not help me get the job but you did see to it that I got on the air.

You referred the letter to as fine a bunch of fellows as can be found anywhere—the Order of Brasspounders, Chapter No. 1, St. Louis, Missouri. They supplied me with an SW-7 receiver, 'phones, code practice oscillator and helped me get my ticket. After I got my ticket they supplied me with the transmitter and a converter to supply a.c. for the plates and filaments. They also gave me 135 volts of "B" batteries when power lines here were too noisy for reception last summer. They have given me many other things too numerous to mention by name. Now I find that they have made me a present of one year's subscription to QST. Truly my cup runneth over. . . .

—Waldo E. Good, W9ZND

More Ham Helpfulness

2304 Chamberlain Ave., Chattanooga, Tenn.

Editor, QST:

Through good fortune and a little forethought, my vacation this year included the VE2 Hamfest at Halifax, Nova Scotia. I took my father, now 82 years old, to see the two remaining members of his generation, my mother's sister in

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Cement Coated TRANSMITTING POWER WIRE WOUND RESISTORS

NO SIR! IRC Cement Coated Wire Wound Transmitting resistors were never designed for beauty. Yet, there is a certain "something" about them — the same beauty you'll find in a prize bull dog. No more. No less! It is the beauty of intense ruggedness — toughness — loyalty — dependability through thick and thin.

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- Maximum overall diameter, 23/8", special steel cup set screws, heavy N.P. brass hubs, permanently staked or other rotary R.F. units which require dependable insulation from the control mechanism.
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Equipped with the RMA standard 3-prong "B" battery socket and adaptor.

Portable equipment can be powered with the No. 762 battery when in the field and easily transferred to heavy duty batteries for more permanent locations.

Plug-in connections also make it easy to shift batteries from one experimental set-up to another.

NOTE: The No. 762 battery equipped with screw terminals and insulated knurl nuts is still available as No. 762-S.

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Radio Amateurs in the Television Picture

(Continued from page 10)

the circuit adjustment, not in the assembling and wiring.

How much will the parts for the vision receiver cost? In the neighborhood of one hundred dollars, everything included. If parts already on hand are worked in, or if an alternative input tuning system is used, the cost may be lower. Then again, if a larger-type tube than a 5-inch or 7-inch size is demanded by the more ambitious, it may cost more. In other words, the price will be on the order of what many amateurs pay for their communication-type receivers.

Who will be able to make first practical use of the receiver design, construction and adjustment information? The answer to that is, of course, those within range of a television transmitter. In the beginning, this will mean, generally, amateurs in the metropolitan areas of cities that have experimental television transmitters in operation at the time the receiver articles are completed, which will be late this winter. (A list of cities which now have experimental transmitters and in which transmitters are contemplated for the early future is given in W2KJL's article elsewhere in this issue.) As it happens, the areas in which television signals will first be available are practically the same as those where ultra-high frequency amateur activity has been, and is, greatest. The u.h.f. gang is in a good position to take advantage of that logical coincidence.

How will all amateurs benefit? From the articles themselves, every amateur who is sincerely interested in developing his technical knowledge will profit by reading them and learning thoroughly the lessons they teach. Even though the individual may not be in position to build and make immediate use of a receiver, it will serve him well to make himself as familiar as possible with the practical technique of television. Commercial television executives have stated to us that commercial television broadcasting will demand hundreds of engineers and thousands of servicemen who are familiar with television technique, and that in television, as in broadcasting, amateur radio must be the reservoir of technical personnel.

How can amateur radio contribute to the technical progress of television? Those within range of the experimental transmitting stations will make valuable contributions to the development of television by reporting on the transmissions received, particularly with regard to the signal strength, synchronization under different transmitting conditions, variations in signal-noise ratio. A large number of receivers distributed over a wide area promises to answer one of the most perplexing problems worrying the television people to-day; namely, what is the effective range? They are looking to us to give an answer. We are confident that we can do it.

By such cooperation, we shall continue the traditional proving-ground service to radio development which has played its part in earning
HAMMARLUND now introduces another exclusive transmitting condenser development — the "N-10" neutralizing condenser! This new condenser, designed for horizontal adjustment, affords easier and safer operation. Thick aluminum plates with round edges are polished over all surfaces. For smooth micrometer control the "N-10" features an oversized fine thread screw with lock nut. A stop is provided to prevent any possibility of shorting. Insulation is B-100 isolantite. Capacity range is from 2 to 10 mmf, with air gap range from 1/16" to 5/64". Two-hole base mounting.

Illustrated below are other recent Hammarlund transmitting condenser developments that have rapidly gained the favor of amateurs the world over. For quality transmission, install the new "N-10" along with other precision transmitting condensers by Hammarlund!

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for amateur radio the position it holds to-day. Our cooperation will not revolutionize the advancement of television, of course, any more than our participation in television development will revolutionize amateur radio. But by our constructive cooperation we shall contribute to its progress—while continuing our other activities in full stride.

Introduction to Modern Television

(Continued from page 16)

2. Channel width, 6 megacycles.
3. Spacing between television and sound carriers, approximately 3.25 megacycles.
4. Television carrier higher in frequency than sound carrier.
5. Polarity of modulation, negative or positive.
6. Number of lines per picture, 441 (interlaced).
7. Picture or frame frequency, 30 per second; half-frame or field frequency, 60 per second.
8. Aspect ratio (width to height of picture), 4 to 3.
9. Percentage of television signal amplitude devoted to synchronizing signal, not less than 20%.
10. Duration of horizontal impulse, approximately 3/10 of the time to scan one line; duration of blanking impulse, 3/10 of the time to scan one half-frame; position of synchronizing impulse, approximately at leading edge of blanking signal impulse. (Average brightness of the picture transmitted by either varying the pedestal height or by d.c. modulation of the output of the transmitter.)

A simple formula gives the minimum bandwidth necessary in the receiver to obtain satisfactory pictures. This formula is

$$P = 0.64 \frac{A \times N \times n^2}{2}$$

where \(P\) = the maximum modulation frequency transmitted, \(A\) = the aspect ratio, \(N\) = the number of complete pictures scanned per second, \(n\) = the number of lines, and 0.64 is a correcting factor to give equal vertical and horizontal detail.\(^4\)

It will be seen from this formula that it is necessary to transmit a sideband approximately 2 1/2 megacycles wide. This means that intermediate frequency stages must pass at least 2 1/2 megacycles with the signal tuned in so that single-sideband reception is approached.

UNITS OF THE TELEVISION RECEIVER

In the block diagram Fig. 7 are outlined the components of a modern television receiver. It consists of four different units. The first contains two power supplies, one for the tuner and sweep circuits, the other to generate high-voltage d.c. to accelerate and focus the cathode-ray beam. The second unit contains a sound receiver which may be a simple ultra-high frequency type. The third unit is the vision receiver, which may be either a tuned r.f. job, if one is comparatively near a transmitter, or a superheterodyne for more effective

\(^4\) Kell, Bedford and Trainor, Television (RCA Technical Press).
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Radio Sales and Service
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The Quiet Centralab Control
offers maximum resistor length for case diameter . . . close uniformity between resistors . . . accurate tapers . . . uniform current distribution . . . better power dissipation and longer life

Fine phrases seldom fool a radio man. Graphs, curves and self-praise may read well . . . but customer complaints put a "negative-bias" on such bouquets.

So, when an "old timer" like Mr. Chandler writes . . . "Since 1925 I've used your controls almost exclusively, in fact each time I have gone back to Centralab, because it is the only control that I have ever found that will stay quiet." . . . we say

"Here's proof for manufacturer . . . for experimenter and for the servicemen." Specify Centralab.

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Research and testing, then more research and more testing. To the Amperex engineer it's a constant struggle for improvement. Our engineers make no "compromise" with quality. They do not subordinate the maximum efficiency of a tube to merchandising or ballyhoo opportunities. Amperex tubes give superior performance... last longer... and operate economically. That's why we say Amperex tubes give amateurs "truly engineered performance."

HF-100
An ultra-high, normal R. F. power amplifier and oscillator and class B audio amplifier or modulator. Outstandingly efficient in ultra-high frequency circuits.
Net Price $12.50

ZB-120
Low Distortion zero-bias class B amplifier and modulator, high efficiency R. F. frequency multiplying power amplifier, conventional R. F. power amplifier. It approaches nearer the ideal in a zero-bias class B tube and is, in addition a highly efficient performer in many other classes of service.
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79 WASHINGTON ST., BROOKLYN, N. Y.

The operation of the receiver requires that there be provision for control of the frequency of the line-sweep generator and of the frame-sweep generator, and there must be control of the width of the picture and the height. There also should be controls for determining the picture brightness and contrast, in addition to the sensitivity controls for the sound and the vision receivers. Most of these controls, however, can be set by a screwdriver adjustment and left without attention for long periods.

The tubes, including the cathode-ray tube, in even a simple vision receiver must be designed for the purpose. Few standard receiving tubes are suitable as video-frequency amplifiers because high transconductance and low input and output capacity are required. At present the National Union Radio Corporation is developing such tubes especially designed for the purpose.

It should be pointed out that at this time television signals are being transmitted only on an experimental basis in the metropolitan areas of New York, Philadelphia and Los Angeles; in New York jointly by RCA and the National Broadcasting Company, in the Philadelphia area by RCA, Philco and Farnsworth, and in Los Angeles by the Don Lee Broadcasting System. These transmissions are not at present on consistent schedule; but, before this series of articles is completed, it is expected that transmissions will be more regular. The Columbia Broadcasting System is making an installation on the Chrysler Building in New York, and it should not be long before this transmitter also will be in operation.

Reliable information indicates that experimental television transmitters are also in prospect for Boston, Mass., Albany, N. Y., Bridgeport, Conn., and Kansas City, Mo., with others likely in the near future. Accordingly, no small number of amateurs throughout the country will be in a position to make early practical use of the information contained in this article and in those to follow.

The second article of this series, treating the functional operation of television receiver circuits, will appear in an early issue.—Editor.

W2KR tells how he fearfully looked for a bell-less apartment house when moving into New York City from the country. Finding a good location on Riverside Drive, he nervously asked the manager of the house if it would be all right to have a radio station there. Whereupon the manager said, "Are you a ham? I'm ex-W2AWZ"—and the roof was promptly signed over to 2KR!

VE2DR thinks the ham station pictured in an ad in the latest call book deserves credit for some startling work. The shack wall shows confirmed contacts with VE7, CM3, XE6, and SM8!
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The New Super Skyrider is advanced in conception and engineering — it must be seen and operated for full appreciation. So stop in at the Harvey Radio Co. — look over the amazing new Super Skyrider, or write for complete information.

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TERMS AS LOW AS
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$99.00

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Come in to see the New Super Skyrider — let "Mort" point out its many exclusive features and demonstrate its marvelous performance. You'll like M and H personalized service.

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- 1000° Band Spread
- 11 Tubes
- 5 to 550 Meter Average
- Wide Range Variable Selectivity
- Better than 1 Microvolt average sensitivity
- 6 Bands including 5 Meter Band and Broadcast Band
- Improved Expanding I F Transformer

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PHILADELPHIA, PENNSYLVANIA

Say You Saw It in QST — It Identifies You and Helps QST
HERE'S GOOD NEWS!

YOU CAN BUY ANY HALLICRAFTERS RECEIVER ON HINDS & EDGARTON EXCEPTIONALLY LIBERAL TIME PAYMENTS

WHY NOT ENJOY the marvelous performance of a new 1938 Super Skyrider—the most modern of all communications receivers—now? You don't need to wait until you have the full cash price—a small down payment will bring your Super Skyrider—the balance you pay on Hinds and Edgerton easy monthly payments—so low you'll never miss them.

You'll enjoy your relations with Hinds and Edgarton. We guarantee satisfaction and you'll get Hinds and Edgerton personalized attention. In Chicago, we are in excellent position to give you real service. Our customers are our friends and we treat them as such.

Mail in the coupon today! Let us send you complete information on the new Hallicrafters receivers and full details on Hinds and Edgerton Easy Time Payment Plan.

The NEW 1938 SUPER SKYRIDER
FEATURES
• Over 1000° Band Spread
• 5 to 550 Meters Coverage
• 5 Meter and Broadcast Band
• 11 Tubes
• Wide Range Variable Selectivity
• Better than 1 Microvolt average sensitivity

$99.00
Less Crystal and Speaker
With Crystal $111.00
P. M. Dynamic Matched Speaker $12.00

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W9APY  HINDS & EDGARTON  W9WR
19 SOUTH WELLS STREET, CHICAGO, ILL.

Please rush me complete details of New Super Skyrider and Hinds and Edgerton Time Payment Plan.

Name.......................................................... Call..................................
Address.......................................................... City..................................

Say You Saw It in QST — It Identifies You and Helps QST
An Improved Dual-Diversity Receiver for High-Quality 'Phone Reception
(Continued from page 21)

Attached to the shaft of the tuning knob is a heavy four-inch cast-iron fly wheel, the purpose of which is to allow the dials to be spun by a quick twist of the knob, thereby avoiding the tedious business of having to turn the tuning knob 35 times to go from one end of the main dial to the other. With this arrangement two or three quick flips on the knob will spin the tuning dials rapidly over that complete range.

**Panel Arrangement**

The meter on the left-hand side of the receiver is a zero-center type reading 50 ma. either side. Its purpose is to check the operations (particularly to equalize the gain) of the two receiver circuits. It is connected in a balanced bridge circuit in such a manner that when the gain of one receiver practically equals that of the other, the meter will read zero. Below the meter are three knobs. The center knob is the master r.f. gain control. The knobs to its right and left are the gain controls for the i.f. amplifiers of circuit "A" and "B," respectively. With the key switch to the left of the meter in its center position, both receivers work in diversity; and when thrown up or down it switches either receiver to work independently. Of the controls near the bottom of this same panel, that at the right is the variable infinite-rejection control for circuit "A." Next to it is the power factor corrector resistor for this circuit. Alongside this is the 'phone jack, which is connected across the output of a 500-ohm line transformer. Approximately 300 milliwatts is the maximum output available from the first audio stage. On the extreme right hand panel is located the signal intensity meter which will read either the signal intensity of receiver "A" or "B" separately, or the signal level for the combination in diversity. This meter is in the circuit of the d.c. vacuum-tube voltmeter connected across the combined diode load. The two key switches are for c.w.-'phone operation and stand-by (send-receive) switch. The standby switch has a locking and non-locking position. Below the meter is the master audio gain control. The other knobs are for audio tone control and c.w. pitch control.

**Practical Results**

The small unit with two meters, shown on top of the receiver, is the diversity meter box. With the set operating as a diversity receiver, these meters show at a glance the fading effects in the two separate circuits. Under normal conditions in long-distance high-frequency reception they will vary up and down, from zero to plus 9, very rapidly. The interesting point is that very
EIMAC HAS MADE THE INDUSTRY VACUUM CONSCIOUS

GUARANTEE

No injury to the operation of Eimac tubes will result from gas released from either the plate or grid assembly during a short accidental or intentional dissipation overload.

EITEL McCULLOUGH, Inc.
San Bruno, California

Your tube is no better than its VACUUM!

Long filament life . . . uniformity of characteristics . . . outstanding performance and Complete Freedom from Failure Caused by Gas depend entirely upon one important factor . . . Vacuum.

Obviously the material of which the elements are fabricated has a direct bearing on vacuum. Eimac uses Tantalum because this material has a very low initial gas content, and when properly handled can be completely degassed. Gas content of Tantalum is but 1/10 that of molybdenum and only 1/1000 that of conventional carbon anode. While Tantalum has many advantages, its use alone does not necessarily produce a better tube. This material requires expert handling to get full advantage from its peculiar properties. Eimac engineers developed an exclusive process (patent pending) for the fabrication and exhaust of their tubes. That's why Eimac tubes are guaranteed never to fail because of gas released internally.

Eimac disproves the popular fallacy that anode temperature affects emission. In conventional tubes, high anode temperature releases gas that should have been removed in the original exhaust. This gas is what affects . . . or poisons . . . filament emission. The temperature of the anode in an Eimac tube will never affect filament emission because the gas has been properly removed. Eimac tubes are conservatively rated as to plate dissipation. Momentary overloads of 400% to 600% which is sufficient to cause the anode to become incandescent will positively not release gas.

Ceramics as used for vacuum tube insulators are incapable of complete evacuation and therefore are a potential source of gas. Since Eimac tubes have no internal insulators this source of gas is entirely eliminated. The proper use of Tantalum . . . the elimination of all internal insulators . . . plus a severe exhaust on high speed diffusion and oil pumps, produces a better and more dependable vacuum than can possibly be obtained by the use of a chemical agent or "getter." Eimac uses no "getter."

Try Eimac Tubes in your transmitter and you'll agree that the use of the more expensive materials, the long severe exhaust and the unique construction produce outstanding results.

EIMAC TUBES

EITEL & McCULLOUGH, INC. • San Bruno, California

Say You Saw It in QST — It Identifies You and Helps QST
"There is nothing on the market that can compare with this new receiver," says Charles W. Esgenweiler, Los Angeles, California. Mr. Esgenweiler adds, "The new 'Super-Pro' is very quiet and selective. The splendid Hammarlund workmanship and engineering has made it the last word in receivers. On 10 meters, it beats anything I have ever tried."

Countless others are likewise applauding this distinctive receiver with such outstanding features: two stages of R.F. on oil bonds, including the 20-40 mc. bond providing an overall sensitivity of 0.85 micro-volt (30% modulated) with a signal to noise ratio of 6 to 1! The image rejection ratio is so high as to provide complete freedom from "two-spot" tuning except in exceedingly rare instances, viz., at 28 mc. the ratio is 150 to 1; at 7 mc. — 10,000 to 1.

Other features are — four air tuned I.F. electrostatically shielded input, electrical band spread, variable band width (3 to 16 kc.) panel control, direct tuning stand-by switch, relay terminal strip, variable crystal filter, etc. Crystal or standard models for table or rack mounting, or new console for 7½ to 240, 15 to 560, or 15 to 2000 meters. Mail coupon for further details!

Just Issued . . .

**Building an Amateur Radiotelephone Transmitter**

An introduction into Amateur Radiotelephony. Written for the man who has a Class C or Class B license. A companion book to "How to Become a Radio Amateur."

CONTAINS simple description of the process of modulation and principles of good design for 'phone. Description of inexpensive low-power transmitter and modulator, with complete operating instructions plus some antenna dope of particular interest in 160- and 10-meter operation. It tells what a new or inexperienced ham should know before attempting to use 'phone.

25 CENTS POSTPAID (no stamps, please)

American Radio Relay League, Inc.
WEST HARTFORD • CONNECTICUT

Say You Saw It in QST — It Identifies You and Helps QST
The Designer of the Orthotech All-Wave Set Says:

"None but the Best for Me"

Mr. Raymond P. Adams, well known West Coast radio engineer and designer

Jefferson Transformers are all liberally proportioned and combine all the experience, skill and knowledge of transformer engineering gained through the manufacture of transformers since radio's inception. No. 467-451 transformer has two classes B. The characteristic of each type is accurately set up and proved in laboratory and field operation. To insure the greatest satisfaction — be sure to insist on "Jefferson." Your parts jobber can supply you or get any particular type you require...

JEFFERSON ELECTRIC COMPANY,
Bellwood, Illinois

August 24, 1937

In my particular line of activity — the design, development, and description of special radio and communication equipment utilizing standard parts — I find it increasingly necessary to depend upon those but the very best in power components.

Over a period of some years in this work, it has been my privilege to become intimately familiar with Jefferson Transformers and, since, to exercise Jefferson engineering in the development of better plans, the design, and the production and quality of these parts to a degree and to a point that is self-evident to all who have had occasion to use them. It is not only through the quality of the parts and the efficiency of the line as a whole, you on the ultimate high quality and efficiency of the line as a whole.

Jefferson Transformers are all liberally proportioned and combine all the experience, skill and knowledge of transformer engineering gained through the manufacture of transformers since radio's inception. The characterization of each type is accurately set up and proved in laboratory and field operation.

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To insure the greatest satisfaction — be sure to insist on "Jefferson." Your parts jobber can supply you or get any particular type you require...

Send the attached coupon for free complete catalog and set of new amplifier circuit diagrams...

JEFFERSON ELECTRIC COMPANY,
Bellwood, Illinois

Canadian Factory: 535 College Street, Toronto, Ont.

No. 467-451 — Transformer for Class B Driver

Low-Power Contest Results

(Continued from page 81)

from 96 QSO's. This is the highest score in the "home station" group and was made by two operators, VE3GT and VE3BC. Operation was on 3.5, 7 and 14 Mc. Transmitter power came from the a.c. mains, receivers were run from d.c. In fifth place is a single-operator home station, W6NLZ... 90 QSO's, 150 points. He also chose to use a.c. power sources for the transmitter, self-power for the receiver. A separate rig was used on each band — 3.5, 7, and 14 Mc. The various stories told by those taking part closely parallel the June Field Day experiences, which were quite fully given in November QST.
THERE IS A Santa Claus

He's YOUR Radio Parts Distributor, serving you every day of the year. Your Radio Parts Distributor cheerfully gives his time and attention to YOUR problems. His stock of excellent radio gear makes his store a veritable sleigh load of values. Yes sir, he's an honest - to - gosh Santa Claus to every Ham who knows him. We are as proud of our Distributors as you are. They represent the cream of the industry. We acknowledge their acclaims, and the praise of all amateurs, who know Taylor Tubes' "More Watts Per Dollar" value. Taylor Tubes and Taylor policies are built on customer satisfaction and four square dealing. We sincerely appreciate the compliment of top sales that you, the amateur, and our mutual friend, your Distributor, have given us during 1937. Our hats are off, as are those of the Amateur, to the Amateur Radio Parts Distributor—Long may he serve.

TAYLOR TUBES EXTENDS HEARTIEST
*SEASON'S GREETINGS*
Warren Taylor        Frank Hajek, W9ECA        Rex Munger, W9LIP

"More Watts Per Dollar"
Taylor HEAVY CUSTOM BUILT DUTY Tubes
so we will not go into great detail again here. However, a few notes taken from the various reports may prove of interest: "Sure surprised at the good signals most of the low power rigs had. Compared very favorably with 100 and 300 watt rigs."—W5DYH. . . . W6JWY used 1.75-Mc. 'phone entirely, working 48 stations. . . . "Called 34 stations and worked 25—not bad for 16 watts."—W6LDA. . . . W9TDR used but 2.28 watts, apparently the lowest powered station in the contest. . . . Conditions (both radio and weather) were reported bad in many quarters. . . . All but one of W9FUEH's 74 QSO's were on 14-Mc. 'phone. . . . There is no rest for a ham—W3DOD and W3CGA were aroused from their sleep in the early morning hours to re-erect the mast which came thundering earthward at W4BRB-4. . . . About 50% of the operation at W6KBB-6 was on 56 Mc. 'phone. . . . A near emergency existed for some of the boys out in the open when the rain started to come down by the buckets-full—it seemed that they would have to make real emergency use of their sets. . . . Input at W8JA-3 varied between 3.5 and 4.8 watts. . . . Only 3 watts input at W8KO-8. . . . 19 contacts were made on 14-Mc. 'phone at W2KR-2. . . . W6NRE's work was all on 1.75-Mc. 'phone. . . . 4 watts input at W1JAH. . . .

Like the Field Day in June, the August Low Power Contest provided another test for emergency/portable apparatus. We are now coming into the season when many of us may be called upon to use our auxiliary gear in actual emergencies. Are you ready? Participation in the F.D. and L.P. contests help prepare us for these emergencies. Plan now to get into all such activities in the future. You'll have a lot of fun at the same time you do something worth while!

—E. L. B.

LOW POWER CONTEST SCORES

<table>
<thead>
<tr>
<th>Station</th>
<th>Operator(s)</th>
<th>QSO's</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>VE3GT</td>
<td>VE3BC-VE3GT</td>
<td>16</td>
<td>159 R</td>
</tr>
<tr>
<td>W6NLZ</td>
<td>W6NLZ</td>
<td>8</td>
<td>160 R</td>
</tr>
<tr>
<td>W6TOP</td>
<td>W6TOP</td>
<td>63</td>
<td>120 R</td>
</tr>
<tr>
<td>W6RQM</td>
<td>W6RQM-W6RJR-W6HLB</td>
<td>73</td>
<td>124.5 R</td>
</tr>
<tr>
<td>W6FQ</td>
<td>W6FQ</td>
<td>50</td>
<td>100 R</td>
</tr>
<tr>
<td>W3DRE</td>
<td>W3DRE</td>
<td>45</td>
<td>90 R</td>
</tr>
<tr>
<td>W5F</td>
<td>W5F-AW5FBB (log keeper)</td>
<td>60</td>
<td>67.5 R</td>
</tr>
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<td>W1F</td>
<td>W1F</td>
<td>50</td>
<td>80 R</td>
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<td>W1AHA</td>
<td>W1AHA-W1CMB</td>
<td>41</td>
<td>76.5 R</td>
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<tr>
<td>W6J</td>
<td>W6J</td>
<td>41</td>
<td>76.5 R</td>
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<tr>
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<td>W1FZI-W1FZK</td>
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<td>37</td>
<td>70.5 R</td>
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<tr>
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<td>W1JAH</td>
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<td>58 R</td>
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<td>48 R</td>
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<td>40 R</td>
</tr>
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<td>33 R</td>
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<td>31.5 R</td>
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<td>30 R</td>
</tr>
<tr>
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<td>W3FQ</td>
<td>15</td>
<td>33 R</td>
</tr>
<tr>
<td>W4EPT</td>
<td>W4EPT</td>
<td>15</td>
<td>33 R</td>
</tr>
</tbody>
</table>
Leading manufacturers of variable condensers select Isolantite* for end support and base insulation—because Isolantite has been shown, by laboratory test and practical performance, to possess all the desirable characteristics of a high quality ceramic insulation. Typical of the condenser applications in which Isolantite is liberally used are Cardwell's Single Trim-Air Type ZU-140-AS and Dual Trim-Air Type ET-30-AD; National's heavy duty transmitting condenser Type TMA, and Hammarlund's new Type N-10 neutralizing condenser, just placed on the market.

For the amateur, Isolantite ceramic insulators offer the same advantages that have recommended them to manufacturers of commercial equipment who demand an insulator high in mechanical strength and precision, low in dielectric losses and moisture absorption.

*Registered Trade-name for the products of Isolantite Inc.
**SPECIFICATIONS**

- **A.C.-D.C. Voltage Ranges from 0 to 2500 volts at 1000 ohms per volt.**
- **D.C. Current Ranges:**
  - 0-1
  - 0-10
  - 0-100
  - 0-250
  - 0-1000
- **D.C. Resistance Ranges:**
  - 0 to 1 amp.
  - 0 to 10 mgs.
  - (provision for self-contained batteries).
- **Decibel Ranges from -10 to plus 63DB.**
- **Ohmmeter ranges powered by self-contained supply.

Net price to amateurs: $19.95

**New "PRECISION" New SERIES 830**

**D.C. VOLT-OHM-MILLIAMMETER**

**SPECIFICATIONS**

- **Five D.C. voltage ranges:**
- 0 to 2500 volts at 1000 ohms per volt.
- **Four D.C. current ranges:**
- 0 to 1 amp.

Net price to amateurs: $10.95

Write for our new No. 18 Catalog. See these and other PRECISION instruments at your jobber.

---

**Field Stations**

- W6DKJ-2: 200 cycles on up to 15,000, using 400 cycles as a reference. At the low end, however, the output showed a rise instead of the previous drop, possibly regeneration.
- W8FOU: 36 dB at 100 cycles. Check on the oscilloscope showed, as expected, a phase shift at the low end which indicated reduction of feedback or possibly regeneration. The former seems more probable, since there was no tendency toward oscillation, nor did the output rise above the normal.

---

**New Frequency Run on the Amplitude**

A new frequency run on the amplifier showed that the response now was within 1 db from about 200 cycles on up to 15,000, using 400 cycles as a reference. At the low end, however, the output showed a rise instead of the previous drop, possibly regeneration. The former seems more probable, since there was no tendency toward oscillation, nor did the output rise above the normal.
IT'S A NEW SPORT
—but BURGESS
had the Portable Power for it

With the Burgess 4Z2SC for its ignition and two W30BPX batteries for its super-regenerative receiver, this radio-controlled model belonging to Pat Sweeney, Chicago, and Benjamin Porter, W1FOR, is capable of making controlled flights within a radius of eighteen miles. Thousands of other gas model airplane builders are using Burgess 4Z2SC batteries for ignition in their tiny planes. These tiny batteries, like all other Burgess products, maintain the Burgess tradition of dependable, economical portable power. They weigh less—they're built for the application—they last much longer.

Whatever the problem, Burgess provides dependable service at lowest cost.

BURGESS BATTERY COMPANY
FREEPORT ILLINOIS

BURGESS

Say You Saw It in QST — It Identifies You and Helps QST
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To qualify for such a job, you must hold a second class radio-telegraph license with at least a second class radio endorsement; you must have a complete knowledge of procedure, forms, aids to air navigation, weather, symbols, official ATA code and other pertinent subjects. You must be capable of copying both on the "mill." These are some of the requirements... MIDLAND TRAINING COVERS EVERY REQUIREMENT THOROUGHLY AND COMPLETELY.

Midland's present employment record closely approaches 100%. Frequently our students have been reserved in advance. All indications point to a substantial continued growth of the airlines and an increased demand for properly qualified radio operators. AND OUR TRAINING STANDARDS WILL BE MAINTAINED AT SUCH A HIGH LEVEL THAT OUR STUDENTS WILL ALWAYS BE IN DEMAND.

If you are between the ages of 18 and 30, have a high school education, are free of uncorrectable physical defects and have a sincere desire to enter the profession of Airline Radio Operating, write or wire for complete information immediately. Address your inquiry to

NORM G. SOUTHER

AVIATION DIVISION
MIDLAND TELEVISION, INC.

Dept. 130-M, Power & Light Bldg., Kansas City, Mo.

Columbia network basic broadcasting station KMBC

Say You Saw It in QST — It Identifies You and Helps QST

GETTING MORE POWER OUTPUT

Although 10 watts from the driver is sufficient to excite a great many Class-B combinations, the additional 5 watts which self-bias operation will give is often desirable, especially when the Class-B tubes' grid requirements are near the 10-watt figure. Excess driver power is helpful in improving grid regulation and thus reducing distortion. In this case a slight rearrangement of the power supply and the addition of an inexpensive rectifier-filter bias-supply system were all that was necessary. The power transformer specified originally is provided with a secondary tap for bias purposes so that no special transformer or circuit is necessary. The revised power-supply diagram is given in Fig. 3. The bias-supply circuit consists of the 1-V rectifier, filter L2C2, and volt-

The penalty for improved frequency response with inverse feedback is reduction in gain. This means that more input voltage must be applied to the 6J7 grid for the same power output from the 2A3's. No accurate figure is available on the gain reduction under the amplifier conditions originally existing, because on completion of the work of installing negative feedback the 2A3's were shifted from self-bias to fixed-bias to increase the power output. With this change, the amplifier gain is down about 8 db at the 10-watt output figure. For 15 watts output (obtainable without distortion with fixed bias) the input voltage required is about three times that originally needed for 10 watts with self-bias. There is still more than enough gain for a crystal microphone, since the original sensitivity was considerably in excess of normal requirements.

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The penalty for improved frequency response with inverse feedback is reduction in gain. This means that more input voltage must be applied to the 6J7 grid for the same power output from the 2A3's. No accurate figure is available on the gain reduction under the amplifier conditions originally existing, because on completion of the work of installing negative feedback the 2A3's were shifted from self-bias to fixed-bias to increase the power output. With this change, the amplifier gain is down about 8 db at the 10-watt output figure. For 15 watts output (obtainable without distortion with fixed bias) the input voltage required is about three times that originally needed for 10 watts with self-bias. There is still more than enough gain for a crystal microphone, since the original sensitivity was considerably in excess of normal requirements.

Although 10 watts from the driver is sufficient to excite a great many Class-B combinations, the additional 5 watts which self-bias operation will give is often desirable, especially when the Class-B tubes' grid requirements are near the 10-watt figure. Excess driver power is helpful in improving grid regulation and thus reducing distortion. In this case a slight rearrangement of the power supply and the addition of an inexpensive rectifier-filter bias-supply system were all that was necessary. The power transformer specified originally is provided with a secondary tap for bias purposes so that no special transformer or circuit is necessary. The revised power-supply diagram is given in Fig. 3. The bias-supply circuit consists of the 1-V rectifier, filter L2C2, and volt-
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Triodes—Pentodes—"Beam Power" Tubes.

Raytheon Amateur Tubes have been designed and manufactured with your requirements in mind.
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The CB-55 RADIOTELEPHONE and telegraph transmitter offers the user one of the finest units of its kind at an unheard of price, employing the latest circuits and beautiful workmanship. The use of the new T-20 in the output stage assures the user the possession of a commercial looking installation of a real power output and broadcast station quality.

The CB-55 will give fine results on the 1.7 MC, 3.5 MC, 7 MC, 14 MC, and 30 MC bands. Inputs of 95 watts can be used for phone operation. Many amateurs buy the CB-55 particularly for 10 and 20 meter operation. The CW-55 RF unit, P-558 Power supply, L-40M Modulator unit, FB-55 Rack Frame, 3 high grade surface type milliammeters, meter cords and plugs, power connecting cables and plugs comprise the CB-55 unit.

Size: Overall dimensions, height 32", width 10", length 17".

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51 Vesey Street, New York
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To reduce the plate voltage to the rated figure for the 2A3's (in the self-bias arrangement there was a drop of about 60 volts in the cathode resistor) the plate supply filter is changed from condenser- to choke-input and the transformer secondary taps changed from 360 to 425 volts. Under load conditions, the supply voltage to the 2A3's is 320 volts, allowing for a slight drop in the output transformer windings.

$R_b$ is a slider-type resistor, the slider being set to give the proper operating grid bias. This may be done with the aid of a high-resistance voltmeter or—and this probably is the preferable method—by adjusting the slider so that the plate current to the 2A3 is 80 milliamperes under no-signal conditions. The positive lead can be temporarily disconnected from the output-transformer primary center-tap and the meter inserted to get the reading.

In connecting the bias-supply filter condenser, make sure that the positive terminals are grounded and the negatives connected to the choke. This is the reverse of the normal procedure, and it may be necessary to make a conscious effort to overcome habit!

The extra bias lead requires the use of an 8-wire cable instead of the original seven, so that it becomes necessary to substitute 8-prong sockets and plugs in place of those originally specified for the supply connections between the two units.

The lower plate voltage under the revised circuit conditions reduces the voltage available to the low-level tubes through the voltage regulator. As indicated on the diagrams, the regulated voltage is approximately 200 volts. This is adequate for all stages, including the push-pull stage driving the 2A3's. The rated 15 watts output can be developed without perceptible waveform distortion.

There is plenty of room in the power-supply chassis for mounting the extra parts. The most convenient arrangement is to mount the I-V socket on the chassis in the position formerly occupied by the voltage control, $R_b$, moving the latter to the edge of the chassis where it can be reached without removing the cover. The choke and condenser for the bias-supply filter can be mounted on a convenient inside edge.

Although the conditions existing in the amplifier with feedback do not approach the ideal—for example, with resistance coupling throughout the phase shift could probably be eliminated within the useful audio range—it does seem to us that the improvements resulting from the changes described above indicate that equal benefits could be secured in other types of speech equipment through a few simple modifications. Provided the amplifier reserve gain in the first place is high enough to take care of the reduction brought about by the use of inverse feedback, it should always be possible to improve the frequency characteristic and to reduce distortion. Most of us find such possibilities interesting, and certainly worth a trial when little besides time needs be expended.
The New 1938 Edition of the RADIO AMATEUR'S HANDBOOK

TWELVE men, each a specialist in some phase of amateur radio, collaborated four months in the production of the 1938 edition of THE RADIO AMATEUR'S HANDBOOK. Virtually thousands of hours of effort have been expended in a thorough-going rewriting of the book. Larger than ever before and still more profusely illustrated, the HANDBOOK is without question the most comprehensive ever produced. Further, the selection of the material and its arrangement have resulted in the most understandable presentation. Two entirely new chapters have been added — the first a thorough treatment of workshop practice covering the problems faced in working with raw material, assembling and wiring the component parts of station equipment. It includes designs for work benches and operating tables. The second new chapter is devoted to the ever-important field of emergency and portable equipment. Designs are given for the last word in emergency gear and special attention is paid to the power supply problem. In response to wide demand, an entirely new chapter has been written on the general subject of fundamental principles. The new chapter is aimed at those individuals, young or old, who have absolutely no knowledge whatever of electrical and radio phenomena but who demand a painless introduction to the subject. The remaining chapters have all been vigorously rewritten, involving an entirely new text. Those dealing with apparatus construction have benefitted from a three-months' laboratory program devoted to the design and construction of modern transmitters, receivers and power supplies, incorporating modern tried and proven circuits. In all these circuits and in the equipment built around them, a special attempt has been made to avoid anything freaky or unusual. Indeed, the work has been greatly that of selecting from the maze of good, bad and indifferent circuits only those which comply strictly with modern practice. In contrast to previous editions of the Handbook, many of the apparatus designs were prepared especially for the book and are exclusive to it.

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Modulator using:

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STANDARD TRANSFORMER CORPORATION

850 BLACKHAWK STREET • CHICAGO, ILL.

A Rotary Spider-Web Loop Antenna with Reflector

(Continued from page 86)

sembled. All the poles are laid out on the ground as shown in Fig. 1 so that their included angles are 45 degrees and lengths O-B, O-C, and O-D are made 6 feet. Then lengths O-B’, O-C’, and O-D’ are trimmed to 12 feet (at the small ends of the poles, since these portions are rather weak). They are then lashed together at point “O” with the large ends of the poles at points A, B, C, D and A’.

Ordinary antenna insulators are used at “X” and “Y.” Two insulators at point “Y” can be used to better advantage than a single insulator since this will provide a means for drawing up the radiator to make it taut after it is of the correct electrical length. At all points other than “X” and “Y” (a total of eleven) where either the radiator or reflector is secured to a point on any bamboo pole, the above-mentioned porcelain cleats or other insulators are used.

The distance from insulator “X” to point “G,” at the center of reflector, is approximately one-quarter wave. The reflector is cut long and pruned for greatest current in the reflector at point “G” with the radiator excited. A small incandescent bulb (Xmas tree type) shunted across a few inches of the reflector at point “G” is a simple means for indication of maximum current at this point. Should you have a radio-frequency meter around the shack with appropriate scale, it can be used to advantage. The reflector length was found to be quite critical.

The spacing of the reflector and radiator should be set with a signal-strength meter if possible. Testing with a distant station is also all right, provided the receiving station has a meter of some kind for indication of signal input and the band is in a steady condition at the time of the tests. This latter, however, is practically impossible to attain. In tuning up be careful to make sure that the antenna is always at the same height because the effective height above the ground influences radiator and reflector lengths. In one instance here we found that the radiator had to be lengthened 7 inches when 4 feet off the ground whereas at 24-foot height it had to be this amount shorter. Remember that care in pruning is the difference between an antenna that goes places and one that is just another antenna.

As mentioned previously, the array can be suspended between two masts or poles by making a simple bridle of rope (similar to a kite bridle) attached to points 1, 2, 3, 4, 5, 6, 7, 8, and 0. We tried attaching the bridle to points 1, 2, 3, 4 and 0, but prefer the former because it prevents sag. Shortening up on the forward ropes permits adjustment of the tilt angle. A separate rope could be run to the operating room to adjust the tilt angle if preferred. This could be accomplished by running a rope through a small pulley which is secured to a stick driven in the ground directly beneath the antenna pole intersection. We have
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<table>
<thead>
<tr>
<th>Type</th>
<th>Price</th>
<th>Screens</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 mfd. 2000 V, DC</td>
<td>$1.50</td>
<td>2 mfd. 2000 V, DC</td>
<td>2½ x 3½ x 1½ lbs</td>
<td>1½ lbs</td>
</tr>
<tr>
<td>3 mfd. 1200 V, DC</td>
<td>$2.75</td>
<td>3 mfd. 1200 V, DC</td>
<td>3½ x 3½ x 1½ lbs</td>
<td>1½ lbs</td>
</tr>
<tr>
<td>5 mfd. 900 V, DC</td>
<td>$3.75</td>
<td>5 mfd. 900 V, DC</td>
<td>4 x 3½ x 1½ lbs</td>
<td>1½ lbs</td>
</tr>
<tr>
<td>(Including 2½&quot; Bakelite Standoffs)</td>
<td>$1.75</td>
<td>(Including 2½&quot; Bakelite Standoffs)</td>
<td>4½ x 3½ x 1½ lbs</td>
<td>1½ lbs</td>
</tr>
</tbody>
</table>

CORRECTION!
An error was made in the listing of the Prices on the Utah Amateur Transmitter Kits ON PAGE 37 OF THE NEW NEWARK HAM CATALOG. The correct prices of the Kits are given below. Please change the prices in your catalog accordingly.

<table>
<thead>
<tr>
<th>Kit No.</th>
<th>Price</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>UTAH JR.</td>
<td>$15.95</td>
<td></td>
</tr>
<tr>
<td>UTAH KIT NO. 1</td>
<td>$49.75</td>
<td>Complete with tubes, crystal and speaker.</td>
</tr>
<tr>
<td>UTAH KIT NO. 2</td>
<td>$44.50</td>
<td></td>
</tr>
<tr>
<td>UTAH KIT NO. 3</td>
<td>$13.95</td>
<td></td>
</tr>
<tr>
<td>UTAH KIT NO. 4</td>
<td>$49.75</td>
<td></td>
</tr>
<tr>
<td>UTAH KIT NO. 5</td>
<td>$49.75</td>
<td></td>
</tr>
</tbody>
</table>

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Price $129.00 $24.00 $18.50 $12.50 $9.47
National NC-100X complete with tubes, crystal and speaker in cabinet.

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Brand New! Different! Better! Never before has such valuable Transmitter data been offered you, free. Shows you how to put new life in your old rig. Contains complete data on how to build 16 NEW TRANSMITTERS! Gives complete schematic blueprints of new circuits, from 5 watts to 1 kw. Gives complete lists of all parts necessary. Lists the new Stancor Transformers for all the new tubes.

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Cash Down 3 Months 6 Months 12 Months
Price $129.00 $24.00 $18.50 $12.50 $9.47
National NC-100X complete with tubes, crystal and speaker in cabinet.

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Very Special
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not attempted this, but believe it could be made to work.

A word about the tilt angle. A fixed tilt angle of 15 to 20 degrees, determined experimentally here at this location, seems to be about right. On tests with stations in this country we found that a tilt angle of approximately 20 degrees increased the signal strength nearly 33 percent as compared to either a tilt angle of 0 degrees or 45 degrees. As the tilt angle approached 45 degrees the gain equaled that which was obtained in the horizontal position. The radiation to the rear decreased at a 20-degree tilt angle and increased to half the forward radiation at both 0 and 45 degrees. This made for a front-to-back gain in the array of approximately 8 db at the distant receiving station.

In Fig. 2 a field-strength diagram is given for the array. This was taken by setting up a field strength meter 300 feet distant from the antenna and then rotating the array. The curve is plotted for db values above the minimum observed. The pattern is unbelievably sharp for such a simple array. Often, after hearing some station, we rotate the beam until we get maximum signal strength on the receiver. You really get a kick hearing a weak DX signal build up until it is above the noise. Also, it is amusing how it discriminates against signals that would otherwise make a QSO impossible.

In addition to having a lobe right off the front there are also lobes off the top and bottom. Working at a height of one-half wavelength above ground seems to assist in cancelling these two lobes. However, they are not entirely lost and they undoubtedly help from a high-angle radiation standpoint. It seems to work out in practice that during the daylight hours when skip is comparatively close in, possibly only 1 to 2 S-points difference in signal strength may be noted with rotation of the array. However, at other times, when the skip distance is much greater, a differ-
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ence of as high as 6 S-points have been noted after rotating the array.

W8MJM has had one up for approximately five months and claims much for it, especially from the receiving angle. W9CH, Bob Palmer at Ashland, Wis., has also had one up for quite some time. He has been reported "S9 plus" in Manila, P. I., at noon, C.S.T., and says that to date he never has had less than S7 from VK's. The snapshot of W8MJM's installation shows it to be more of the conventional type of rotary set up. Bob has his on top of the house.

In conclusion, we can state that the rotary web array has far surpassed the general run of fixed type antennas used at this location. It has been in operation since March 20, 1937, and has given excellent service since its installation. QRM is decreased to a remarkable extent when using the array for a receiving antenna; and the system also has been a revelation in hearing and working DX.

... 78° North, 72° West

(Continued from page 51)

signals have been heard on the 3.5- or 8-Mc. bands. On 28 Mc., during the first part of October, I did hear a few weak signals. However, not much time was spent there; merely listening just to see what conditions were like. I hope we shall be able to contact all of you boys who want to get another country or zone that lies up here for you. Your messages, relays and contacts are all greatly appreciated by Captain C. J. MacGregor, by the crew and me. We will be frozen in here at Reindeer Point, near Etah, Greenland at least until the middle of next July — then we leave as soon as the ice breaks up and we can get out.

The MacGregor Expedition Transmitter

The r.f. line-up consists of an RK-25 crystal oscillator capacity coupled to an RK-39 buffer-doubler. This stage is link-coupled to a pair of RK-20's which furnish ample power to drive the final, consisting of two HK-354's running at 2000 volts with an input of 500 watts. When this layout was decided upon it was borne in mind that it would be possible to use the RK-20's as the final should reduced-power operation become desirable.

To guard against burning out irrereplaceable parts, an underload and an overload relay were incorporated in the power supply of the final.

The audio-frequency end of the transmitter was built to operate from a crystal microphone. The speech equipment is divided into two sections, a pre-amplifier and main amplifier, so designed that the frequency response characteristic and hum level are satisfactory for re-broadcast use. The pre-amplifier is resistance coupled up to the output, and is very compact. Two gain controls are provided to take care of the different levels of the microphones used. The volume con-
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Service engineers and technicians will find it useful for checking transformer defects, the analysis of phase and frequency modulation in Lissajou’s figures, and in many other applications.

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Low frequency drift crystals (Type L T C) supplied within 0.1% of your specified frequency and calibrated to within 0.05% are priced as follows: 1750 and 3500 kc. bands --- $2.50 each. 7000 kc. band $4.00 each. Holder $1.00.

(Holder as illustrated to fit G.R. Jacks or round holder to plug into a tube socket can be furnished. G.R. jacks to plug illustrated holder into --- $1.15 pair.)

* X cut PRECISION crystals carefully ground for maximum power supplied within 0.1% of your specified frequency and calibrated to within 0.03% are priced as follows: 7750, 3500 and 7000 kc. bands --- $3.00 each. Add $1.00 if holder is desired.

*AT* cut crystals for commercial use quoted on at your request. When ordering be confident you are assured of the finest obtainable. Now in our seventh year of business.

PRECISION PIEZO SERVICE

487 Asia Street
Baton Rouge, La.

Say You Saw It in QST — It Identifies You and Helps QST
"Our experience with Delco-Remy police generators during the past four years has been most satisfactory and we now have nearly all of our radio cars using Delco-Remy equipment. The high charging rate of these generators at low engine speeds is most desirable for scout cars and cruisers and we have found their performance most dependable."

CAPTAIN ROBERT TURNER
Inspector of Motor Vehicles
Detroit Police Department

LIEUTENANT EDWIN C. DENSTAEDT
Supervisor of Radio
Detroit Police Department
Past President, Associated Police Communication Officers

THE MOTOR CITY KNOWS ITS GENERATORS

The use of Delco-Remy Special Service Generators by the Police Department of Detroit—fourth city of the United States—is another outstanding example of the widespread selection of Delco-Remy generating equipment by local and state law enforcement agencies. Delco-Remy police generators are high-output generators designed and built to furnish the extra current required for police radio work. Coupled with Delco-Remy Current and Voltage Regulators, they give continuous, trouble-free operation and keep cruisers and scout cars in service the maximum amount of time. Amateurs, too, find that Delco-Remy High-Output Generators provide ample current for two-way radio service and experimental work in their own cars.

Any Branch or Electrical Service Station of United Motors Service can supply Delco-Remy High-Output Generators for special installations. Ask them to suggest a generator for your needs.
great difficulty with r.f. pickup coming in from a 1400-foot unshielded cable connecting a field amplifier of −25 db output to the speech amplifier illustrated. We had expected, too, that this pickup could be eliminated by choice of band-stop or low pass filters inserted in the 500-ohm line. However, even such drastic methods would not stop the r.f. interference. Then the 6J7 pentode was installed in the amplifier and the trouble was cured completely. Furthermore, this almost phenomenal success has been duplicated by us with entirely different setups.

Cathode Coupled Driver for Class-B Modulators
(Continued from page 58)

preamplifier, employing, for instance, push-pull 6CS's, 56's, 76's, or their equivalent, as the final stage.

It is well to admit here and now that the drive delivered by the 6L6 to the 805's in this circuit possesses some harmonic content at high power levels, but this is so small that on voice amplification it is not noticeable to the ear, and shows up but slightly on a 'scope. This should not be misconstrued as a reflection on this economical drive system; many of the conventional plate-coupled drivers produce much more distortion.

The modulator, shown in Fig. 1, is so designed that it will work from any line having a level of +14 to +20 db, although it could be coupled directly to a low-level stage by use of an interstage transformer with a 3:1 step-up ratio. As previously mentioned, this type of driver is degenerative, and thus more voltage must appear from the grid of the 6L6 to ground than across the primary of the driver transformer T2. This means that more voltage is usually needed at the grid of the 6L6 than could be obtained from a low-level stage. The 6L6 is operated with 400 volts on the plate and 300 volts on the screen. A variable resistor is used in the cathode of the 6L6 tube. This is for adjusting the bias on the 6L6 (−20 to −22 volts). A jack for reading the plate current of the 6L6 (50 to 55 ma.) is also included so that the tube may be adjusted for maximum swing without overloading. This condition would be indicated by a shift in the plate current of the 6L6. Furthermore, the driver transformer used is of the variable-ratio type, which allows adjustment for best results and covers a wide range of ratios. Thus the constants of the circuit in which the 6L6 operates may be varied for optimum performance.

The best ratio, as found by the author, was a step-down ratio, primary to 1/4 secondary, of 1.30 to 1.0; that is, a step-up ratio, primary to total secondary, of 1.154—so that an r.m.s. grid voltage of 150 volts grid-to-grid at the 805's necessitates approximately 100 volts on the primary of the driver transformer, and approximately 120 volts to the grid of the 6L6—which boils down to approximately the original +14 db level input, when transformed from the 500-ohm line.

SIGNAL ELECTRIC MFG. CO., Menominee, Michigan
ESTABLISHED 1892

DO YOU WANT TO LEARN
WIRELESS and TELEGRAPHY?

TWO BOOKS EVERY AMATEUR
SHOULD HAVE —

Send Now

10¢ Each
POSTPAID
COIN, OR STAMPS

Hundreds of ama­
teurs have learned
from these books, so
they can you.

These books give you the fundamentals of
wireless and telegraphy. They contain the codes
and how to learn them. Mail your order now to:

SIGNAL ELECTRIC MFG. CO., Menominee, Michigan
ESTABLISHED 1892
Troubles CAN BE OVERCOME IN 1938 WITH QST BINDERS

priced at $1.50 postpaid

(Not available outside of the United States and Possessions)

(One set of yearly labels (1921-1940) provided with each binder)

American Radio Relay League
West Hartford, Connecticut

Say You Saw It in QST — It Identifies You and Helps QST
A Complete Oscilloscope

(Continued from page 27)

are shown. These have proven entirely satisfactory, although the holes in the bottom and back are still necessary because without them there is practically no ventilation and even the tubes radiate a respectable amount of heat. The cabinet should be mounted on rubber feet to permit the air to enter the cabinet through the bottom.

The frequency response range of the amplifiers should be very great, extending from the very lowest audio frequencies to the lower r.f. frequencies. No facilities have been available for check-

Fig. 2—Placement of the principal components is indicated by this sketch.
NEUTRALIZING CONDENSERS

National pioneered the unusual design of these neutralizing condensers. Widespread use has proved the soundness of their principle and the honest quality of their construction. All sizes have both plates insulated by Insolantite, and have heavy aluminum plates machined to a smooth rounded edge.

Three sizes are offered. The smallest (Type NC-800, Net Price $1.80) is suitable for the RCA-800, EIMAC 35T, 50T and similar tubes. The next larger size (Type NC-150, Net Price $3.90) is for tubes like the HK-345, RK-36, 150-T, 300-T and 852. The largest size (Type NC-500, Net Price $7.50) is suitable for the WE 251A and similar tubes.

The chart at the left shows the capacity in mmf. for various settings of the spacing between the plates.

NATIONAL COMPANY, INC.

NO HALF-WAY MEASURES
CANDLER TRAINED OPERATORS

YOU ACQUIRE CODE SKILL plus A RADIO EDUCATION WHEN YOU'RE CANDLER TRAINED

Why stumble along by yourself trying to learn code the hard way? Walter Candler will develop your sending and receiving senses to work AUTOMATICALLY! You will read entire words — even sentences of code, just as easily as you read print. It's so easy when you practice right! And that's not all! Candler trains you in the Theory and Practice of Radio! You get code training PLUS a Radio Education — all at one surprisingly low price. Candler is personally interested in making every one of his students an all 'round good operator. You can soon be pounding brass with the best of them. Why wait? Mail the coupon TODAY!

MAIL COUPON TODAY FOR FREE BOOK

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Dept. Q-12, Asheville, N.C., U.S.A.

Say You Saw It in QST — It Identifies You and Helps QST
NOW! A NEW QUALITY CRYSTAL MICROPHONE
MODEL T9
(PERFECT TONE)

Don't be satisfied with anything but the newest crystal mike.

- Excellent for both voice and music, Hi-level — minus 53 DB.
- New shock proof interior — noise and breakage eliminated.
- Semi-Directional — less feedback and background pickup.
- Beautiful chrome and ebony finish.
- Iron Clad guarantee.

LIST MODEL T9 With stand $22.50

THE TURNER COMPANY
Cedar Rapids, Iowa
Licensed under Patents of the Brush Development Co.

BIRNBACH IMPROVED STANDOFF INSULATORS
Are the Favorites of the Experts

Because they are made of better ceramic. Come in a complete range of heights, for condenser, coils, tube sockets, etc. Can be mounted with a minimum of labor.

White glaze.

No. 430 . . . 4 1/8 16c list No. 432 . . . 1 1/8 20c list
No. 431 . . . 1 1/4 15c list No. 432 . . . 1 1/2 25c list
No. 431 1/2 . . . 1 3/4 20c list No. 433 . . . 2 1/2 50c list
No. 4333 . . . . . . 2 3/4 50c list

NEW LOW PRICES ON Transmitting Sockets
It pays to buy the best, so specify "Birnbach"

No. 434 . . . . 4 1/4 50c list No. 435 . . . . 4 1/5 10c list
watt, list ea. . . . . $ .25 watt, list ea. . . . . $ .85

Special Low Prices in Large Quantities
Ask your jobber

BIRNBACH RADIO CO.
145 HUDSON ST. BIRCO NEW YORK, N. Y.

transformer may then be reassembled in its shield and installed.

If proper components are used and no mistakes have been made in the wiring, the oscilloscope will go right to work without any adjustments except rotation of the tube so that the horizontal deflection will be horizontal and the vertical deflection vertical, and trimming of the i.f. transformer to the proper frequency.

When wiring the 913 socket the leads should be left long enough to permit 90-degure rotation of the tube. The i.f. transformer may be tuned to resonance at the i.f. frequency by coupling the grid of the 85 to the grid of the last i.f. stage in the receiver with a small mica condenser. The chassis of the scope should be connected to the receiver chassis. Then with a strong signal tuned in, the i.f. transformer in the scope should be adjusted for maximum vertical deflection. The linear sweep circuit should be used for horizontal deflection. Because the input capacity of the 85 plus the lead to the scope will detune the receiver i.f., it will be necessary to retrim the receiver i.f. for maximum sensitivity and selectivity.

Control R5 is useful to permit some of the observed voltage to be coupled to the linear sweep to keep the pattern from moving on the screen. Resistor R4 is the vernier sweep-frequency adjustment and SW1 is the coarse sweep frequency control. Resistor R11 controls the horizontal amplifier gain and R16 the vertical low-frequency amplifier gain, while R12 controls the i.f. amplifier gain. R20 controls the brilliance of the picture and R15 controls the focus, although these controls are interlocking to some extent and proper focus involves proper adjustment of both. The use of the other controls should be evident from the diagram and panel view.

The satisfaction derived from the use of the instrument will more than justify its cost; and not a little of the satisfaction will come from knowing that the inclusion of the i.f. amplifier makes it more complete for amateur use than most of the expensive commercial oscilloscopes.

Silent Keys

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

Harry B. Boyer, W8FRL, Youngstown, Ohio
Wm. L. Coogan, W1HZH, Winthrop, Mass.
Harry G. Cotter, W8AXF, Toledo, Ohio
Robert E. Dennis, W3DJE, Washington, D. C.
Samuel Frankel, W8BYI, Wilkes-Barre, Pa.
Jack Gaston, ex-W9ECO, Burlington, Iowa
Logan Howard-Smith, W3FBV, Rosemont, Pa.
Carl F. Wilson, W7AAW, Bonner, Mont.

Say You Saw It in QST — It Identifies You and Helps QST
BE SURE TO SEE OUR CATALOGUE IN THE 1938 ARRL HANDBOOK

Here you will find interesting information on six of our most popular transmitting units — ranging from high to low power; the compact and versatile UHX-10, the popular 80-T, the modern 700-R, the quick-shifting 200-R, the ultra high frequency UHX-35 and the multi-channel transmitters 200-S and 60-S. See them in the new 1938 Handbook. Write us direct or if you are in Boston visit our plant for any further information and prices.

HARVEY RADIO LABORATORIES, INC.
25 Thorndike St., Cambridge, Mass.
resulted in the following changes: pres., FS, and ttes. HC. If still all. This is the Christmas party. Congratulations are in order for Ed, a new XL operator has arrived. Will the following please drop me a line to the S.C.M. before the 16th December: AK, EQ, CY, DA, EG, FR, GD, HR, IF, JH, KP, LBT.

Traffic: VE6LU 8 EF 11 EC 32 AB 7 DR 14 EE 10 KN 12 HI 6 LG 5.

VANALTA DIVISION

ALBERTA—SCM, Alfred D. Kettenbach, VE4LX—Due to the illness of his son, LX will be absent from Alberta until March 1st. During his absence GD, of 611 First Ave., N.W., Calgary, will act as S.C.M. Please send Jim your monthly reports and notes on Ham doings. FT bought an R.C.A. 14-Mc, crystal, AAB using the Varisth Ham Club rig. AH has finished receiver which is now located in Winnipeg. CQ of lying points in Manitoba would be appreciated by your SCM, who has completed a new super receiver, RO works all the bands. AG finds 3.9-Mc. 'phone much more comfortable on 28 Mc. AFK is putting out a nice signal on 14 Mc. with a pair of 85's TNT. HJ has completed rebuilding, Probably the most consistent 14-Mc. transmitter. OK is replacing his RK20 with a T35. OK is still using his T55. OM is now using an HFlO0. AJA is a new Juke Jam ham; welcome, OM. OP has his stick up on a new QTH. MI, formerly working out of Flin Flon, is back again at 702 on Govt. Elbow. OV is chasing the elusive DX on 28 Mc. ZC snared an OX. RF, HQ and SY are new comers to Saskatoon. SQ is heard on 9.5-Mc. 'phone. JB is now at Yorkton. VK is on 28-Mc. 'phone while he works input. On his hands; handling traffic and studying for 2nd class ticket. ACC rebuilt transmitter to a new 6L6 tritet. ZQ is proud possessor of an ACR-136. AFB is pleased with his vibrator power supply. PY is needing 500 volts from wet battery. MX is ready again on 3.5 Mc.

ATLANTIC DIVISION

EASTERN PENNSYLVANIA—SCM, John Buck Morgan, W3QP—RM's SAKB, 3AQN, 3EOP, 8ASW, P.A.M.—3EOZ. 3BGS looked three new countries. 3DGC is sporting new Harvey 60X. 3GMK is going strong on 144 Mc. SAKB had the shack done over and is open for business. SDHB is set for all net schedules. SAKB has 616-560 working in great shape. SAKS wants in on traffic net. 3CE reports 3GFK either struck oil or is putting up a signal squitter. 3QX is on 28 Mc. 3GJ is about finished rebuilding. 3GMK has his rebuilt receiver working. 3EJ is operating with a pair of 45'S TNT. HH is going to try P.P. e.c. rig. HJ is going to try P.P. e.c. rig. BW is after 14-Mc. DX. AFT still leads the traffic hounds. 'Phone in spare time. ZX has completed his schedules with the gang. Congratulations. 3ADE and 3AGK are all shined up for big season. 3AQN and 3E9HZ are keeping schedules. SFAQ attended Hudson Div. Conv. 8EUA reports SBT-BW's Silent Key. Your SCM sends B.F.L. this month on deliveries. Last but not least, we have on for "Ripley." Your SCM has taken unto himself a wife, and at this writing is on a honeymoon to parts unknown.

The gang joins the stooge writing this report in saying "Congratulations, Jack and much happiness."

Traffic: W4ADZE 9 3AGE 4 3AKB 87 3AQN 75 2BDG 4 3DGC 22 3ERZ 8 3ETM 8 3EWJ 85 3GJ 35 3GUM 6 3GMK 6 3GNF, second op for long time at 3IU, is running 5 to 6 watts input. 3GUM is O.P.S. in Baltimore. 3GJA is on 14 Mc, 3GUM is on 7 Mc, 3GUM is sporting new Harvey 60X. 3GMK is going strong on 144 Mc. SAKB had the shack done over and is open for business. SDHB is set for all net schedules. SAKB has 616-560 working in great shape. SAKS wants in on traffic net. 3CE reports 3GFK either struck oil or is putting up a signal squitter. 3QX is on 28 Mc. 3GJ is about finished rebuilding. 3GMK has his rebuilt receiver working. 3EJ is operating with a pair of 45'S TNT. HH is going to try P.P. e.c. rig. HJ is going to try P.P. e.c. rig. BW is after 14-Mc. DX. AFT still leads the traffic hounds. 'Phone in spare time. ZX has completed his schedules with the gang. Congratulations. 3ADE and 3AGK are all shined up for big season. 3AQN and 3E9HZ are keeping schedules. SFAQ attended Hudson Div. Conv. 8EUA reports SBT-BW's Silent Key. Your SCM sends B.F.L. this month on deliveries. Last but not least, we have on for "Ripley." Your SCM has taken unto himself a wife, and at this writing is on a honeymoon to parts unknown.

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The gang joins the stooge writing this report in saying "Congratulations, Jack and much happiness."
SOGU, JCG and GWY have done good work by filling in as temporary N.C.S. in W.N.Y. 1 Traffic Net. PLA leads the Division in one of the sections. Our new O.R.S., QMR, has a real total with his first report. AOE, DHU, MQX, KXA and GWT expect to line up some real active schedules. PCW is conducting code classes at his usual round of schools and community organizations. QIL wants to join O.R.S. and A.A.R.S. LGH and PWU send fine examinations on O.R.S. Test. KXA says EBO has new receiver and NFT is operating portable 3.9 Mc. 'phone. VVZ reports 'phone and antenna and is doing wonderful DX work on 14-Mc. 'phone; has a new local DX 'phone. AGLU requests to write the S.C.M. for application blanks for Class B modulated. OL U has married. Stations rebuilding and have 350 watts. EUM's rig is now 750 watts, with 100 percent of China refugees. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone.

Traffic: W8PLA 271 GES 156 (WLMN 50) QMR 53 FOC 47 DSS 24 DHH 8 CGU-QDP 6 FOC 9. 184. 94. 12. 91. 90. 89. 88. 87. 86. 85. 84. 83. 82. 81. 80. 79. 78. 77. 76. 75. 74. 73. 72. 71. 70. 69. 68. 67. 66. 65. 64. 63. 62. 61. 60. 59. 58. 57. 56. 55. 54. 53. 52. 51. 50. 49. 48. 47. 46. 45. 44. 43. 42. 41. 40. 39. 38. 37. 36. 35. 34. 33. 32. 31. 30. 29. 28. 27. 26. 25. 24. 23. 22. 21. 20. 19. 18. 17. 16. 15. 14. 13. 12. 11. 10. 9. 8. 7. 6. 5. 4. 3. 2. 1.


Traffic: PLA 271 CSE 156 (WLMN 50) QMR 53 FOC 47 DSS 24 DHH 8 CGU-QDP 6 FOC 9.

NEW ENGLAND DIVISION

CONNECTICUT—SCM, Frederick Ellis, Jr., W1CTT—JMY is having a grand time in Nutmeg and A.A.R.S. nets with his new NC10IX. JHU has a new NC10IX also. XPX finds traffic good in both Nutmeg and Humdinger nets. JHU joined A.A.R.S. ITI tried 28 Mc. AFB is active on Trunk "C". HXZ made R.C.C. HYF won the main prize at the Royal Technical University, Stockholm, Sweden, as a recent visitor in Portland on an exchange. Where he is spending his year, SM5SX plans to visit some of the those whom he has worked many times on 14-Mc. 'phone, HV has purchased 1938 Skyrider and is building complete new outfit. PD is now living in Bedford, N. D. ELC plans are under way for formation of A.A.R.S. Maine Section. QBO has married. Stations rebuilding and have 350 watts. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone. MGZ is on 3.9-Mc. 'phone.
SPREADER: Light in weight as well as exceptionally efficient, these NATIONAL spreaders offer unusual advantages. The material is non-hydroscopic and weatherproof. The slender shape minimizes surface leakage. The power factor is of the order of 0.15%. The weight is but one ounce each. Catalog Symbol AA-3.

Net Price $.18

NATIONAL COMPANY, INC.
MALDEN, MASS.

At Last!
A Perfected AUTOMATIC SENDER

Save your fist. Let the Automatic Sender raise your stations for you. Repeats calls or messages indefinitely. Length of messages practically unlimited. Sends from 2 to 70 words a minute. Motor driven. Entirely automatic. Built-in tape perforator. Absolute uniformity in spacing of characters. Used with buzzer or oscillator, makes excellent code teacher for novice and speed-builder for the advanced amateur. Complete with 4 rolls of tape and full instructions. No extra equipment needed.

FULLY GUARANTEED

A New High-Impedance RELAY
- Faster
- More Compact
- Quieter
- Moisture-Proof
- More Applications

Plug-in base fits UX socket
Only 1 inch wide, 3 inches tall

Ideal for use with vacuum tube. Its quiet operation, compactness, and ability to follow at speeds far above the professional "bug" make it a perfect keying relay. Can be used as a time-delay, and in many other circuits. Available in 6, 25, 50, 100, 150 volts.

If your dealer can’t supply you, write us

Gardiner-Levering Co. Haddon Heights
New Jersey, U. S. A.

108 Bay You Saw It in QST—It Identifies You and Helps QST

Standard Frequency Transmissions

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<th>Date</th>
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STANDARD FREQUENCY SCHEDULES

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TRANSMITTING PROCEDURE

The time allotted to each transmission is 8 minutes divided as follows:
2 minutes—QST
3 minutes—Characteristic letter of station followed by call letters and statement of frequency. The characteristic letter of W9XAN is “O”; and that of W6XK is “M.”
1 minute—Statement of frequency in kilocycles and announcement of next frequency.
2 minutes—Time allowed to change to next frequency.

W6XK: Don Lee Broadcasting System, Los Angeles, Calif., Frank M. Kennedy in charge.

WWV Schedules

Each Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station, WWV, transmits with a power of 20 kw. on three carrier frequencies as follows: 10:00 to 11:30 A.M., E.S.T., on 0000 kc.; noon to 1:30 P.M., E.S.T., on 10,000 kc.; 2:00 to 3:30 P.M., E.S.T., on 20,000 kc. The Tuesday and Friday transmissions are unmodulated c.w. except for 1-second standard-time intervals consisting of short pulses with 1000-cycle modulation. On the Wednesday transmissions, the carrier is modulated 30% with a standard audio frequency of 1000 c.p.s. The standard musical pitch A = 440 c.p.s. is also transmitted from 4:00 P.M. to 2:00 A.M., E.S.T., daily except Saturdays and Sundays, on a carrier frequency of 5000 kc., power 1 kw., 100% modulation. The accuracy of the frequencies of the WWV transmissions is better than 1 part in 5,000,000.

Strays

And according to an AP dispatch, outdoor television pickups are being relayed to the studio by means of an ultra-violet wave transmitter!
For true dependable performance in the 40-meter band you'll want a B 5 Crystal Unit in your transmitter. This superior crystal unit will carry 35% more RF current than the popular Bliley LD2 40-meter crystal unit which it replaces. It has a higher activity and is even more dependable — yet there is no increase in cost. Your distributor has the B 5 Unit for 40-meters in stock for $4.80.

For 80 and 160-meters, your distributor has the low drift LD2 Unit in stock for $4.80.

The B 5 Crystal Unit for 20-meters brings higher standards of frequency control to the 20-, 10- and 5-meter bands. Having a drift of less than 4 cycles/Mc°C, and a high activity, this new unit will give your transmitter a degree of frequency stability never before possible at a reasonable cost. You can get the B 5 Unit in the complete range from 14.0 to 15.0 Mc. from your distributor for $7.50.

BLILEY ELECTRIC CO.
ERIE, PA.

Announcing THE FOURTH EDITION of EXPERIMENTAL RADIO
(166 p. 6 x 9 cloth, 136 experiments, 167 figures). By Professor R. R. Ramsey, Ind. Univ. A revision of the original book for experimenters and students. Diagrams drawn for power packs and batteries. Many new and original ideas. The earlier editions were the first books to contain new features which are accepted now. Of this edition again it can be said, "Ramsey manages to supply that missing fact which seems to be hidden in other books."

FUNDAMENTALS of RADIO

RADIO ENGINEERING, broadcasting, aviation and police radio, servicing, marine radio telegraphy and telephony, Morse telegraphy and railway accounting taught thoroughly. Engineering course of nine months' duration, equivalent to three years of college radio work. School established 1874. All expenses low. Catalog free.

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THE VALPEY CRYSTALS
Step by Step Precision Made
Type LMA unit consists of an accurately cut crystal of the low drift type. The frequency drift will not exceed 4 c/m°C. The mounting is of low loss moulded bakelite, employing tube pins for tube socket mounting. The embossed cover has the frequency accurate to within .01% stamped on it. Within 5 kc. of specified frequency in the 1.7, 3.5, 7 Mc. bands ........................................ $4.50

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Type VQ2 — Standard X cut crystal, supplied in the 1.7, 3.5, 7 Mc. bands, within 5 kc. of freq. specified ....... $2.25

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INSTRUCTOGRAPH CO., Dept. 0-12
912 Lakeside Place Chicago, III.

WESTERN MASSACHUSETTS—SCM, William J. Barrett, W1JAII—IOT is trying to low power DX on 14 Mc. IOR snags plenty of traffic with the new rig. BVR has been appointed Sales Representative for First Corp. Area A.A.R.S.; Porc handled some Shanghai refugee traffic. ZW reports results of Worcester Radio Assn election: IOR, pres.; JNZ, vice-pres.; IZW, sec.-area. How about some news from the other clubs? EoFXZ is now 1KUQ, ZB raised county total to 111. BKG is still working and there are lining up schedules for winter. KJX is new O.R.S. in Springfield. EOB is about ready to christen new rig with '64A in final. HJR finished second suitcase portable station. BN8Z and IOR are on 3.5 Mc. and looking for schedules. AVK is in Emergency Coordinator for Springfield.

Traffic: W1IOT 424 (W1LGN 64) IOR 324 BVR 109 (W1LG 192) IZW 66 KUQ 55 AJ 54 ZB-BKG 50 HN6 30 AZW 28 KJ-X 10 IN 5 AJD 2.

NEW HAMPSHIRE—SCM, Carl B. Evans, W1BET—The N. H. State Traffic Net is functioning smoothly every night except Sunday from 6:30 to 7:00 p.m. on 3840 kc, as a spot frequency net. QZL’s are called by control station and territory which should be FB for 56 Mc. QC1 has a new spot frequency net. QRZ’s are called by control station and antennae. KOO completed the construction of a frequency right away. It is not necessary to he on every night; two or three nights a week will be sufficient. HOV joined the ranks of the Benedicts on Oct. 23rd. Congrats, beat wishes, and lots of happiness from the whole section, Eddie. The M.V. A.R.C. sponsored a “send-off” party for HOV at BFT’s new radio room and a new microphone. JPZ and ILX visited at HRX, HTJ, BLC and received visits from UE2II, VE2FE, BLC, CUN and TJ. KJK is new O.R.S. in the territory from 3750 to 3900 kc. are covered for anyone want­ning to get traffic into it, for connections are available for rapid relaying to all parts of the U.S.A. and the far East through AQV’s. KVB, a new amateur in St. Albans, is using a new radio in his home on 7, 14 and 28 Mc. KTB is the call of Merwin Forbes, Lyndonville, Vt., who visited KJG and JRU. JLF has been running the 1.7-Mc. station for the past few months. BAY is planning a new shack to house the rig and entertain visitors to the State to attend our Floating Club meetings. DZS is on 15 Mc.; he is a member of “Supporting Division” of E.A.C. BVR has his rig with a pair of 100Mc’s ready to go. BCH is ready for the winter season with a 50 watt and a 800 watt rig. BQZ is rebuilding. BRT finds some time to be on. ESZ is going to move to 3.5 Mc. for the winter. DBB is on 30 Mc. for the winter. BTV is on 1.75 Mc. and received visits from UE2II, VE2FE, BLC, CUN and TJ. JFF has moved to new QTH with BVI and JNO.

Traffic: WFSV 73 GNF 9 KBV 6 AHN 5.

ROANOKE DIVISION

NORTH CAROLINA—SCM, H. S. Carter, W4OOG—SKKQ, the ex-SCM of W. Va. attending school at the un. of N. C. The gang extends a cordial invitation to all visitors to the State to attend our Floating Club meetings. DZS is on 14 Mc.; he is a member of “Supporting Division” of E.A.C. BVR has his rig with a pair of 100Mc’s ready to go. BCH is ready for the winter season with a 50 watt and a 800 watt rig. BQZ is rebuilding. BRT finds some time to be on. ESZ is going to move to 3.5 Mc. for the winter. DBB is on 30 Mc. for the winter. BTV is on 1.75 Mc. and received visits from UE2II, VE2FE, BLC, CUN and TJ. JFF has moved to new QTH with BVI and JNO.

Traffic: W4ABT 51 DWB 42 DW 33 AGF 10 NC 6 DZS 5 ESR 4 DGV 3.

SOUTH CAROLINA—SCM, Ted Ferguson, W4BQE—NYL reports eight hams at Clemson, also that the call ETP has been issued to the Club. DXJ has his O.R.S. DE took a Naval Cruise. Amateurs at the U. of S. C.: 4ERF, CKQ, and BFT. DJW is active on 7 Mc. WX of Lexington was a recent visitor to 4NC, also Ed Day of WLM/W3CX.

Traffic: WA4RT 51 DWB 42 DW 33 AGF 10 NC 6 DZS 5 ESR 4 DGV 3.

Traffic: WA4BDT 116 CZA 30 BW 18 CQ 11 DNR 1. VIRGINIA—SCM, Charles M. Waff, Jr., W3UVU—P.A.M.; 3A1J—R.M.’s: 30PC, 3GJP, 3AKN, 3DBQ, 3BFTX, 3BYA—Organized fall activity has begun in earnest with the formation of the Virginia Traffic Net, O.R.S. re­organized. All interested are enthusiastic. The gang extends a cordial invitation to all visitors to the State to attend our Floating Club meetings. DZS is on 14 Mc.; he is a member of “Supporting Division” of E.A.C. BVR has his rig with a pair of 100Mc’s ready to go. BCH is ready for the winter season with a 50 watt and a 800 watt rig. BQZ is rebuilding. BRT finds some time to be on. ESZ is going to move to 3.5 Mc. for the winter. DBB is on 30 Mc. for the winter. BTV is on 1.75 Mc. and received visits from UE2II, VE2FE, BLC, CUN and TJ. JFF has moved to new QTH with BVI and JNO.

Traffic: W4BQE 51 DWB 42 DW 33 AGF 10 NC 6 DZS 5 ESR 4 DGV 3.

Traffic: WB4BDT 116 CZA 30 BW 18 CQ 11 DNR 1. VIRGINIA—SCM, Charles M. Waff, Jr., W3UVU—P.A.M.; 3A1J—R.M.’s: 30PC, 3GJP, 3AKN, 3DBQ, 3BFTX, 3BYA—Organized fall activity has begun in earnest with the formation of the Virginia Traffic Net, O.R.S. re­organized. All interested are enthusiastic. The gang extends a cordial invitation to all visitors to the State to attend our Floating Club meetings. DZS is on 14 Mc.; he is a member of “Supporting Division” of E.A.C. BVR has his rig with a pair of 100Mc’s ready to go. BCH is ready for the winter season with a 50 watt and a 800 watt rig. BQZ is rebuilding. BRT finds some time to be on. ESZ is going to move to 3.5 Mc. for the winter. DBB is on 30 Mc. for the winter. BTV is on 1.75 Mc. and received visits from UE2II, VE2FE, BLC, CUN and TJ. JFF has moved to new QTH with BVI and JNO.

Traffic: W4ABT 51 DWB 42 DW 33 AGF 10 NC 6 DZS 5 ESR 4 DGV 3.

Traffic: W8GTS 138 (W1GQ 89) (W1MG 115) GPC 72 GSP 32 BFC 26 BJX 18 FMY 14 MOL 6 PHY 4 BIW 6


Traffic: W8QTM 151 MCL 149 HD 65 GY8 60 LCN 52 CZ 17 FSR 4 ELO 2 BWK 2 JSK 6 MOL 6 FRY 4

Traffic: W8FGF 126 LU 55 GZF 36 (WLNC 10) UD 14 BJX 7 BKF 4 HCM 2 IDN 4 PHY 2 (WNDAO 240) (NORC 286) NEW YORK CITY AND LONG ISLAND—SCM, Ed.

Traffic: W8EFG 126 LU 55 GZF 36 (WLNC 10) UD 14 BJX 7 BKF 4 HCM 2 IDN 4 PHY 2 (WNDAO 240) (NORC 286) NEW YORK CITY AND LONG ISLAND—SCM, Ed.

Traffic: W8EFG 126 LU 55 GZF 36 (WLNC 10) UD 14 BJX 7 BKF 4 HCM 2 IDN 4 PHY 2 (WNDAO 240) (NORC 286) NEW YORK CITY AND LONG ISLAND—SCM, Ed.

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Traffic: W8EFG 126 LU 55 GZF 36 (WLNC 10) UD 14 BJX 7 BKF 4 HCM 2 IDN 4 PHY 2 (WNDAO 240) (NORC 286) NEW YORK CITY AND LONG ISLAND—SCM, Ed.
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A 56-Mc. Portable Mobile

(Continued from page 39)

the speaker, and two red jacks for 'phones for duplex. One side of each of these circuits is grounded so there is no d.c. potential on anything—a great help when in a wet location. This also makes it possible to use a standard telephone handset for duplex operation; the common microphone and phone lead of the hand set is plugged into one of the grounded jacks, the microphone lead into the ungrounded microphone jack, and the 'phone lead into the "hot" phone jack. The control to the right of these jacks is the receiver regeneration control.

In the lower right-hand corner is the 5-prong power socket. When working from the 250-volt 50-ma. a.c. power supply, a power plug is inserted which furnishes 6.3 volts a.c. to the filaments and the d.c. potential to the plates. The plug used with the gene motor supply brings in the B-plus and connects the filaments into the battery circuit, as shown by the dotted lines in the circuit diagram. The B-minus is grounded to the case containing the gene motor and filter. No special 5-meter filter is needed with this power supply.

Looking inside the case the modulation choke and 41 modulator tube are mounted next to the transmitter shield, and the first audio tube next to the detector switch. The microphone transformer is mounted under the chassis.

This outfit has a total power consumption of about 50 ma. at 250 volts when working duplex. In spite of the low power, it gets out very well when used with a suitable antenna. The transmitting antenna used on the car is a 37-inch aluminum rod with the bottom end grounded to the center of the rear bumper of a coupe. This rod is fed at the top by an 8-foot wire to one terminal on the transmitter. This makes a 3/4-wave antenna with the far end grounded, when the loading at the transmitter end is considered. The length of the vertical rod was adjusted with a field strength meter for best results.

How Would You Do It?

(Continued from page 40)

with plate glass. He obtained a piece from an automobile "graveyard" at a reasonable price. The superior strength of plate glass helps to prevent breakage in drilling and from unexpected strain from the transmission line. The line is, of course, anchored to the outside wall before passing through the glass. W1AUN recommends the method of drilling described in QST for October.

One idea of which we have heard several times, although we have never seen it tried, is suggested by George Smith of Chicago. The scheme consists of two sheets of heavy tinfoil or possibly sheet metal, one on each side of the window pane, which form a series condenser with the glass as the dielectric. Pieces six or eight inches square should
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354-E $\mu=35$

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- VERY LOW DISTORTION

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Our famous 6L6-T50-T55 kit (see November Harvey QST ad) can now be supplied for operation on 5 meters. Using one of the new Bliley HF2 crystals, this transmitter will put more than 120 watts of crystal controlled signal on 5.

NET PRICES
Transmitter Kit........... $39.95
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Taylor T-20................. 8.00
Taylor T-55................. 8.00

IN STOCK! THE NEW CARDWELL TYPE A\nDISC TYPE NEUTRALIZER for LOW CAPACITY TUBES
such as T-90, T-55, 100-TH, 35-T, 50-T, HF-100, 800, 834, 852, RK-34, RK-35, RK-18, etc... CAPACITY RANGE: 5 Mfd. to 4 Mfd.
A sturdy condenser with fine screw adjustment to eliminate wobble and a knurled thumb nut for easy locking. CARDWELL QUALITY.

NET PRICE $1.80 TO AMATEURS

Problem No. 12

O H. has been doing a lot of hot DX work lately and already he has so many cards that the situation is rapidly getting out of hand. Naturally he wants to make a display of them on the walls of the operating room, but he hates to start putting them up until he has some scheme that will allow a higher order of neatness and convenience than that seen in most shacks. The walls, as it happens, are plaster and our friend agrees with the O. L. that tacks are out. He wants a scheme that will permit ready replacement of the cards without marring their beauty and one that will present a really orderly appearance. Further, O. H. can't help thinking that there must be some inexpensive way of providing against fly bites and dust—some sort of cheap protective surface covering. What say?

Problem No. 12

The resulting crack between the window and the board and the gap between the upper and lower sashes. A very satisfactory method of securing a tight joint between the window sash and the lead-in panel, shown in Fig. 1, is described by P. D. Lawrence of Richmond, Va. If the panel is placed under the lower sash, the top edge of the panel is fitted with metal weather stripping. This requires grooving of the lower side of the sash.

A method which eliminated the necessity for grooving is described by J. M. Overman of Norfolk, Va., and is shown in Fig. 2. A fairly thick lead-in panel is required. The upper and lower edges of the panel are cut out to make overlapping joints with the window sash and frame or sill. He takes care of the gap between the sashes by tacking a piece of rubber inner tube, cut to fit, to the top edge of the lower sash.

The somewhat different arrangement shown in Fig. 3 is suggested by W5GNV. He uses a glass cutter to remove a strip of pane about five inches high. A section of wood or Masonite is substituted for the glass. The edge of the section is stepped to make an overlapping joint with the window sash and frame or sill. Of course, the transmission line moves up and down with the window unless the section is placed in the stationary sash and the arrangement does not permit complete screening of the window.

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for QUALITY products, reliably priced, delivered ON TIME... when you buy here. Nor need you have an inferiority complex if you are not placing a big order. We are proud of our well-balanced inventory of wanted Radio parts, and just as proud of the intelligent and courteous service which has made us so many friends. Seen our latest catalog?

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of the lower sash with feed-through contacts. The contacts are closed when the window is down, but jumpers are required if it is desired to use the antenna with the window open. This scheme is less adaptable to tuned lines.

Several of those who submitted papers pointed out that the Underwriters' requirements may be met satisfactorily by mounting the grounding switch inside the house. However, it is usually desirable to be able to open the window for other purposes, especially during warm weather.

We have selected the following prize-winners:

First—John R. Sanders, W5GNV.


Thanks to the following for their efforts on the problem: W1JZU, 2HAP, 5EAZA, 5FWA, 8BKE, 80MM, GC6DU, GC6ZIP, VE3ACM, D. A. Beuk and F. H. Kistler.

—D. H. M.

And again the contest rules:

1. Solutions must be mailed to reach West Hartford before the 20th of the publication month of the issue in which the problem has appeared. (For instance, solutions of problem given in the March issue must arrive at QST before March 20th.) They must be addressed to the Problem Contest Editor, QST, West Hartford, Conn.

2. Manuscripts must not be longer than 1000 words, written in ink or typewritten, with double spacing, on one side of the sheet. Diagrams and sketches may be in pencil, must be neat.

3. All solutions submitted become the property of QST, available for publication in the magazine.

4. The editors of QST will serve as judges. Their decision will be final.

Prizes of $5 worth of A.R.R.L. station supplies or publications will be given to the author of the solution considered best each month, $2.50 worth of supplies to the author of the solution adjudged second best. The winners should, of course, state the supplies preferred.

---

K7EVM, Fort Yukon, Alaska

(Continued from page 48)
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BECAUSE...there is a better Johnson insulator for every application.

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These disc-type neutralizers may be had in three sizes, which will handle any of the "low C" tubes from the big 450T on down.

Model ABC 6025-N2 shown. All RF insulation LDS Mycalex, 60mmf at ¼-inch airgap per section. Two neutralizing sections 0.4 to 4mmf/section. Other spacings and capacities available.

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Say You Saw It In QST — It Identifies You and Helps QST
is enough so far as a WAC is concerned. Have had only one African contact so far.

"Fort Yukon is located just over the line inside the Arctic Circle at the junction of the Porcupine and Yukon rivers. The name dates back to about 1840 when the Hudson's Bay Company established a trading post here. At that time they thought they were in Canada. Consequently it is the oldest town on the upper Yukon.

"Being inside the Arctic Circle, we can see the sun at midnight for a week or so in June. In December the conditions are reversed with very long nights. The sun is visible by refraction for an hour and a half during the shortest days. The temperature ranges are extreme here; in the summer with continuous daylight it gets to 80 in the shade and the coldest in the four years of my residence here has been 78 below zero.

"I made my start in radio back in 1914 but dropped it until I came up here. I still have the Brandes headphones that I bought then and use them at times. Our mail service is very slow here in winter (dog team) and it took nearly six months to get my license, which was issued in January, 1935. For the first year and a half I used only a battery layout, working on 80 entirely.

"Amateur radio has grown considerably in Alaska since I first got on the air. A considerable network has grown up now and many places that formerly had no communication at all use ham radio with satisfaction. For instance, I maintain a sked with my nearest ham neighbor to the north, VE5QB, which means many hundreds of dollars' worth of business to the local store keepers. We also keep the traders at VE5QB advised as to fur prices, which is worth while to them. Fur is the only product of this region.

"In the spring the rivers break up with a rush, and this year we had an ice-jam which caused the water to overflow in the Yukon and put four feet of water in the house. So I moved the Brandes headphones upstairs and provided the only communication, as the commercial station was out of commission. Then I had to go down, after the water receded several days later, and put the commercial station back on the air. It is a 'phone station in one of the stores and the operator knows nothing about radio!

"Ham radio is not a toy up here but a real part of our lives and QST the bible. More power to you."
"I NEVER WORRY ABOUT MY G-E PYRANOL CAPACITORS"

That's what one ham wrote us three years after he had installed G-E Pyranols in his rig. And why should he worry? These hermetically sealed, Pyranol filled units are truly dependable. They must stand up under a double-rated voltage test, and can safely be operated at 10 per cent above rated voltage. Pyranol, General Electric's well-known, high-dielectric-strength insulator, will not burn.

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NET PRICE, COMPLETE, less speaker and crystal $99.00

Extra for crystal $12.00

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DO YOU WANT A GOOD USED RECEIVER?

We usually have some on hand.

All sets taken in trade are lined up and put in first class working condition before they are resold by us. Stop in and see what we have or write us your requirements.

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when 10,000 MONITOR Crystals are sold in Los Angeles in seven years... they must be good!

If you’re looking for a frequency control that’s made for use and abuse... that’s sold at a price you can afford... do as thousands of others are doing, get a MONITOR.

See your dealer or write factory direct for catalog

A.R.R.L. QSL Bureau

FOR the convenience of its members, the League maintains a QSL-card forwarding system which operates through volunteer “District QSL Managers” in each of the nine United States and five Canadian districts. In order to secure such foreign cards as may be received for you, send your district manager a standard No. 8 stamped envelope. If you have reason to expect a considerable number of cards, put on an extra stamp so that it has a total of six-cents postage. Your own name and address go in the customary place on the face, and your station call should be printed prominently in the upper left-hand corner.

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W2—H. W. Yahnke, W2SN, Lake Ave., Helmetta, N. J.
W3—R. E. Macomber, W3CZE, 418 10th St., N. W., Washington, D. C.
W4—G. W. Hoke, W4DYB, 328 Mell Ave., N. E., Atlanta, Ga.
W6—D. Cason Mast, W6KHY, 423 East E St., Ontario, Calif.
W7—Frank E. Pratt, W7DZX, 5023 So. Ferry St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
VE1—J. E. Roue, VE1FB, 84 Spring Garden Rd., Halifax, N. S.
VE2—C. W. Skarestedt, VE2DR, 236 Elm Ave., Westmount, P. Q.
VE3—Bert Knowles, VE3QB, Lanark, Ont.
VE4—George Behrends, VE4RO, 186 Oakdene Blvd., St. James, Winnipeg, Manitoba.
VE5—E. H. Cooper, VE5EC, 2024 Carnarvon St., Victoria, B. C.
K4—F. McCown, K4RJ, Family Court 7, San Juan, Puerto Rico.
K5—John J. Carr, K5AV, 78th Pursuit Squadron, Albrook Field, Canal Zone.
K6—James F. Pa, K6LBH, 1416D Lunalilo St., Honolulu, T. H.
K7—Leo E. Osterman, K7ENA, Customhouse, Wrangell, Alaska.
KA—George L. Rickard, KA1GR, P. O. Box 849, Manila, P. I.

Strays

In connection with avoidance of image interference with b.c. receivers (page 12, September QST) W9GDB suggests that if the receiver i.f. frequency is unknown, a freqmeter covering the 160-meter band will give a direct reading. Set the b.c. receiver to the desired station and adjust the freqmeter until a beat is heard. The calibration will indicate the operating frequency to be avoided. It may be necessary to use quite close coupling between b.c. receiver and freqmeter to get a good beat.
"Cool as a Cucumber"
Literally True at 10 M.C. with Coil Forms of

**ALSiMAG 196**

Loss Factor: 1 M.C. — .36%
10 M.C. — .23%

Are you getting ALSiMAG 196 in your apparatus?

Ask for it by name...

**"ALSiMAG"**

American Lava Corporation
Chattanooga, Tennessee

BRANCH OFFICES: Chicago, New York, Cleveland, Boston, St. Louis, Philadelphia, San Francisco, Washington, D.C., Los Angeles, Toronto, Canada
(See phone book)

---

'TELMM Present

Leadership the

TRIMM COMMERCIAL HEADSET

Like its companion, Trimm Featherweight, the Trimm Commercial is destined to become the standard by which other headsets are compared. Especially suited to the discriminating amateur — built to more exacting requirements — provides a new high in sensitivity, service, and clarity of sound.

Write today for cata og R-4

TRIMM RADIO MANUFACTURING COMPANY
1770 W. Berteau Avenue
Chicago, Illinois

READ CODE LIKE AN EXPERT!

Learn Quickly at Home; Get Real Speed

It's easy, fascinating, to become a good op with the NEW ALL ELECTRIC MASTER TELEPLEX CODE TEACHER to help you. Only instrument ever produced which records your sending in visible dots and dashes — then sends back to you at any speed you desire. Also sends practice work, recorded by an expert. That is why thousands agree this method is surest, quickest — has taught more ops in the past few years than all other methods. We furnish Complete Course, lend you Master Teleplex, give you personal instruction with a MONEY-BACK GUARANTEE. Low cost.

Send today for booklet Q-12; no obligation.

THE "HAM" SPECIAL

We are the originators of this type instrument

TELEPLEX CO. 76 CORTLANDT STREET
NEW YORK, N. Y.

TELEPLEX — "The choice of those who know"

---

R. R. Jobs for CW MEN

65 TO 80c PER HOUR. YEAR AROUND


CODE-CRAFT CLEVELAND, OHIO
6703-Q Dunham Ave.
Where to buy it

A directory of suppliers who carry in stock the products of these dependable manufacturers.

### SUPERSKYRIDER products

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</tr>
<tr>
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<td>SPRINGFIELD, MASS.</td>
<td>T. F. Cushing 349 Worthington St.</td>
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<tr>
<td>BALTIMORE, MD.</td>
<td>3 North Howard St. Radio Electric Service Company</td>
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<td>BOSTON, MASS.</td>
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<td>BOSTON, MASS.</td>
<td>Radio Shack 46 Brattle Street</td>
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<td>BOSTON, MASS.</td>
<td>110 Federal Street Wholesale Radio Service Company, Inc.</td>
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<tr>
<td>BURLINGTON, VERMONT</td>
<td>Vermont Hardware Co., Inc.</td>
</tr>
<tr>
<td>JAMAICA, L. I.</td>
<td>90-08 166th Street Wholesale Radio Service Company, Inc.</td>
</tr>
<tr>
<td>MONTREAL, CANADA</td>
<td>295 Craig Street, West Canadian Electrical Supply Co., Ltd.</td>
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<tr>
<td>NEWARK, N. J.</td>
<td>219 Central Avenue Wholesale Radio Service Co.</td>
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<td>NEW YORK, N. Y.</td>
<td>460 W. 34th St. Bruno-New York, Inc.</td>
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<td>NEW YORK, N. Y.</td>
<td>Sanford Samuel Corp. 136 Liberty St.</td>
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<td>NEW YORK, N. Y.</td>
<td>100 Sixth Avenue Wholesale Radio Service Co.</td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>Harrison Radio Company 12 West Broadway</td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>124 E. 44th Street Grand Central Radio, Inc.</td>
</tr>
<tr>
<td>PHILADELPHIA, PENN.</td>
<td>Eugene G. Wile 10 S. 10th Street</td>
</tr>
<tr>
<td>PHILADELPHIA, PENN.</td>
<td>Raymond Rosen &amp; Company 117 North 7th St.</td>
</tr>
<tr>
<td>PHILADELPHIA, PENN.</td>
<td>M &amp; H Sporting Goods Company 512 Market Street</td>
</tr>
<tr>
<td>POTTSTOWN, PENN.</td>
<td>E. Norwegian &amp; George St. Sylvester Radio &amp; Supply Co., Inc.</td>
</tr>
<tr>
<td>READING, PENN.</td>
<td>Bright &amp; Company 8th &amp; Elm Streets</td>
</tr>
<tr>
<td>READING, PENN.</td>
<td>Sylvester Radio &amp; Supply Co., Inc.</td>
</tr>
</tbody>
</table>

122 Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them.
A directory of suppliers who carry in stock the products of these dependable manufacturers.

WASHINGTON, D. C. 938 F Street, N. W.
Sun Radio & Service Supply Co.

CONCORD, NEW HAMPSHIRE 80 N. State Street
Carl B. Evans

JAMAICA, L. I.
Wholesale Radio Service Company, Inc.

NEWARK, NEW JERSEY 219 Central Avenue
Wholesale Radio Service Co.

NEW YORK, N. Y.
Harrison Radio Company 12 West Broadway
Wholesale Radio Service Co.

NEW YORK, N. Y.
100 Sixth Avenue
Wholesale Radio Service Co.

WASHINGTON, D. C. 938 F Street, N. W.
Sun Radio & Service Supply Co.

ALBANY, NEW YORK
Uncle Dave's Radio Shack 356 Broadway

BINGHAMTON, NEW YORK
Radio Testing Station 25-27 Sturges Street

BUFFALO, NEW YORK
Dymec Radio 216 E. Genessee Street

HARTFORD, CONNECTICUT
Stern Wholesale Parts Company 210 Chapel Street

NEW YORK, N. Y.
Harrison Radio Company 12 West Broadway

NEW YORK, N. Y.
Terminal Radio Corp. 80 Cortlandt Street

ROCHESTER, NEW YORK
Radio Parts & Equipment Co. 244 Clinton Ave., N.

ALBANY, N. Y.
Uncle Dave's Radio Shack 356 Broadway

BOSTON, MASS.
Radio Shack 46 Brattle Street

BOSTON, MASS.
Selden Radio Company 28 Brattle St.

BOSTON, MASS.
Wholesale Radio Service Company, Inc. 110 Federal Street

BRONX, N. Y.
Wholesale Radio Service Company, Inc. 542 East Fordham Rd.

JAMAICA, L. I.
Wholesale Radio Service Company, Inc. 90-08 166th Street

MONTREAL, CANADA
Canadian Electrical Supply Co., Ltd. 985 Craig Street, West

NEWARK, N. J.
Wholesale Radio Service Company 219 Central Ave.

NEW YORK, N. Y.
Wholesale Radio Service Company 100 Sixth Avenue

POTTSVILLE, PENN.
E. Norwegian & George Sts.
Sylvester Radio & Supply Co., Inc.

READING, PENN.
George D. Barbey Company 404 Walnut Street

READING, PENN.
Sylvester Radio & Supply Co., Inc. 104 North Ninth St.

WASHINGTON, D. C.
Sun Radio & Service Supply Co. 938 F Street, N. W.

Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them. 123
No. 3 $13.95
Antenna Coupling Kit

No. 4 - $49.75
500 Watt RF Amplifier

No. 1 - $49.75
A complete 80 Watt CW Transmitter

No. 5 - $49.75
50 Watt Glass Modulator

EASILY ADAPTED TO YOUR LAYOUT

No. 3 - $13.95
Antenna Coupling Kit
No. 4 - $49.75
500 Watt RF Amplifier
No. 1 - $49.75
A complete 80 Watt CW Transmitter
No. 2 - $44.50
50 Watt Modulator
No. 3 - $49.75
250 Watt Glass H Modulator

MEMORANDUM

You need a copy of the new Bigger-than-ever 1938 Handbook.

You need a binder for your 1937 QST's — and another for 1938.

Xmas suggestion — give a membership-subscription or a new Handbook.

DECEMBER, 1937

I. A. R. U. News

(Continued from page 60)

(phone); George W. Perdue, K8CMC (phone);
Charles Boulangue, ON4SS (phone); Leif Salicali,
LA1G (phone); F. A. Robb, G16TK (phone);
William E. Good, WS1FD; Walter Dewars,
W9TQW; Frederick S. Olsen, W2EMI; Gilbert
L. Crossley, W8YA; Otis R. Dickenson, W2HTU;
E. Schiefer Welch, Jr., W1EVE; Clyde R. Brewer,
W4RA; John G. Claiborne, W5FDI; Alan T.
Margo, W6FZB; John Ginocechio, W2BDBZ;
Joseph H. Harms, W2JME; Robert H. Webb,
W80WB; A. James Kreider, W3SPD; Howard
Gilbert, W8ANN; Leon Frederick Lawioe,
K6MAW; Luis Gaudi, Jr., K4BU; R. S. Wood-
ford, VE5MZ; W. E. Marsh, SU1WM; John Lay,
H39BG; H. C. Warburton, ZT5P; G. H. Searce,
ZU5D; M. Lelupe, ON4LU; P. R. Harvey,
ZL3HK; T. E. Rowlands, ZL6JX; A. E. Smith,
ZLIHH; H. J. Hunt, G5HH; G. Evans, G5YO;
Albert Voitrierz, F8ZZ; Artur Gersch, D4YWM;
Stuart H. Gates, W9CNE; J. A. Twine, ZT6AM;
Dr. J. Lynn Ironmanger, W6MLG (phone);
Glen Katzenberger, W7DYY; R. H. Hoffman,
W9AGO (phone); Robert E. Dawson, Jr., W4DSY
(phone); Thaddeus C. Wood, Jr., W1AH (phone);
Donald P. Wilkes, OA4AB (phone); Petr. Jas-
trembelskas, LY1J (phone); Samuel H. Luitwieler,
W6GRX (phone); F. Paul Bour, P8SAC (phone);
Antonio Cruz Uribe, VE1BT (phone); R. P.
Walker-Alexander, V7TRA (phone); Carl Sheffey,
W1ADM (phone); Carl Sheffey, W1ADM; J. M.
Moyle, VK5BU (phone); A. A. Fietz, VK2QB;
A. C. J. Pritchard, VK3CP; R. A. Priddle,
VK2RA; H. D. Ackling, VK2RX; R. L. Belstead,
VK4EI; E. H. Martin, VK3ZF; Luken Bose,
VU2JN; John W. Miles, W6LEA; R. L. Perry,
W6MTD; Herb. G. Schmitt, W9VZJ; Espea R.
Williams, W6LIF; Charles H. Desellier, W1KD;
Robert G. Wilson, Jr., W3GHID; Herbert J.
Brough, W3FQG; George H. Nibbe, W9NUF;
G. Herbert Smith, V65KI; Clarence E. Vendley,
W6AAB; Oscar W. B. Reed, W3FPP; Roman
Izykowski, SP1LP; John C. O'Connell, W3DAL;
Wallace P. Hagestad, W7ENW; Jozef Napurko,
SP1HN; A. Jeglinek, SP1CM; James Victor
Stout, W3GEB; Art Cook, VE4KZ; Elmer F. Eld,
W2AZB; George E. Forrest, W9ISM; E. L.
Mazery, VQ8AB; José G. Garza, XE2CG; T. J.
Brown, G5TB; Arthur Tibbles, VP2AT; J. Mac-
Intosh V81AA; C. Valkhof, PA0ALO; H. J.
Beene, PA0BE; Fernand Manson, F3AM;
Christian Friedmann, D4WCT; Fritz Gorko,
DS3DK; Hermann Schäfer, D3CVR; Willi Fock,
D4TPJ; H. Herbert Smith, W6AZP; Charles F.
Warner, W6MHH.

Strays

A slippery bug cure suggested by W9MRC:
Take off the glaze with fine sandpaper, apply
some glycerin and then wipe it off with a cloth.
The bug will stick to any surface and will not
smear or scratch the table.
HAM-ADS

(1) Advertising shall pertain to radio and shall be of interest to radio amateurs or experimenters in pursuit of their art.

(2) No display of any character will be accepted, nor can any material be printed nor advertisements inserted for the sale of such material as all or part of any "curious letters" be used which would tend to make one advertisement appear to be part of another.

(3) The Ham-Ad rate is 15¢ per word, except as noted in paragraph (4).

(4) Remittance in full must accompany copy. No cash or cash money orders will be accepted.

(5) Closing date for Ham-Ad is the 20th of the second month preceding publication date.

(6) The minimum rate of 75¢ per word will apply to advertising which, in our judgment, is obviously non-commercial in nature.

(7) A large number of men of the American Radio Relay League. Thus, advertising of bona fide surplus equipment, for sale or buying, or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League takes the rate.

An attempt to deal in apparatus, by an individual, is commercial and takes the 15¢ rate.

Provisions of paragraphs (1), (2), (4) and (5) apply to all advertising in this column regardless of which rate may apply.

Having made no investigation of the advertisers in the classified columns, the publishers of QST take no responsibility for the integrity or for the grade or character of the products advertised.

QUARTZ—direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Price.$2.20.

RADIO engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Byrd St., Valparaiso, Ind.

QSL'S, W2SN, Helmetta, N. J.

CALLBOOKS—new DX calls, new prefixes, hundreds of new cards at lower cost—Send 50¢. W2CNL.

QSL'S. Free samples. Printer, Corwith, Iowa.


QTS' year 1916 wanted. Sell or trade issues 1919-1933. W2EH.

Oct. 1, 1922 trade? Candy, 28 W. Anderson, Aurora, Ill,


SWAP; Code machine, ten tapes, for National SW3 and coils. Clarence Williams, W5ADG, Dallas, Texas.

WANTED—FIS7 general coverage coils. Carrier 115, Cotardox, $2.50.

QSL'S, SWL's, 100, 3 color, 75¢. Laspey, 344 W. 39th, Indianapolis, Ind.

QSL cards, neat, attractive, reasonably priced. Samples free. J. J. Scatter Printers, 1027 Penn., Pittsburgh, Penn.

WESTON zero to 3000 volts d.c. voltmeter, $11. Ten other meters. W3CCA.

SELL PR-10 excellent condition, $45. Self-powered preselector, prewired cabinet. Write for complete list from W4TBN.


AIRLINE pilot's complete amateur rig. Cost over $1.200. Bargain-of-the-year at $500, or might consider what have you in trade up to $100. Three hundred watts of classiest 10-20 meter push-to-talk phone you'll ever see; also 40-meter o. Two-metered modulation monitor alone worth $50. Rig includes radio receiver. Paradio Sales Co., 124 Garrison Ave., San Francisco, Calif.


Radio phone transmitter complete with tubes, overload and remote-control relay, remote switch panel, remote control, centage indicator, audio pre-amplifier. HF rack includes 3 power supplies plus 2 20-meter racks and 1 band of W2CRO's coils, crystals for 75 and 20 meter phone. Collins and link antenna matching network. Modulator rack includes 2 power supplies for pp 66 and 243 amplifier, and pp 282Q QST approved parts all in perfect condition. Price $400 f.o.b. Lancaster, Penn. C. C. Smith, 508 School Lane.


METER scales: ask dealer for Ham Crystals Universal Meter Scales for converting one milliamperes Westons, Jewells, Tripod to multimeter.

CRYSTALS: 8OM X, $1.60. 100M-80M X, $2.25. Beautiful molded bakelite holders, $1. Catalog, Ham Crystals, 1104 Lincoln Place, Brooklyn, N. Y.

QSL'S. 300 one-color cards $1. Samples. 2143 Indiana Ave., Columbus, Ohio.


FREE bulletin describing efficient, stable, and inexpensive long lines 5 meter oscillator. Write Paradio Sales Co., 124 Garrison Ave, Jersey City, N. J.

SELL: National ACR-130, WS9OR, 541 Stillwell Blvd., Fort Arthur, Texas.

SELL: Three band rig, Ush design, 2 xtal. in series, new build, metal rack. W5XWP, 541 Stillwell Blvd., Fort Arthur, Texas.

SPEC-A. $5. Air cell battery. $4.50. Both new. W5HNN.

QSL'S, Free samples. Printer, Cortwood, Iowa.

CRYSTALS—Unconditionally guaranteed. Supplied within 5 days of order. Paradio Sales Co., 124 Garrison Ave, Jersey City, N. J.

SELL: National ACR-130, WS9OR, 541 Stillwell Blvd., Fort Arthur, Texas.

SELL: Three band rig, Ush design, 2 xtal. in series, new build, metal rack. W5XWP, 541 Stillwell Blvd., Fort Arthur, Texas.


SELL: RM69 two months old. Cost, $151.20—Cash. $55. W2W.

SELL: Marconi navy receiver $10. FBX with 20, 40, 80 B. S. coils. $30. W4OF, Atlanta, Ga.

EXCELLENT slightly used equipment. 100X8 and SW3 National receivers. 250-A motor generator, 500 watt self powered preselector, 500 watt self powered preselector, several meters, test instruments; complete portable station; many other items. Canadians attention. Special list of equipment located in Canada. Write for complete list—now. Glassford, W2EZEQ, 1993 University Ave., N. Y.

Say You Saw It in QST—It Identifies You and Helps QST 125

FABERADIO, Sandwich, Illinois guarantees crystal satisfaction. Catalog 37 is ready.

QSL-S—2 color—$1. hundred. Samples. (Stamp) WS8NS.


SELL on ten day trial. Send only $5. with order. HH0s $129.70, RME-65 $90, NC100s $80, SX16 $80, Breiting 16 $175. CRYSTALS: ACR-136s $50, SX18s $54, CR-9s $89. Sky Buddies $13, JS9s $19, SW3s $12.50, other used sels. List free. Write. Bob Henry, WS9A, Butler, Mo.

BUY any new receiver, transmitter, or parts on our own 8% plan with less cost. Trade in your equipment. All receivers shipped on ten day trial. It’s to your advantage to write me. Bob Henry, WS9A, Butler, Mo.

CRYSTALS: Unconditionally guaranteed, 5 kilocycles, 7000-7500 kcs. X cut $1.85, low drift $2.20, $3500 or 1750 kcs. X cut $1.65, low drift $2.20 postpaid. A. E. Rydberg, WS9AED, Mitchellville, Iowa.

WANTED: Sylvania carbon plate 841. WS9AED.

FOR Sale: Pair WE261A's used, good condition, $15. WS9KMC.

CRYSTALS: ground to order. 100-80, X cut 5 kilocycles, $1.50. Spot frequencies $2.50. Three semi-finished, 80 meter blanks, including carborundum, $1.20. Holders, $1., fit GR jacks. Speedy delivery. William Threm, WSFN, 4021 Davis Ave., Cheviot, Ohio.

CRYSTALS: See October Hamads. The Ransom Lab. NEW and used transmitting tubes. WS9AED.

QST's—2 color—$1. hundred. Samples. (Stamp) WS8NS.

QST-S—new 1938 issue. Unbeatable. Samples? (stamp) WS8DE.

TRANSMITTER kits. WS9AED.

EQUIPMENT, complete 160 fone station 150 watts SW3 receiver. All $1.50. WS8EQ, Anoka, Neb.

SELL five tube SW receiver, aluminum chassis, tubes speaker complete as described League Handbook 183, WS8RP.

SHORT wave listener's, amateur's attractive sensational designed QSL's. Samples? (stamp) WS8E6, Holland, Mich.

Announcing the JUNIOR MODEL MAC KEY $4.95. I can’t take all the space necessary to describe this exciting little speed key. Neither myself nor our mutual friends the distributors who handle it, make enough profit on it to spend money advertising it merits. I've got to content myself with this initial announcement and hope that the thousands of operators who're my good friends will pass the word around.

For the newcomers, especially youngsters, who’re tempted by teletype bulletin, a word of caution lest you become a leader at ridiculous prices, this new JUNIOR MAC KEY will be a life-saver. Go to your nearest jobber to set it! Or write me for the date.

T. R. McEloy
713 Congress St. Boston, Mass.
Your Nearest Dealer Is Your Best Friend

Your nearest dealer is entitled to your patronage. You can trust him. He is equipped with a knowledge and understanding of amateur radio. He is your logical and safe source of advice and counsel on what equipment you should buy. His stock is complete. He can supply your needs without delay. His prices are fair and consistent with the high quality of the goods he carries. He is responsible to you and interested in you.

Patronize the dealer nearest you—You can have confidence in him

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<th>ATLANTA, GEORGIA</th>
<th>Wholesale Radio Service Company, Inc.</th>
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<tr>
<td>BRONX, NEW YORK</td>
<td>Wholesale Radio Service Company, Inc.</td>
<td>549 East Fordham Road</td>
<td>&quot;The World’s Largest Radio Supply House&quot;</td>
</tr>
<tr>
<td>BUFFALO, NEW YORK</td>
<td>Radio Equipment Corp.</td>
<td>326 Elm Street</td>
<td>W80BK — Ham, service and sound equipment — W80LB</td>
</tr>
<tr>
<td>BUFFALO, NEW YORK</td>
<td>Dymac Radio</td>
<td>216 E. Genesee Street</td>
<td>Complete Line Ham and BCL Equipment Cl. 2080</td>
</tr>
<tr>
<td>JAMAICA, L. I.</td>
<td>Wholesale Radio Service Company, Inc.</td>
<td>90-08 166th Street (Merrick Road)</td>
<td>&quot;The World’s Largest Radio Supply House&quot;</td>
</tr>
<tr>
<td>MONTREAL, CANADA</td>
<td>Canadian Elec. Supply Co., Ltd.</td>
<td>285 Craig St., W.</td>
<td>Quality parts and equipment for discriminating buyers</td>
</tr>
<tr>
<td>NEWARK, N. J.</td>
<td>Wholesale Radio Service Company, Inc.</td>
<td>219 Central Avenue</td>
<td>&quot;The World’s Largest Radio Supply House&quot;</td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>Gross Radio, Inc.</td>
<td>51 Vesey Street</td>
<td>Fair dealings plus fair prices. Anything in radio</td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>Wholesale Radio Service Company, Inc.</td>
<td>100 Sixth Avenue</td>
<td>&quot;The World’s Largest Radio Supply House&quot;</td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>Harrison Radio Company</td>
<td>12 West Broadway</td>
<td>&quot;The Friendly Ham Supply House&quot;</td>
</tr>
<tr>
<td>PHILADELPHIA, PENNSYLVANIA</td>
<td>Eugene G. Wile</td>
<td>10 S. Tenth Street</td>
<td>Complete Stock of Quality Merchandise</td>
</tr>
<tr>
<td>PROVIDENCE, RHODE ISLAND</td>
<td>W. H. Edwards Co.</td>
<td>32 Broadway</td>
<td>National, Taylor Tubes, Hallicrafters. Complete amateur supply house</td>
</tr>
<tr>
<td>RICHMOND, VIRGINIA</td>
<td>The Arnold Company</td>
<td>527 W. Broad Street</td>
<td>W3EHL—&quot;The Virginia Ham Headquarters&quot;—W3FBL</td>
</tr>
<tr>
<td>ROCHESTER, NEW YORK</td>
<td>Radio Parts &amp; Equipment Co.</td>
<td>244 Clinton Avenue, North</td>
<td>Complete stock amateur-BCL parts. Standard discounts</td>
</tr>
<tr>
<td>SPRINGFIELD, MASS.</td>
<td>S. S. Kresge Company</td>
<td>1540 Main Street</td>
<td>Standard discounts, standard lines. Advisory service: W1JO, W1FOF</td>
</tr>
</tbody>
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Say You Saw It in QST — It Identifies You and Helps QST
You Are Protected When You Buy From QST Advertisers

"Advertising for QST is accepted only from firms who, in the publisher's opinion, are of established integrity and whose products secure the approval of the technical staff of the American Radio Relay League."

Quoted from QST's advertising rate card.

Every conceivable need of a radio amateur can be supplied by the advertisers in QST. And you will know the product has the approval of the League's technical staff.
The DB-20 Preselector when connected to a superheterodyne receiver adds several valuable features to the performance of any receiver.

**HERE ARE THE DETAILS**

1. Frequency coverage is from 9 to 550 meters (550 KC to 39,000 KC) coinciding with the range incorporated in the RME-69 and other receivers.

2. Average gain of the two stages of tuned circuits is uniform between 20 to 25 db, when used in conjunction with the RME-69.

3. Signal to image ratio averages 50,000 to 1.

4. Power supply is self-contained, not depending on the power from the receiver.

5. Input circuit is so designed that either a single wire Marconi type antenna or one of the doublet types may be used.

**DB-20 by RME**

**SIGNAL AMPLIFIER AND IMAGE REJECTOR**

6. Output impedance of the unit is approximately 300 ohms so that direct connection may be made to the input of the RME-69 without mismatch.

7. The DB-20 has its own gain control in addition to the regular six band switch and finger-tip control mechanism.

8. The cabinet is identical in design and finish to the regular RME-69 cabinet and matches it in every detail.

9. Cabinet size is as follows: 9½" high, 9½" wide, 10¾" deep, either black or gray crinkle finish.

10. The entire unit is rigidly built and tested to RME specifications.

11. The tubes used in the DB-20 are two 6K7 amplifiers and one 80 rectifier.

WRITE FOR CIRCULAR

**RADIO MFG. ENGINEERS INC.**

PEORIA  ILLINOIS

Say You Saw It in QST — It Identifies You and Helps QST
UTC VARIPOWER plate transformers will give you the wanted voltage. They never become obsolete. They can be used again and again if other voltages are required.

A wide range of voltages and currents are obtainable from UTC VARIPOWER plate transformers when used in various circuits. The chart below will facilitate in determining the one best suited for your general requirements.

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PLATE TRANSFORMERS

Primary 105, 115, 220, 230 Volts A. C. 50-60 Cycles

PA-110 515 or 625 each side of center at 300 MA, 400 V.D.C. or 500 V.D.C. Your cost $6.00
PA-111 750 or 900 each side of center at 350 M.A., D.C. voltage 600 or 750. Your cost $10.20
PA-112 1250 or 1500 each side of center at 500 M.A., D.C. voltage 1050 or 1250. PA-6, List Price $32.00. Your cost $19.20
PA-113 1750 or 2100 each side of center at 500 M.A., D.C. voltage 1500 or 1750. Your cost $26.10
PA-114 1750, 2350, 3000 or 3500 each side of center at 500 M.A., D.C. voltage 1500, 2000, 2500 or 3000. Your cost $45.60
PA-115 3500, 4000 each side of center at 500 M.A., 3500 V.D.C. Your cost $60.00
PA-116 1250 or 1500 each side of center at 750 M.A., D.C. voltage 1050 or 1250. Your cost $30.00
PA-117 5000 each side of center 1050 or 1250. Your cost $6.00
PA-118 1250 or 1500 each side of center at 300 M.A., D.C. voltage 1050 or 1250. Your cost $13.80
PA-119 3500 or 4000 each side of center at 3000 V.D.C. or 3500 V.D.C. Your cost $69.00
PA-120 1750 or 2400 each side of center at 350 M.A., D.C. voltage 1500 or 2000. Your cost $21.00
PA-121 1500 or 1750 each side of center at 1 amp. D.C. voltage 1050 or 2000. Your cost $45.60

Say You Saw It in QST—It Identifies You and Helps QST
QST

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QST for December, 1937, EASTERN Edition
Even in lesser details the NC-81X is outstanding. For instance, take a look at the dial above. Each of five amateur bands covers one span of the dial with extreme and uniform bandspread. Calibration is direct and an indicator inside the dial points to the proper scale. The knife-edge pointer travels over a mirror scale to eliminate parallax. Logging markers, adjustable from outside the dial case, indicate at a glance the position of most-used frequencies. The tuning knob, with automatic ratio shift, is at just the right height for easy tuning. . . . The NC-81X is notable for convenience as well as for the circuit developments that make its performance possible at such low cost.

NATIONAL COMPANY, INC.
LOOK AT THE CONSTRUCTION
Husky electrodes, ruggedly supported in a large envelope assuring maximum heat radiation. Ceramic base and plate lead out of top for maximum insulation. Large plate cap for easy and low-loss connections.

LOOK AT THE RATINGS

<table>
<thead>
<tr>
<th>D-C Plate Voltage</th>
<th>CLASS C TELEGRAPHY</th>
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<tbody>
<tr>
<td>Full input to 60 megacycles</td>
<td>750 max. volts</td>
</tr>
<tr>
<td>D-C Plate Current</td>
<td>100 max. milliamperes</td>
</tr>
<tr>
<td>Plate Input</td>
<td>75 max. watts</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>25 max. watts</td>
</tr>
<tr>
<td>Filament Voltage</td>
<td>6.3 volts</td>
</tr>
<tr>
<td>Filament Current</td>
<td>2.5 amperes</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>50</td>
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New design provides high efficiency and low driving power at moderate plate voltages. High-mu grid means low bias requirements. Heavy duty filament and large electrodes provide for safe, conservative ratings.

LOOK AT THE PRICE
Only $2.50 Net!

AND THEN YOU WILL BE SATISFIED ONLY WHEN YOU OWN A NEW RCA-809
Your distributor has them in stock. See him or write us for full technical information.

RCA presents the "Magic Key" every Sunday, 3 to 5 p.m., E.S.T., on NBC Blue Network

RCA for Amateur Radio

AMATEUR RADIO SECTION
RCA Manufacturing Co., Inc., Camden, N. J. - A Service of the Radio Corporation of America
RCA ENCOURAGES THE RADIO AMATEUR TO TRY HIS HAND AT A NEW FIELD OF EXPERIMENTATION

TELEVISION
RCA knows and is deeply appreciative of the radio amateur’s contribution to the art of ultra-high frequency communication. The early development of television gave rise to problems best solved in the laboratory, but as the art slowly emerges from this status to the stage where field experiments can best answer the current problems, RCA believes that the amateur can and is eager to contribute to the perfection of this new art.

**Television Problems**

**Definition**... Before television for the general public becomes an actuality, the picture must be sufficiently clear and detailed to hold the public’s interest. Briefly, it must compare favorably with good printed illustrations or motion pictures.

**Geographic Coverage**... Present television systems require exceedingly wide band widths—a channel six megacycles wide. Because space in the radio spectrum is not available at the low frequencies, ultra-high frequencies must be used. At present these are more or less limited to line of sight transmission distances, which means a multiplicity of stations to cover even one state. Building these stations and relaying television programs to them for broadcasting is a tremendous commercial problem.

**Programs**... There is no point in the general public buying television receivers until programs are provided. And there is no point in putting a program on the air until there is an audience. This “cat chasing its tail” situation must be ended before television is ready for the public.

**Standardization**... Television receivers must be designed to synchronize with the particular transmitter whose programs they receive. Transmissions employing different standards of definition than that for which a receiver is designed cannot be received. Thus no standardization should take place until satisfactory definition is achieved because no great change can be made in either the transmitter or the receiver without obsoletign the other.
Present Status of Television

RCA's field tests in New York area have been well publicized. Other investigators are conducting experimental transmissions in several parts of the country. However, there may be lack of standardization between these transmissions so that receivers suitable for one system may be unsuited for others. No regular program service is being offered since stations are frequently off the air redesigning and rebuilding their equipment. These constant changes in transmitters during the field test work may make receivers designed for receiving experimental transmissions obsolete—or otherwise may require corresponding changes in receivers.
In Radio and Television it's 
"RCA ALL THE WAY!"

RCA will continue field experiments in the New York area. These experiments look toward the solution of many and varied problems, such as a satisfactory standardization of definition, suitable transmitter and receiver designs, and acceptable program technique.

RCA has designed and is manufacturing a television system for the Columbia Broadcasting System. CBS will also conduct field experiments with a view of having adequate experience when television is ready for the general public.

What this Means to the Amateur

As television gradually steps out of the laboratory... as the number of experimental stations on the air increases... the radio amateur has the opportunity to experiment with an entirely new kind of apparatus. Even more important, RCA believes that the radio amateur now has an opportunity to contribute valuable technique to an art which has been hailed as one of the greatest cultural forces ever created for mankind's use.

What the amateur's contribution can or will be no one knows, any more than the early television experimenters could predict current technique. However, using the past to predict the future, RCA believes the amateur's contribution will be considerable.

To enable the amateur to begin television experiments, RCA announces

**RCA-1800 and RCA-1801**

two Kinescopes* for television reception. Full technical information will be sent upon request. We invite those of you who are located in areas where television experimental transmissions are in progress to try your hand at this fascinating art.

RCA-1800 Kinescope* ....... $60.00  
RCA-1801 Kinescope* ....... $40.00

A deflecting yoke for the operation of either of these tubes is also available.

*Registered Trade Names of RCA Manufacturing Co., Inc.
Another year is drawing to a close! To myself and my associates it has been a good year, and we take this means of expressing our sincere appreciation to you, our many friends, who have made it so. To all Amateur Radio we extend our best wishes for a very Merry Christmas and a Happy New Year.

W. J. Halligan
The Greetings of the Season

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