devoted entirely to amateur radio
Everyone who has built transmitters has at some time or another contended with the problem of coupling a push pull amplifier to an unbalanced load. Difficulty—preventing one tube from doing all the work. Even inductive coupling is likely to unbalance the tube loads unless great care is taken.

It occurred to us that the simple system used in Collins 30J's and 32G's might be of interest. Fig. 1 shows the usual Collins pi tank connected to a two wire balanced line. Fig. 2 shows the same network connected to an unbalanced load such as a concentric line with no changes except the addition of a small “phasing coil.” Size of phasing coil is not critical except that it should be roughly adjusted to carry 4 to 10 times the current in the transmission line. The circuit is adjusted for resonance and proper loading in exactly the same manner as Fig. 1. Very simple and no trouble at all.

Perhaps, this arrangement would be a suitable subject for a technical article, but is really so simple that no further explanation is needed. We mention the phase inverter in this advertisement as an example of the many useful innovations you find in a Collins transmitter.
TO ALL AMATEURS
our sincere wishes
for
A Very
Merry Christmas
and a
Happy New Year

the halicrafters inc.
STEAMING across the Pacific to remote Hollandia in Dutch New Guinea, a fast ship is carrying a new Dual Diversity Receiving System to the Archbold Expedition for the American Museum of Natural History. In the shack of W6LYY in San Diego, Calif., Barney Boyd already has installed another Dual Diversity. Soon these two Hallicrafters Diversity receivers will be helping maintain dependable communications across 7000 miles of Pacific Ocean, between the crew of the gigantic $250,000 Consolidated flying boat "GUBA" of the expedition and their base station, Barney Boyd's shack.

Realizing the importance of regular communications between the expedition and their home base, these two Hallicrafters Dual Diversity Receiving Systems were recently ordered, to provide the most modern and dependable radio reception available today. You will find Hallicrafters Dual Diversity Systems used wherever the finest of Radio Reception is demanded.

Ask your Hallicrafters Dealer about the Hallicrafters Dual Diversity Receiving System, or write for complete information.
QST devoted entirely to AMATEUR RADIO

PUBLISHED, MONTHLY, AS ITS OFFICIAL ORGAN, BY THE AMERICAN RADIO RELAY LEAGUE, INC., AT WEST HARTFORD, CONN., U. S. A.; OFFICIAL ORGAN OF THE INTERNATIONAL AMATEUR RADIO UNION

CONTENTS

Editorials ............................................................ 7
Calls Heard .......................................................... 8
Bound Volume XXII of QST .......................................... 8
Ham at 30° Below .................................................... 9
Feeding Vertical Antennas .......................................... 13
What the League Is Doing ........................................... 18
New Transmitting Tubes ............................................ 19
One-Half Cubic Foot of Transmitter ............................. 20

A Wide-Range Audio Amplifier ................................. 24
Phone "Splatter" ..................................................... 28
The Cairo Regs Go into Effect ..................................... 30
Another Method of Keying with Controlled Rectifier Tubes 31
With the Affiliated Clubs ........................................... 32
Technical Aspects of the New Regs ............................. 33
Selectivity with the 2-Tube Regenerative Receiver ............. 36

A Dual-Frequency Crystal Calibrator ........................... 38
The Coaxial Vertical Radiator ...................................... 42
Construction and Alignment of the Television Receiver ....... 45

A.A.R.S. Activities .................................................. 53
2nd Annual "A.R.R.L." QSO Party ................................ 54
A Compact Crystal-Controlled 56 & 28-Mc. Phone Transmitter 55
Naval Communication Reserve Notes ........................... 60

Book Review ......................................................... 61
I.A.R.U. News ........................................................ 62
A Signal-Metering Valve ........................................... 64
How Would You Do It? .............................................. 67
Silent Keys ........................................................... 68
Hints and Kinks ..................................................... 69
Operating News ...................................................... 72
Correspondence Department ....................................... 76
Standard Frequency Transmissions ............................. 82
A.R.R.L. QSL Bureau ............................................... 102
New Apparatus ...................................................... 122
Hamads .............................................................. 123
QST's Index of Advertisers ........................................ 126

JANUARY 1939

VOLUME XXIII
NUMBER 1

STAFF

Editorial
Kenneth B. Warner
Editor and Business Manager

Clark C. Rodmon
Managing Editor

James J. Lamb
Technical Editor (on leave of absence)

George Grammer
Acting Technical Editor

Donald H. Mix &
Thomas M. Ferrill, Jr.
Technical Assistants

Vernon C. Chambers
Laboratorian

Advertising
F. Chester Beeckley
Advertising Manager

Charles Brunelle
Asst. Advertising Manager

Circulation
David H. Houghton
Circulation Manager

Ralph T. Baabun
Asst. Circulation Manager

OFFICES
38 La Salle Road
West Hartford, Connecticut

Subscription rate in United States and Possessions and Canada, $2.50 per year, postpaid; all other countries, $3.00 per year, postpaid. Single copies, 25 cents. Foreign remittances should be by international postal or express money order or bank draft negotiable in the U. S. and for an equivalent amount in U. S. funds.


Copyright 1938 by the American Radio Relay League, Inc. Title registered at United States Patent Office.
Section Communications Managers of the A.R.R.L. Communications Department

All appointments in the League's field organization are made by the proper S.C.M. elected by each Section listed. Mail your S.C.M. (on the 16th of each month) a postal covering your radio activities for the previous 30 days. Tell him your QST at the newsstands; he wants a report from every active ham. If interested and qualified for O.R.S., O.P.S. or other appointments he can tell you about them, too.

<table>
<thead>
<tr>
<th>Eastern Pennsylvania</th>
<th>W3OP</th>
<th>John H. Morgan</th>
<th>Blue Bell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maryland-Delaware-District of Columbia</td>
<td>W3BAK</td>
<td>Edgar L. Hudson</td>
<td>Laurel, Delaware</td>
</tr>
<tr>
<td>Southern New Jersey</td>
<td>W3REE</td>
<td>Ed Preston</td>
<td>Audubon</td>
</tr>
<tr>
<td>Western New York</td>
<td>W3COE</td>
<td>Kendall Speer, Jr.</td>
<td>Tully</td>
</tr>
<tr>
<td>Western Pennsylvania</td>
<td>W3FPO</td>
<td></td>
<td>Lower</td>
</tr>
<tr>
<td>Illinois</td>
<td>W9RMN</td>
<td>Leslie M. Dickson</td>
<td>Waukegan</td>
</tr>
<tr>
<td>Indiana</td>
<td>W9GQ</td>
<td>Noble Burkard</td>
<td>Indianapolis</td>
</tr>
<tr>
<td>Iowa</td>
<td>W9IK</td>
<td>Darrell A. Lowry, Rolf C. Bird</td>
<td>Walworth</td>
</tr>
<tr>
<td>Michigan</td>
<td>W8PE</td>
<td>E. H. Gibson</td>
<td>Milwaukee</td>
</tr>
<tr>
<td>Minnesota</td>
<td>W8HT</td>
<td>Alfred C. Krones</td>
<td></td>
</tr>
</tbody>
</table>
BACK FROM THE ARCTIC WITH KENYONS

The photo above shows Gerry Sayre (OX2QY, W1OXAB, WAWG) chief operator for the MacGregor Arctic Expedition and one rack of the transmitter which for sixteen months maintained communication with all parts of the world. Several times during the expedition’s stay in the north re-broadcasts were made over national chains. The technical staff of the commercial broadcasting company made many favorable comments on the excellent quality of the signal. The wide range frequency response and low distortion of the audio system were praised as being exceptional in a transmitter of this type.

Every transformer used by the MacGregor Arctic Expedition was a KENYON "T"-line type. The transmitter as described in the December 1937 issue (page 27) of QST was designed to modulate 500 watts input to the class "C" stage. The main power supply chassis is shown above beside the audio and power rack. A close examination of this un-retouched photograph will show the cases badly corroded and pitted. One interesting thing to note is that the chassis at the bottom of the rack were considerably more affected by this condition than those at the top.

When the transmitter had not been used for some time and a change of temperature occurred so that metal parts were cooler than the air, pools of water would collect. This water of course was salty, and made it necessary to wipe thoroughly all high potential parts before starting a transmission.

For sixteen months the "T"-line transformers and chokes took this rigorous test and NOT ONE UNIT FAILED. No laboratory test could demonstrate in such a positive manner the value of vacuum impregnation FULLY POURED UNITS.

The complete filling of these units with a moisture proof compound is the only thing which prevented the collection of pools of water inside the case. Once this had happened, low resistance leakage paths would be formed and it would not be long before breakdowns would occur.

Gerry Sayre informs us that he considers the transformers as good as ever and intends getting on the air in the near future with the same transmitter.

The "T"-line transformers stood the test and are in condition to deliver many more hours of satisfactory service because they were fully poured.

F. P. Kenyon
THE AMERICAN RADIO RELAY LEAGUE

Directors

President
EUGENE C. WOODRUFF, W8CMP

Vice-President
GEORGE W. BAILEY, W1KH
74 Webster Road, Weston, Mass.

Canadian General Manager
ALEX REID, VE2BE
103 Logan Ave., St. Lambert, P. Q.

Atlantic Division
WALTER BRADLEY MARTIN, W3QY
Box 121, Benton, Pa.

Central Division
R. H. O. MATTHEWS, W2RZ
100 East Ohio St., Chicago

Dakota Division
FRED W. YOUNG, W8MAEN
107 Hanover St., Mankato, Minn.

Delta Division
R. E. ARLEIDGE, W5RE
P.O. Box 390, Pine Bluff, Ark.

Hudson Division
KENNETH T. HILL, W2AHG
115 Willow St., Davenport, L. L. N. Y.

Midwest Division
FLOYD E. NORTON, JR., W9EFC
120 South Fourth St., St. Louis, Mo.

New England Division
PERCY C. NOBLE, W1BVR
37 Broad St., Westfield, Mass.

Northeastern Division
RALPH J. GIBSON, W1KV
c/o United Air Lines, Portland, Ore.

Pacific Division
J. L. MCCARRON, W9CEY
66 Hamilton Pl., Oakland, Calif.

Rocky Mountain Division
H. L. CAVINESS, W4DW
State College Station, Raleigh, N. C.

Southeastern Division
EDWARD C. PICKMAN, W9ESA
618 S. Williams St., Denver

Southwestern Division
BENNETT R. ADAMS, W4APU
1512 Grove Place, Homewood, Ala.

Southwestern Division
CHARLES B. MULLACK, W6GO
443 Main St., El Centro, Calif.

West Gulf Division
WAYLAND M. GROVES, W5NW
c/o Humble Pipe Line, Mt. Pleasant, Texas

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.

IIIIRAM PERCY MAXIM, FIRST PRESIDENT

Officers

President
EUGENE C. WOODRUFF, W8CMP
State College, Pa.

Vice-President
GEORGE W. BAILEY, W1KH
Weston, Mass.

Secretary
KENNETH B. WARNER, W1EII
West Hartford, Connecticut

Treasurer
ARTHUR A. HEBERT, W1BDO
West Hartford, Connecticut

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

General Counsel
PAUL M. SEGAL
1026 Woodward Building, Washington, D. C.

Address all general correspondence to the administrative headquarters at West Hartford, Connecticut.
"IT SEEMS TO US—"

1938 IN REVIEW

As the clocks move swiftly onward to the end of an eventful year, it is interesting to cast a reflective eye backward and see where we got in 1938. It should help us in the coming year.

Amateur radio continued its slow and wholesome growth, at a rate just fast enough to be encouraging, slow enough to provide for easy assimilation. In the United States the number of licensed stations reached 50,000 for the first time. Despite immense congestion we have made some improvements in the ease and reliability of communication and are more than holding our own. This is accomplished through no slackening of general amateur spirit and activity but under quite the converse circumstances, for the contests and operating activities of the past year enjoyed more participation than ever before.

Mid-year brought the effective date of the inter-American treaties of Habana and the gradual putting into effect of their amateur provisions by early-acting countries. Here is the Western entente at work, emphasizing the community interest of the Americas in radio problems in a spirit that is a satisfying departure from the stock views of the Old World. The coming year will see us appreciate more and more this solidarity of western viewpoint, will see increasing liberalization of amateur communication. The great Cairo conference was successfully hurdled, amateur frequencies unchanged except in palpitating Europe. Our domestic regulations were revised late in the year in a way that has provided general satisfaction.

In the field of technique there is place for a mild glow of satisfaction over the increasing consciousness of the need for independent thinking by the individual amateur, pressing a return to more intelligent experimenting and development work rather than the blind copying of stereotyped styles. New apparatus appeared in such profusion as to constitute an embarrassment of riches—sturdier tubes, new tubes requiring remarkably low excitation, better and cheaper receivers marked by improved variable selectivity, a considerable trend towards manufactured transmitters both complete and in units, and many interesting auxiliary pieces of gear. Great interest prevailed in improved antenna systems and higher efficiencies were attained with closer-spaced systems, while amateur ingenuity produced many interesting solutions of the mechanical problems of rotatable systems. In transmitters themselves the trend has been distinctly towards the capacity to shift frequency quickly, involving not only band-switching exciters but ganged tuning of whole transmitters and a notable revival of self-excited and consequently flexible exciters. The latter have struck perhaps the sorest technical note of the year, figuratively as well as literally. Of undeniable value, they are probably here to stay but the average of their performance in 1938 was decidedly less than it should be, indicating the need for more study. And, as with any strange implement, we showed that we have not yet learned how to use them with discretion and courtesy, so that on this score we took a small step backwards which we must hasten to overcome. With commercial television looming, amateurs learned much about the technique of the new art from the triple standpoints of engineering interest, the probable construction of their own receivers and, of most consequence, as preparation for two-way television ultimately finding a place in amateur communication. U.h.f. technique bettered noticeably, while abnormal transmission conditions provided amateur radio an opportunity to contribute substantially to knowledge of the performance of the ionosphere.

Amateur radio as an institution awakened mightily to awareness of its public-service duty in emergencies. The southern California flood and the New England flood and hurricane provided the outstanding examples of organized amateur performance. Phone stations markedly improved their ability to serve in emergencies. Increased consciousness of the duty to be prepared led both to remarkable new government regulations to foster and protect our work and to the building of a prodigious quantity of new portable emergency apparatus, tested in the most successful Field Day event ever held. Administrative organization paralleled equipment building, so that the year-end finds us satisfyingly improved in ability to perform.

Within the A.R.R.L., mention also needs to be made of the holding of the first national convention in over a decade, with the greatest attend-
ance ever recorded at an amateur gathering; and of the commissioning of the new W1AW, model headquarters station of the League. An active membership was increasingly aware of its own responsibility in a democratic self-governing institution; gave intelligent and spirited study to its problems; was not appreciably misled by circus-barkers who, for their own ends, sought to break down the faith of amateurs in their own unique cooperative association. All of which augurs immensely well for the society's future.

Death seemingly selected from our ranks this year an unusual number of the shining marks she loves so well.

A considerable number of names famous in our annals were added to the roll of silent keys, including that of our own late editor, Ross A. Hull. Hard-paid tolls exacted by unrelenting Time, they are the sad part of the 1938 story.

With increased verve and improved appreciation of its circumstances, duties and rights, amateur radio marches into 1939 with torches aloft, knowing that its devotees alone will determine what that year shall be.

MUR XMAS ES HPI NEW YR

It is that glad season of the year again when friend greets friend with warmest wish. It is notably true of the brotherhood of amateur radio, whose raw material is intracommunication. The members of the headquarters staff of the American Radio Relay League send cordial greetings and hearty good wishes for happiness, health and prosperity to the radio amateurs of every land!

Our New Year's present to you all is a new and better-looking QST and the promise of a journal constantly increasing in the interest and value of its contents. 73.

K. B. W.

Strays

The other night we heard a chap on about 14,040 kc., calling CQ and asking for a frequency check, explaining to the world that he had a new crystal and wanted to know whether it was in the band or not. Hi! Do you reckon the monitoring stations'll give him the info he wants? And will he have to do some fast thinking when the F.C.C. asks him for a description of his frequency-checking equipment?

Use of old half-tone cuts (copper) for Faraday shields is suggested by W2WD. As it is necessary to visit the printer to obtain the material, W2WD suggests further that the printer be persuaded to cut the slots to within half an inch of one edge with his metal saw. The shield is then completed unless the ambitious ham wishes to rub it on a sheet of sandpaper to make a more finished job.

According to a college paper description of W9ZOL, the station of Synton radio fraternity at the University of Illinois, "... the power input to the one-hundredth tube in the final stage of the transmitter is 300 watts." Apparently, the linotype operator hadn't heard of a 100-TH tube!

Ex-W4HJ, one of the operators at the Asheville, N. C., Police radio station, sends the following: "Our system at WPFS employs 'two-way' communication between the cars and headquarters. The cars are identified by various numbers, and it so happens that the county sheriff's car is number 88. Imagine the amusement of visiting amateurs when they hear a decidedly bass and very much businesslike voice calling, "88 to headquarters, 88 to headquarters ... ."

Bound Volume XXII of QST

We have a limited number of Bound Volume XXII of QST. This volume is made up in two sections, each containing six issues of 1938 QST. Handsomely bound and gold imprinted the complete volume is priced at $6.00, postpaid.

Calls Heard

Tel-Aviv, Palestine

(14-Mc. band, Oct. 16th, 5-7:30 p.m. EST)

W1FH, GKH, BFT, LAX, BHM, BA, CCK
W2GUD, BNX, AGW, AAS, FKE, HSZ, FZI, BWE, AJ, RS, AOA, AP, LND, CBL, IYO
W3CKA, COD, FFH, GAU, GHL, GWL, GWI, GWJ
W4DWU, EAK, AQL, FDA, EPL, EYI
W5BFK
W6MIK
W8BTI, DFH, CRA, LBD, LIW, GMZ, JAX
K4AOP, KD, FCV, FHR
K5AU
NY1AB
CM2GR

Beirut, Syria

(14-Mc. band, Oct. 17th, 5-6:30 p.m. EST)

W1DBS, LAX, AXX, GNE, KHY, DED, LMO
W2EDM, KEZ, ECI, IYO, IXT, AOA, FKE, KJY, HOX, ISO, BHV, GSA
W3EUJ, EZN, HJL, US, CRW, BHV, GWJ, FOQ, AOO, CTL, GTR, OP, WU
W4DE, FJI, CFJ
W2G5Z
W9KFL
K4RD, FCV
K5AA
NY1AB

— Max Buch, W2AMA

3rd Op., Aboard S.S. Excalibur, KGWT
A group of North Greenland Eskimos enjoying the noon-day sun. The polar bear and fox-skin pants still stand guard against chilly nights, even in midsummer. The sport in the left foreground with the “howl” haircut has evidently blown himself to a white shirt and suspenders at a Danish trading post.

Ham at 30° Below

Being the Musings and Random Comment of an Amateur Radio Operator with an Arctic Expedition Signing OX2QY-W10XAB

BY A. G. ("GERRY") SAYRE, W2QY

Remember that QSO we had from above the Arctic Circle?

You probably envied me, then, sitting in my snug berth and working the world. To some extent you were right—from the number and variety of the contacts available it was a ham’s heaven up there near 80° N.

But there is another side to the story, too—a story of headaches and heartaches, of hardship and downright misery. It is my hope to bring you something of both sides in this story.

Picture a typical night’s operation at OX2QY-W10XAB-WAWG: DX’ers calling us by the dozens. I try to answer each of them in turn and complete a FB QSO in the short time at my disposal. But Father Time marches right along—the supply of gasoline is none too large and must be conserved—so we cut it short. Boy! What a thrill to hear the lads calling and what a pity when I am unable to answer each in turn. Stations five deep on various frequencies—try to get a solid QSO out of it all! It really was hard, when the allotted time had been used up and hundreds were still calling, to have to close down and say goodnight.

What characteristic waver you reported on our signals...yes, you had it, too. Hollow-sounding, with rapid fluctuations in signal strength. Must be characteristic of the paths over which the signals were travelling...there’s something worth noting. Looking back over it, we see that almost invariably the stations we contacted best had higher power and, most important of all, they had some form of special antenna to throw the signal up to us, to enable them to reach out and over the interference.

So it went, night after night. Ah, a new station calling us! We go back, give him a report, and—bang! He is wiped out by QRN from someone else QSY’ing right on his frequency trying to get a new country. Wonder if this bedlam will ever let up...Very little static was experienced, except during winter periods. When dry, hard snow and ice particles drifted down from the plateau above us and struck the antenna and feedline, the discharge brought not only severe bursts but substantial jolts on contact. Frequently it jumped over in the receiver, and even a few times in the final tank condenser. This was our worst trouble. Hash from the three windchargers which operated the 32-volt system, from the radio engine ignition and also the exciter and generator, was minimized by filtering.

It was interesting, too, to note the variations in signal strength, before, during and after magnetic disturbances or storms. Signals are supposed to increase in strength just preceding and just following such storms, and that seemed to check quite well with our log. Complete fadeouts always brought home to us thoughts of other years when men had spent the long Arctic night without radio to furnish them with the latest news, or a world series baseball game or the major football game of the week. Possibly it might be Jack Benny or the Breakfast Clubbers to whom we would turn for our amusement. To miss them and others left our day only partly filled.

Maybe I ought to go back to the beginning, and set the scene a bit, so you can appreciate that.

* Milton, Rock County, Wis.
It started on July 1, 1937. That was the day the MacGregor Arctic Expedition sailed away from Port Newark, N. J. The radio equipment had not been completed or tested. The first day I was assigned the job of installing the 120-volt lighting system throughout the ship. But the fumes from leaky exhausts and seasickness got me. Sick was no word for it—I was out!

The first leg of the trip was completed July 9th when we docked at Lunenburg, N. S. There, Donald Whittemore, W2CUZ of N.B.C. and I got the rigs going after infinite checking and rechecking, building and rebuilding. VE1CD, VE1GC and VE1GH deserve a lot of credit for their aid and thanks for their hospitality. Finally, everything was working on all frequencies. We put up the ship's antennas there, too—a vertical Marconi and a 17-Mc. doublet.

On the 14th we left Lunenburg for Sydney. There we tested with W2C and got to work on the 'phone. VE1CR helped in true amateur fashion. Don Whittemore left us at Sydney, and on July 20th we shoved off again. What a treat there! We tested with WOO and got to work on the 'phone. VE1CR helped in true amateur fashion. Don Whittemore left us at Sydney, and on July 20th we shoved off again. What a treat there!

The next day we crossed the Arctic Circle. The sky was a variety of hues—what a picture! Water black, shaded to green, sky to the west covered with purplish tint. Radio conditions improved that day, too.

On August 13th, following a flock of radio troubles and QSO's with W10XDA and W9BBU, we put in at Idglorsuit on the east shore of Hare Island. This is the place where Rockwell Kent spent a winter and based the story of Salamina on his experiences, you know. Glaciers, icebergs, the Eskimo settlement, flowers still in bloom but no trees—all the color one would want. We delivered Mr. Kent's presents to the natives, and were they happy! Saw our first kyacks, and the accurate harpooning at either birds or seal. These people are unique, having small, dark, squat bodies, plump, round faces, and cheerful smiles. They love to have visitors—had a coffee party and dance for us that night.

We got some dogs there, and then set out for the North again—through the thickest pack of icebergs encountered on the trip. The absence of static is noticeable—in contrast to WHD's plaint that thunderstorms made it hard to read us back in New York. On August 17th, north of 73°, we sent the first messages from the crew to W8ITK. Vibration of the ship's motors shook the final grid coil from its mounting; it broke two RK-20's as it fell. Just another thing to do better next time!

For the next ten days or so we struggled further north. The temperature grew colder, hanging between 32 and 44° F. Then we struck floe ice and freshly-frozen layer ice. It began to look as though we would not reach our destination at 82° N. Finally, unable to get across to Ellesmereland, we turned back and entered Etah fiord.
An enlargement from an 8 mm. film which shows in the foreground the rear stick that held up the rhombic. The ship can be seen frozen in the ice.

went ashore to stretch our legs for the first time since Sydney!

Etah began to look attractive as a headquarters. It was a large fiord, and there were little flowers still blossoming there. A 14 x 20-foot cabin left by the British Arctic Expedition would make a good nucleus for the headquarters. So on August 29th we started the tedious, heavy job of unloading ship and ferrying the gear and supplies ashore in boats. After tentatively deciding on a possible location for a rhombic just east of the shack, we lost 4000 feet of antenna wire overhead. I honestly felt like weeping!

Two days later we were blown out of the fiord by strong gales. The anchor was out and one hawser was attached to a deadman ashore, but the hawser broke and the anchor dragged, and out we went. The engines were started, and barely kept us off the rocks. The gales were too strong to permit re-entry and the way to the north was blocked, so we just tacked back and forth until the winds died.

But our troubles were not ended. The next day, on again entering Etah, one propeller fouled with the line. Then the other motor backfired and caught fire. We lay to and all hands fought desperately with water, Pyrene, and sand. We tried not to think of the 3000 gallons of gasoline in the hold! Finally the fire was put out, and an outboard motor on a dory pushed us into the fiord.

Do you begin to see now what I mean, when I say there are two sides to the story? If you don’t think it’s a lot more fun to sit back home in the comforts of civilization and work the expeditions, you’re crazy!

However, whatever our feelings, we had work to do. The remaining stores were unloaded and installations completed. Most of the details of the equipment were given in the yarn I sent down by radio to the boys at QST, which was printed in the December 1937 issue, so I won’t go into that again.

But I do have a few observations and explanations I should like to make. First of all, we want to thank all the stations, both commercial and amateur, for their splendid cooperation all the time we were out. Such amateurs as W2CIF, W3DPU and WSCJJ were especially helpful throughout the entire year. QRN, QRM, QSB and skip all caused repeats and delays, but nevertheless we cleared the hook. ‘Phone schedules with W3DHM, allowing Mrs. MacGregor and her daughter to talk with the Commander, were usually very successful. W2JKQ was also of great service in piping us through to parents and families. All in all, we appreciate ham radio far more than we did before we went “up North”!

Conditions seemed to be quite different from those good old days when Don Mix took WNP up there in 1923–24. Then, of course, they worked 220 meters from 10 P.M. to 5 A.M. We could hear regular broadcast signals only a few times between Sept. 1st and May 31st, even with the gain of the big rhombic ashore. But the 14-Mc. band was consistently open most all night long and throughout the daytime. In the region between 1500 kc. and 7000 kc., however, no signals were heard at any time day or night, winter or summer—during the time we were ashore. Only rarely did anything come through even on 7 Mc.

Between 9- and 18-Mc. signals were heard practically every day, with variations for time of day, season and fadouts. Conditions in this region seemed similar to those back home. Ten-meter signals were never good, but on a few days wavered in and out with deep fading. No signals were heard on 56 Mc. This collapse on the part of both the lower and the higher frequencies was a source of considerable surprise to us, since we had expected to use both. Incidentally, two different makes of superhets and an SW-3 were used, so the receiver can’t be blamed.

We had anticipated a large amount of work with antennas, but when that 4000 feet of wire went down our good intentions went also. There was barely enough left to erect the diamond. We did put up one doublet, but it blew down and did not give us much service. Of course, the rhombic gave a huge gain on both transmission and reception compared with the ship antennas.

On checking our log with the magnetic conditions as observed by RCA we found substantially complete agreement. (A complete summation of all our findings is not yet available. We are now investigating many angles.) Incidentally, during the April 1938 fadeouts (12th–17th) we are told that our magnetic recorder showed the strongest magnetic storm ever observed at any point on earth to date! Other complete fadeouts occurred on January 16th–17th and February 7th.
There were months when VE1-2-3 and W1 were barely audible. Then, of course, other sections would come through in great style. Sometimes only VE4-5 and W6-7 would be good. Schedules would be arranged only to find conditions such that nothing could be received. It's all in the game!

Input to the Gammatrons varied, but finally we settled on 400 watts input—200 ma. at 2000 volts—with plenty of bias to hold them down. This was equally satisfactory on ham and broadcast work, press and commercial schedules, phone and c.w. No trouble was experienced in getting the rhombic to load up on any of the frequencies used, ranging from 8655 to 17,310 kc.

Our main purpose was to report the daily weather summary to the U. S. Weather Bureau in Washington, to send a weekly magnetic summary to the Carnegie Institute of Terrestrial Magnetism in Washington, to deliver at least one NBC broadcast a month, and to furnish press news to the New York Times station, WHD. After all of these were served we might have an hour for amateur schedules and general contacts.

I hope that all of you appreciate just how things go on an expedition. They are not so smooth and rosy as they are painted before you leave port! Hamming is the last thing the expedition proper cares for. On the other hand, we had to rely on amateurs for many of our contacts. Our hats are off to you! We owe all of you much. That applies especially to the gang at W2CIF. We could always depend on you to handle whatever we needed, and all of us grew to know that 2500 miles away there were friends on whom we could rely. Our thanks, too, to W2BCR for his invaluable aid and to W3DHM. Space does not permit the full acknowledgment of our debt to all of you. There are many more who handled lesser amounts of traffic to whom we owe a similar tribute.

A week after the anniversary of our departure from New Jersey we set sail from Etah on the return voyage. The fiord ice had just opened to allow us to continue. We rounded Cape Race next day at noon, and then calmed and a high pressure area set in. This high-pressure zone apparently held the hurricane which hit Long Island and New England and sent it over land, doing all the damage.

Finally, on October 14th, having lost a mainsail in the meantime, we held our last QSO with W2CIF while entering the Narrows of New York harbor, and then closed the rig down for good.

There are plenty of things that one learns on a 15-month jaunt of this sort. One notable point is to protect all equipment against condensation of moisture. Otherwise every time the switch is turned on, something blows up. We tried chemicals to dry the air, larger tank condensers, and other methods. Finally, we adopted the system of pre-heating the operating shack before each schedule period. The warm air absorbed the condensed moisture and permitted satisfactory operation. Ample safety factors are, of course, essential. It will be hard for you to visualize conditions as they were. When your bunk gets damp and mildews, when your clothes get sticky and clammy as you hang them up, when...
Feeding Vertical Antennas

BY ARTHUR LYNCH,* W2DKJ

Methods of Using Vertical Elements Singly, and in Combination to Form Simple Directive Systems

It seems strange that there should be any problem regarding the proper method of feeding a vertical radiator, yet that such a problem exists is most certainly true. After all, except for a few comparatively unimportant details, there should be nothing more to feeding a vertical than feeding the more familiar horizontal types.

In giving consideration to the method for feeding any particular antenna, we must give some thought to its physical characteristics. It is well-known that the physical dimensions, for an antenna which is to be used on a certain frequency, will vary somewhat as a result of the proximity and the character of other bodies which may be in the active field of the antenna. The height above ground and the character of the ground have marked effects. The current literature is so full of information covering these important subjects that we will skip it entirely. It is mentioned only to indicate that it has not been given attention in the following text and that the dimensions given here cannot be set down for rule-of-thumb guidance, but are intended only as guide posts for determining the starting point for the particular antenna and feed system which will best fit into a particular group of conditions.

It is not to be assumed that any of the information given here is especially new; in its fundamental form, most of it is to be found in the A.R.R.L. Handbook. Those novel kinks, such as are illustrated in some of the last figures, are but conveniences which make for better operating conditions where it is necessary to make compromises, forced upon us by lack of space or local restrictions of one form or another.

The Quarter-Wave "Marconi"

Several years of operating ultra-high-frequency equipment in airplanes and cars, to say nothing

* 136 Liberty St., New York City.
of yachts and high buildings, has brought us to the conclusion that too little attention is given to the quarter-wave "Marconi" antenna. For most mobile purposes we have found it to be ideal, and certainly much less trouble to install and use than any of the more elaborate types. Then, too, we have never found any of the others, except beams, to perform better. A telescopic type of broadcast antenna, extended to approximately 4 feet, was hastily attached to a wooden cross-member of an airplane and the point was pushed up through the skin. It was installed with a view to making a single flight. It stuck with the ship, through all kinds of weather, for more than a hundred thousand miles. Actual tests made later with other types showed no superiority in performance electrically, and all of them were a headache mechanically. Very much the same story can be told of the job on our car.

So, when there is not much room and you want to put up an aerial which is the least conspicuous, give some consideration to one of the arrangements shown in Figs. 1. They are the shortest units possible for good performance on a particular band and, since they are to be current fed, the insulation problem is not a serious one.

Also, the impedance between the base of such an antenna and ground is in the vicinity of 35 ohms. Some of the better twisted-pair transmission lines have an impedance in the vicinity of 75 ohms. If the line is to be short and the power not too high, the mismatch of impedance, when the arrangement shown in Fig. 1-A is used, doesn't really cut much ice. Theoretically, yes; practically, no! If you want to run a longer line or want to run more power, or if you're just fussy about efficiency, the arrangement shown in Fig. 1-B will fill the bill nicely for you. Here two twisted-pair lines are run in multiple, making certain that they are of the same polarity, and you have cut the surge impedance in half and doubled the power-carrying ability of the line. You have not, however, cut down the dielectric loss per foot in the line itself, although the temperature rise will be less if the line is being overloaded.

In Fig. 1-B we have indicated the method for feeding a vertical quarter-wave "Marconi" with a concentric or coaxial line. If a line of 30 or 35 ohms is available it will do the trick very nicely, but the mechanical difficulties which are generally encountered in making such a line are seldom justified by the improvement in performance, if any.

In all three of these cases we have shown one side of the transmission line grounded adjacent to the base of the antenna. It doesn't seem to make much difference if this part of the line is permitted to hang in thin air. The line may, of course, be random length.

For most practical purposes, a quarter-wave radiator on 5 meters is 4 feet, 10 meters is 8 feet, 20 meters is 16 feet, 40 meters is 33 feet, 80 meters is 66 feet, and 160 meters is 133 feet.

**Half-Wave Dipoles**

Where two quarter-waves are used, as in Fig. 2, we have the typical half-wave dipole. In free space, where the antenna is not influenced by the ground or surrounding objects, the impedance at the center is approximately 72 ohms. This is, 1 W. C. Tinus, "Ultra-high Frequency Antenna Terminations," *Electronics*, August, 1935.

---

**Fig. 2**—Center feed through twisted and concentric lines.

---

**Fig. 3**—Representative end-feeding methods. In "D" the inductance of the loading coil should be adjustable.

---

2 L.e., each wire in one feeder connected to the corresponding wire in the other. The wires usually are coded in a two-conductor cable. — *Editor.*

of course, a “perfect” match for some of the transmission lines which have been designed to have an impedance of 72 ohms. Twisted pairs (within the limits of their power carrying capacity), flexible coaxial conductors of the proper impedance, or solid coaxial lines may be used to feed this very simple type of antenna.

It should be remembered that all coaxial lines are not of the same impedance and that the proper line for a given type of antenna feed system should be used. This is equally true of twisted-pair feeders. They will be found to vary from about 65 to 170 ohms. This variation is not very important if the line is not to be too long and is not made to carry a power overload.

The Half-Wave “J”

Because, no doubt, of the popularity of the “J” type of antenna for police high-frequency installations, many amateurs are using this serial in one form or another. We have played some nasty tricks on this type of antenna, and it seems to have taken the abuse very nicely. A unit of the type shown in Fig. 3-A was made up of rather heavy wire. A rope was fastened to an insulator attached to the top, and the whole business was run up to the top of a yacht's mast, among steel shrouds, etc. The lower end was held in place by winding the twisted-pair transmission line up and down over a belaying pin, which was brass and grounded. The line was run some 20 feet along the deck and into a cabin window. Using only a few watts, we were able to contact other installations of the same character, on 5 meters, up to about 35 miles. On the lower-frequency bands, the results to be obtained are very satisfactory.

The simplest way to get such an antenna started is to make the length 0.97 × a half-wave (492,000/λ) and the matching section can generally be cut a quarter-wave long. If it is possible to shock-excite the whole system the point of highest current may be found on the matching stub, and will be the point where a low-impedance transmission line should be attached.

There is little difference between such a simple system and the one shown in Fig. 3-B other than the use of the shorting bar and the open-wire higher-impedance transmission-line. The shorting bar is placed in the stub, at the point of highest current, as indicated by a current-squared galvanometer, and the transmission-line is slid up and down above the shorting bar, with the power on, until a point is found where the standing waves on the line are minimum or disappear altogether.

For a permanent installation, where objection will not be raised to the unsightly appearance of the open wire line, particularly where power above 200 watts is to be used, this arrangement is to be preferred to the simpler system at 3-A.

Of course it is always possible to use “Zepp” feeders with almost any kind of vertical antenna, and the arrangement shown in Fig. 3-C is suggested as a typical case. For full details on the use of this kind of line reference should be made to the A.R.R.L. Handbook.

Where operation is desired on more than one band, it is possible to do a fair job by taking advantage of the system shown in Fig. 3-D. A loading coil is inserted between the base of the vertical radiator and one end of the “Zepp” feeders. If the loading coil is of the flat spiral type, the positions for the tuning clips can be marked on the copper strip, for the various frequencies desired, so that the adjustment may be made with the least loss of time.

A new setting of the variable condensers in the feeders will need to be made and they may be marked in a similar fashion. The condensers may be adjacent to the final amplifier or in any other convenient part of the line, depending on the

---

* More commonly, the factor is taken as 0.95 for the half-wave antenna and 0.97 for a two-wire open feeder. In any event, if exactly the right length is wanted the system had best be adjusted experimentally. — Espron.
length and type of tuning (series or parallel) used. A good arrangement for this type of antenna is to place the loading coil in a weather-proof housing which is set right at the base of the vertical radiator.

**Two or More Half-Waves in Phase**

A lot of the energy which is shot up at too high an angle to be useful, when one of the foregoing vertical antennas is used, is pulled down and shot out in more desirable directions when half-wave antennas are operated in phase and stacked one above the other. Everything else being equal, the radiation from one of the systems shown in Fig. 4 should be just about 150 per cent that which could be had from any of the other aerials we have considered.

Any former remarks concerning matching stubs and transmission lines may be considered as applying directly to these aerials, in just the same manner. The method of feeding from the end, as shown in Fig. 4-E, may be a mechanical convenience, but it is likely to produce a system which is not as symmetrical as the center-fed methods. Various types of transmission-lines may be used in connection with the matching stub (Fig. 4-E) as outlined previously. However, it is desirable to leave off the stub and the transmission-line and find the correct position of the shorting bar on the phasing section, by shocking the antenna and locating the point of highest current in the phasing section with a current-squared galvanometer. Then the stub may be attached and fed in the same manner as with any other form of aerial.

Additional half waves may be added, if additional phasing sections are used, but they are not very useful if the entire system is not more than a half wave above ground at its lowest point.

**“Pitchfork” Bi-directional Half-wave Beams**

In locations where space is limited, and where a bi-directional antenna may be a convenience, we should not lose sight of the possible gain to be had from the “pitchfork” (Fig. 5) over the ordinary type of vertical antenna. In many cases, it will be an improvement over two half-waves in phase, for the reason that it tends to put the signal where we want it. For receiving, it tends to cut out interference from stations in undesired directions as well as increasing signal strength from those stations in desired directions.

Since the spacing between the two vertical sections is only an eighth wavelength and the matching stub is only a quarter-wave long, it is possible to set such an array above an apartment-house roof, using self-supporting vertical rods. The entire assembly does not become too cumbersome, even though it is used on the 20-meter band, when the vertical elements become about 29 feet high, with a separation of about 8 feet. Some of the more ingenious fellows have made beams of this nature rotary, but where rotation is possible, we prefer the arrangements shown in Figs. 6-A and 6-B, for reasons outlined later.

In locations where rotation is not possible and a single aerial is all that can be used, the pitchfork has its advantages if we choose the two directions with care. If two such beams can be set up a reasonable distance apart, we can cover all directions with a great deal more efficiency than would be
The vertical two-section "WJLJ" rotatable beam installed at W2AZ. Self-supporting 20-meter half-wave elements are used. The beam is bi-directional and the antenna need be rotated only 180 degrees for complete horizontal coverage.

possible with any of the single units previously considered.

The use of three vertical elements for making a fixed beam which covers four directions, with fair results, is shown in Figs. 6-C and 6-D. It will be seen that the center unit is used with both systems and we have, in effect, two distinct beams at right angles to each other and having two distinct feed systems. The results which have been produced by this layout have been most encouraging. While they are not so good as those to be had from two similar beams a reasonable distance apart, and while it is possible to find current in the vertical element which is not in use, the performance is distinctly better than we thought it would be. This holds true for both transmitting and receiving.

The double-pole double-throw switch used to make the experiments on the 10- and 20-meter hands was located near the transmitter. It is thought that a suitable switch located at the base of the antenna, and remotely controlled, would bring about even better results.

One marked advantage of this double pitchfork beam was its gain over a single half-wave radiator for use in covering all directions simultaneously. To accomplish that result it was only necessary to feed the two transmission lines in multiple. The advantage of such an arrangement for general covering purposes is obvious.

As outlined before, any desirable transmission-line may be run to the quarter-wave stub, if the conditions for using those lines are met.

Vertical Rotary Beams

It is a bit difficult to know just where to give credit for the various ideas which have been conceived and worked out by so many investigators, and it is likely that much credit is given to some who have not been the first to use various arrangements because those who have actually been first have not made their findings known.

In outlining the next two types of arrays, we wish to thank Lawrence M. Cockaday, W2JCY, and Frank Lester, W2AMJ, for much of the electrical and mechanical work which they have done and for the information this work brought to light.

Many investigators have had the impression that Brown's paper before the I.R.E. which so ably covered the subject of half-wave radiators and close-spacing was intended to convey the idea that his findings would apply only to the use of a single radiator and a single director or reflector. It has been generally thought that the use of both director and reflector would not be an advantage. We think that what he intended to convey was the thought that the actual results which he described were found to be true under a given set of circumstances and that other sets of circumstances had not been investigated. In any event, there is no doubt now that both the director and the reflector, used with close-spacing and a half-wave radiator, provide better performance than either of them alone.

The mechanical difficulties usually encountered with nearly every type of rotary beam are reduced to a minimum when the arrangements shown in Fig. 6-A and 6-B are employed. In the former, we have shown a half-wave radiator with a director and no reflector, while in the latter we have shown the manner in which both may be used. Again, all the information regarding transmission-lines and matching stubs applies to this case, and two of the simpler methods have been illustrated.

It will be seen that changing the direction of radiation with this type of beam depends entirely upon the location of the director and/or reflector and that the radiator, matching stub and transmission-line remain fixed. The mechanical details for bringing this condition about are obviously simple, even where it is desired to use the three-element array on 20 meters.

Single-Wire Feed

One of the least used and one of the simplest methods of getting energy from a final tank circuit to an antenna is

(Continued on page 108)

Fig. 7 — Half waves in phase with single-wire feed and phasing stub.

MORE EXAMINATION POINTS

The Federal Communications Commission has drawn new 125-mile circles around three of its sub-offices: at Savannah, Ga., Tampa, Fla., and San Diego, Calif. The Class C examination is no longer available within these areas. Frequent examinations will be held at these offices for Classes B and A, but by special appointment with the office, not on regular schedule.

Examinations are now also available at the sub-office at Juneau, Alaska, by appointment, but Class C is still available throughout K7. In addition to this, Class A and Class B examinations continue available in Alaska by arrangement with any Army Signal Corps station, and at other points through Coast Guard officers.

THE INTER-AMERICAN ARRANGEMENT

There is a rumor going the rounds that Mexico has repudiated the inter-American radio treaty of Habana and that there will be a serious amateur interference situation as a result. The rumor is unfounded. Mexico on October 28th did reject the North American broadcasting arrangement but on that same date did approve the Habana Convention and the Inter-American Arrangement concerning Radio Communications. The latter is the important administrative agreement assigning amateur bands exclusively to amateurs and subdividing them in agreed manner between 'phone and ew. as reported in last February's QST. Thus Mexico, rather than creating an interference situation, has gone the whole way in the support of amateur radio. Incidentally, the other countries that have so far approved the Habana arrangement are the United States, Chile, Haiti and Peru.

THE CENTRAL DIVISION MATTER

A young tempest has been kicked up in the Central Division by some members who have not understood the reasons for the outcome of the nominations for director this year. There are murmurings of an "unholy alliance" between the incumbent director, Mr. Mathews, and the Executive Committee, with the latter invoking petty technicalities to keep the former improperly in office. The matter seems to need some further discussion.

First off, we call attention to a letter from Director Mathews appearing in this month's "Correspondence." In 1937 the Board of Directors adopted new rules for the eligibility of candidates for directors, included in which was the requirement that all candidates must have been continuously both a licensed amateur operator and a member of the League for at least four years immediately preceding nomination. The Executive Committee received petitions for six nominees: W8JK, W9UZ, W9ZN, W9BAZ, W9BJE, W9PNV. W8JK and W9ZN withdrew their names by written communication. The petition for W9PNV carried the signatures of only nine League members and so could not be regarded—at least ten are required. Neither W9UZ nor W9BAZ satisfied the requirement of four years uninterrupted membership preceding nomination. W9BJE had neither continuous operator license nor continuous League membership for the four years preceding nomination. These rules are adopted by the Board for the control of the Executive Committee and are binding upon the latter. There was simply no candidate eligible under the rules and so there was no election.

The question now is what happens under such circumstances. The answer is that another rule, By-Law 21, comes into play: it provides that directors are elected for a term of two years or until their successors are duly elected and qualified. The division having failed to name a candidate eligible under the rules, the incumbent director automatically remains in office. This is a customary rule in all such organizations as ours, and in our case has for its purpose preventing the division from losing its vote and its representation through failure to name an eligible candidate. It is true that Mr. Mathews was not a candidate, having withdrawn his name, and it is also true that he would not have been eligible under the present rules to stand as a candidate for re-election. But he was eligible when elected, the rules having been changed since, and his automatic retention in office is not only legal but the only possible outcome of the unusual circumstances. The Executive Committee of course would be open to the gravest criticism if it accepted candidates who were ineligible under the rules. There is reason to feel that the rules themselves may be too severe when they disqualify this many otherwise desirable candidates. With-
FINANCIAL STATEMENT

The third quarter of the League’s operations for 1938 showed increasing gross revenues but naturally continuing expenses, resulting in another substantial operating loss before appropriations. Net result is that the League enters the last quarter of the year about even. It is expected that the last quarter, which sees the appearance of the new Handbook, will yield a substantial gain. Third-quarter figures:

STATEMENT OF REVENUES AND EXPENSES, EXCLUSIVE OF EXPENDITURES CHARGED TO APPROPRIATIONS, FOR THE THREE MONTHS ENDED SEPTEMBER 30, 1938

<table>
<thead>
<tr>
<th>REVENUES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership dues</td>
<td>$12,220.38</td>
</tr>
<tr>
<td>Advertising sales, QST</td>
<td>21,548.55</td>
</tr>
<tr>
<td>Advertising sales, booklets</td>
<td>510.00</td>
</tr>
<tr>
<td>Newsdealer sales, QST</td>
<td>10,503.98</td>
</tr>
<tr>
<td>Handbook sales</td>
<td>4,618.94</td>
</tr>
<tr>
<td>Spanish edition Handbook revenues</td>
<td>21.43</td>
</tr>
<tr>
<td>Booklet sales</td>
<td>1,834.62</td>
</tr>
<tr>
<td>Calculator sales</td>
<td>232.19</td>
</tr>
<tr>
<td>Membership supplies sales</td>
<td>1,541.39</td>
</tr>
<tr>
<td>Interest earned</td>
<td>500.53</td>
</tr>
<tr>
<td>Cash discounts received</td>
<td>207.41</td>
</tr>
<tr>
<td>Bad debts recovered</td>
<td>39.32</td>
</tr>
<tr>
<td>Deduct:</td>
<td>$3,996.58</td>
</tr>
<tr>
<td>Exchange and collection charges</td>
<td>15.01</td>
</tr>
<tr>
<td>Cash discounts allowed</td>
<td>345.85</td>
</tr>
<tr>
<td>Loss decrease in reserve for newdealer returns of QST.</td>
<td>20.61</td>
</tr>
<tr>
<td>Net Revenues</td>
<td>4,330.83</td>
</tr>
<tr>
<td>EXPENSES</td>
<td>$49,576.71</td>
</tr>
<tr>
<td>Publication expenses, QST</td>
<td>$19,948.07</td>
</tr>
<tr>
<td>Publication expenses, Handbook</td>
<td>3,062.29</td>
</tr>
<tr>
<td>Publication expenses, booklets</td>
<td>283.16</td>
</tr>
<tr>
<td>Publication expenses, calculators</td>
<td>118.64</td>
</tr>
<tr>
<td>Salaries</td>
<td>24,493.82</td>
</tr>
<tr>
<td>Membership supplies expenses</td>
<td>920.76</td>
</tr>
<tr>
<td>Postage</td>
<td>1,746.03</td>
</tr>
<tr>
<td>Office supplies and printing</td>
<td>1,058.02</td>
</tr>
<tr>
<td>Travel expenses, business</td>
<td>699.70</td>
</tr>
<tr>
<td>Travel expenses, contact</td>
<td>1,747.62</td>
</tr>
<tr>
<td>QST forwarding expenses</td>
<td>987.53</td>
</tr>
<tr>
<td>Telephone and telegraph</td>
<td>627.70</td>
</tr>
<tr>
<td>General expenses</td>
<td>1,322.59</td>
</tr>
<tr>
<td>Insurance</td>
<td>203.32</td>
</tr>
<tr>
<td>Rent, light and heat</td>
<td>1,121.47</td>
</tr>
<tr>
<td>General Counsel expenses</td>
<td>265.55</td>
</tr>
<tr>
<td>Communications Dept. field expenses</td>
<td>119.89</td>
</tr>
<tr>
<td>Headquarters station expenses</td>
<td>714.91</td>
</tr>
<tr>
<td>Alterations and repairs expenses</td>
<td>60.00</td>
</tr>
<tr>
<td>Bad debts written off</td>
<td>67.00</td>
</tr>
<tr>
<td>Provision for depreciation of:</td>
<td>419.97</td>
</tr>
<tr>
<td>Furniture and equipment</td>
<td>35.49</td>
</tr>
<tr>
<td>Total Expenses</td>
<td>57,168.52</td>
</tr>
<tr>
<td>Net loss before expenditures against</td>
<td>$7,551.81</td>
</tr>
</tbody>
</table>

New Transmitting Tubes

HK 24

A tube in an entirely new size range for transmitting lines is the Gammatron 24. This tube makes use of a tantalum plate with enclosed top to obtain dissipation capability rated at 25 watts.

Maximum height of the tube is 4 3/4 inches, and maximum diameter is 1 1/4 inches. The measured height of one tube, exclusive of the plate terminal at top, is 3 3/4 inches, while the bulb diameter of the same tube measures 1 3/4 inches.

Below are given some of the ratings of this tube:

- Plate-grid capacity: 1.7 µfd
- Grid-filament capacity: 2.5 µfd
- Plate-filament capacity: 0.4 µfd

Operation as r.f. power amplifier, Class-C unmodulated:

- D.C. plate voltage (max. value): 1200 volts
- D.C. plate current (max. value): 75 ma.
- D.C. grid voltage: -120 volts
- D.C. grid current: 20 ma.
- Peak r.f. grid voltage: 240 volts
- Grid driving power: 3.8 watts
- Power output: 89 watts

For operation as Class-C r.f. amplifier with 100-per cent plate modulation, the plate supply voltage is reduced to 1250 and the plate current is reduced to 60 ma. The tubes are rated at 125 watts output in Class-B audio operation.

The maximum ratings for the 24 apply for frequencies up to 60 megacycles; a slight reduction is necessary for 112-Mc. operation, and data on the performance of the tube at frequencies up to 360 Mc. are given by the manufacturer.

810

A new carbon-plate tube suited for operation at 500 watts input as an unmodulated Class-C amplifier, or for 590 watts output (per pair) in Class-B audio operation, is the RCA 810. This tube, including end shields for the filament in a design for more efficient operation at low voltage (2000 volts maximum), makes possible compact construction of high power transmitters for 375 or 750 watts output using one or two of the new tubes. The maximum ratings of the tube are for frequencies as high as 30 megacycles.

(Continued on page 59)
First and foremost, a frank admission is in order: The outfit to be described is not the result of a pre-formulated plan. Its size and shape were determined at the outset by a sheet of aluminum which I had on hand. The rig arrived at its present state in two distinct stages, beginning as a 160-meter 'phone portable without benefit of buffer. It was built rather hurriedly for a vacation trip, and was much in use in New England this past summer. All in all, the results were satisfactory. The 'phone quality was good and DX contacts of a few hundred miles were not uncommon, but it seemed that at every turn some person of non-ham status would ask me, "How far can you talk on your radio sending set?"

Now, to a ham with nothing but 160-meter coils in his duffle bag, that's just plain embarrassing. My attempts at explaining the higher frequency bands were all but futile; the fact remains that we amateurs have the reputation of talking around the world. No amount of mumbling about "skip distance," 10-meter DX, and the like would satisfy them—or me either for that matter—because, quite naturally, I had talked myself into 20 and 10 meters for the small rig. The job is done, and the methods and results are to be described for what they may be worth.

**Oscillator and Harmonic Generator**

In the circuit diagram of Fig. 1, a 6F6 (metal tubes are a necessity to conserve space) is used in a conventional pentode crystal oscillator circuit. The feed-back capacitor, C4, was found necessary when quadrupling to 10 meters in the harmonic generator. The oscillator must be tuned quite near its peak (the oscillator is responsible for a large share of the excitation at the control grid of the final amplifier in this circuit) and therefore cleaner keying resulted from the use of a slight amount of regeneration. The cathode of the oscillator is keyed for break-in. If the oscillator circuit of Fig. 1 is used, the 6F6 shield is grounded at the socket. If the Reinartz circuit is substituted, the shield should be tied to the cathode end of the coil and condenser. Only a 160- and a 40-meter crystal are required for operation in the five lowest frequency amateur bands.

Another 6F6 is utilized in the second stage of the harmonic generator, and is used only when doubling to 20 or quadrupling to 10 meters from a 40-meter crystal. On 160, 80 and 40 meters the Class-C amplifier is driven by the crystal oscillator. The 807 doubles to 80 meters for c.w. operation only at present. If 75-meter 'phone is contemplated, or if the last possible watt of output is desired, a special coil form should be made for L1 and L2 and the second stage switched in. It is suggested that this extra long form be made in a length of 1½-inch diameter bakelite tubing fastened to a tube base. The coil sizes and spacing are included in the list. When driving straight through, the second 6F6 should be removed from its socket, although the circuit will function with it in place. 8W1 is a very small homemade knife switch with a victron base, and appears between the oscillator tuning condenser and the power supply choke in the under-chassis view. It is necessary to omit cathode bias in the second stage and to operate the screen grid at the voltage indicated (a round figure of 200 volts is used at all screens for convenience) for best results.

On the New England trip mentioned in the article, Mr. Rice found time to drop in on us at Headquarters last summer, and the gang was greatly impressed by the neat portable job he was carrying around with him. Naturally we inquired as to the possibility of getting a story on it, and here is the result. We think you'll like the outfit as well as we did.
Foot of Transmitter

Phone-C.W. Rig for Five Bands

BY H. E. RICE, JR.,* W9YZH/A

The Final Amplifier

The final amplifier is strictly conventional with the one exception of the connection of screen by­pass C12, the 'phone-c.w. switch, cuts in a screen dropping resistor for 'phone operation, and in the c.w. position it does about everything possible to make the most of the available voltage consistent with a clean keyed signal.

Audio

The speech amplifier and modulator are also conventional, and have proved satisfactory. The audio system is, in fact, practically identical to the Class-B amplifier for portable use described in the current RCA "Receiving Tube Manual." A double-button carbon microphone is used.

Antenna Coupler

The antenna coil consists of 36 turns of No. 18 bare copper wire, 1 ½ inches diameter, winding length 2½ inches, with spring brass slider clips at either end, one to vary the tap and thereby the coupling to the final tank and the other to short out turns from the voltage end. Suffice to say that with the 360-µfd. condenser connected across the coil the resultant tank circuit will tune to 160, 80 and 40 meters.

Power Supplies

The main power supply uses an 83 rectifier and delivers 300 volts under full load. SW2 is the send-receive switch.

It is granted that a separate bias supply for a transmitter of this power may, at first glance, seem out of place. In this instance, cathode biasing of the 807 meant a sacrifice of precious power, and it is out of the question in the second stage. I prefer to key the oscillator and I don’t like soaring plate current whether or not the plate dissipation rating of a tube is exceeded thereby.

Constitution

The chassis measures 10 by 12 inches and is 2 ½ inches deep. It is made of ½-inch half-tempered aluminum, and is equipped with rubber mounting feet at the four corners. The layout of parts is controlled by the chassis, and unless a slightly larger size is used, would have to be followed quite closely if the performance is to be duplicated.

Beginning at the right rear corner, the power transformer is mounted under the chassis with the cover plate on top. This is believed to be the simplest and neatest method of mounting this

* Great Smoky Mountains National Park, Gatlinburg, Tenn.

COIL DATA

<table>
<thead>
<tr>
<th>L1</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) 1.75-Mc. crystal: 52 turns No. 24 enamel closewound.</td>
<td></td>
</tr>
<tr>
<td>(b) 7-Mc. crystal: 14 turns No. 20 d.c.c. closewound.</td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>Description</td>
</tr>
<tr>
<td>(c) 3.5 Mc.: 26 turns No. 20 d.c.c. closewound.</td>
<td></td>
</tr>
<tr>
<td>(d) 14 Mc.: 7 turns No. 18 enamel, length ½ inch.</td>
<td></td>
</tr>
<tr>
<td>(e) 28 Mc.: 3½ turns No. 18 enamel, length ½ inch.</td>
<td></td>
</tr>
</tbody>
</table>

Sufficient to say that with the 360-µfd. condenser connected across the coil the resultant tank circuit will tune to 160, 80 and 40 meters.

This is the complete transmitting layout, ready to be hooked to an antenna and the 110-volt power source. The microphone input circuit, in the aluminum box at the right, contains the mike battery, transformer, and microphone-current control. It could be incorporated in the main unit by making the chassis a little larger. With two crystals, the set can be operated on all bands from 1.75 to 28 Mc.
The transformer in all cases since the cut-out edges are hidden and thus do not need to be smooth. The electromagnetic properties are in no way impaired.

The antenna tuning condenser is mounted vertically on small standoffs just to the left of the power transformer, with the coil form suspended from it by aluminum brackets. A National ceramic form, 1 ½ inches diameter by 2 ½ inches long, was found suitable for this purpose and is fastened permanently in place. Next in line along the rear is the rectifier tube, with the modulation transformer at the corner. The 6N7 modulator, driver transformer, 6N7 driver, and 6C5 speech amplifier at the left front corner follow in that order in a staggered row along the left-hand edge. The crystal pilot-bulb current indicator, oscillator tube, and oscillator and harmonic generator coil form with C2 of Fig. 1 mounted inside are grouped in a shield compartment to the right of the 6C5. The right front corner of this shield is folded to the right three quarters of an inch, and serves as a support for a panel bushing to guide the insulating rod which turns the antenna condenser. The socket for the harmonic generator tube is located just outside the shield, with its center 1 ¼ inches from the front and 5 inches from the right-hand edge of the chassis. It was necessary to crowd this socket as far to the left as possible to leave room behind the chassis front for the two d.p.d.t. toggle switches. The center of the socket for the 807 is 3 ½ inches from the front and 3 ½ inches from the right-hand edge of the chassis. The final tank coil socket is to the right and to the rear of the 807, with the condenser at the right front corner.

The power supply chokes are mounted end to end on an aluminum bracket under the chassis. The main filter condenser is bolted through in the usual way directly behind the oscillator shield compartment. The bias pack with its rectifier tube is under the chassis ahead of the transformer. C1 is also underneath, and tunes with a screwdriver from the front. It will be noted that the screwdriver hole is fitted with a rubber grommet to prevent accidental short circuits. Lock washers are used throughout, and all variable condensers are set reasonably tight.

The microphone input with its battery is in a separate aluminum box 4 by 4 ½ by 6 inches, the bottom of which extends out from the left side to form a weighted base to which the straight key is bolted. A length of crystal microphone cable connects from R6 to the grid of the 6C5. These details can be seen in the photograph. The microphone input, complete as shown, was on hand at this station. It would be entirely practicable to mount the transformer under the transmitter chassis, in which case the voltage should be taken from the power pack, and the gain might well be fixed for the normal input to the modulated amplifier.

**Operation**

No hum troubles were encountered, so it was not found necessary to connect the chassis to an earth ground. In the event of an accidental short circuit to ground, the 1/32-ampere fuse in the bias supply will prevent possible damage to the rectifier tube from a grounded power line.

Parasitic chokes were found necessary on 20 and

---

Most of the below-chassis space has been utilized, as this below-chassis view shows. Note the 6H6 bias rectifier in the upper right-hand corner. The chassis is bent from a sheet of semi-hard aluminum.
10 meters. Ten turns of No. 18 enameled wire, \( \frac{1}{4} \) inch diameter (wound on a test prod) cleared the circuit. The choke was wired in by soldering directly to the 807 plate clip.

Provision for metering is accomplished by the use of shorting type 'phone-tip jacks in the grid and plate circuits of the final amplifier. A test meter is used for this purpose. The antenna coupling is adjusted to draw 6.5 plate milliamperes for 'phone operation and 85 for c.w. Thus the input varies between 16 and 25 watts. With bias and plate voltage applied, there is enough excitation at the control grid of the 807 to cause 6 to 7 grid milliamperes to flow through 6000 ohms at 10 meters and 10 or more on the lower frequencies. Be that as it may, it is important that excitation be controlled. There is a very definite optimum for each plate current reading for linear operation and greatest output. Between 3½ and 4 milliamperes will be about right. The plate tank of the second 6F6 may be detuned when necessary. However, in most instances, satisfactory control of excitation can be main-

tained by detuning the oscillator, which practice lowers the crystal current and improves the keyed signal.

This transmitter is one solution of a completely self-contained rig, for use away from the home station, in which nothing but power is sacrificed. It has been of very real interest as a proving ground for the harmonic generator operated at a low plate voltage and for the small bias pack. A socket could be wired in readily to provide for convenient connection to an independent power source for field use. My 300-watt transmitter is very much on the shelf for the present.
The wide-range 30-watt amplifier complete with power supply. The gain control knob is at the left on the front of the chassis, with microphone jack, pilot light (2.5-volt light in parallel with the 2A3 filaments), and power switch in order toward the right. The two 6J7 tubes are at the left front corner of chassis, with the two 6N7 tubes directly behind. The output transformer is located at the front center of chassis, with power transformer to the right and 250-ma choke at the right front corner. The four condensers are in a row behind the transformers and large choke, and the two small chokes are directly behind the condensers. The input transformer for the 2A3 tubes is directly behind the 6N7 tubes.

A Wide-Range Audio Amplifier

All-Push-Pull Stages Applied to 30-Watt Amplifier-Driver

BY T. M. FERRILL, JR.,* WILMI

If all of the different phases of interest in amateur radiophone work were averaged, it would probably be found that the first interest of the operators in their equipment is quality and fidelity, with power, flexibility, and general utility following closely in some such order as that given. It should be realized, however, that neither an extremely wide frequency response range nor extremely low percentage distortion is necessary for an amateur 'phone station of excellent voice quality. A frequency range with less than 2 db variation between 100 and 4000 cycles is adequate for this purpose. The usual broadcast program has a range of the order of 100 to 5000 cycles, and experience indicates that a frequency range of 80 to 8000 cycles is adequate to give excellent reproduction of all sounds except certain types of noises. Amplitude distortions of 3 to 5 percent are detectable but are not considered objectionable, while 10-percent distortion is quite noticeable.

What characteristics, then, should a 'phone operator "go after" when building a high-quality transmitter? If any of the audio equipment is to be used for other services, such as public address or theatre amplifier work, it would be desirable to include a range of 60 to 15,000 cycles, making possible substantially perfect reproduction of music as well as speech. In modulation of an amateur 'phone transmitter, however, such a broad range is not only unneeded, but also very undesirable. The high-frequency portion of this range would add little to the naturalness of the speech if reproduced in the receiver, and a superheterodyne with sufficient selectivity for satisfactory reception in the crowded 'phone bands loses this high-frequency part of the transmitted speech. Reference to a typical receiver selectivity curve shows that even if the transmitter has absolutely no frequency discrimination in the audible range of frequencies, the audio output of the second detector in the receiver will be approximately 25 db lower at 5000 cycles than at 100 to 500 cycles and approximately 50 db lower at 10,000 cycles, so that there is nothing to be gained by transmitting the audio frequencies above 5000 cycles. More important for amateur communication work is the fact that the high frequencies not received by the station contacted may interfere with reception of the stations 10 to 15 kilocycles from the frequency of the transmitter.

The amplifier shown and described here is intended not as a compromise between a narrow-range system and one suited for purposes other than amateur 'phone work, but as an excellent amplifier for any audio-frequency application. As shown in Fig. 2 it is provided with a condenser (Cg) which limits the high-frequency response of the system, with the resulting curve shown in dashed line in Fig. 1. This curve coincides with

* Technical Dept., QST.
Another factor often found to be the cause of poor low-frequency response is insufficient primary inductance of audio coupling transformers, particularly those used to couple power amplifier stages. Better transformers are at least a partial solution to this difficulty, but sometimes this solution is too expensive to be justified.

Coupling condensers used between voltage amplifier stages must be included in the list of items which might impair the low-frequency response of the amplifier, but tubular paper condensers rated at 600 volts and at 0.01 to 0.1 µfd. are entirely satisfactory.

Causes for loss of high-frequency response in audio amplifiers include decrease of effective plate load impedance of one stage by high effective input capacity of a following stage (most noticeable with high-mu triode types having high plate-to-grid capacity) and decrease of effective plate load impedance of a voltage amplifier stage by high capacity of the plate transformer windings. If the first of these two troubles is experienced, it may be reduced by use of either a lower-mu triode or lower values of plate and grid coupling resistance. If the latter is the offender, a better (and usually more expensive) transformer is the direct solution.

Since it is possible to replace range-limiting condensers with larger capacitances at very little cost relative to the resulting improvement of the frequency range, there is a strong tendency in the design of amplifiers toward use of resistance coupling of voltage amplifier stages in preference to transformer coupling.

A means of improving the frequency range of an amplifier is the introduction of inverse feedback in one stage, or over two or three; this requires provision for more gain than would otherwise be necessary, and requires additional apparatus, although the result usually gives more than justification for the expense and work neces-
Inverse feed-back also tends to reduce the hum and the amplitude distortion in the stages over which it operates.

The amplifier described in these pages is entirely orthodox in all features except one — the use of push-pull stages throughout. As will be seen from the solid line of Fig. 1, inverse feed-back is not needed for extension of the range of this amplifier, since the response at the low- and high-frequency ends of the desirable range is quite high.

This excellent frequency characteristic is made possible primarily by use of push-pull stages throughout so that the current through the bias resistors is almost constant over the audio cycle, and thus the use of cathode by-pass condensers which might cause frequency discrimination is made unnecessary. Use of resistance-coupled voltage amplifier stages with sufficient coupling-condenser capacity and with coupling resistors chosen with due regard to the high-mu triodes is a further step toward wide-range response. Since the output stage in an amplifier of this power is almost invariably push-pull, and since a push-pull stage is usually considered a desirable driver for the output amplifier (particularly with such an output stage as four small triodes which are likely to have some grid-current flow on audio peaks), the use of push-pull stages from the input of the amplifier simplifies the problem of driving the output stages without a transformer.

Whereas addition of inverse feed-back to an amplifier makes a marked decrease in hum level, the push-pull stages throughout this amplifier perform this function also, to a very marked ex-3Ferrill, "Refinements in Combination Exciters," QST Oct., 1938.

Fig. 2 — Circuit diagram of the amplifier with range limiter

C1, C2 — 0.006-µfd. mica, 600-volt.
C3, C4, C5, C7 — 0.01-µfd. paper tubular, 600-volt.
C3 — 0.1-µfd. paper tubular, 600-volt.
C8 — 0.002-µfd. mica, 600-volt.
C9, C10 — 6-µfd. sections of dual electrolytic, 250-volt working (Mallory RM252), positive leads grounded, negative leads connected to ends of L1.
C11 — 16-µfd. electrolytic, 500-volt working (two Mallory HD683 connected in parallel).
C12 — 8-µfd. electrolytic, 500-volt working (Mallory HD683).
J — 3-wire jack.
R1, R2 — 2-megohm, ½-watt carbon.
R3 — 600-ohm, ½-watt carbon.
R4 — 0.6-megohm, 1-watt carbon.
R5, R6, R9, R11 — 0.25-megohm, 1-watt carbon.
R7, R8 — 2-gang, 500,000-ohm potentiometer (Centralab 4-010804).
R12, R13 — 0.5-megohm, 1-watt carbon.
R14 — 700-ohm, 1-watt carbon.
R15, R6, R17, R18 — 100-ohm, 1-watt carbon.
R19 — 2,500-ohm, 25-watt, semi-variable (see text).
T1 — Push-pull driver input transformer (Thordarson 74D32).
T2 — Multi-match driver transformer (Thordarson 15D80).
T3 — Power transformer to deliver a.c. voltages as follows: 435 volts each side of center-tap at 250-ma. d.c. load; 80 volts (single tap) for bias rectifier; 2.5 volts, center-tapped, at 10 amperes; 2.5 volts at 3 amperes, 5 volts at 3 amperes, 6.3 volts, center-tapped, at 1.5 amperes (Thordarson 73R30).
L1 — 7.2-henry, 120-ma. choke (Thordarson 7C49).
L2 — 22-henry, 35-ma. choke (Thordarson 18C92).
L3 — 13-henry, 250-ma. choke (Thordarson 75C51).
RFC — 2.5-millihenry, 125-ma. c.f. chokes.

QST for
tent when hum in the amplifier would arise from a slight a.c. content in the power supply output voltage.

Since the non-uniformity of 2A3 tubes has been the subject of some comment in discussions of push-pull power amplifiers, readers may desire an explanation of the reason for use of these tubes in an amplifier designed for better-than-ordinary performance. To meet this demand, measurements were conducted on a small assortment of 2A3 tubes of different makes and ages. Although much variation was noted in the static plate currents of different tubes at maintained grid and plate voltages throughout the operating range of the tubes, it was found that the change in plate current with a definite change in grid voltage was quite uniform for the assortment of tubes tested. Since the second-harmonic distortion produced in a push-pull amplifier of transformer output is dependent on the non-uniformity of dynamic characteristics of the tubes rather than on differences of static characteristics, the second-harmonic distortion generated in the output stage as a result of non-uniformity of the tubes will be smaller than the distortion contributed by other causes, and thus may be neglected in the choice of tubes.

Construction

The amplifier is built on a steel chassis measuring 17 by 10 by 2 inches. The arrangement of parts is planned for short, direct wiring, more for convenience than for reasons associated with the operation of the amplifier. The only precautions necessary in the wiring are that the input wiring (from microphone jack to grids of 6J7 tubes) be shielded, and that the a.c. leads be kept away from the circuits of the first two stages.

R.f. chokes are used to isolate the input of the 6J7 stage from radio frequency pickup in the microphone cable, which latter should be of the two-wire shielded type. The shielding braid of the cable and the shell of the microphone are grounded, and the two wire conductors of the cable are connected to the crystal element of the microphone (or to the high-impedance transformer winding in a velocity type). Resistors $R_1$ and $R_2$ shown in the circuit diagram of Fig. 2 serve as a voltage divider as well as a d.c. connection between grids and ground, so that only two wires are necessary to connect the output of the microphone to the amplifier input.

The two-section gain control, $R_3$, is provided with two complete separate elements operated by a single shaft, and has three connection lugs on each element. These lugs should be connected as pairs; the pair at the counter-clockwise ends of the resistance strips (viewing the control from the front panel) should be connected to ground, the pair of middle lugs should be connected to the grids of the first 6N7 amplifier, and the pair at the clockwise ends of the strips should be connected to the 6J7 coupling condensers.

The output transformer is provided with taps (only two connections are made to two jacks at bottom of the transformer) connected to jacks on an outside terminal board. Impedances corresponding to turns ratios of 1: 1, 1: 1.25, 1: 1.5, 1: 1.75, and 1: 2 are made readily available for matching almost any desired pair of Class-B modulator grids. By means of a terminal strip at the side of the chassis, two wires may be run directly to the grids of the Class-B amplifier, while a third wire (from terminal connected to the transformer secondary center-tap) may be used for application of fixed bias to the modulator grids, or may be grounded for zero-bias Class-B tubes. The fourth and fifth terminals on the strip are used as 110-volt a.c. terminals, to facilitate use of the amplifier for various purposes and to suit it to connection of power cables in a transmitter installation.

The 2,500-ohm semi-variable resistor provides for adjustment to −62 volts of the bias voltage applied to the 2A3 grids. In the amplifier shown here, this voltage was obtained with the tap on the resistor set for the full 2500 ohms. This would suggest the use of a resistor of 3000 ohms which might well be obtained at the beginning of construction of the amplifier, so that there is no danger of finding the available range of bias voltage too small. If no voltmeter suitable for measuring the bias voltage is available, the slider tap on this resistor should be set for a no-signal plate current of 40 ma. per tube. With the bias resistor setting determined, a plate milliammeter may be inserted in series with each 2A3 plate (the other three plates should be connected directly to the ends of the transformer primary winding during each measurement) and the no-signal plate currents of the four tubes at this bias may be determined. If it is found that one parallel pair of 2A3 tubes is carrying much higher current than the other pair, the tubes may be interchanged until the total currents to the two pairs are approximately equal. This is not a particularly important operation, however, as the previous remarks regarding unbalance of the tubes indicate, and is only suggested as a step to satisfy the most exacting builder.

WSQBW writes that it has been called to his attention that a flashlight-lamp antenna current indicator (QST, October, 1938) may be the cause of a chirpy signal when used in conjunction with a self-excited oscillator feeding the antenna. Comparatively few of these are in use nowadays, but it's a point worth remembering if a bulb should be used with one of them. It's not likely to occur with a crystal oscillator or m.o.p.a.
'Phone "Splatter"

Not all Broad 'Phone Signals Result from Overmodulation

BY DOUGLAS FORTUNE,* W9UVC

Those crackles extending out beyond the normal side-bands accompanying voice transmission may be caused by overmodulation — and again, they may not. So don’t be too sure that your 'phone is "sharp" when the oscilloscope says the modulation peaks are staying below the 100 per cent mark. How come? Well, read what W9UVC has to say about a prevalent, but overlooked, cause of 'phone "splatter."

At the present time there is a great deal of discussion concerning the broad signals so prevalent in our 'phone bands. It is a fair estimate to say that 95 per cent of all 'phone stations occupy more space in the band than they should, in spite of the fact that some operators conscientiously try to reduce the band width by limiting the frequency response of their speech amplifiers. Although this measure does help matters, the "splattering" still continues. This condition, although generally attributed to overmodulation, may be due to a number of causes. In reality overmodulation, by the very nature of the design of the average amateur transmitter, is often an impossibility.

"Splattering" is the result of any condition which causes the 'phone signal to occupy an exceedingly wide channel. Since the channel occupied is equal to twice the highest audio frequency, any audio distortion in the form of harmonics will tend to broaden the signal. Thus a 'phone transmitter modulated by a 400-cycle sine wave occupies a channel width of 800 cycles. However, if the 400-cycle signal should contain an appreciable amount of third-harmonic distortion, the highest audio frequency would be 1200 cycles and the band width 2400 cycles. The addition of the third harmonic has thus trebled the band width. For this reason "splattering" is due not only to overmodulation but also to excessive audio distortion, most frequently introduced in an overdriven Class-B modulator or driver stage. A step in the direction of eliminating "splattering" in the bands is through the use of automatic modulation control. This circuit, if operated in conjunction with a properly designed modulator, actually will increase the average side-band power and eliminate excessive audio distortion.

For a given amount of peak power, speech operation of a Class-B modulator calls for an average plate current of only one-half the sine-wave value as specified by the tube manufacturer. Since the Class-B plate current meter is the usual modulation indicator the amateur, in nine cases out of ten, "kicks up" the average speech plate-current to the sine-wave value. Under these conditions the power represented by the increase in average modulator plate current corresponds to an increase in average power without appreciably increasing the peak power. This in turn corresponds to alteration of the wave shape, or the introduction of distortion in the form of harmonics which broaden the signal.

Average vs. Peak Power

Fig. 1 shows the dynamic characteristics of the RCA 809. It may be seen that the characteristic

---

is fairly straight up to a grid voltage of 65 volts. However, beyond this point the characteristic bends sharply, with the result that above 65 volts an input signal of any wave shape will become flat-topped. At this point the grid impedance of the Class-B stage changes abruptly, and further flattening of the wave takes place in the driver stage. It should be noted that beyond 65 grid volts the peak current (from which peak power is determined) does not change appreciably although the average power, which is proportional to the area of the wave, increases rapidly. This may be seen more clearly from Fig. 2, which shows a sine wave, a flat-topped wave, and a square wave, the peak values of which are equal to E. The average value of each of the waves is different and is equal to the area under the wave divided by the base. It may be seen that as the wave form approaches the square wave the average power increases. Now it must be remembered that in a Class-B modulator the peak power is the limiting factor and the average power falls where it may, depending entirely upon the wave shape. If distortion is to be avoided in speech operation the average power must be equal to only one-quarter the peak value, and as a result the average power of speech, with peak power the limiting factor, is rather low in comparison to the sine wave or the square wave.

For modulation purposes it is important to have as high a value of average power as possible without distorting the wave by causing it to become flat topped. To this end broadcast operators "ride the gain," increasing the gain for weak signals and decreasing it for strong signals. If the gain is not varied but set so that full output power is obtained with the strong signal, the output will be below normal for the weaker signal. By the same token if the gain is set so that full output is obtained from the weak signal, overload and distortion will result on the strong signal. However, if the gain is varied with the signal, the average power is increased without distortion taking place. The same effect of "riding the gain" may be obtained automatically by means of an automatic modulation control circuit which maintains the speech amplifier output constant for any input signal above a certain level. In this manner the amplifier gain is high for low input signals, and it is decreased proportionally for high inputs, thus increasing the average power.

It is not the purpose of this article to show the automatic modulation control circuit, which has already been described, but a few words on the operation of such a circuit may be in order. For correct operation, the gain control should be advanced slightly beyond the point for normal operation so that on strong signals the rectifier circuit supplying the bias to the control tube will be brought into operation.

In using automatic modulation control, it is quite possible for the Class-B stage to be overdriven without overmodulation taking place, and as a result the amateur who has incorporated one of these circuits in his transmitter may be unaware of the "splattering" which he is causing.

In using the automatic modulation control circuit, it is safe to say that the circuit is not operating properly if the average modulator plate current, on speech, is much greater than one-half the sine wave value. If it is found that this is so, the Class-B plate-to-plate load may be reduced below its original value.

**Overmodulation?**

The fact that overmodulation is sometimes impossible may be seen from Fig. 3, which shows the familiar plate characteristics of the 809. The normal load line of $\frac{4400}{4}$, or 2100 ohms, is shown at $AB$. For an average sine-wave power output of 100 watts, the peak plate current is $\sqrt{200}$ or 2100 0.315 ma. at point X on the load line. The peak voltage developed across the load is 0.315 X 2100 or 660 volts, and the minimum plate voltage is thus 750-660 or 90 volts. The 660 peak volts across one-half the primary are transferred to the secondary of the modulation transformer to vary the effective voltage of the Class-C stage. If by a wild stretch of the imagination the 809 grids were driven sufficiently hard so that the entire voltage of 750 volts were effectively across the load, the transmitter would be modulated only $\frac{750}{660} \times 100$ or 114 per cent. In actual practice the minimum plate voltage would not drop much below the value of peak grid voltage (point Y) and the transmitter would be modulated $\frac{750-65}{660} \times 100$ or 104 per cent, so that even under ideal conditions this would not cause a great deal of "splattering." Poor regulation in either the a.c. line or in the power supply will tend to lower the value of minimum plate voltage. The primary resistance of the output transformer also tends to reduce this value since the voltage lost across the primary must be calculated from the value of peak current, which is usually high even for a medium-power modulator.

The tube manufacturer's Class-B rating is based upon theoretical considerations, and does

---

1 Plummer, Waller. "Negative-Peak Automatic Modulation Control for Plate Modulated Phone Transmitters," QST, October, 1937.
The Cairo Regs Go Into Effect

A Few Changes of Interest to Amateurs, Effective January 1st

BY KENNETH B. WARNER, WIEH

On the first of the New Year the changes in the international radio regulations adopted at the Cairo Conference go into effect except those relating to frequency allocations, which are not effective until September 1st next—and which have no application to amateur radio in the Americas, anyway. There is nothing very important in these other subjects, but there are a few details that we think will interest the active amateur.

We should perhaps first examine the question of the changes in the code characters for punctuation marks. These are not embodied in the new radio regulations, but originated in the telegraph conference held simultaneously in Cairo and were consented to by the radio conference. A.R.R.L. Hq. is having a great deal of difficulty in ascertaining the extent to which these changes will be adopted in radio procedure on January 1st—nobody seems to know. We know that they take effect on the land lines of Europe; it is probable that the international point-to-point radio circuits will adopt them; but it seems very questionable whether they will be put into effect in American domestic work, particularly in the maritime mobile service which is our closest relation in the commercial services. If the domestic commercial and government services adopt the changes, we of course shall want to also, but there is a general reluctance to change and we doubt its happening. So the dope at the moment is that, at least until further notice in QST, we of the A.R.R.L. are not adopting these punctuation changes.

An interesting change occurs in the Q code. You are all aware of the confusion in QSA meanings because signal strength and readability have been combined in one indication—the situation that impelled amateurs to the adoption of the RST system. The administrations now take a page from our book by separating these functions, assigning the strength indications to QSA on a 1-to-5 scale and the readability indications similarly to QRK. The following new practice is now established:

<table>
<thead>
<tr>
<th>Strength</th>
<th>Readability</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSA 1</td>
<td>QRK 1 — Unreadable</td>
</tr>
<tr>
<td>QSA 2</td>
<td>QRK 2 — Readable occasionally</td>
</tr>
<tr>
<td>QSA 3</td>
<td>QRK 3 — Readable with difficulty</td>
</tr>
<tr>
<td>QSA 4</td>
<td>QRK 4 — Readable</td>
</tr>
<tr>
<td>QSA 5</td>
<td>QRK 5 — Perfectly readable</td>
</tr>
</tbody>
</table>

Phone men who have retained the practice of making mumbo-jumbo about "QSA 4, R8," and so on, should find this new nomenclature preferable—if they feel they must use telegraphic abbreviations instead of saying it with words. In voice operating most of us prefer to talk about strength and readability, using those terms. For c.w. work, we'll be sticking to RST as preferable. But we thought you'd like to know the new meanings, to understand practice in the commercial mobile service.

Three uninteresting additions have been made on the end of the Q code:

QUK? means, "Can you tell me the condition of the sea observed at . . . (place or coordinates)?", while the accompanying meaning for QUK is, "The sea at . . . (place or coordinates) is . . . ."

In similar fashion, QUL? asks, "Can you tell me the swell observed at . . . (place or coordinates)?", while the companion answer QUL means, "The surge at . . . (place or coordinates) is . . . ."

QUM asks, "Is the distress traffic ended?", and QUM itself asserts that "The distress traffic is ended."

There is one new two-letter abbreviation, a useful one: TU means, "Thank you for the cooperation given." Being shorter, it is now probably preferable to our TNX and TKU.

Those of you who listen in on the maritime mobile service will be interested to know that, in addition to two forms of CQ, there is now to be a CP call. In amateur radio we use CQ as a general inquiry signal, ending the transmission with a K, but for our broadcasts of general A.R.R.L. information we use the call QST. The mobile service uses the inquiry signal CQ in just the way that we do, but they also use it, omitting the terminal letter K, for their broadcasts of information intended to be used by anyone who can receive it—that is, as a call to all stations without a request for reply. The new call CP is a restricted version of the latter use and is designated as a call to certain receiving stations without request for reply. The call is followed by two or more call

(Continued on page 111)
Another Method of Keying With Controlled Rectifier Tubes

BY BYRON GOODMAN, W1JPE

Those hams whose inclinations are toward pre-filter keying, but who have hesitated to oust a pair of perfectly good 866’s in favor of more expensive grid- or magnetically-controlled tubes, will find this article of interest. Only one controlled rectifier tube is needed — and the existing power supply is hardly disturbed.

PRIMARY keying of power supply transformers has enjoyed a certain amount of popularity because, keying through the power supply filter, it gives a “softness” that prevents thumps and eliminates clicks. One of its major disadvantages, especially in high-power circuits, is the bad sparking at the key or relay contacts due to inductive surges from the transformer primary. This disadvantage was eliminated by the introduction of grid- and magnetically-controlled mercury-vapor rectifier tubes, to be used in the regular full-wave rectifier circuits. However, there is a fairly simple way to retain the desirable characteristics of rectifier keying with only one controlled rectifier instead of the usual two.

The controlled rectifier tube can be used only in circuits where the anode voltage is reduced to zero during part of the cycle, otherwise when the current has once started flowing the grid can never again regain control. For this reason the tube cannot be used in ordinary keyer-tube applications or other d.c. circuits but it can be used in rectifier circuits. Ordinarily two are used in the usual full-wave rectifier circuit, where the anode voltage is zero during one-half of the

Fig. 2 — One method of applying a single controlled-rectifier to multi-stage keying.

T1 — Bias transformer, 300-volt each side, low current, insulated for total plate voltage.
T2 — Driver plate transformer.
T3 — Final plate transformer.
T4 — Keyed-rectifier filament transformer. 2½-volt, 10,000-volt insulation.
KT — Controlled rectifier tube. (Elmac KY-21 or Sheldon KY-866.)
C1 — .25 µfd., 600-volt paper.
C2 — 1 µfd. if driver uses high voltage and low current; 2 µfd. if driver takes low voltage and high current.
C5, C6, C8 — Final amplifier filter.
R1 — 30,000-ohm, 2-watt carbon.
R2 — 1-5 megohm, or high-voltage voltmeter.
R3 — Driver stage grid leak.

(Continued on page 118)
WITH THE AFFILIATED CLUBS

A.R.R.L. AFFILIATED CLUB HONOR ROLL

All members of these are A.R.R.L. members

Bridgewater Amateur Radio Association, Bridgeton, Conn.
Chester Radio Club, Chester, Pa.
Electric City Radio Club, Scranton, Pa.
Fellows Radio Club, Medford, Mass.
Huron Radio Club, Huron, S. Dak.
Kaw Valley Radio Club, Topeka, Kansas
Moncton Amateur Radio Club, Moncton, N. B., Canada
Mound City Radio Amateurs, St. Louis, Mo.
Norfolk County Radio Association, Norwood, Mass.
Northern Nassau Wireless Ass'n, Manhasset, L. I., N. Y.
O.B.P., Chapter No. 1, St. Louis, Mo.
Pendleton Amateur Radio Club, Pendleton, Oregon
Santa Clara County Amateur Radio Ass'n., San Jose, Calif.
The Northwest Amateur Radio Club, Des Plaines, Ill.
The Portland Seven's, Portland, Oregon
Valleym Radio Club, Eugene, Oregon
Yakima Amateur Radio Club, Yakima, Wash.
York Radio Club, Elmhurst, Ill.
York Road Radio Club, Glenside, Pa.

Affiliated Club Stations

The August, 1938 issue of QST carried a comprehensive list of calls of amateur stations operated by A.R.R.L.-affiliated clubs. Add to that list the following:

W3AQ Delaware Valley Radio Association
W5DIG Galveston Amateur Radio Club
W7AQ Yakima Amateur Radio Club
W9YB Purdue University Radio Club

A Challenge

The Northern Nassau Wireless Association would like to challenge other radio clubs to competition in the game of nine-pins, matches to be played via amateur radio. Clubs interested should communicate with the secretary, R. Weinmann, Hammond Road, Glen Cove, L. I., N. Y. . . .

The N.N.W.A. is looking ahead to increased activity and has recently purchased four lots (forming a strip 40 ft. by 250 ft.), upon which the Association hopes to build a club house.

Exhibit Stations

The Delaware Valley Radio Association set up and operated its station, W3AQ, at the Trenton State Fair Grounds (Trenton, N. J.) during the week September 25th-October 1st. The layout consisted of a 300-watt rack-mounted rig on 1622 kc., 'phone (for demonstration to John Q. Public) and a telegraph rig running 100 watts on 7236 and 3535 kc. (for traffic work). W3AQ tied in with A.R.R.L. and A.A.R.S. Nets, and many messages were handled for all parts of the United States and its possessions. The D.V.R.A. is stressing the Civic Radio Center-Emergency Station idea in Trenton, and a building fund already has been established for the erection of a club house and emergency radio station. The main purpose of the exhibit at the Fair was to acquaint the public with the useful work amateur radio is doing.

The Milwaukee Radio Amateurs' Club had an exhibit station at the Wisconsin Hobby Exp.

Manchester Radio Club

Through the cooperation of the Manchester Chamber of Commerce, the Manchester (Conn.) Radio Club has secured a permanent meeting place in the Hotel Sheridan. This is the result of activities of members during the hurricane and flood. As an expression of appreciation of the community, the Chamber has placed at the club's disposal their Board of Directors' room, which seats about forty, and a banquet hall that will seat about one hundred and twenty.

A combined "house-warming" and farewell party for Mr. and Mrs. J. L. Reinartz, W1QP, who have moved to Union, N. J., was held in the new quarters, November 2d, some 115 amateurs attending. Talent from broadcast station WTIC furnished the entertainment, and R. P. Alford, W1JAM, was toastmaster. ZL2JQ, visiting at A.R.R.L. headquarters, was in attendance, and told those present about amateur radio in New Zealand. A roast beef dinner was enjoyed by all.

Monthly Raffle

The South Jersey Radio Association raffles off a "no charge" door prize each month with the following aims: (1) To check membership and visitors; (2) to aid the membership committee in getting after new members; (3) To advertise A.R.R.L. and what it has done for the amateur -- the door prize is always League merchandise.

Emergency Preparedness

The Galveston Amateur Radio Club, W5DIG, is sponsor of the extensive Gulf Coast Storm Net, well known for its excellent performance during the storm season.

The Associated Radio Amateurs of Southern New England, W1AQ, has purchased a 110-volt (Continued on page 120)
There's no lack of information on the construction and use of equipment which will make compliance with the new amateur regulations, announced in December QST, easy. This article gives a few pointers, tells where to get the more detailed information you'll need if you:

1. have a modulated oscillator on five meters;
2. try to shoulder up to the last kilocycle in a band;
3. are in the 900-watts-input-or-more class.
If you don't qualify in any of these there isn't much to worry about.

Some Suggestions on Making Equipment and Practices Conform to New Requirements

Technical Aspects of the New Regs

* BY GEORGE GRAMMER,† WIDE

The new F. C. C. regulations affect the technical operation of amateur stations in three ways: In requiring a check of the transmitting frequency by means independent of the transmitter itself; in providing that the 56-Mc. band come under the same provisions with respect to frequency stability that have been in force for the lower frequencies, and in requiring measurement of input power when power in excess of 900 watts is used. Insofar as measurement of power and frequency are concerned, the new regulations simply constitute a statement of a principle that should have represented universal amateur practice anyhow, since the responsibility for staying within a band and for keeping within the power limit always has been with the individual. The principal difference now lies in the fact that blaming the crystal is no longer a valid excuse (if it ever was) in reply to a pink slip.

Let's take the three divisions separately and see what compliance involves.

Frequency Measurement

The regulation (Sec. 152.44) says that the transmitter frequency must be checked regularly by means independent of the transmitter itself, and of sufficient accuracy to ensure operation inside the band. This works no hardship on the man who does not crowd the edges. The frequency checks can be made readily with the station receiver, provided it is capable of giving a beat note on the transmitting oscillator. The average superhet easily will meet this requirement.

If the receiver is of the type having a general-coverage "band-set" dial with a separate band-spread dial tuning a low-capacity condenser gang, it will be necessary to note quite accurately the band-set dial setting which gives the desired spread. With a "standard" set of conditions, then, a frequency calibration curve can be plotted for the band-spread dial. The handiest thing for calibrating is a simple 100-ke. oscillator which can be set on frequency by checking against WWV or a broadcast station. Every ham ought to have—and use regularly—one of these gadgets, and now is a good time to build one if you haven't done it already. Nothing could be more simple or cheap, and it's a bare junk-box indeed which won't furnish most of the parts. It will give to a rather high degree of accuracy all the band edges which are even multiples of 100 kc.—better accuracy, certainly, than the receiver is capable of maintaining.

Now that we have the band edges and enough intermediate points to draw a calibration curve, it's a simple matter to make a frequency check. Turn on the transmitter oscillator, tune it in on the receiver, and note the dial setting. If it is well inside the band there's nothing further to worry about—provided you haven't picked the wrong harmonic along a string of frequency doublers! That certainly shouldn't be a factor if the transmitter is in regular operation, but is well worth keeping in mind in testing out a new rig.

Now just how much dependable accuracy does this checking method have? It depends upon a number of factors. The oscillator in a superhet is ordinarily a fairly stable job, so that it is quite safe to say that its frequency, if nothing in the receiver is changed, will not vary over 1 per cent from any predetermined value. With a decent dial, reset errors can be included in this figure. With a possible error of 1 per cent, the actual frequency may differ from that given by the calibration curve, for a given band-spread dial setting, by \( f \) kilocycles times 0.01, which comes out 35 kc. at 3500 kc., 70 kc. at 7000 kc., and so on. Since we don't know whether the error will be on the high- or low-frequency side, we have to assume the unfavorable case; that is, it is necessary to stay 35 kc. inside the edge at 3500, 70 kc. inside at 7000, 140 kc. at 14,000, and similarly on other bands. If this seems like chopping off a lot of ter-
ratory, remember this—you're depending upon a calibration which must be "safe" even if no signal can be heard in or near the band. Naturally, if a commercial marker station of known frequency, and whose position on the dial at the time of calibration is known, is on the air it can be used as a check on the calibration, and thus indicate the extent of the shift and its direction. Likewise, the 100-kc. oscillator can be brought into play if WWV or the broadcast station against which it is checked is on the air. Under these conditions, of course, the band edges can be approached with a great deal more confidence. But there are lots of times when no guideposts are at hand, and we have to be prepared to accept the resulting limitations when we operate in those hours.

If the transmitter is crystal-controlled and the crystal frequency is 10 kc. or more inside on 3.5 Mc., 20 kc. on 7 Mc., and so on, operation is pretty safe under any conditions if the receiver checks the frequency as being at its usual place in the band. The two independent frequency sources are considerably more reliable than one alone, provided they agree. It is not enough, however, to depend upon the crystal by itself.

With a small amount of preliminary work the dependability of the receiver easily can be determined. For instance, the drift under varying conditions of room temperature can be measured by comparison with a marker station or the 100-kc. oscillator. The reset accuracy can be similarly checked. The effect of disconnecting the antenna or reducing the gain to get a small enough signal can be observed. Adding all these things together (they may vary from band to band) will show the percentage accuracy that can be maintained over a considerable period of time.

In making these checks, don't forget that on cold winter mornings the slack temperature may be as much as 40 degrees below what it hits on a mid-summer day—the receiver won't forget to change its frequency accordingly.

The problem takes on a different aspect if the receiver is of the autodyne type. Here it is difficult, if not impossible, to determine with any reasonable accuracy where the transmitter frequency is in the band because the receiver usually blocks. In that case the transmitter must be tuned in on a separate monitor which can be calibrated by the means already described, picking up the monitor signal in the receiver for zero-heating against the calibration points. With reasonably good construction, the monitor becomes a quite satisfactory heterodyne frequency meter.

Speaking of heterodyne frequency meters, the average well-constructed instrument of this type will give somewhat higher accuracy than the average receiver, principally because it operates under a fixed set of conditions and hence can be made rather stable. It is not difficult to maintain the accuracy within 0.2 per cent, which will permit operating that much closer to the edges of the bands; up to 7 kc. from the edge at 3500, 14 kc. at 7000, and so on. This presupposes an initial accurate calibration, regular re-checking of the calibration, a readable dial, and use only after a warm-up period to minimize drift from temperature effects. More care, of course—but that is the penalty for the supposed advantage of working near the edge of a band. Information on calibration (the 100-kc. oscillator is best) and use of such a frequency meter will be found in the A.R.R.L. Handbook, as well as in the bibliography appended to this article.

Now for the chaps who shave kilocycles. There's no leeway here, and the highest accuracy that can be obtained is needed. The only apparent solution is the use of a good 100-kc. oscillator, adjustable to exact frequency by comparison with WWV transmissions and preferably checked against a broadcast station of known frequency stability when the Bureau of Standards transmissions are not available. A simple and inexpensive oscillator will suffice with continuous checking against a standard; the accuracy then will be nearly as good as that of the source. Without such checking it is no more dependable than the ordinary heterodyne frequency meter. The construction and use of such oscillators has been thoroughly covered in QST. Refinements such as a harmonic amplifier and a multivibrator which modulates the amplifier may be added, the latter particularly for measurement of frequency inside a band and for locating band edges, such as the limits of the 14-Mc. 'phone band, which are not exact multiples of 100 kc.

The preferred arrangement of this sort is one which uses a 100-kc. crystal oscillator. With reasonably-stable supply voltages, the frequency variation of such an oscillator will be determined almost wholly by the temperature coefficient of the crystal. If the oscillator is operated at low power so that heating from r.f. is not appreciable, the frequency change with normal room-temperature excursions will be much smaller than with a self-excited oscillator. However, the variation should be checked over a period of time against WWV so that the maximum shift can be determined, since in setting the transmitter frequency it is still necessary to allow for the variations in crystal frequency. These may be anywhere from a hundred cycles to over a kilocycle at 3.5 Mc. (or a few hundred cycles to 4 or 5 kc. at 14 Mc.) depending on the temperature range and the temperature-frequency coefficient of the particular crystal. Temperature control of the oscillator will go far to increase the 24-hours-a-day reliability. But even temperature control does not make such an outfit a second WWV, so use caution in sneaking up within a few hundred cycles of the edge.

Some useful information on the construction and use of a crystal calibrator is contained in
another article in this issue. A good deal of the discussion applies to the use of any 100-kc. oscillator, whether or not of the type actually described.

Finally, one more point must be considered when the transmitter frequency is near the edge. If the receiver or freq-meter used for checking is a.c. operated, the frequency of its oscillator is very likely to take a jump when the power goes on the transmitter — just one more factor which limits the accuracy with which measurements can be made, and in turn the distance one can legitimately go toward the edge of the band. When it comes down to a matter of cycles, it is doubtful if a reliable check is possible in the station itself; someone far enough away to get a relatively weak signal, and not affected by the same line-voltage variations, must do the job.

56-Mc. Transmitters

Speaking generally, compliance with the new stability requirements on 56 Mc. is likely to involve the use of crystal control, from preference although not from necessity. At any rate, the construction and operating technique of the lower-frequency bands must be adopted. These are familiar enough at 28 Mc., and their extension to 56 Mc. has been the subject of several QST articles. The chief difference is in greater care in the selection of tubes and in laying out circuits for greatest operating efficiency, both of which have been the subject of considerable discussion.

For those who want simple u.h.f. equipment a shift to the 112-Mc. band is imperative. The new regulation serves a double purpose, in that it gives much needed relief of congestion on 56 Mc. and also provides an incentive for occupancy of the, until now, neglected 2½-meter band. The new Handbook contains new data on the construction of more effective transmitters and receivers for this band, and there will be more to come in future QST's. In fact, 112 Mc. should be an ideal band for short-distance communication and emergency work, since interference from man-made static is negligible and the smaller antenna dimensions permit compact construction of effective antenna systems. And, although there has been no indication of it so far, who knows but that one of these days we'll be finding 2½-meter signals coming back from the ionosphere, just as they do now and then on five?

In thinking of u.h.f. work, don't forget that the frequency-measuring requirements apply here just as much as to the lower frequencies. The measurement technique described above can be applied to 56 Mc. quite readily, but on 112 Mc. and higher it would seem that Lecher wires constitute a good-enough check. Their use is explained in the Handbook.

January 1939

35
Selectivity With the 2-Tube Regenerative Receiver

When QST devotees read this story about a two-tube regenerative receiver with selectivity comparable to that of a superhet, I can almost hear the gust of Gargantuan laughter sweeping the ranks. All right, laugh! If I were the reader of this instead of the writer, I, too, would bray as loud as the loudest.

In QST for June, 1934, there was described a two-tube regenerative receiver— in my opinion, a receiver which is still "tops" in simplicity, low cost and performance. I believe it also appeared in some of the subsequent Handbooks. I made a lot of them. However, there were two drawbacks— lack of selectivity and the difficulty of fitting an antenna free from hum, especially on 20 meters. I recently wondered what would result if this set were made up pee-wee fashion something like the "QSL-Forty" transmitter. Not being an expert and so lacking that sometimes unfortunate gift of prophecy, the only way to find out was to try it and see.

1 Grammer, "What About the Simple Receiver?", QST, June, 1934.

Space is at a premium underneath the chassis, but with a little care all the parts can be fitted in.

The photographs show the set on a chassis 4 3/4 inches by 5 inches and 3 3/4 inches deep, and the thing sticking up from the antenna post is the antenna—a piece of 3/4-inch copper tubing 12 inches long. You might make it a couple of feet longer, if it does not project through the dining-room floor and interfere with the Old Man’s ankles as he dunks his morning doughnut.

I don’t like to refer to the set as a nice little portable (even if it be so) because the average rig called by that name is about as "portable" as an 8-hp. outboard motor.

Performance

Let’s get on with a little account of the performance of the set. I have here a list of c.w. stations located from coast to coast and from Florida to the Lakes, heard on this receiver. There isn’t any point in listing the calls; for one thing there is no space to spare, and you will have to take my word for it anyway.

Fig. 2— Chassis dimensions and drilling data. Folds are made on the dotted lines.
This little two-tube regenerative receiver is just about the same size as the "OSI Forty" transmitter described by the same author in February, 1938, QST. The rod antenna which has given such satisfactory results is visible at the right.

Fig. 1 — Circuit diagram of the compact receiver.

C1, C2 — 100-µfd. variable (Hammarlund MC-100-S).
C3, C4, C5 — 100-µfd. mica.
C6 — 5-µfd. 400-volt electrolytic.
C7 — 10-µfd. 50-volt electrolytic.
C8 — 0.01-µfd. paper, 400-volt.
C9, C10 — 0.005-µfd. paper, 400-volt (capacity not critical).
R1 — 0.5 to 5 megohms, 1-watt.
R2 — 50,000-ohm potentiometer.
R3 — 25,000 ohms, 10-watt.
R4 — 2000 ohms, 1-watt.
R5 — 1 megohm, 1-watt.
R6 — 75 ohms, center-tapped.
RFC — 2.5-mh. r.f. choke (National R-100).
L1 — See coil table.
L2 — 1000-henry choke (Thordarson T-29C27).

Note: C6 and C7 should not be over two inches long.

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Total Turns</th>
<th>Cathode Spread</th>
<th>Band- Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>1450 to 3400 kc.</td>
<td>544/4</td>
<td>37/4</td>
<td>2934</td>
</tr>
<tr>
<td>3050 to 7100 kc.</td>
<td>271/4</td>
<td>13/4</td>
<td>1134</td>
</tr>
<tr>
<td>6100 to 14,200 kc.</td>
<td>10 1/4</td>
<td>5/4</td>
<td>4/4</td>
</tr>
<tr>
<td>10,600 to 24,000 kc.</td>
<td>71/4</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>18,000 to 41,000 kc.</td>
<td>34/4</td>
<td>1/2</td>
<td>1/2</td>
</tr>
</tbody>
</table>

All coils are wound with No. 24 d.c.c. wire on 1¼-inch diameter forms, the length of the coil being 1½ inches in all cases. The figure in parentheses after each frequency range indicates the amateur band for which that coil is used. The taps are counted off from the lower or ground terminal.

January 1939

37
A Dual-Frequency Crystal Calibrator

Amateur radio, like other radio communication services, must keep in step with technological development. We amateurs are given a rather free hand in the use of our frequencies, but as our number increases and radio technique advances, higher technical standards of operation are required for our mutual benefit and for the comfort of services outside of our own frequency bands.

The amateur-band limits are definitely stated and are inflexible quantities — they are as precise as frequency can be determined. We are not supposed to work outside the limits specified, but some of us, through zeal for catching elusive DX, in an attempt to obtain an essentially clear channel or just from sheer carelessness, have let our operating frequencies slip "just a little bit" beyond the legal limits. This often causes interference with other radio communication services and results in severe criticism of amateur radio.

The new F.C.C. amateur regulations have placed the responsibility for maintenance of correct, frequency squarely on our shoulders. The particular rule states, in effect, that each amateur station must have some independent means for measurement of the transmitter frequency and must establish a procedure for checking it regularly. This means that an off-frequency citation from now on will really be a serious matter.

The frequency-checking device need not be in the actual possession of the station operator and need only be of sufficient accuracy to insure operation within the band limits. When the transmitter frequency is well within the band limits the station receiver can suffice, but when operation is very close to the band edges a precision frequency standard is necessary. Obviously, it is much better practice for each amateur to have his own checking apparatus rather than to depend on the generosity of a neighbor.

Frequency-Checking Equipment

The problem is, just what type of equipment should be used? Different types of frequency monitors have been described in past issues of QST, and each possesses certain advantages. The most accurate and dependable arrangement, however, is a low-frequency secondary standard the harmonics of which can be used to outline and subdivide the bands. Because the frequency of the standard can be checked against transmissions from WWV, it is a reliable device independent of calibration curves, charts, etc. It can be used in conjunction with the regular station receiver, thereby simplifying the equipment and at the same time affording flexibility.

It is usual practice to choose a frequency of 100 kc. for the secondary standard. This value provides adequate calibration points for general application, and is sufficiently high that the harmonics are usable at very high frequencies. One objection to this frequency, however, is the fact that a harmonic spacing of 100 kc. is small in relation to usual receiver dial calibrations at high frequencies. As a result, it is not difficult at the high frequencies to become confused as to which harmonic is which.

The difficulty of identifying harmonics can be

BY F. A. LENNNBERG, W8CQQ

This simple device generates 100-kc. harmonics up to 20,000 kc., and 1000-kc. harmonics up to 60,000 kc. The dual-frequency crystal can be seen in the center between the two tubes. Immediately in front of the crystal is the frequency adjusting condenser. At the left bottom is the 100-kc. inductance, L, and the tuning condenser C₁, for the 1000-kc. tank. The panel controls include R₁ and the three switches shown in Fig. 1.

— Sales Engineer, Biley Electric Co., Erie, Pa.

*A New Type of Frequency-Checking Device," QST, June, 1938.
eliminated through the use of two oscillators, one at 100 kc. and the other at 1000 kc. The procedure then becomes merely a matter of locating the 1000-kc. calibration points and then sub-dividing them with 100-kc. harmonics. This provides the necessary flexibility but complicates the apparatus.

It is a known fact that quartz crystals have two or more frequencies of oscillation. For instance, an X-cut crystal will oscillate at a certain frequency largely determined by its thickness and also at a much lower frequency largely determined by the length of the crystal along its so-called mechanical axis. If we intentionally grind an X-cut crystal to oscillate at 100 kc, on one dimension and at 1000 kc. on another dimension, we have a simple means for constructing a double-frequency calibration oscillator.

The manufacture of a dual-frequency crystal presents somewhat of a problem because the crystal dimensions in relation to frequency are somewhat interdependent. Changing one frequency by grinding will influence the other frequency of oscillation. It is not difficult to imagine the infinite patience and juggling ability which would be required to bring both crystal frequencies to exact specified values. This problem was solved by grinding the 100-kc. mode of oscillation so that the crystal frequency could be adjusted to exactly 100-kc. by means of a small variable condenser placed in parallel with it, and by allowing a grinding tolerance of 0.05 per cent for the 1000-kc. frequency. After all, the 1000-kc. frequency is largely for the purpose of providing sign posts along the way, and its absolute frequency therefore need not be precisely 1000 kc.

A Practical Calibrator

The crystal calibrator pictured was designed around a dual-frequency crystal. This device is simple, flexible and easy to construct. It is excellent for amateur frequency monitoring and for general calibration purposes. The output is rich in harmonics and either crystal frequency is instantly available by a mere flip of a toggle switch. Usable harmonics can be obtained up to 20,000 kc. from the 100-kc. frequency and through 60,000 kc. from the 1000-kc. frequency. The exact upper limit, of course, depends somewhat on the sensitivity of the receiving equipment employed. The oscillating frequency is practically independent of loading effects because electron coupling is employed.

The calibrator described here is a low-cost instrument capable of a rather high order of accuracy in locating the edges of the various amateur bands — at least those whose edges are multiples of 100 kc. The crystal oscillates in two modes to give 100- and 1000-kc. fundamental frequencies, the uses of which are — or should be — well known to the amateur fraternity by this time. Capable of adjustment to zero beat with WWV, the 100-kc. frequency can be maintained to a precision limited only by temperature and voltage effects, the temperature coefficient being approximately 10 cycles/Mc./degree C.

For wider frequency range (extending the 100-kc. harmonics to 28 and even 56 Mc.) and checking at closer frequency intervals, the oscillator output readily can be fed into an amplifier and multivibrator of the type described in June, 1938, QST.

Fig. 1 shows the complete wiring diagram of the instrument. Note that only a small number of inexpensive parts is required. Because the current drawn from the power supply is low, a resistance-capacity filter rather than an inductance-capacity filter is used. The filtering action is ample, since a 3-inch oscilloscope (without amplifier) connected to the d.c. output showed no trace of a.c.

A double-pole double-throw toggle switch, Sw1, is used to select the proper tank for either crystal frequency. It should be noted that this switch also disconnects condenser C6 when the crystal oscillates at 1000 kc. In the original model C6 was permanently connected across the crystal but it was found that the added capacity greatly decreased the activity at 1000 kc., and the crystal became quite sluggish in starting. Disconnecting C6 by Sw1 completely cured this difficulty. The leads between C6 and Sw1 should be kept reasonably short and placed to keep any stray capacity at a minimum. Since we are dealing with relatively low frequencies, however, it is not necessary to go to exceedingly great pains to keep all leads physically short.

For easy detection of the calibrator harmonics in a receiver, it is often advantageous to modulate the calibrator output. Modulation in this instrument is obtained by connecting the plate of the oscillator tube to the input of the power supply filter. Switch Sw2 provides instantaneous choice of a modulated or unmodulated output. The screen-grid of the 6F6 tube is always fed with d.c. to prevent frequency modulation which could occur were the screen also connected to the filter input at the same time.

The output control, Ra, is not essential but is advantageous in preventing receiver overloading, especially when the calibrator output is allowed to beat in the receiver with a weak incoming signal. For simplicity, Ra and the power switch Sw1 are combined into one unit. The operation
of the output control did not come up to expecta-
tions in the original model due largely to the fact
that no shielding of the output leads was used
and partly to radiation coupling between the
calibrator and the receiver. The use of a shielded
leads to the output terminal would undoubtedly
have increased the effectiveness of the control
several times.

The alternate attenuator diagrammed helps to
decrease the effects of radiation coupling be-
cause the receiver input sensitivity is reduced
at the same time that the calibrator output is
attenuated. This arrangement can be used to
advantage in amateur practice because it pro-
vides a simple means for shorting the receiver
r.f. input when the station transmitter is turned
on for a frequency check. The disadvantage of
the system, however, occurs when low output from
the calibrator is desired, since the receiver
sensitivity is reduced by the action of the attenua-
tor. Either attenuator has its advantages, but
the original arrangement is best for general cali-
brator purposes.

Switch Sw3 offers a simple means of discon-
necting the calibrator from the receiver without
disturbing the attenuator setting. The switch,
however, will be highly effective only when the
output lead is shielded to prevent stray pick-up
from the calibrator itself.

Preliminary Checks

The tuning condenser C1 for 1000 kc. is not
critical and can be adjusted without the use of
meters. Connect the calibrator to the receiver and
tune the receiver to some frequency at which a
1000-kc. harmonic should appear. Adjust C1
until the crystal oscillates and leave the adjust-
ment at a point where the crystal starts readily
when Sw1 is thrown to the 1000-kc. position.

To adjust the crystal frequency to 100 kc., tune
in WWV on 5000 kc. The standard frequency
schedules for WWV are published in each issue of
QST. WWV transmits on 5000 kc. (with 440-
cycle modulation) daily, except Saturday and
Sunday, between 4:00 P.M. and 2:00 A.M., E.S.T.
Couple the calibrator to the receiver and set
Sw3 for 100 kc. A beat note will be heard which is
the result of the 50th harmonic of the oscillator
beating against WWV. Adjust C5 until the beat
frequency reduces to zero. If the receiver is
equipped with an S-meter, the meter will follow
the beats when the frequency difference becomes
a matter of only a few cycles. By watching the
meter motion, you can easily determine when the
beat is reduced to zero.

If the adjustment is made when WWV is
modulated at 440 cycles, be sure that you observe
the beat between the carrier and the calibrator
harmonic. It is possible to obtain a beat against
one of the side bands and this, of course, is in-
correct. When the tone-modulation is broken for
a station announcement, the beat should remain
the same; if incorrect the beat will be 440 cycles.

Don't expect the calibrator to hold zero beat
for indefinite periods of time. Temperature
changes and oscillator voltage variations will
cause small shifts in frequency. This is to be ex-
pected and can be eliminated only by tempera-
ture control and the use of a voltage regulated
supply — refinements which are necessary only
if an extremely high degree of precision is wanted.

Calibrating

For calibrating a receiver, simply connect the
calibrator to the receiver antenna post and note
the dial settings at which the calibrator harmonies

![Circuit Diagram](image-url)
Note the simplicity of layout and wiring. The power supply is at the left and the r.f. end is at the right. The variable condenser in the center is in parallel with the crystal to provide a frequency adjustment. The r.f. output is fed to the feed-through insulator at the bottom of the picture. The single pie r.f. choke, at the center left, is L1. Sw2 is at the left top, Swa at the center, and Sw1 at the right.

appear. The use of modulation will assist in locating the harmonics. If the receiver has an S-meter, the dial setting for each harmonic can be accurately determined by tuning for maximum reading. It will, of course, be necessary to start from some known frequency in order to determine the frequency of each successive harmonic. This presents no particular problem because there is an ample supply of radio stations which will serve as markers. The frequency of the station need only be known to a degree sufficient for identification of the first calibrator harmonic to be used. All other frequencies, in a series, are then known because each successive harmonic differs from the preceding harmonic by the fundamental oscillator frequency. For instance, if the first harmonic used from the 100-kc. oscillator frequency is 7000 kc., harmonics will appear at 7100 kc., 7200 kc., 7300 kc., etc. Naturally, care must be taken not to skip a single harmonic for that would upset the calibration.

When working at low and medium-high frequencies, only harmonics of the 100-kc. calibrator frequency need be used. At high frequencies, however, it is best first to locate 1000-kc. points and then to subdivide them by harmonics from the 100-kc. frequency. This prevents confusion where the 100-kc. calibration points are close together and it would be easy to miss a count or two. Once the procedure is understood, a complete receiver calibration can be effected in a short space of time.

For calibrating a variable oscillator, feed the output from both the calibrator and the oscillator into a suitable receiver. Tune to each successive calibrator harmonic with the receiver and set the oscillator to zero beat with each harmonic. In this way the calibration can proceed at a rapid rate. Be sure that the fundamental of the oscillator rather than a harmonic is picked up in the receiver. Of course, harmonics of the oscillator can be used just as well, but calculations to correct for the harmonic order will be required.

The frequency of any signal can be determined with fair accuracy by interpolation in a receiver. Note the dial settings at which the signal and the two adjacent calibrator harmonics appear. Elementary arithmetic will then provide the answer. The final accuracy will depend upon the precision to which the dial readings can be determined and the linearity of the receiver between the measuring points.

For the uninitiated, it may be pointed out that interpolation is a process of determining an unknown by its relation to known values. Let us assume that the frequency to be measured appears at dial setting 26.6 while adjacent 100-kc. harmonics appear at 15.1 and 55.1. From the receiver calibration it is determined that the harmonic at 15.1 must be 3200 kc. while the harmonic at 55.1 must be 3300 kc. This means that the signal frequency must be between 3200 kc. and 3300 kc. There are 55.1 minus 15.1 or 40 dial divisions between the harmonics. The frequency difference is 100 kc., therefore each dial division represents 100 divided by 40 or 2.5 kc. Since the unknown signal is 26.6 minus 15.1 or 11.5 divisions higher than 3200 kc., its frequency must be 3200 kc. plus 11.5 times 2.5 or 3228.75 kc.

If the signal being measured is very near the edge of the band, it may be difficult to interpolate with reasonable accuracy. In this case, allow the signal and the calibrator harmonic to beat together in the receiver so that an audio-frequency note will be produced. The frequency of the note will then be the frequency difference between the signal and the calibrator harmonic. This frequency...
The Coaxial Vertical Radiator

An Improved Half-wave Antenna System for Low-Angle Radiation

BY JOHN J. LONG, W8ABX

The coaxial antenna installed at W8XAI, mounted on stand-off insulators on a wooden pole. This installation uses a commercial 3/4-inch concentric feed line. The lower quarter wave section of the antenna through which the line runs is two-inch tubing. Less expensive arrangements can easily be devised for amateur work. A portion of the ground screen is just visible at the bottom.

The antenna to be described was first used, so far as the writer knows, by the Western Electric company for their new ultra-high-frequency police transmitters. Although the antenna gives exceptional results, very little information has been available on why it works as well as it does. The explanation to be given later is simply that of the present writer. The results, however, are real — so real that any one wishing to operate on 5 or 10 meters will do well to put up such a rig.

Briefly, the antenna is a simple half-wave vertical dipole with the power fed into the center by running the concentric-line feeder up through the lower quarter-wave section of the dipole. This can be done by any number of mechanical arrangements, and two such arrangements, used experimentally at W8XAI and W8PK, will be described. W8PK operated on five meters and W8XAI on 31.6 Mc.

At W8XAI, a 3/4-inch isolantite-insulated coaxial line was used to feed the dipole. A piece of two-inch copper tubing was soldered to the end of the line by placing a disc of copper at the top, as shown in Fig. 1. The upper quarter-wave section was mounted on an insulator, and consisted of a piece of quarter-inch brass tubing. The whole assembly was mounted on insulators as shown in the photograph. The antenna power was 100 watts, and tests were made with different members of the WHAM staff and other listeners in Rochester, 16 miles away, to get information on how this antenna compared with a "J" type antenna which was formerly used. The new type of feeder system was so superior to the old that the improvement was very impressive.

The end-fed "J" type antenna is shown in Fig. 2, while the type used at W8XAI is shown in Fig. 3. This antenna feed system was quite unsatisfactory. On one test, the half-wave antenna was disconnected from the feeders and practically the same signal strength was reported as when the antenna was on, showing that the feeders were radiating considerable energy all by themselves! It so happened that the feeders were in a very unfavorable spot for doing much radiating, so most of the power was being wasted in heating the shielding on the building.

Ground Screens

We have been reading about the theoretical half-wave antenna erected over perfectly-conducting earth for so long, and never seeing one in operation, that we were pretty well disgusted with the theoretically-perfect antenna. It looked beautiful on paper but there just didn't seem to be any perfectly-conducting earth on this particular globe. We had some copper screen left over which was used for shielding our transmitter building, and which was supposed to be the last word in conductivity. We said, "Why not set up a piece of synthetic perfectly-conducting earth under our half-wave antenna and see what happens?" A test was made by placing this copper screen directly under the antenna, and reports at once showed that the theory was right, but that the earth as we know it was not so hot.

It is a simple matter to place a good ground screen at least a half wavelength in radius under a five- or ten-meter antenna. We wish it were as simple in the broadcast band!

Five-Meter Results

Before we get to the cracker barrel opinion on what happens with a vertical "J" antenna, let's see what W8PK did with a five-meter antenna built along the same lines.

He did not have a rigid piece of concentric line available so he made up the rig shown in Fig. 4.

* Chief Engineer, WHAM; 63 Sonora Parkway, Brighton, N. Y.
The concentric line consisted of a piece of low-grade No. 14 rubber-covered house wire pulled through a length of quarter-inch brass tubing. A piece of ½-inch copper tubing was soldered to the end of it, and the top quarter-wave section was an extension of the inner conductor. The whole assembly was suspended from the top by a regular antenna insulator.

The boys on “five” said it was as loud as a beam job that he spent considerable time building — minus the trouble of having to go out and turn it whenever he wanted a different direction. The thing puts an R9 signal into W8ABX, 18 miles away, on five meters. The beam job never did that. Maybe he didn’t have the beam operating at maximum efficiency, but that is the point — there are plenty of beams that are not working to the utmost! Just because the signals get weaker when the antenna is turned in the opposite direction is no sign that it is working efficiently in the direction at which it is pointed.

There was some doubt about the length of the lower quarter-wave section, but it was found by using a sliding sleeve on the outer tubing that the length was the same as that of the upper section, and came out exactly as calculated. Forty-eight inches for 56.5 Mc. will give you some idea of the lengths for other bands.

Why It Works

Now for some guessing: Apparently a vertical “J” type antenna with a vertical quarter-wave “Zepp” type matching section at the end of the half-wave antenna has voltage which is out of phase in each side 180 degrees. But looking at it from the antenna’s angle, the feeder becomes part of the antenna if it does any radiating itself. If this setup is operated above a ground, it is a ¾-wave antenna. A ¾-wave antenna has a very husky lobe of high-angle radiation and a weak lobe of practically horizontal radiation. This is so when the antenna is above perfectly conducting earth! Wasting all of the main part of the radiation in a high-angle lobe is not good “ham radio” at these frequencies. Anyway this new method of feeding is doing its stuff, so why worry with theory which is only correct when figured over perfectly-conducting earth — of which there is none!

To check the idea, a vertical dipole was supported from a concentric line out of the attic window at WSABX as shown in Fig. 5, thereby

This is a description of the new Western Electric antenna developed for U.H.F. police work. Installed at short-wave broadcasting station W8XAI, its performance was so evidently superior to the old “J” type that the hams on the staff just naturally had to give it a workout on amateur bands, with the results recounted in this article. It should be excellent for 5-meter work, since it is designed to give more intense low-angle radiation than it is possible to achieve with the more conventional forms.

---

**Fig. 1** — The coaxial antenna at W8XAI. Its performance is markedly better than that of the resonant-line fed antenna (Fig. 3) formerly used.

**Fig. 2** — The “J” antenna, showing a “net” standing wave on the matching section, because of current or phase unbalance. Radiation from the matching section will tend to raise the angle of radiation.

**Fig. 3** — The old W8XAI antenna, used before the coaxial antenna was installed.
eliminating the vertical matching section. This antenna gets better reports than were ever obtained with an end-fed job.

Remember this: An antenna with power being fed into it is not the same as a theoretical antenna in free space. If the feeders radiate any energy which will interfere with the radiation pattern of the antenna itself no one can tell what is happening without making an elaborate field-strength survey. This is not being done by the average amateur.

After all this talk you will probably say, "My antenna is the best one I ever tried." OK, but don't say we didn't tell you about the "theoretically-perfect" vertical half-wave antenna!

Erron's Note.—This article was written before the coaxial antenna had been described in print by its designer, Arnold B. Bailey, of the Bell Telephone Laboratories. Subsequently an article by Mr. Bailey appeared in the September, 1938, issue of Pick-ups, monthly publication of the Western Electric Company. The principle of operation is essentially as outlined by W8ABX, the intention being to eliminate radiation from the feeder system and, in the case of the common form of u.h.f. police antenna, from the grounded metal pole of which the top section is usually considered to be the radiating antenna. The inner surface of the quarter-wave tube can be considered to be an extension of the outer surface of the coaxial transmission line and does not carry current (except when power is coupled into it, as in the case of a nearby antenna). The outer surface, however, acts like the lower quarter-wave section of a vertical half-wave antenna; the current does not penetrate below the surface because of skin effect. The quarter-wave tube and the section of coaxial line it encloses can be looked upon as a high-Q circuit, so that a large potential difference appears between the lower end of the tube and the line proper. This is equivalent to placing a wave-trap in series with the lower end of the antenna and the outer surface of the concentric feed line, with the result that practically no power is transferred to the outer surface of the line itself; hence no current flows in it and it does not radiate.

Tests carried out by Bell Labs have shown that an average signal-strength increase of 8 db results when the coaxial antenna is substituted for the ordinary "J."

It should be pointed out that, except for reduction of feeder (and pole) radiation the coaxial antenna is not a more "efficient" antenna, in the sense that it radiates more of the power supplied to it than does the ordinary half-wave dipole. It is, in fact, still a half-wave dipole. Its greater effectiveness lies in the fact that it eliminates stray radiation and thus permits the dipole to approach its theoretical performance in concentrating radiation along the horizontal. In other words, more of the radiated power will be pushed along the ground — the place where it is wanted in the case of normal u.h.f. work. Since low-angle radiation is desirable for long-distance 28-Mc. work, the antenna should also be highly effective for DX as well as local work on that band.

Incidentally, W8ABX's suggestion of using a ground screen under the antenna is well worth considering, particularly at these frequencies. Several of the W8AM gang have found such screens to increase materially the effectiveness of the antenna, and at 56 and 28 Mc. the area to be covered is not large (a circle a wavelength in diameter at most). In a recent conversation, W8ABX suggested that a radius of 0.3 wavelength should be sufficient, since the current tends to concentrate at this point, and that tests had shown that going beyond this distance to a radius of a half-wavelength did not appreciably improve the results. — G. G.

\footnote{W8EBS reports that the use of a chicken-wire ground screen under his 10-meter rotary beam has improved the output very noticeably, making it better than the coaxial antenna, as would be expected. He also reports that the radiation angle could be changed to suit the station he was working, which also is according to the book. The screen should be a half wave below a horizontal antenna for lowest angle of radiation. Under a vertical antenna, the screen should be placed near the bottom of the lowest vertical element. — Arrows.}

Strays •

In your haste to see How's DX did you notice the dope on Regs? One concerns the Cairo Conference and the other clears up the technical difficulties of the FCC Regs.
Construction and Alignment of the Television Receiver

**R.F. and I.F. Coupling Units—Test Equipment—Performance Curves**

**BY C. C. SHUMARD**

In December *QST* the circuit of the superheterodyne television receiver was given, as well as a functional analysis of the various stages. In this article, the construction of the "hand-tailored" parts will be described. The alignment and operating procedure will be explained in detail.

**CONSTRUCTION**

**R.F. Input Stage Assembly**

In photo "A," the lower right-hand unit shows the r.f. and antenna coil assembly, with switch $s_1$ (refer to Fig. 2 of December *QST*) mounted on a 3-legged bracket above the coil form. Design data for the three coils $(L_1, L_2$ and $L_3)$ are given in Fig. 4. The coil form is made of thin-walled bakelite tubing. The single-turn antenna coil, wound with No. 14 enameled wire, has its output leads crossed over for a distance of about $\frac{1}{2}$ inch; the leads then go through separate holes in the chassis to the two-lug terminal strip mounted on the opposite side of the chassis. These leads are short enough to make the antenna coil self-supporting — it is not directly fastened to the coil form, except on the ground lug where the center-tap connection is made. Another view of this unit is shown in photo "B" (at left). The various by-pass condensers and resistors are mounted around the coil form, with very short leads.

It may have been noted that the parts list given in the legend of Fig. 2, December *QST*, is quite specific as to the particular parts employed. Many of the parts were carefully chosen for small physical size, so that they would go in the rather limited space available in the shielded units.

**Oscillator-Mixer Stage Assembly**

Photo "A" (upper unit) shows the oscillator-mixer coil assembly, with switch $s_2$ mounted at the top. Design data for coils $L_4, L_5$ and $L_6$ (circuit constants are referred to Fig. 2) are given in Fig. 5. The oscillator coils $L_5$ and $L_6$, wound with heavy enameled wire, are held in place by the pressure of the wire on the coil form, assisted by the short, stiff output leads soldered to nearby circuit parts. Coil $L_4$ is held in place by small soldering lugs riveted to the form at each end of the winding. Collodion, used sparingly, also helps to hold the windings in place. The coil form is of the same material as in the r.f. unit.

**I.F. Coupling Units**

The design of the four I.F. coupling units and of the sound-buffer coil assembly is quite similar, so that it is worth while to make a metal template for the "base plates" used in each of these units. This template, shown in Fig. 6, can also be used to mark the coil forms and shield cans for drilling. The material used for the base plates and coil forms is a special grade of hard rubber, "Radio X2B" compound, made by the American Hard Rubber Company, New York, N. Y. This material is used principally because of its low leakage, which is important in the i.f. coupling units in order to avoid leakage currents through the a.g.c. circuit. The dimensions of the base plates are $3\frac{1}{2}$ by $1\frac{1}{2}$ by $\frac{3}{8}$ inches.

Photo "C" shows an assembled i.f. unit, with the various condensers and resistors mounted around the coil form and on the base plate. Design details of the i.f. coils are given in Fig. 7, and are exactly the same for all four i.f. units. The i.f. coil forms ($3\frac{1}{2}$ long) are cut from solid, hard-rubber rods $\frac{3}{8}$ inch in diameter, made of the same hard-rubber material as the base plates.

---

* RCA Manufacturing Co., Inc., Harrison, N. J.

FIG. 3 FRONT VIEW DIMENSIONAL DRAWING—TELEVISION RECEIVER PANEL

A — 5/16" HOLE
B — No. 44 DRILL
C — 1/4" HOLE
D — No. 6 DRILL
E — No. 30 DRILL
F — No. 28 DRILL
G — 3/8" HOLE
H — No. 10 DRILL
C' — 1/4" HOLE FOR 3/16" KNOCKOUT
Sound Buffer Input-Coupling Unit

The input-coupling unit of the sound buffer stage is constructed very much like the i.f. units, as can be seen from photo "D." Coils design data for this unit (L7 and L8) are given in Fig. 8. The coil form is made of thin-walled bakelite tubing, as used for the r.f. coils.

Video Input-Coupling Unit

The two coils comprising the input coupling and compensating unit (L21 and L22) of the video amplifier stage are shown in photo "E." Design data for the windings are given in Fig. 9. The coil forms are similar to those used in the i.f. units. The inductance values of L21 and L22 are important. These coils, in conjunction with the circuit and tube capacitances present, compensate the video input circuit so that the desired video characteristics are obtained. No adjustment of the video input circuit should be necessary if the coil and layout specifications are followed closely.

Video Output-Coupling Unit

Photo "F" shows the output coupling and compensating unit of the video amplifier. Design data for inductance L23 are given in Fig. 10. The output compensation provided by L23 should be satisfactory where the Kinescope grid terminal is placed close to the video output network. Such placement minimizes the Kinescope input-circuit capacitance.

General Circuit and Wiring Considerations

The wiring of the receiver, in general, should follow good practice for ultra-high-frequency equipment. All h.f. grounds should be made direct to the chassis with the shortest possible leads. All leads carrying high frequencies should be kept reasonably clear of other wiring and circuit components.

The "hot" plate and grid leads of the r.f. oscillator, mixer, i.f. sound buffer, and video stages are wired with single strands of No. 30 wire, insulated with spaghetti tubing where necessary; in some cases, no insulation is used except where the leads pass through the chassis or through a shield can. The use of this small wire, carefully spaced from all grounded parts, is important in reducing unwanted capacitive effects.

One side of the common heater winding is grounded; the other side of the heater supply circuit is by-passed to ground directly at the socket of each r.f. and i.f. stage.

Test Equipment and Alignment Procedure

The exact alignment of a receiver is usually a laboratory operation. However, it is believed that if the specifications which have been given are followed closely, the alignment of the i.f. coupling stage will be the only job requiring special test apparatus. A calibrated oscillator covering the i.f. frequency band and a good vacuum-tube voltmeter are required, in addition to the auxiliary short-wave "sound" receiver mentioned in the preceding article.

Test Oscillator

A test oscillator covering a frequency range from about 8 to 14 Mc., and having an output voltage at low impedance adjustable up to about 0.3 volt, is necessary for the i.f. and sound-buffer line-up. It is, of course, also essential that the r.f. output voltage for a given attenuator setting should remain substantially constant throughout the frequency range employed.

An RCA Type 153 test oscillator was used to align this receiver. In using the Type 153 oscillator, it was considered desirable to make a slight change in its output circuit before starting the alignment procedure. A 40-ohm carbon resistor was inserted between R13 and R14 (see Figs. 11 and 12). The reason for this will be explained later. Two different methods of coupling the test oscillator to the receiver were employed. For i.f. unit No. 4, next to the detector, a fairly large signal voltage is required because the gain of only this one stage is effective. For the line-up of this stage, the oscillator is coupled to the i.f. tube grid by means of the coupling network C1, C2, and R3. The lead to C2 is broken at point "X" (see Fig. 12) and connected with a short lead directly to the oscillator output terminal marked "Medium." The same connection is also used for i.f. unit No. 3, the oscillator signal being suitably reduced by means of the attenuator, R12 (Fig. 11). The transmission line shown in Fig. 12 is not used for units 4 and 3, and is left unconnected at both ends during their alignment.

For the line-up of i.f. units Nos. 2 and 1, the transmission line, consisting of a short length of shielded wire having an impedance of about 50 ohms, is connected as shown in Fig. 12. The 40-ohm resistor previously inserted allows both.

Changes in Receiver Constants

Since publication of the television receiver circuit in December QST, further work with the receiver indicates that the following changes in circuit constants are advisable in the interests of better performance from the hum standpoint:

<table>
<thead>
<tr>
<th>Component</th>
<th>Old Value</th>
<th>New Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C7</td>
<td>50-µfd., 25-volt</td>
<td>100-µfd., 25-volt</td>
</tr>
<tr>
<td>C85</td>
<td>0.01-µfd., 200-v.</td>
<td>50-µfd., 25-volt</td>
</tr>
<tr>
<td>C70</td>
<td>0.05-µfd., 400-v.</td>
<td>0.002-µfd., 400-v.</td>
</tr>
</tbody>
</table>

Resistor R41 should be eliminated.

January 1939
the input and output terminations of the line to be made 50 ohms, which approximately matches the line impedance. The use of the line for the two high-gain stages permits the signal voltage to be applied directly between the tube grid and ground, and minimizes pick-up and feedback which might exist with direct wire coupling. The magnitude of the oscillator output voltage cannot easily be determined, but this is not essential. It is more important that the oscillator voltage should be substantially constant over the i.f. band.

Vacuum-Tube Voltmeter

Because of the very high frequencies involved, the vacuum-tube voltmeter employed must have a very low input capacitance. A v.t. voltmeter using a 954 Acorn tube was described in QST for May, 1935. An instrument of this general type is suitable for the alignment work. A sensitive microammeter should be used for the indicating meter. One requiring 200 µa for full-scale deflection is suitable. The v.t. voltmeter should be designed and calibrated for at least two ranges. The maximum voltage for these ranges should be about 0.8 volt and 2.5 volts. Space limitations preclude more complete information on the design of tube voltmeters, but good references dealing with this subject are available.

I.F. Alignment

With the test equipment all at hand, the alignment procedure can be started. The last i.f. coupling unit (No. 4) is, of course, first to be aligned. No connections need be made from the receiver to the scanning unit. As a preliminary, it is advisable to short-circuit the plate of the r.f. tube and of each i.f. tube (except V7) to the +B lead, by means of a direct wire jumper. Oscillator tube V5 can be left out of its socket. These precautions prevent any possible output from the shorted stages and do not seriously upset the voltages from the power supply unit. The general procedure is as follows:

Connect the common a.g.c. bias lead (see Fig. 2, December QST) to the -3 volt end of R55, instead of to R54, so that the tubes will get their bias, temporarily, direct from the power unit. Connect the test oscillator to the grid of V7, using the coupling method explained under "Test Oscillator." Remove the i.f. shield can, disconnect the high side of C63 (the detector plate-circuit condenser) and substitute the short v.t. voltmeter input leads to the 954, from the detector plate to ground. The 6H6 is left in its socket. Set C40 to about ¼ maximum capacity and replace the shield can. Adjust the test oscillator for a suitable output and set the v.t. voltmeter on its most sensitive scale. The voltage output or response curve of i.f. unit No. 4 can now be obtained.

For any i.f. stage, the output curve will have two peaks, as in Fig. 13-B, when proper adjustment is made. The frequencies at which the two peaks occur can be used as an "index" of the alignment. Fig. 13-B may be taken as typical of what is desired. The peaks on this curve occur at about 10.6 Mc. and 12.8 Mc., and will show quite plainly as maximum readings on the v.t. voltmeter as the test oscillator is tuned rapidly through the desired frequency range. The frequency range being covered should be mentally correlated with the v.t. voltmeter readings so that the general shape of the curve can be visualized readily without the curve actually being plotted on paper.

For the first trial, some curve such as Fig. 13-A may be obtained. Here, the low-frequency i.f. peak is very large and the high-frequency peak is almost non-existent. This type of curve indicates that the capacitance of C62 is too large. Curve 13-C shows the effect of too small a value for C62. Some intermediate setting of C62 should give the desired curve, 13-B.

It will be noted that this curve drops more rapidly at the 10.5-Mc. end than at the 13-Mc. end. This is the effect of the series-coupling circuit L19C62 (also of L10C54, etc.), which should tune to approximately 8.5 Mc. The nominal value of

---

1The probe type or "gooseneck"; QST, May, 1935, p. 90.
$C_{62}$ (also $C_{54}$, $C_{46}$, and $C_{35}$) is shown in the legend of Fig. 2 as 18 µµfd. If the actual value is less than 16.5 to 17 µµfd., the effect is to cut into the 10.5-Mc. end of the i.f. response curve. A value greater than 18.5 to 19 µµfd. will also be detrimental to the band-pass characteristic. Different condensers may be tried if the desired curve cannot otherwise be obtained. The values of the i.f. termination resistors ($R_{84}$, $R_{90}$, $R_{25}$, and $R_{20}$) are also important, and should not vary from the nominal figure by more than ± 5 per cent.

For the line-up of i.f. coupling unit No. 3, the grid circuit of $V_7$ is connected normally, the jumper is removed from the plate circuit of $V_8$, and the test oscillator is coupled to the grid of $V_6$ in the same manner as it was to $V_7$. The v.t. voltmeter is left connected across the detector input circuit for the entire alignment, inasmuch as only overall response curves ordinarily need be taken.

A representative overall curve of i.f. units Nos. 4 and 3 is shown in Fig. 14. The peaks here occur at about 10.5 and 12.5 Mc. This curve is obtained as for i.f. unit No. 4, except that both plate condenser $C_{52}$ and grid condenser $C_{55}$ are adjusted. $C_{52}$ should be used essentially to adjust the low-frequency peak and $C_{55}$ the high-frequency peak, although some effects on both peaks are produced by either adjustment. These effects may be readily checked by tuning the test oscillator fairly rapidly through the proper range and simultaneously observing the rise and fall of the v.t. voltmeter reading. The coupling units are so designed that only a small amount of the capacitance of either condenser should be required. It will be found that the peaks will become more pronounced and more easily checked on the v.t. voltmeter as more cascaded stages are lined up, because the overall curve represents the product of the gains of all the stages in operation.

January 1939
I.f. unit No. 2 should next be aligned according to the general procedure just described. The jumper across the plate circuit of V5 should not be forgotten, and must be removed. The test oscillator is coupled to the grid circuit of V5, using the coaxial line connected as shown in Fig. 12, and condensers C14 and C47 are adjusted. A typical overall curve for i.f. units Nos. 4, 3, and 2 is shown in Fig. 15.

Before i.f. unit No. 1 is adjusted, it is necessary to align the sound-buffer stage. It has been mentioned that the 1853 sound-buffer tube is used to prevent the oscillator of the sound receiver from feeding into the video i.f. stages, inasmuch as the frequency of the oscillator in the sound receiver is usually close to the video i.f. band. The sound buffer tube is not used for amplification of the sound i.f. signal, but it serves as a coupling tube in addition to its other function. For the alignment, proceed as follows:

Connect the antenna and ground terminals of the sound receiver to the 50-ohm termination (R16) of the sound-buffer transmission line, shown in Fig. 2. Disconnect the sound input lead (coming from the plate circuit of the mixer tube) at R13 and connect the free end of R13 to the test oscillator, using transmission-line coupling. Set the test oscillator at 11.25 Mc. (with 400-cycle modulation now applied) and tune the sound receiver to this frequency. Adjust C33 until the modulated 11.25-Mc. signal is a minimum in the sound receiver. This adjustment should be made at a low output level — that is, with a small oscillator signal and a low receiver volume-control setting — after the signal has once been tuned in. Next, set the oscillator at 9.75 Mc. and tune the sound receiver to this signal. Then adjust C35 until the signal is a maximum at a low output level. Repeat the entire procedure once more, starting again with the 11.25-Mc. modulated signal. This
should complete the adjustment of the sound buffer stage, so that its input lead can be reconnected to the mixer plate circuit.

The test oscillator should now be connected to the mixer input and i.f. unit No. 1 aligned, according to the procedure previously described for i.f. unit No. 2. After the proper adjustment of $C_{28}$ and $G_{s1}$, an overall i.f. curve similar to Fig. 16-A should be obtained. The mixer is thus used, for this step of the alignment, as an i.f. amplifier under mixer tube conditions.

It will be seen that the curve of Fig. 16-A substantially fulfills the requirements for the desired type of i.f. response, according to the theoretical considerations discussed in the preceding article. An effect of the sound buffer stage is to reduce the response variation over the i.f. band and to reduce the i.f. gain in the neighborhood of 13 Mc. This reduction of gain at the high i.f. (low video)
end of the video sideband is desirable in order to minimize overlapping of the low video frequencies, as pointed out in December QST (see Fig. 1). The tendency for such overlapping or "doubling up" of the low video frequencies is, of course, due in part to the fact that single-sideband reception is employed in the receiver.

The curve of Fig. 16-B gives the overall gain characteristic of the receiver, exclusive of the r.f. and video stages, with r.f. input to the mixer tube used to beat with the inserted oscillator signal. The oscillator frequency for this curve was set at 58.75 Mc.

When the alignment procedure has been completed and the final i.f. response curve has the desired characteristics, the vacuum-tube variations in the a.g.c. controlled tubes and is an important factor in obtaining the operating characteristic of the receiver, exclusive of the magnetic units, and the various receiver controls and circuits function just as described.

If, however, one of the electrostatic Kinescope and scanning units shown earlier is to be employed, some variations in procedure are required. In Figs. 3 and 4 (October QST) the external connection to the Kinescope grid is marked "Video Input." A 0.5-µfd. d.c. blocking condenser must be inserted in this lead before it is connected to the output terminal of the video amplifier in the picture receiver. With this capacitive coupling, the Kinescope receives its d.c. background-control bias from the Kinescope power pack, as shown in October QST, and not from the picture receiver. The receiver terminal marked "To cathode of Kinescope" and bias potentiometer R65 (Fig. 2, December QST) are thus not used with the electrostatic units. This means, of course, that the automatic background-control circuit in the picture receiver is not put to use, because of the "a.c. coupling" of the video input signal.

After the 0.5-µfd. condenser has been inserted in the Kinescope grid circuit, the picture receiver is connected to the other units as shown in the circuit diagrams, omitting the Kinescope cathode connection at the receiver. The chassis of the various units which go to make up the complete receiver should all be tied together with a good, low-resistance ground strap.

The antenna feeders, assuming a half-wave doublet antenna is used, consist of a twisted pair. The feeder leads are connected to the two antenna terminals provided on the picture receiver chassis. Switches S1 and S2 are set in the maximum-capacitance position (on C8, C9, C10 and C12), for a station in the 44-49 Mc. range.

The scanning circuits are put into operation as described in October QST, so that the rectangular picture area is scanned.

For locations where a strong signal from the transmitter is available, no particular difficulty should be encountered in tuning in the signal. Usually, an adjustment of the oscillator frequency (by means of C12) will bring in some signal. Once a signal is obtained, the effects of tuning, synchronizing, and the background control will readily be noticed on the Kinescope screen. One of the first steps is to tune the pre-selector and mixer controls until the signal is strong enough to obtain proper synchronization of the scanning oscillators with the transmitter. The background

(Continued on page 110)

THE Eighth Corps Area of the Army Amateur Radio System is comprised of the states of Texas, Oklahoma, Colorado, New Mexico, Arizona and a small corner of Wyoming in which is located Fort Francis E. Warren. This is, roughly, a little more than 22 per cent of the entire area of the United States, to be covered by the Corps Area Nets. Headquarters and the Net Control Station are located at Fort Sam Houston, Texas, near San Antonio.

The Eighth has had its share of disastrous emergencies. Hurricanes, floods and even ice storms as late as the winter of 1937-38 have tested the efficiency of the A.A.R.S. and its organization.

The reason so many good amateurs are in favor of traffic handling systems and nets is because these systems provide the necessary training to make an amateur operator an efficient operator. Traffic handling and drill periods make good operators better. Good operators are essential in an emergency because they know what to do more quickly and efficiently than those without training. For the benefit of everyone, amateur radio must be prepared to operate immediately at any given time.

Some good amateur operators hesitate to enroll in the A.A.R.S. for fear they will not have time to fulfill the drill period requirements. While there is no limit to the amount of time a member may devote to A.A.R.S. work, the Eighth Corps Area has defined for its members the minimum weekly requirements. These requirements are as follows:

1. Copy a broadcast from the Army Net Control station, WLM, Washington, D. C., once weekly on Monday nights.
2. Copy a broadcast from the Corps Area Net Control Station, W5OW, Fort Sam Houston, Texas.
3. Prepare a message to the State Net Control Station stating that the two above broadcasts have been copied.
4. Contact by radio the State NCS or his alternate and send him the message that has been prepared.

These four weekly requirements constitute a basis for scoring members under a system similar to baseball batting averages. Each item is a time at bat. Four hits each week give a member a batting average of 1,000. Members not having an abundance of time will find that the minimum may be held to as little as an hour each week if all goes well.

When a member has enrolled he is furnished with a copy of Circular No. 6. This circular is a combination of five pamphlets covering all the details found in drill practice, cryptography, etc. After a two months' probationary period, a member is issued a certificate of membership and enrolled in the active files of his particular State Net.

Normally, all stations in a state operate on the State Net frequency. This is usually in the 80-meter band on c.w., although some nets use phone and the 160-meter band. Drills are normally conducted on Monday nights but may be authorized at other periods of the week. In fact, several nets meet nightly for the exchange of traffic and ideas. The Corps Area Net, conducted by WLJ on 6990 kc. is open each evening except Sunday and traffic reaching WLJ is expeditiously handled through the Army Net.

The Net Calls and Spot Frequencies of the different states in the Eighth Corps Area are as follows: Colorado (CO) 3840 kc.; New Mexico (NM) 3702.5 kc.; Arizona (AZ) 3597.5 kc.; Oklahoma (OL) 3682.5 kc. and Texas (TX) 3657.5 kc.

The Army Net and Corps Area Net Broadcasts are made on Monday nights at the following times: WLM at 7:00 P.M. and 10:00 P.M. E.S.T., simultaneously on 3497.5 and 6990 kc. W5OW at 6:30 P.M. C.S.T. on 3790 kc. The Corps Area Broadcast is made twice, at 6:30 P.M. and 8:30 P.M. C.S.T. on 3790 kc.

Beginning with the April 1938 issue of QST, a cryptogram has appeared at the close of the A.A.R.S. activities article. Several of these have been quite difficult to solve. Eighty persons have submitted solutions as follows: April, 49; May, 23; June, 43; July, 27; August, 10; September, 3 and October, 1.

Following is this month's problem: UABUW WFUZN DUBAY DAOZC ATAPT EFVVFT EOGDG SDWII QWHP IGWIM KUVOA EIKFF JEOAJ MQQJG JIDMP IGXGU WFGCA UMDZW SSOFK EXXX

Correct solutions submitted to the Liaison Officer, A.A.R.S., 3441 Munitions Bldg., Washington, D. C., will be acknowledged.

W2KSF has finally found a use for his old variable condensers—he uses them as slicers for hard-boiled eggs!
2nd Annual “A.R.R.L.” QSO Party!

Fun and Fraternalism for Members—January 7th-8th (Sat.-Sun.)—Distinctive Membership Charms with Calls to be Awarded in each Section—Try Your Luck in Get-Acquainted Party for All Members—Start a QSO List, Call “A.R.R.L. de . . . ,” Use ’Phone or Telegraph.

Any Bands in This Activity

Members in each Section are invited to chat with as many other A.R.R.L. members (anywhere) as they can. The leading member station in each Section will receive his own call on the attractive watch charm medallions (illustrated) as soon as results have been analyzed.

Only A.R.R.L. Members are eligible. It is a family party for all of us members, a chance to see who our fraternity brothers are. CQ’s are out! The way to get contacts in this will be to send “A.R.R.L. de . . . .” In the course of a contact members will tell each other two things, the name of their Section¹ and the date their membership expires, month and year.

Log forms (not necessary) will be sent free on request to HQ., or rule your own, just three columns listing calls, Sections¹, dates. In radiotelephone contacts the Section, membership month and year will be named. No special order is required. The exchange can be a small part of the conversation. Radiotelegraph members will abbreviate Section names and use four numerals to show membership dates. “Conn. 0343” will mean “Connecticut Section, my membership good until March 1943,” for example. Information to be exchanged in every case comes right off your own League membership certificate or pocket card. Members will not enter in either a radiotelegraph or radiotelephone classification. Many use both.

Scores can be all by one mode, or part telegraph and part voice—and any combination of frequencies you like. Advance entry is unnecessary. Just take part and send in the list of members you worked with claimed score.

Starting Time: Saturday, January 7th, 0800 11 P.M. Greenwich; 3 P.M. PST; 4 P.M. MST; 5 P.M. CST; 6 P.M. EST or the equivalent at any point.

Ending Time: Monday, January 9th, 0801 8:01 A.M. Greenwich; 12:01 A.M. PST; 1:01 A.M. MST; 2:01 A.M. CST; 3:01 A.M. EST or equivalent.

Operate any 20 hours of the 33-hour party. State contest hours you did not operate if your score is over 10,000.

Scoring: 1 point for each complete set of information sent; 1 point for each set of data received and logged. No member can be worked to get more than one complete exchange for 2 points. The sum of points will be multiplied by the number of different Sections (and continents² outside field organization territory) in which at least one member has been worked and exchange effected. A convenient way to keep record of new and different Sections as you work them is to circle and number the name of the Section the first time it is written in your list.

A lot of fun assured. See how many members you can work on this January Saturday-Sunday weekend. And if you work anybody not a member, ask him “Why not?” It’s one of the big annual events. See you there.

—from F. E. H.

¹ See complete list of 71 A.R.R.L. field organization Sections, in this issue of QST. An insignia award is also available to the leading member in each continent (outside field organization territory). All members outside the field organization use the name of their continent instead of a section abbreviation. Note that CO-CM, K4-6-7, KA, and VO as well as W-VE members are in the field organization and cannot be also counted under a continental status. HQ. staff stations and WLAW will participate but are not eligible for awards.

² The multiplier is the sum of the number of Sections and continents outside the field organization territory in which at least one A.R.R.L. member is contacted. But a single multiplier times the sum of points gives the score. Example: W6XXX has completed two-way exchanges with 57 different stations located in 31 different A.R.R.L. Sections and Europe and Oceania. His multiplier is 33. Score? 2 X 57 = 114. 114 X 33 = 3762.

QST for
A Compact Crystal-Controlled 56-28-Mc. 'Phone Transmitter

A 25-Watt Input Band-Switching Unit Adaptable to Fixed-Station or Portable-Mobile Use

BY D. D. KAHLE,* W9AUF

With the ever increasing activity on the 5- and 10-meter bands, the writer felt that a small transmitter, suitable for both portable mobile and fixed station use and designed for quick changing between 5 and 10 meters, would be welcome to the ultra-high-frequency minded amateur. This unit has been designed with several unusual features, among which are a unique system of band-switching, a high-quality audio system, and a minimum number of parts consistent with good design and compact construction.

R.F. Section

The transmitter is built on a chassis measuring 7 by 7 by 2½ inches. The r.f. system consists of a 6V6 metal tube as a Tri-tet oscillator, operating from a 20-meter crystal, and an 807 final amplifier. The Tri-tet oscillator is conventional, and the only precaution necessary is that the cathode and output tanks should be well shielded from each other, since the cathode circuit tunes to a frequency fairly close to the output circuit. In the transmitter described, the cathode tuned circuit is mounted above the chassis while the output circuit is underneath. This is advantageous since the fact that the grid of the 807 comes out underneath the chassis makes an extremely short grid lead possible. A 250-milliampere (6.3-volt) pilot lamp in series with the crystal barely glows, showing a low value of crystal current. The plate current of the oscillator is about 25 ma. loaded.

The 807 is used as a straight amplifier on 10 meters or as a doubler for operation on 5 meters. The grid current is about 4 milliamperes, which is slightly more than needed on 10 but is just about the correct value to drive the 807 as a doubler to 5. It is important that an I.R.C. old-style resistor with the metal ends be used in the grid circuit of the 807. Resistors of the new insulated type, both 1- and 2-watt sizes, were tried but apparently the insulation loss at 10 meters is very high, because both heated so badly that the insulation cracked, even with no tube in the final amplifier. Only 2 milliamperes of excitation were obtained with the insulated type whereas 4 milliamperes are obtained with the old metal-ended type.

Ceramic material is used for insulation in the old type but the material in the new insulated type is evidently very poor for high-frequency use. Any resistor using ceramic insulation should operate satisfactorily. 1

The 807 socket is extended above the chassis to the top of the chassis so that the overall height of the unit with the 807 in the socket is 6½ inches. This allows the transmitter to be mounted in a standard 7-by-8-by-8 cabinet. A large hole is cut in the chassis to enable the shield, which is mounted on the socket, to extend above the chassis.

A novel system of band-switching was designed for simplicity. As shown in the diagram, a single coil, condenser and 2-gang isolantite-insulated 1 A good r.f. choke in series with the leak would prevent loss of this sort, since without the choke the resistor must carry r.f. as well as d.c. The insulated-type resistors have larger capacity in addition to the bakelite casing; both factors contribute to the greater loss as compared to the older type.—Ennor.

55

January 1939
switch are used in the tank circuit. In an attempt to improve the efficiency of the 56-megacycle tank circuit, series tuning was chosen. Since the output capacity of the tube and capacity of wiring, etc., is practically all the capacity needed for a tank circuit of proper LC ratio for 5 meters, the addition of any external parallel capacity results in high circulating current. Because of skin effect and higher resistance at ultra-high frequencies, this high current results in reduced power output. With series tuning, we eliminate the disadvantage of additional parallel capacity and allow the circulating current to flow through the plate and screen leads of the tube. Since the 807 is designed for maximum input at 60 megacycles, it is able to withstand these circulating currents through

The top-of-chassis layout. The final tank circuit is at the left, next to the 807 tube. Oscillator and cathode tank circuit occupy the right foreground. The small can just behind the crystal is the microphone battery case. Audio section is along the rear edge.

---

QST for
Although the tube efficiency may not be increased, the actual tank efficiency is undoubtedly increased.

For 10-meter operation, the condenser is switched in parallel with the coil, and a by-pass condenser is switched in from the "B"-plus side of the tank coil to ground. This arrangement results in a tank circuit of proper LC ratio for 10 meters. It is now seen that 5- to 10-meter band-switching is accomplished without any loss of efficiency, and it is highly probable that some efficiency is gained through the use of series tuning on 5 meters.

The tank condenser, 25-µfd. maximum capacity, tunes about three-fourths of the way in on 10 and one-fourth in on 5, using the same crystal. The plate current of the 807 at resonance, unloaded, on 10 meters is 8 ma. with 360 volts on the plate. On 56 Mc. it is about 22 ma. with the same plate voltage. The minimum plate current unloaded, however, is not a true indication of efficiency; the figures are given simply as a comparative value on which the amateur can base his own findings.

Audio Equipment

The speech amplifier and modulator were designed with the idea in mind of obtaining the best quality possible with standard parts. Two stages of speech amplification were used so that sufficient gain would be available for fixed station operation. The 6J7 pentode feeds a 6G6G pentode driver for a 6N7 modulator. A large amount of negative feed-back is used from the plate of the 6G6G to the cathode of the 6J7 to reduce distortion which develops in the pentode driver stage. The use of negative feed-back also cancels most of the hum in the first two stages and reduces the overall gain to a usable value for carbon-microphone operation. No decoupling filter is necessary in the 6J7 plate circuit. A 50- or 100-µfd. fixed condenser from cathode to ground in the 6J7 stage may be necessary to prevent r.f. feedback in the audio system, although it was not used in the original model. The 12,500-ohm 2-watt resistor is used to drop the plate voltage of the 6G6G to 180 volts. The 6G6G was chosen as a driver principally because of its better driving capabilities and lower heater current.

With the assistance of W9CJJ of KFEL, a complete test was made on the audio system. The results were surprising indeed. The unweighted noise level measured — 44 db. The overall response from the grid of the 6J7 to the secondary of the modulation transformer, measured from zero level at 1000 cycles, was found to be flat within 2 db from 50 to 12,000 cycles. The total harmonic distortion measured 9 per cent at 20 watts input to the final amplifier with 100 per cent modulation.

It may seem strange that a single-button microphone is used after all the talk about the high-quality audio system, but the microphone used is a telephone type F-1 which has excellent quality for a carbon microphone. However, the idea in mind in giving information on response, noise level and distortion is to show what can be obtained from standard low-priced components, negative feed-back and proper design. The type F-1 microphone, however, sounds very good on
the air. A used button will not sound nearly as
good as a new one, as those which have been in
telephone service have been operated above 1.5
volts and in a good many cases the carbon is
"frozen." Operating these buttons at 1.5 volts
improves the frequency response because of the
reduced current (about 10 milliamperes) through
the primary of the input transformer. These but­
tons are now available from the Western Electric
Company at a cost of $4.50. Since they operate at
such low current, a standard 1.5-volt flashligh­
t cell can be used to supply current to them.

The round object next to the Thordarson mod­
ulator-input transformer is the microphone bat­
tery case. It was made of two pieces of ½-inch
wall brass tubing. The plug-in part consists of a
piece of 1½-inch inside diameter by 2½-inch long
tubing, with a spiral flashlight spring soldered to
a piece of brass plate and the plate in turn sol­
dered to the tubing; after soldering, the excess
material is turned off in a lathe. A hole is cut in the
chassis, and a piece of bakelite with a brass ma­
chine screw filed off flat and inserted in it is
mounted underneath the chassis. This screw acts
as the positive terminal for the battery. A piece of
1½-inch inside diameter tubing is cut three-
fourths of an inch long and two spade lugs for
mounting are soldered on the inside. This piece
of tubing is drilled and tapped for a ½ screw
and the case countersunk for this screw. The
battery is inserted in the case and then slipped
into the larger ring which is mounted on the
chassis and the screw tightened, holding the
battery and case firmly in place. The case can be
chromium-plated for about 50 cents ... The head of
the holding screw comes out on the side of the
chassis, and a piece of bakelite in turn sol­
dered to the tubing; after soldering, the excess
material is turned off in a lathe. A hole is cut in the
chassis, and a piece of bakelite with a brass ma­
chine screw filed off flat and inserted in it is
mounted underneath the chassis. This screw acts
as the positive terminal for the battery. A piece of
1½-inch inside diameter tubing is cut three-
fourths of an inch long and two spade lugs for
mounting are soldered on the inside. This piece
of tubing is drilled and tapped for a ½ screw
and the case countersunk for this screw. The
battery is inserted in the case and then slipped
into the larger ring which is mounted on the
chassis and the screw tightened, holding the
battery and case firmly in place. The case can be
chromium-plated for about 50 cents. The head of
the holding screw comes out on the side of the
chassis, and a hole is drilled in the cabinet so the
battery can be removed without taking the chas­
sis from the cabinet.

The microphone "on-off" switch is incorporated
on the gain control.

For crystal microphone operation, it is neces­
sary that a pentode stage of preamplification such
as a 6J7 be added. The microphone battery case
and transformer should be removed to make
room for the tube, resistors and condensers. The
rest of the amplifier need not be changed. Nega­
tive feed-back is not necessary on the preampli­
fer stage as distortion should be very low. The
additional parts for a preamplifier stage will not
cost any more than the battery case and trans­
former and it would probably be well worth
while to use a crystal microphone if the transmis­
ter is to be used for fixed station operation most of
the time.

Power Supply and Metering
The entire unit is operated from a 150-mili­
amper 350-volt supply for fixed station opera­
tion. Although most amateurs have such a power
supply or the parts for one lying around, the cir­
cuit diagram and list of parts is given in Fig. 2
for those who would have to purchase one. The
regulation is excellent considering that at 25
watts input to the final, 100 per cent speech mod­
ulation does not kick the plate-current meter
downward. At 22 watts input, the plate voltage
drops to 380 volts and the plate current is about
66 ma. This input presents a load impedance of
5000 ohms to the modulator.

A vibrator supply can be made up for portable­
mobile operation by using two 75-milliamper­
300-volt units in parallel. The heater drain of the
transmitter is 2.6 amperes.

The oscillator plate, final grid, final plate,
and modulator plate currents are measured by
means of a 10-milliamper 350-volt meter and a 2-circuit
4-position switch. The shunts are made by buying
one Mallory-Edial 10-watt, 2-ohm wire wound
resistor and 4 extra clips. Three 100-milliamper­
shunts can be made from one resistor and soldered
across the switch terminals. It is very easy to
make these shunts. The ceramic tubing on which
the resistance wire is wound can be broken very
easily with a pair of side cutters and the clips put
on and adjusted with a standard 100-ma. meter
so that the 10-mil meter will read about 95 ma.
with the standard reading full scale. Then the
resistance wire can be filed off until 100-milliam­
 full scale reading is obtained. This system is
practically as cheap as the plug and jack system
and is much more convenient.

A 500-ohm resistor is connected across the
switch terminals measuring the grid current.
This resistor across the 10-milliamper movement
does not affect the meter reading and, of course,
the meter being shunted across it does not affect
the grid current to the final.

Antenna Coupling
For fixed station operation, link coupling is
used to an antenna coupling system. Fig. 3 shows
the diagram. This coupling system is very simple
and allows either tuned or untuned feeders of any
impedance to be matched to the transmitter.
Voltage-fed feeders are usually connected near
the ends of the coil while current-fed feeders are
connected closer to the center. By adjusting the
position of the clips on the twisted-pair line, any
degree of coupling can be accomplished. This
system is usually correctly tuned when the final
tank condenser tunes to resonance in the same
place loaded as it does unloaded. Care must be
taken to keep the clips in the same electrical

Fig. 3 — Antenna tuning unit.
L — 4 turns No. 12, diameter 1½ inches, spaced ½ inch.
C — 50-µfd., variable.
position on each side of the center of the coil. If tuned feeders are used on an antenna for 5 and 10 meters, and if they are voltage fed on both bands, then it is possible that no change in the adjustment of the clips will be necessary and only the condenser need be retuned. For portable operation, a better coupling arrangement would be had by tapping on the tank coil with a single-wire feeder.

The pictures show fairly well the parts placement and it is suggested that the constructional design be followed closely to insure efficient operation. No trouble should be experienced provided the circuit constants are duplicated. This unit operated exactly like the preceding "haywire" model with the exception of the r.f. feed-back as mentioned above. All ground and by-pass connections should be as short as possible, and in the r.f. stages should be made to the same point in each stage wherever convenient. It will be a simple, foolproof transmitter and with a reasonably good antenna will provide many reliable contacts.

Dual-Frequency Calibrator

(Continued from page 41)

Frequency can be estimated or, if desired, compared with some standard such as an audio-frequency oscillator, a piano or a mouth-organ.

The edges of the new 160-meter band and the 20-meter 'phone band are not multiples of 100 kc. They can be determined closely by interpolation, however, or with a strong signal, by performing the measurement at the second harmonic (1750 kc. \(\times 2 = 3500\) kc., 2050 kc. \(\times 2 = 4100\) kc.).

Images in Superhet Receivers

Other than the necessity for always starting with some known harmonic, there is an additional precaution which must be observed when the calibrator is used in conjunction with a superheterodyne receiver. Misleading calibrations or measurements can result from the presence of images. Unless the images are recognized and ignored, the calibration or measurement will be in error. Suppose we want to locate 7000 kc. with a 1000-kc. harmonic and the receiver i.f. is 465 kc. If the selectivity of the receiver is not extremely high, the 7000-kc. frequency will apparently occur at two points close together. One is correct, the other is an image of 8000 kc.

When the receiver is tuned to 7000 kc. the local oscillator is at 7465 kc. Now if the receiver is tuned to 6070 kc., the 7000-kc. signal may beat with the oscillator to produce the i.f. at 465 kc. and the same signal will be heard again at 6070 kc. (7000 kc. \(-\) (6070 kc. \(+\) 465 kc.) = 465 kc.). Similarly, the image of the 8000-kc. harmonic will appear at 7070 kc. Therefore, signals may be heard at 7000 kc. and 7070 kc., with 7070 kc., the image, being the weaker of the two. This is not too confusing with 1000-kc. harmonics but could be quite difficult with 100-kc. harmonics because of their closer spacing. With a 465-kc. i.f. and 100-kc. harmonics there would be an image 70 kc. above (or 30 kc. below) each calibration point. Fortunately, however, the natural attenuation of the 100-kc. harmonics with increasing frequency is sufficiently great so that, in most cases, the images are barely discernible.

The problem of images becomes more serious as the frequency is increased because the frequency difference between the image and the correct frequency becomes a smaller percentage and, therefore, the receiver selectivity to images becomes less. By careful observation, with the knowledge that images may be present, incorrect measurements will be avoided. Once the images are recognized, their presence will cause no great concern.

The various controls for the crystal calibrator were designed to provide flexibility so that the instrument can be placed on the operating table and permanently connected to the station receiver. In addition to their application for frequency measurement and checking, the calibrator can be used to indicate dead spots or low sensitivity areas in any one tuning range or seriously decreased sensitivity from one range to another. After the mechanics and technique of using the calibrator have been learned, the instrument will prove to be a valuable adjunct to any amateur station.

810

(Continued on page 19)

Below are given some of the manufacturer's data: Direct interelectrode capacities:

Grid-plate. ........................................ 4.8 µµfd.
Grid-filament. .................................... 8.7 µµfd.
Plate-filament. ................................... 12 µµfd.

Class-C telegraphy at maximum plate voltage:

D.c. plate voltage .................................. 2000 volts
D.c. grid voltage .................................. 160 volts
Peak r.f. grid voltage ............................. 300 volts
D.c. plate current .................................. 250 ma.
D.c. grid current .................................. 40 ma.
Driving power, approximate .................... 12 watts
Power output, approximate ..................... 375 watts

— T. M. F.

Strays

A lady to whom W2GVD recently delivered a ham message wrote a note of thanks and included, "I have a son in California who was an amateur once, but now is earning a nice salary and has his own home."

Cheer up, hams!!

January 1939 59
Twelfth Naval District, U. S. Naval Communication Reserve

BY LIEUT. (JG) RALPH A. JACK, N6FPW

The U. S. Naval Communication Reserve of the Twelfth Naval District, commanded by Lieutenant-Commander Henry U. Linkins C-V(S) USNR, has headquarters at 105 Market Street, San Francisco, Calif. Naval Reserve Radio Control station NDH is at NCR headquarters, NDO, the Reserve alternate control station, is located at Fresno, Calif. The District is divided into ten Communication Reserve Sections and 32 units. Sections average about 20,000 square miles and contain several units. The distances between Section District and Unit headquarters are on an average about 60 miles. The distance makes the radio work more interesting and simulates real communication situations where contacts must be made by radio. NCR Section headquarters are at San Francisco, Oakland, San Mateo, Fresno, Berkeley, Santa Rosa, and Marysville, Calif., and Elko, Nev., Salt Lake, Utah, and Denver, Colo.

Section Three, the San Joaquin Valley Section, has been selected as a typical example of the NCR sections and is described in this article. Headquarters are in the Naval Reserve Building at the Fresno Municipal Airport. The Section contains four units located respectively at Turlock, Fresno, Lindsay and Bakersfield, as well as the Section headquarters at Fresno. Units One, Four and Five are respectively 90, 65 and 100 miles from the Section headquarters. The diagram shows the radio circuits operating into and out of the Naval Reserve Building in Fresno. The arrows show direction of command, although traffic is handled both directions on all circuits. The Western Net, controlled by NPG, San Francisco, extends from Honolulu to Seattle and San Diego. The District Circuit, controlled by NDH, San Francisco, reaches from San Francisco to the four states, California, Nevada, Utah, and Colorado. Section Three participates in these circuits through NDO on the Western Net and CX12B on the District Circuit. Circuits confined to Section Three are the Section Circuit from Fresno to the four-unit headquarters at Turlock, Fresno, Lindsay and Bakersfield, and the unit circuits. The units each maintain two control or guard transmitters. One of these is on the Section circuit and the other is the unit control station. The unit control station contacts the individual radio stations of the members of the unit. Each unit conducts its own drill on its own frequency. Drills usually last two hours and are held weekly. For approximately 30 minutes Navy Radio NPG broadcasts naval reserve information to all members of the District. By means of the circuit plan it is possible to send information or dispatches from the District headquarters to any reservist at his own radio station in his home and receive answers via the other circuits in a short time. All communication is done on c.w.

The references made to stations and radiomen are made in their amateur station calls, although each radioman also has a Naval Reserve call assigned him for use on Navy frequencies. Each unit has several men enlisted as seamen who are training to become either radiomen or signalmen. This offers an excellent chance for young men who want to develop into radiomen or signalmen. They are given free training. Qualified radiomen are enlisted in rates as radiomen. Inquiries should be addressed to U. S. Naval Communication Reserve Commander, 105 Market Street, San Francisco, Calif.

Two interesting phases of the NCR work are the training duty at sea and at the Naval Reserve Aviation Bases, and the Emergency Com...

The site of emergency communications by N6DXG, N6ENA, N6FPW and N6GBT during snow disasters marooning several hundred people in the Sierra Mountains.
communication services rendered in cases of local
disasters. Many radiomen train annually as
radiomen on ships of the U. S. Navy at sea, or as
radiomen in planes of the U.S. Navy operating
out of Naval Reserve Aviation Bases. Section
Three radiomen have cruised to Alaska, China,
Hawaii, Panama, Mexico, South America, as
well as the coastwise cruises. As this is being
written, a Unit Three yeoman is on his way to
Honolulu on NCR training duty.

One of the most fascinating branches of the
work is the emergency communication service
which is performed whenever disaster strikes.
Many articles have appeared in QST about this
type of service, so only a summary is given here
of the emergency services performed by Section
Three during the last few years. Unit Five,
Bakersfield, furnished the emergency
communications needed for six days when a cloudburst
derailed and buried a portion of a train in the
Tehachapi Mountains. Unit Three provided
emergency communications when a California
State Prison Camp was cut off from the outside
world for weeks by exceptionally heavy snows.
Radiomen N6DXG, N6ENA, N6GBT, N6CLB
and N6FPW furnished communications
continuously until roads were reopened and 'phone
lines up again. The same combination handled
emergency communication service when it was
necessary to relay word back to snowplow crews
to open a little used road, covered with 12 feet
of snow at Hume Lake, so a woman could be
removed to a hospital in Fresno, 70 miles away,
for an emergency appendicitis operation. By use of
NCR radio circuits, word reached the California
State Highway Camp, isolated by snow and with
'tphone lines down. Roads were opened and the
woman was brought out and the operation
performed successfully all within eight hours.

All units have aided in Flood Emergency
communication work. Unit Three and the Section
Staff were called upon twice last winter for such
service. Members of Section Three Staff and of
Unit Three spent 82 hours in the air in searching
planes last spring, flying over snow-covered

mountains, searching for a lost airliner, passen­
gers and crew.

The U. S. Naval Communication Reserve
offers amateurs an opportunity to communicate
on circuits that really perform, an opportunity
to become proficient in radio communication
work, training duty as radiomen at sea with the
U. S. Fleet, training duty in the air as radiomen
in the planes of the Naval Air Bases, a chance
to be a part of an efficient emergency disaster
communication system and a rating in the Naval
Reserve that is recognized by the U. S. Navy.
The Naval Communication Reserve serves the
amateur as a large Radio Club with a local
chapter in his home town and chapters in most
of the cities of the United States. The Club is the
amateur's dream of the "Club with its own radio
station, circuits, club house and real operators
as members."

**Book Review**

*Electrolytic Capacitors,* by Paul McKnight Deeley;
276 pages, profusely illustrated. Cornell-
Dubilier Electric Corp., South Plainfield, N. J.
Written in a most readable manner by the chief
engineer of the Electrolytic Division of Cornell-
Dubilier Electric Corp., *Electrolytic Capacitors*
constitutes the first treatment of the subject
which may be called complete.

While it does not divulge details of processing which might
be termed "trade secrets," it is, nevertheless, an excellent
source of technical information on the theory, construction,
characteristics, testing and application of electrolytic capaci­
tors of all types. Numerous block drawings and charts are
used to illustrate the various steps in fabrication and to
demonstrate the influence of each of the many factors
involved.

The book concludes with an appendix describing the
construction of simplified measuring and testing equipment.

—D. H. M.
COUNTRIES

We are again running the list of countries used in computing the DX Century Club standings. The changes have been few and minor, amounting to the addition of several Pacific island groups (see last month's "How's DX?"). the consolidation of the British New Hebrides and French New Hebrides under one head (after it was determined that whether a French or English call is signed depends solely on the nationality of the operator!), and the deletion of Austria. Austria still counts, of course, under Rule 6 of the Club rules.

<table>
<thead>
<tr>
<th>Country</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aden</td>
<td>NA</td>
</tr>
<tr>
<td>Aegean Islands</td>
<td></td>
</tr>
<tr>
<td>Afghanistan</td>
<td></td>
</tr>
<tr>
<td>Alaska</td>
<td></td>
</tr>
<tr>
<td>Albania</td>
<td></td>
</tr>
<tr>
<td>Aldabra Islands</td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td></td>
</tr>
<tr>
<td>Andaman Islands</td>
<td></td>
</tr>
<tr>
<td>Andorra</td>
<td></td>
</tr>
<tr>
<td>Anglo-Egyptian Sudan</td>
<td></td>
</tr>
<tr>
<td>Angola</td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td></td>
</tr>
<tr>
<td>Ascension Island</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td></td>
</tr>
<tr>
<td>Azores Islands</td>
<td></td>
</tr>
<tr>
<td>Bahamas Islands</td>
<td></td>
</tr>
<tr>
<td>Barbados</td>
<td></td>
</tr>
<tr>
<td>Bechuanaland</td>
<td></td>
</tr>
<tr>
<td>Belgian Congo</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>Bermuda Islands</td>
<td></td>
</tr>
<tr>
<td>Bhutan</td>
<td></td>
</tr>
<tr>
<td>Bolivia</td>
<td></td>
</tr>
<tr>
<td>Borneo, Netherlands</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td></td>
</tr>
<tr>
<td>British Honduras</td>
<td></td>
</tr>
<tr>
<td>British North Borneo</td>
<td>VP8</td>
</tr>
<tr>
<td>Buelna</td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td></td>
</tr>
<tr>
<td>Burma</td>
<td></td>
</tr>
<tr>
<td>Cameroon</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td></td>
</tr>
<tr>
<td>Canal Zone</td>
<td></td>
</tr>
<tr>
<td>Canary Islands</td>
<td></td>
</tr>
<tr>
<td>Cape Verde Islands</td>
<td></td>
</tr>
<tr>
<td>Carolines Islands</td>
<td></td>
</tr>
<tr>
<td>Cayman Islands</td>
<td></td>
</tr>
<tr>
<td>Celebes and Molucca Islands</td>
<td></td>
</tr>
<tr>
<td>Ceylon</td>
<td></td>
</tr>
<tr>
<td>Chagos Islands</td>
<td></td>
</tr>
<tr>
<td>Channel Islands</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td></td>
</tr>
<tr>
<td>Choceon (Korea)</td>
<td></td>
</tr>
<tr>
<td>Christmas Island</td>
<td></td>
</tr>
<tr>
<td>Clipper Island</td>
<td></td>
</tr>
<tr>
<td>Cocos Island</td>
<td></td>
</tr>
<tr>
<td>Cocos Islands</td>
<td></td>
</tr>
<tr>
<td>Colombia</td>
<td></td>
</tr>
<tr>
<td>Comoro Islands</td>
<td></td>
</tr>
<tr>
<td>Cook Island</td>
<td></td>
</tr>
<tr>
<td>Coromia</td>
<td></td>
</tr>
<tr>
<td>Costa Rica</td>
<td></td>
</tr>
<tr>
<td>Crete</td>
<td></td>
</tr>
<tr>
<td>Cuba</td>
<td></td>
</tr>
<tr>
<td>Cyprus</td>
<td></td>
</tr>
<tr>
<td>Czechoslovakia</td>
<td></td>
</tr>
<tr>
<td>Danzig</td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
</tr>
<tr>
<td>Dominian Republic</td>
<td></td>
</tr>
<tr>
<td>Easter Island</td>
<td></td>
</tr>
<tr>
<td>Ecuador</td>
<td></td>
</tr>
<tr>
<td>Egypt</td>
<td></td>
</tr>
<tr>
<td>England</td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
</tr>
<tr>
<td>Estonia</td>
<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td></td>
</tr>
<tr>
<td>Falkland Islands</td>
<td></td>
</tr>
<tr>
<td>Fleming Island</td>
<td></td>
</tr>
<tr>
<td>Federated Malay States</td>
<td></td>
</tr>
<tr>
<td>Fiji Islands</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td></td>
</tr>
<tr>
<td>France</td>
<td></td>
</tr>
<tr>
<td>French Equatorial Africa</td>
<td></td>
</tr>
<tr>
<td>French India</td>
<td></td>
</tr>
<tr>
<td>French Indochina</td>
<td></td>
</tr>
<tr>
<td>French Oceania</td>
<td></td>
</tr>
<tr>
<td>French West Africa</td>
<td></td>
</tr>
</tbody>
</table>

Member Societies

INTERNATIONAL AMATEUR RADIO UNION

Headquarters Society: THE AMERICAN RADIO RELAY LEAGUE, West Hartford, Conn.

MEMBER SOCIETIES

- American Radio Relay League
- Asociación Amatorios Romani de Urdia
- Asociación Radioaficionada Italiana
- Canadian Section A.R.R.L.
- Ciekobexenami Amaniif Vallica
- Deutscher Amateur Sender und Empfangs Verein
- Enríquele
- Federation des Emetteurs Belges
- Irish Radio Transmitters Society
- Norwegian Radio Relay League
- Polnische Zwiazek Krotkofalowcow
- Radio Club de Cuba
- Radio Club Venezolano
- Radio Society of Great Britain
- Rode des Emetteurs Portugais
- Reesnu der Emitters Francais
- Union de Radioaficionados Españoles
- Union Suedo-norsk Amateur Radio Union
- Unión Española de Amateuros de la Telecomunicación
- Unión de Radiosindicados Españoles
- Unión Suiza de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unión Sueco-Noruega de Radiomásters
- Unió
<table>
<thead>
<tr>
<th>Country</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fritjof Nansen Land (Franz Josef Land)</td>
<td></td>
</tr>
<tr>
<td>Galapagos Islands</td>
<td>CZ</td>
</tr>
<tr>
<td>Gambia</td>
<td>D</td>
</tr>
<tr>
<td>Germany</td>
<td>D</td>
</tr>
<tr>
<td>Gilbert &amp; Ellice Islands and Ocean Island</td>
<td>FR1</td>
</tr>
<tr>
<td>Goa (Portuguese India)</td>
<td>CR8</td>
</tr>
<tr>
<td>Gold Coast Colony (British Togoiland)</td>
<td>CR8</td>
</tr>
<tr>
<td>Gough Island</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td></td>
</tr>
<tr>
<td>Greenland</td>
<td></td>
</tr>
<tr>
<td>Guadeloupe</td>
<td>FG8</td>
</tr>
<tr>
<td>Guam</td>
<td>KB6</td>
</tr>
<tr>
<td>Guernsey</td>
<td>G</td>
</tr>
<tr>
<td>Guinea, British</td>
<td>V93</td>
</tr>
<tr>
<td>Guinea, Islands (Surinam)</td>
<td>FZ</td>
</tr>
<tr>
<td>Guiana, French, and French</td>
<td>F85</td>
</tr>
<tr>
<td>Guineas, Portuguese</td>
<td>CR5</td>
</tr>
<tr>
<td>Guineas, Spanish</td>
<td></td>
</tr>
<tr>
<td>Haiti</td>
<td></td>
</tr>
<tr>
<td>Hawaii</td>
<td></td>
</tr>
<tr>
<td>Hejaz</td>
<td></td>
</tr>
<tr>
<td>Honduras</td>
<td></td>
</tr>
<tr>
<td>Hong Kong</td>
<td>V66</td>
</tr>
<tr>
<td>Hungary</td>
<td>H5</td>
</tr>
<tr>
<td>Iceland</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td></td>
</tr>
<tr>
<td>Iran (Persia)</td>
<td>EP</td>
</tr>
<tr>
<td>Iraq (Mesopotamia)</td>
<td>Y1</td>
</tr>
<tr>
<td>Ireland (Northern)</td>
<td>GI</td>
</tr>
<tr>
<td>Irish Free State</td>
<td></td>
</tr>
<tr>
<td>Isle of Man</td>
<td>G</td>
</tr>
<tr>
<td>Italy</td>
<td>I</td>
</tr>
<tr>
<td>Jamaica</td>
<td>PK5</td>
</tr>
<tr>
<td>Japan</td>
<td></td>
</tr>
<tr>
<td>Jarvis Island, Palmyra group</td>
<td>KG6</td>
</tr>
<tr>
<td>Java</td>
<td></td>
</tr>
<tr>
<td>Johnston Island</td>
<td>KE9</td>
</tr>
<tr>
<td>Kenya</td>
<td>VQ4</td>
</tr>
<tr>
<td>Kenya, Madagascar Islands</td>
<td></td>
</tr>
<tr>
<td>Kuwait</td>
<td></td>
</tr>
<tr>
<td>Lucadive Islands</td>
<td></td>
</tr>
<tr>
<td>Latvia</td>
<td>YL</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>LX</td>
</tr>
<tr>
<td>Macau</td>
<td>CR9</td>
</tr>
<tr>
<td>Madagascar</td>
<td></td>
</tr>
<tr>
<td>Madeira Islands</td>
<td>CT3</td>
</tr>
<tr>
<td>Maldives Islands</td>
<td>V69</td>
</tr>
<tr>
<td>mailbox</td>
<td></td>
</tr>
<tr>
<td>Manchasucuo (MX)</td>
<td></td>
</tr>
<tr>
<td>Mariana Islands</td>
<td></td>
</tr>
<tr>
<td>Marshall Islands</td>
<td>J9</td>
</tr>
<tr>
<td>Mauritania</td>
<td>V98</td>
</tr>
<tr>
<td>Mauritius</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td></td>
</tr>
<tr>
<td>Michael Island</td>
<td></td>
</tr>
<tr>
<td>Midway Island</td>
<td>KD8</td>
</tr>
<tr>
<td>Miquelon and St. Pierre Islands</td>
<td>FPS</td>
</tr>
<tr>
<td>Monaco</td>
<td></td>
</tr>
<tr>
<td>Mongolia</td>
<td></td>
</tr>
<tr>
<td>Morocco, French</td>
<td>CN</td>
</tr>
<tr>
<td>Morocco, Spanish</td>
<td>EA9</td>
</tr>
<tr>
<td>Mozambique</td>
<td>CR7</td>
</tr>
<tr>
<td>Nepal</td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td></td>
</tr>
<tr>
<td>Netherlands West Indies (Curacao)</td>
<td>PJ</td>
</tr>
<tr>
<td>New Caledonia</td>
<td>FR8</td>
</tr>
<tr>
<td>New Hebrides</td>
<td>FO8, YJ</td>
</tr>
<tr>
<td>New Guinea, British</td>
<td></td>
</tr>
<tr>
<td>New Guinea, French</td>
<td>PK6</td>
</tr>
<tr>
<td>New Guinea, Territory of</td>
<td>V95</td>
</tr>
<tr>
<td>New Guinea, Territory of Port.uguese</td>
<td></td>
</tr>
<tr>
<td>New Hebrides</td>
<td>FO8, YJ</td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
</tr>
<tr>
<td>Niue</td>
<td>ZR2</td>
</tr>
<tr>
<td>Non-Federated Malay States</td>
<td>V83</td>
</tr>
<tr>
<td>Norway</td>
<td>LA</td>
</tr>
<tr>
<td>Nyassaland</td>
<td>ZD8</td>
</tr>
</tbody>
</table>

**January 1939**

<table>
<thead>
<tr>
<th>Country</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oman</td>
<td></td>
</tr>
<tr>
<td>Palau (Pelew) Islands</td>
<td>ZC8</td>
</tr>
<tr>
<td>Panama</td>
<td></td>
</tr>
<tr>
<td>Papuas Territory</td>
<td></td>
</tr>
<tr>
<td>Paraguay</td>
<td>ZP</td>
</tr>
<tr>
<td>Peru</td>
<td>OA</td>
</tr>
<tr>
<td>Philippine Islands</td>
<td></td>
</tr>
<tr>
<td>Phoenix Islands</td>
<td>VR6</td>
</tr>
<tr>
<td>Pitcairn Island</td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td></td>
</tr>
<tr>
<td>Portugal</td>
<td>CT</td>
</tr>
<tr>
<td>Principality of San Thome Islands</td>
<td></td>
</tr>
<tr>
<td>Puerto Rico</td>
<td></td>
</tr>
<tr>
<td>Reunion Island</td>
<td>FR8</td>
</tr>
<tr>
<td>Rhodesia, Northern</td>
<td>VQ2</td>
</tr>
<tr>
<td>Rhodesia, Southern</td>
<td>ZE</td>
</tr>
<tr>
<td>Rio de Oro</td>
<td></td>
</tr>
<tr>
<td>Romanaia</td>
<td>YR</td>
</tr>
<tr>
<td>Rota</td>
<td></td>
</tr>
<tr>
<td>Salvador</td>
<td>VS</td>
</tr>
<tr>
<td>Sardinia</td>
<td></td>
</tr>
<tr>
<td>Samoa, American</td>
<td></td>
</tr>
<tr>
<td>Samoa, Western</td>
<td></td>
</tr>
<tr>
<td>Sarawak</td>
<td></td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td></td>
</tr>
<tr>
<td>Scotland</td>
<td>G3</td>
</tr>
<tr>
<td>Seychelles</td>
<td>VQ9</td>
</tr>
<tr>
<td>Siam</td>
<td></td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>ZD8</td>
</tr>
<tr>
<td>Socotra</td>
<td></td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>VR4</td>
</tr>
<tr>
<td>Somaliland, British</td>
<td>VQ5</td>
</tr>
<tr>
<td>Somaliland, French</td>
<td></td>
</tr>
<tr>
<td>Somaliland, Italian</td>
<td></td>
</tr>
<tr>
<td>South Georgia</td>
<td>VPS</td>
</tr>
<tr>
<td>South Orkney Islands</td>
<td>VPS</td>
</tr>
<tr>
<td>South Shetland Islands</td>
<td>VPS</td>
</tr>
<tr>
<td>Southwest Africa</td>
<td>Z58</td>
</tr>
<tr>
<td>Soviet Union:</td>
<td></td>
</tr>
<tr>
<td>European Russian Socialist Soviet Republic</td>
<td></td>
</tr>
<tr>
<td>White Russian Soviet Socialist Republic</td>
<td>U2</td>
</tr>
<tr>
<td>Ukrainian Soviet Socialist Republic</td>
<td>U5</td>
</tr>
<tr>
<td>Transcaucasian Socialist Federal Soviet Republic</td>
<td>U6</td>
</tr>
<tr>
<td>Uzbek Soviet Socialist Republic</td>
<td>U8</td>
</tr>
<tr>
<td>Turkmen Soviet Socialist Republic</td>
<td>U8</td>
</tr>
<tr>
<td>Asiatic Russian S.F.S.R.</td>
<td>U8</td>
</tr>
<tr>
<td>Spain</td>
<td></td>
</tr>
<tr>
<td>Straits Settlements</td>
<td>VSI</td>
</tr>
<tr>
<td>Sumatra</td>
<td></td>
</tr>
<tr>
<td>Svalbard (Svalbergen)</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td></td>
</tr>
<tr>
<td>Syria</td>
<td></td>
</tr>
<tr>
<td>Taiwan (Formosa)</td>
<td>J9</td>
</tr>
<tr>
<td>Tanganyika Territory</td>
<td>VQ3</td>
</tr>
<tr>
<td>Tangier (Zone)</td>
<td></td>
</tr>
<tr>
<td>Tannu Tava</td>
<td></td>
</tr>
<tr>
<td>Tasmania</td>
<td>V7</td>
</tr>
<tr>
<td>Tibetan</td>
<td></td>
</tr>
<tr>
<td>Timor, Portuguese</td>
<td>CR10</td>
</tr>
<tr>
<td>Togoland, French</td>
<td>FDS</td>
</tr>
<tr>
<td>Tokelau (Union Islands)</td>
<td></td>
</tr>
<tr>
<td>Tonga (Friendly Islands)</td>
<td>VR5</td>
</tr>
<tr>
<td>Transjordan</td>
<td>ZCI</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>VPS</td>
</tr>
<tr>
<td>Tristan da Cunha</td>
<td>ZU9</td>
</tr>
<tr>
<td>Tunisia</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
</tr>
<tr>
<td>Turks and Caicos Islands</td>
<td>VPS</td>
</tr>
<tr>
<td>Uganda</td>
<td>VQ9</td>
</tr>
<tr>
<td>United Kingdom of South Africa</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>W1</td>
</tr>
<tr>
<td>Uruguay</td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td></td>
</tr>
<tr>
<td>Virgin Islands (Island)</td>
<td></td>
</tr>
<tr>
<td>Wake group</td>
<td></td>
</tr>
<tr>
<td>Wales</td>
<td>OJ</td>
</tr>
<tr>
<td>Windward Islands</td>
<td>VPS</td>
</tr>
<tr>
<td>Wrangel Island</td>
<td></td>
</tr>
<tr>
<td>Yemen</td>
<td></td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>YU</td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
</tr>
<tr>
<td>Zanzibar</td>
<td>VQ1</td>
</tr>
</tbody>
</table>
A Signal-Metering Valve

A Different Approach to the Limitation of Signals and Noise Peaks in Receivers

BY H. O. TALEN,* W9PYQ

A variety of methods has been developed for limiting the signal and noise peaks which blare out of our loudspeakers and earphones so unexpectedly at times. Some of the devices are applicable to the intermediate frequency channel in a superheterodyne receiver, others to the detector or audio channel, but very few to the high-frequency circuits in the receiver.

The circuit arrangement to be described is one which was evolved during a series of experiments with a 14-Mc. receiver of the tuned r.f.-regenerative detector type. It has not been tried out here in a superheterodyne line-up as yet.

The Problem

Automobile sparks, static and heavily modulated carriers have a natural but disconcerting way of getting into and through the first tuned circuits of the receiver. Fading signals, especially those which "fade in" to an R9+++ are equally distressing with a receiver which has little or no automatic gain control action.

It has previously been pointed out by J. J. Lamb that the limitation of signal and noise peaks should take place in the earlier circuits in the receiver, before the high-Q tuned circuits are reached. The difficulty involved depends primarily upon the insensitivity and relatively slow response of the majority of limiting devices available. The usual methods involving additional bias on the grids of the r.f. or i.f. tubes appear inadequate and difficult to apply at high frequencies, as numerous attempts have shown.

The Approach

An r.f. amplifier is usually operated as a Class-A amplifier designed to permit signal-voltage excursions somewhat in excess of those required to handle the signal levels ordinarily encountered. For this reason noise peaks, etc., come through without much hindrance. If the grid voltage range of the input circuits is too limited, cross modulation effects and partial demodulation may be expected.

In spite of these threatened disadvantages, it was decided to experiment with an r.f. stage with severely limited grid voltage range, and if possible, to make use of any rectification which occurred on voltage peaks to reduce the amplifier gain with a minimum of time lag. In any event, the control tube, or "signal metering valve" was to be followed by a regenerative detector and audio channel (or i.f. amplifier) to bring the signal up to the required level.

A little attention to the radio textbooks brought out the fact that opposite changes in plate current are produced by grid-leak detectors and plate or grid-bias detectors, i.e., strong signals cause a decrease of average plate current in the former, but an increase with the latter type. It was learned also that a grid leak detector may be expected to produce about three times as much change in average plate current as a grid-bias detector.

Bridge Circuit Possibilities

In order to make use of the characteristics mentioned a bridge circuit, in which the opposite effects would tend to balance the branches, suggested itself. A double triode was chosen for the first trial, even though feedback troubles could be expected. Accordingly, the circuit shown in Fig. 1 was set up, using one of the triodes as a grid-leak biased amplifier and the other as a cathode-resistor biased amplifier, both expected to operate at times as rectifiers.

It will be noted that the grids are driven in phase and that the two plates are connected to opposite ends of a unidirectional center-tapped winding in such a manner that the fields produced by the two plate currents will cancel each other.

* 5532 Tennessee Ave., St. Louis, Mo.
1 J. J. Lamb, QST, February, 1936, and April, 1936.

Fig. 1—Circuit arrangement of the signal-metering valve, using a double triode. In the author's receiver this circuit is inserted between a tuned r.f. stage and a regenerative detector. The coils have the usual constants for interstage applications; in the output circuit, L1 has three turns each side of center-tap, L2 14 turns total, for operation in the 14-Mc. band. Other constants are as follows:

- C1 = 100 µfd.
- C2 = 0.005 µfd.
- C3 = 250 µfd.
- R3 = 1 megohm.
- R5 = 5000-ohm variable.
- X = tap for negative feedback (see text).
The man with an autodyne receiver ought to turn out to be a pretty good operator—he has to cope with so many things, such as noise and interference, which the superhet owner has a chance to overcome. Except for audio limiters, practically all noise-reducing circuits have been aimed at owners and builders of superhets. The experimental circuit described here, however, is an exception—it can be used with either type of receiver, and it should not be hard to add it to a plug-in coil t.r.f. set. Certainly worth a trial if you’re in a noisy location.

other, more or less. Assuming that the characteristics of the triodes are identical, and that they are operated at the same grid and plate voltages, the cancellation of the fields should be substantially complete, which is borne out fairly well in practice. By shifting the operating point of either triode with respect to the other, signals will be passed through because of the unbalanced condition.

Demodulation and Cross-Modulation

A milliammeter in the cathode lead of the signal valve shows a tendency to follow the modulation on strong signals, indicating demodulation of the peaks. For this reason and others, it is to be expected that the individual plate circuits carry harmonic currents, portions of which do not balance out in the common return to the cathode. However, the resultant signals, judged by the loudspeaker output, have not suffered sufficient distortion to make them any less acceptable, without being hyper-critical about them. Part of the explanation may lie in the fact that the “knee” of the resultant curves C in Fig. 2 becomes decreasingly sharp as minimum gain is approached. The least demodulation will occur when operating midway between the knee and plate current cut-off, a point dependent more or less on the operating conditions otherwise chosen.

During the time that the signal valve has been in use, no moderate cases of cross-modulation have been observed which could be attributed directly to this part of the receiver. As usual, the very powerful local ‘phone signals effectively blanket any weak signals in their vicinity on the band.

Choice of Tubes

The experiments with the signal metering valve conducted to date have been confined to the use of the double triode, admittedly to save the work of installing an extra socket and the wiring for a pair of r.f. pentodes. The latter tubes should cause less trouble from feed-back between the plates and control grids. In the triode set-up, the plate coils must be kept reasonably small, should be close wound and placed near the ground end of the following grid coil.

As a further means of controlling oscillation in the triode signal valve, the by-pass condenser, C₄, from the center tap of the plate coil was disconnected from ground and connected about ¾ of a turn from the ground end of the triode grid coil (point X in Fig. 1). This is an application of the circuit trick discussed in an article in QST for March, 1938, giving negative feed-back of currents in the plate return lead. With this arrangement, which may or may not give exact neutralization, the triodes become stable enough to work between a regenerative r.f. pentode and a regenerative detector without interlocking of the two except when the regenerative gain in the first circuit is materially advanced.

The grid circuit of the signal valve tunes rather broadly due to the loading effect of the grid-cathode resistances. In a superheterodyne or other receiver with automatic gain control voltage provided by means other than that described here, the signal valve circuit with both grids biased directly, instead of having one of them biased by grid leak, could be incorporated either as an r.f. or an i.f. amplifier. In the latter application, the need for providing a center-tapped plate coil would not present the same difficulties as in the high-frequency end, particularly in a multiband receiver.

In Fig. 2 are shown some grid voltage-plate current curves to illustrate the effects which may be expected from the arrangement in Fig. 1. For the sake of simplicity, no consideration is given to the fact that the plate current of the grid-leak triode (A) depends upon the combined effect of the signal voltage and the bias developed across the leak by the grid current.

In Fig. 2 (b), the triodes have equal bias and


![Fig. 2—Illustrative grid-voltage plate-current curves for the double triode.](image)
the "gain curve" is a horizontal line, C. In Figs. 2(c) and 2(d), the curves have been separated by increasing the cathode bias on triode B. The grid leak of triode A is returned directly to the common cathode connection and the bias developed on grid A is substantially independent of the change in voltage drop across the cathode resistor $R_s$, within limits.

As the difference in bias is increased, the resultant curves (C) begin to have sufficient slope to indicate amplification through the signal valve. Strong signals and noise peaks can be amplified to the full extent of the slope, beyond that they can cause little change in the net voltage fed to the next stage, and accordingly the peaks are cut off or suppressed so far as the following circuits are concerned. In practice, the limitation of the peaks is readily appreciated, and the absence of noise crashes and blaring signals is a pleasant relief for which the price paid is a loss of part of the overall gain otherwise available from the r.f. stage devoted to control purposes.

If the bias on triode B is gradually made less negative than that on grid A, a similar series of effects would be obtained, as in Fig. 2(a). It may be necessary to apply an actual positive bias to the grid of triode B to obtain a sufficient separation of the characteristic curves.

**Automatic Gain Control**

As mentioned, the triode A, with grid-leak bias, tends to shift its operating point to a lower plate current, which is equivalent to moving its operating curve to the right. The decreased current should have the effect of lowering the voltage drop across the cathode resistor, thereby reducing the bias on triode B. The latter triode, on the other hand, will tend to draw a higher current, equivalent to moving its curve to the left by a relatively small amount. The net effect (when the bias on B exceeds the bias on A) is to reduce the slope of the resultant curve C, and therefore to reduce the effective gain of the signal valve. The length of the "linear" portion of the slope also decreases to a certain minimum which is a function of the curvature of the $E_p-I_p$ characteristic of the triodes near plate current cut-off.

The net decrease in plate current caused by a strong carrier can be observed on a milliammeter in the cathode or plate lead, and amounts to as much as 10 per cent of a total current of from one to two milliamperes. The a.g.c. action, if any, on weak signals is important only as it concerns fading, and no experimental proof of such action has been attempted.

The proper setting of the adjustable cathode resistor, $R_s$, can be found readily enough by observing the point at which minimum signals are obtained, and then increasing the resistance until a satisfactory signal level, or the maximum tolerable noise level, is reached. The "minimum" setting depends upon the value of grid leak $R_t$ and the plate voltage used. In the experimental set-up, a one-megohm leak worked more satisfactorily than a half megohm or two megohms. The plate voltage was kept at about 90 volts, which may or may not be the optimum value.

**Volume Expansion**

From the foregoing discussion, it is apparent that a limited degree of "volume expansion" could be obtained by operating grid $B$ at a more positive potential than grid $A$. It may also be noted that, when the biases are adjusted for low output with a.g.c. action, a strong carrier will reverse the relation of the biases and volume expansion will occur, particularly on modulation peaks. Under these conditions, the louder signals on the band come through with very little background and heterodyne noise. Transient peak voltages continue to be limited by the signal-valve action.

"Phone "Splatter"

(Continued from page 69)

not take into account practical limitations usually encountered in actual practice. As a matter of fact, it is safe to say that because of the above considerations most amateur stations cannot be modulated 100 per cent. The remedy for the above condition lies in decreasing the Class-B plate-to-plate load, thus increasing both the peak current of the tubes and the value of minimum plate voltage. Although this procedure will cause overload for a sine-wave signal, for speech purposes the tubes are operating well within their average-current and plate-dissipation limits. In fact, it is possible to obtain a considerable amount of speech power by decreasing the plate-to-plate load to the correct value. In conclusion, the intelligent use of the automatic modulation control circuit and the correct adjustment of the Class-B modulator will result in a clear-cut understandable signal which requires a minimum of bandwidth and which causes a minimum of interference to adjacent channels.

When W1TS sent his msg nr 73 in the recent SS Contest, W7CMB replied with his nr 88. When 1TS sent his msg nr 88, VE9GT answered with his msg nr 73.

W2QY says, "The wiring arrangements of too many ham transmitters are not so well suited for the label 'Underwriter's Approved' as for the version 'Undertaker's Approved'!"
During the past year or two, Our Hero has uncovered many worth-while kinks of general interest in his search for solutions to his various problems. He feels, however, that the purpose of the Problem Contest would be better served if others brought their problems out into the open. He believes there are many knotty problems of general interest which pop up from time to time in the experiences of other amateurs.

If you have a problem of general interest, or know of someone who has such a problem, why not jot it down on a card and mail it to the Problem Contest Editor, QST, West Hartford, Conn., and see what the gang can do with it? Even if you already have a solution, perhaps a better one can be found.

We shall endeavor to use as many as possible of the problems submitted. How about it?

ANTENNA SWITCHING WITH CONSTANT LOADING

It will be remembered that Problem No. 22 (see QST for October) involved switching the transmitter to any one of several antennas of various types and, at the same time, maintaining constant transmitter loading so that the transmitter might be switched quickly from one system to another without adjustments of any kind.

All solutions received ran along similar lines. A separate antenna tuner is provided for each antenna system. Low-impedance lines lead from the antenna couplers to the switching arrangement, and thence to a link, coupled to the output-amplifier tank circuit. Some means, such as a variable link, is provided for each antenna tuner so that coupling may be adjusted to the desired degree.

Fig. 1 shows various antenna-coupler arrangements. The arrangement at A is especially suitable for medium-impedance transmission lines although it is sometimes used with tuned lines. The system at B will be recognized as the series-parallel tuner used commonly with tuned lines feeding Zepp or center-fed antennas. At C is shown the method of coupling to a simple voltage-fed antenna or to a single-wire transmission line. An antenna fed with a low-impedance cable line needs no adjusting coupler as indicated at D. W8OMM suggests the arrangement shown at E in which variable condensers are eliminated by the use of a variable-inductance coupler.

In A and C, the tank circuit should be capable of tuning to resonance at the operating frequency. At B, the size of the coil will have to be adjusted experimentally for the feeder length and frequency at which it is to be used. The size of the variable inductance coil at E will also depend upon the characteristics of the line with which it is to be used. The inductance should vary from 0.25 to 1 microhenry per meter for medium low-impedance lines. For tuned lines, the inductance should vary from about 5 microhens per meter to zero, depending upon feeder length.

The various schemes for switching the low-impedance link lines from one antenna coupler to another are shown in Fig. 2. At A, a pair of ganged rotary switches selects the proper link line while the d.p.d.t. switch or relay switches the particular antenna in use from transmitter to receiver. The arrangement at B, suggested by W1FHH and W1KFN, is the same except that one side of each link line is common so that a single rotary switch unit may be employed.

At C, a system of two d.p.d.t. switches by W3HDI is used to take care of as many as four antenna systems. At D, is the system of plugs and jacks used by W2JQM.

Adjustment

As mentioned previously, some means of adjusting the coupling between the link line and the antenna coupler should be provided in each case. This may be accomplished by providing a swinging link winding or by tapping the link line on the antenna tank coil. The output amplifier tank coil should also be provided with a variable link to permit adjustment of coupling and to remove d.c. voltage from the link line. If one of the antenna systems in use employs a low-impedance line of 70 ohms or thereabouts, the transmitter should be first tuned and adjusted for proper loading with this antenna system. The output tank circuit coupling should be fixed for this antenna system and the coupling for the other antenna systems should be adjusted at the antenna coupler rather than at the final amplifier.
The coupling for each of the other antenna systems is adjusted to duplicate the loading of the first.

Most communications-type receivers will work satisfactorily, even though most input circuits are designed for somewhat higher impedances, if the low-impedance line is fed directly into the input terminals, unless the connecting link lines must be of appreciable length. In this case, a circuit tuning to resonance may be placed near the receiver, and the receiver input and low-impedance transmission line coupled to this tuned circuit by means of separate link windings, preferably one of which may be varied for best matching. WSBYU uses 300-ohm lines to provide a better match for the receiver input. This line may consist of a pair of No. 12 wires spaced one-half inch. Once set, it should not be necessary to change the receiver coupler adjustment when switching from one antenna to another.

With each of the antennas adjusted as described, it should be possible to switch quickly from one antenna to another, when the occasion arises, without the necessity for further adjustments.

**Prize Winners**

First Prize — Kenneth V. Curtis, W1FHJ.

Second Prize — Floyd L. Rittman, WSBYU.

Rules under which the contest is conducted are as follows:

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 January issue must arrive at QST before January 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 must be neat and legible.

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 five dollars’ worth of A.R.R.L. station supplies or publications will be given to the author of the solution considered best each month, two dollars and fifty cents’ worth of supplies or publications to the author of the solution adjudged second best. The winners are requested to specify the supplies preferred.

---

**Silent Keys**

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

Frank B. Arup, EI3M, Sandycove, Dublin, I. F. S.

Henry R. Chetham, W1HC, Somerville, Mass.

Robert S. Connavale, W3KFM, Springfield, N. Y.

Edward Germeroth, W2CHT, Ridgewood, L. I., N. Y.


Arthur Kammer, W2PH, Lynbrook, L. I., N. Y.

Melford Sewalson, W7BDZ, Butte, Montana

George L. Steen, W3AYQ, Bordentown, N. J.

---

**PROBLEM NO. 21**

Our Hero is in a quandary. He put off replacing the halyards on his sixty-footer just a bit too long. The other day a stiff breeze put enough strain on the rope to break it. This leaves Our Hero gazing skyward, with one end of his antenna on the ground, wondering how he is going to replace the halyards without taking down the mast. The mast has two sets of guy wires, one set about half-way up and the other set at the top. How would you go about replacing the halyards?
AN OSCILLATOR WHICH COMBINES MANY FEATURES

After four years of experimenting with oscillators, crystal and e.c., and using almost every oscillator tube from a '99 to my big 803, I have at last hit upon a solution to my woes.

Ideal oscillator requirements include the following conclusions:

1. The oscillator must key readily, even with cranky crystals.
2. There must be no chirp in the note.
3. Key clicks must be absent to permit easy break-in operation and also to avoid broadcast interference.
4. The oscillator must permit key leads of any length without resort to a relay.
5. The current keyed must be small to save keying contacts.
6. There must be no possibility of getting shocked when the hand is put across the key.
7. The base of the key or bug must be grounded to prevent shocks between receiver and key.
8. Crystal current must be less than 30 ma. at all times.
9. When operated as an e.c. oscillator the stability must be comparable with that of an X-cut crystal.
10. The oscillator must not require a special high-regulation power supply.
11. It must not require any outside power, or entail a loss in available voltage. (Vacuum tube keyer is thus unsuitable because of drop in voltage and because of need for extra equipment.)

Does your oscillator meet these requirements? If not, try the circuit of Fig. 1. I do not claim high power output for this oscillator, but it has high stability and good keying.

With a 7½-watt lamp as load, I experimented with various voltages and circuits, and found that the Tri-tet circuit with the 802 was the best suited to my purpose. Using a 60-ma. lamp to indicate crystal current, and variable resistors for obtaining proper voltage for screen and suppressor, I found that the output remained nearly constant down to 35 volts on the screen and 30 volts on the suppressor. The plate voltage was 450. With this potential, things did not heat up, and the crystal current dropped off so low that it did not light up the 60-ma. bulb at all; this was with a VF-1 SO-meter crystal and output on 40 meters. After getting that part of the problem settled, keying was taken up. Keying the negative connection produced clicks, and besides one could easily get a shock when touching the key. Keying the ground lead of the cathode coil works very well with crystal control but not so well for e.c. operation as it causes variation of the frequency. Positive keying produced clicks and a chirp with e.c. Screen or suppressor keying failed to cut the output to zero, with the additional disadvantage of putting high voltage on the key. Finally, after studying the Handbook in search of ideas, I noted that grid block keying (illustrated for an amplifier stage) might have possibilities. No sooner said than done, so I installed a 45-volt battery to try it out temporarily. It worked so nicely that I haven't bothered to obtain the blocking voltage from a bleeder. Anyway, the battery is used to bias the 803 final, so why not use it if available? If a little more crystal current is not objectionable, the grid resistor might be increased, but I found by using a variable one that 10,000 ohms was best for crystal and about 2000 ohms for e.c.o. I left it at 10,000 ohms, however, since undoubtedly many crystals would cause keying difficulties with only 2000 ohms. However, the lower the better from the

January 1939 69
standpoint of crystal current. I might mention that this VF-1 crystal has a minimum frequency of 3500 kc., and it is often operated for output on 7000.2 kc., so crystal current is especially important with a negative temperature coefficient of the crystal.

Using the e.c.o., the only difference I can detect is the fact that a ripple is slightly noticeable. This is as expected, for the present filter is inadequate for an e.c.o. More is to be added later. The crystal tone is quite pure.

No shock is possible, and the key leads are over 50 feet long. The keyed current is exceedingly small.

Although I have not had a chance to use it very much since I built it, all reports have been crystal, and most of the fellows are very much surprised to know that I use e.c.o. It is very stable and the drift is negligible. The low screen voltage plays an important part in reducing drift. The accompanying circuit is that of the resulting oscillator (Fig. 1). It could be simplified somewhat by use of a single low-resistance bleeder with taps, using the power supply itself for the blocking voltage (which is between 22? and 45 volts).

--Alan Buffington, W3EEW

TROUBLE GOING TO TEN METERS?

AFTER much difficulty had been experienced in attempting to drive a push-pull amplifier on ten meters with an 814 buffer stage, it was found that rearrangement of the amplifier parts and wiring made possible an increase of excitation grid current from 50 to 70 ma. The layout which resulted from experiments with the ten-meter amplifier is shown in the accompanying illustrations.

The grid coil is mounted directly on the Cardwell MT70GD tuning condenser (equipped with high-frequency dielectric strips) which is mounted beneath the chassis with rotor plates almost touching the chassis when open.

Feed-through insulators directly in line with the bottom plate connections of the neutralizing condensers make possible extremely short leads, while the top plate connections of the neutralizing condensers extend almost directly to the stator connections on the plate tuning condenser.

The Johnson 70DD70 plate condenser was chosen for several reasons: Reversing the end angles and extending them by using the panel mounting pillars (supplied with the condenser) permitted mounting the B. & W. high-power coil directly on the condenser. The construction of the condenser (with stator plates flaring out to greatest overall width at what is normally the base of the condenser) makes it possible to have the tops of the amplifier tubes come almost to the stator terminals.

It is particularly important on ten meters if...
the r.f.-carrying links between stages are long and are likely to have fairly high r.f. voltage across them, that a line using good high-frequency dielectric be used rather than the more common twisted-pair line. The latter type became quite hot when used to couple the grid circuit of the ten-meter amplifier to the plate circuit of the buffer, and since the total power output of the buffer is small compared to the output of the transmitter, noticeable heat at this point represents a relatively large loss of driving power. The link used here consists of two No. 12 wires spaced 1/4 inch between centers. The wires are held in this spacing by tight-fitting holes drilled through small blocks of Victron.

Four filament by-pass condensers are used; two are connected directly to the filament terminals of each socket, and the four ground ends of the condensers are connected to a ground point on the chassis. Separate heavy twisted pairs are then run to the filament transformer, which is placed in an inconspicuous position beneath the front of the chassis.

Although no circuit change was made when the final amplifier was rebuilt for ten-meter operation, and although the circuit used (see Fig. 2) is quite conventional, the rearrangement of the parts from the former layout which required longer connecting wires and longer ground return paths has made it possible to more than adequately drive the amplifier with an 814 buffer which, previously, had insufficient output.

—W. K. Thomas, W5QAN

EMERGENCY GRID TANK

Although crystal frequency control alone may be used during normal operation of an amateur station, provision for readily converting the oscillator from crystal control to self-excited operation may be of value for several reasons. For instance, it is sometimes desirable to make measurements on an antenna system for a wide range of frequencies, or to determine whether certain tuned circuits in the transmitter are capable of covering entire bands. Unless the operator is so fortunate as to possess several crystals of suitable frequencies, self-excited operation of the transmitter is the logical solution for these purposes. Probably a greater reason for providing some means for self-excited operation is the possibility that some unforeseen condition might make it very important that the transmitter be operated on some frequency for which no crystal is readily available, with the stability of the oscillator a secondary consideration in this case.

The simple and effective coil-and-condenser tank shown in Fig. 3 is the outcome of such thoughts on the part of Walter S. Rogers, W1DFS. A 5-prong coil with tuning condenser internally mounted is used for the complete gadget, with one end of the winding and one connecting wire from the condenser connected to one of the base pins ordinarily used for crystal connection, and the other condenser connection and coil end connected to the other crystal pin, as shown in Fig. 4. The coil form is a Hammarlund SWF-5, and the condenser is a Hammarlund APC-100 midget designed especially for mounting in the form. The condenser shaft at W1DFS is provided with a bushing-type shaft extender, and a bakelite knob is used for convenient tuning of the tank. Alternatively, screwdriver adjustment of the condenser may be used—the shaft is made with slot provision for this purpose.

Tanks for the 160-, 80-, and 40-meter bands are made by closewinding 60 turns, 23 turns, and 12 turns, respectively, of No. 22 d.c.c. wire on the 1½-inch diameter coil forms. These inductances allow tuning on all three bands in the maximum capacity range of the condenser.

James Dickert (/A New Automatic Noise Limiter," QST, November, 1938) drops us a note to say that the 6Y7G or 6Z7G can be substituted for the 6M7, 6A6, etc. in the noise limiter with equally satisfactory results. The advantage is that these tubes have smaller envelopes and therefore probably can be fitted more readily into existing receivers. Another point of interest to builders of the circuit is that hum caused by heater-cathode leakage can be cured by reducing the heater voltage: 3½ to 4 volts on the heater is sufficient for good circuit operation, and eliminates hum from this source.
The Member Party. The biggest event in operating, to start the year off right, is the special activity dedicated to all League Members, to be held January 7th and 8th... call-emblem-insignia prizes... only League members eligible. See the announcement back a few pages and get in on the fun!

Use MH-ML-HM-LM Sub-Band Tuning.
We repeat below the tuning definitions 1 discussed last month with suggestions from outside this country on how-to-work-DX. The point that was to make good QSO's easier, results better, all of us amateurs should use all our frequency bands, not just pile up on the edges ineffectively with only a few brute power radiators able to get through.

It is now suggested, with due thanks to W1AVB, that the QMH signals be described more completely, as applying to specific sub-bands rather than to entire amateur bands. At 20 meters, for example, we have in the U.S.A. a 400-kc, band which is (in operating effect) two "outside" sub-bands in which c.w. predominates, separated by a central portion in which voice work predominates. It is logical that the QMH-QLM operating signals should not be used in cross-band operation, but should always apply with respect to each sub-band segment 2 alone!

All stations outside the United States are asked to make liberal use of the QMH, QML, etc. abbreviations or their equivalents in accord with example 2 below. In this manner more satisfactory contacts, much more free of interference, may readily obtain.

Emergency Readiness. OM Winter came early this year with extra-heavy snowfall. It is timely then to call attention to the fact that we should be prepared for the hazards of winter, and the likelihood of a flood season to follow. Amateur radio communication must be ready to function on short notice to replace disrupted or overloaded wire circuits in either isolated or general-relief type emergencies. Preparedness is the prime need of the whole amateur service.

Have you equipped so you could go self-powered in a hurry should you find yourself the only skilled "radio" person in your community? Are you all lined up with the League's Emergency Corps (whether self-powered or not) so you know the practice and policy thoroughly? Are you lined up with your Coordinator so you know "just" where you would fit into the picture best in emergency?

Every amateur with a license should "register" in the A.E.C. Qualified men to represent the amateur service as EMERGENCY COORDINATORS are needed in scores of communities. These appointments are made by S.C.M.'s. E.C.'s have the responsibility of framing plans for almost any contingency for their locality, of forming local amateur-planning committees, and of maintaining contact with local officials, keeping the community aware of what we amateurs are prepared to do. As an individual amateur, maintain annual registration in the A.E.C. To those now registered: Be sure you return (filled out) the colored survey form that will reach you direct from Hq. after the turn of the year. It will be the "annual round-up" or roll call to assure activity and readiness, and we are obliged to drop those not responding in order to know just where we stand from a preparedness standpoint from year to year.

The new F.C.C. Emergency Regulations for the amateur service are explained (pages 405-407) in the new Radio Amateur's Handbook. Refer to those sections, or ask your local A.R.R.L. Coordinator what you must do, should a communications emergency condition arise. When F.C.C. "declares" a communications emergency these F.C.C. restrictions on 1.8 and 3.5-4-Mc. work become mandatory. More on Emergency Work next month.

— F. E. H.

BRIEFS

When you're out on your New Year's Eve celebration, try a CQ on your horn or other noise maker... you might be surprised — like W2KZQ was when he tooted a CQ while ushering in 1938, and raised W2JKN on the other side of the dance floor!
If you need Arizona for W.A.S., look for the following stations: 18 Mc. — W6KMM OIP XNS NOJ PQQ OKK OWX NNO MAE ORX QPQ KMG PNN NEL LSK JFO. 14-Mc. 'phone — W6IMR KTV KVE; c.w. — PFL PEO CVW QAP PJP KMM. 9 Mc. — W6IYZ NXO PNN LYU NEL PUM QBX PFL LST 8 Mc. c.w. — W6NRP NNC NOX JNO KNN KMM. 7 Mc. — W6LYG JIW PQW OWX. 6 Mc. — W6KMM JKN HVY LKE POM OFE. 1.75-Mc. 'phone — W6LYG JIW PQW OWX.

An amateur radio station was displayed and operated at the DeKalb County Fair, Auburn, Ind., during the first week of October, '38. The rig was set up in a special booth in the county courthouse. Much interest was shown by the fair-goers. The transmitter was the property of W6IWN, whose call was used. W6YIZ furnished the receiver, W6YCF the modulation meter and additional equipment.

Attention is called to the fact that W hams too often do not put enough postage on QSL's addressed to Canada. Cards should carry a $0.20 stamp, letters 30¢.

Flood Traffic

BY THERON E. TAPPAN, W8AVD

PRIZES FOR BEST ARTICLE

The article by Mr. Theron E. Tappan, W8AVD 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 of 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, ten Jogs, eight pads radiogram blanks, DX Map and three pads or any other combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

We've got a pile of work to do
We short-wave hams, you know
When rivers rise to flood stage
Their banks to overflow.
Each tiny mountain rivulet
Swells to amazing size
As it feeds the roaring river
With the downpour from the skies.
Whole towns are swept like matches
In the rush of raging tide
And families gaze in terror
As they watch their homes subside.
Why can't we pull together
When disasters like this come;
Not fill the air with nonsense,
Making QSO's quite bum.
For in some tiny hamlet,
Or a city, dark and bleak
With no electric power
No means by which to speak
Upon a friendly telephone.
Some hams, in grim despair
Works desperately with batteries
To put him on the air.

Don't heckle him with messages,
Don't make him leave his mike
To seek your friends and relatives,
For he can't take a hike
Through flooded streets and byways
To find some homeless soul
Who's likely fed for refuge
And found some dry, safe goal.
The poor guy's trying vainly
His QRR to send,
To tell of needed families,
To ask that help we lend;
For they need food and clothing,
And maybe serum too;
Upon the heels of floods you know
Disease is nothing new.
The Red Cross wants to hear his needs
So just stand by and wait.
And make efficient QSO's
Until the floods abate;
No time for wild hysteria;
Far better, don't you think
To keep the airways clear for him —
His one remaining link,
You wouldn't want your mike or key
To QRM his call
By booming out a signal
When there's no need to at all.
So forget your pride and power,
Keep the ether clear for him.
Give him help — for boy, he needs it;
Don't you know his power's dim?

BRIEFS

Didja notice W1AW's advertised amateur transmissions on 8001 kc. (page 20, Dec. QST)? It should have been 1800 kc., of course. We're going to make the proof reader answer the pink ticket!

In connection with 1.75-Mc. Trans-Atlantic work G2PL reports logging W1AW (R5 S2) on 1808-kc. 'phone at 11:30 p.m., EST, November 12th., and on 1800-kc. c.w. (RST 4,59) at midnight EST, December 3rd.

W1CPV reports the following: The Leichhardt Expedition in the Simpson Desert, Central Australia, is operating two transmitters on 187, 56.6 and 34 meters under calls VK8W and VK8WB. Very low power is used, two to four watts from a pedal-driven generator.

The Casper Radio Amateurs Club entered this distinctive float in the "Wyoming on Parade" celebration. At the operating position is Stacy K. Anderson, W7FWM, club president. H. McFarlane, W7CBL, is driver of the truck, which was donated by Charles Burdick, W7EOI, and decorated by club members.

January 1939 73
There's no doubt but what it's a fine thing to believe in Santa Claus. We do, especially when we call someone the whole band's calling. And no doubt a lot of other folks do, if the letters we get are any indication. Lots of people write in taking us to check our QSO lists from K12A, K14AS, PJ1BV, etc., but no have got. The only lists we do have, which we use only for checking for the Century Club (or WAC) are from PK6XX, OX2QY, RKNVJ, Y2P2CU, ITAA, XA6XX and Y22LR (through Nov. 17th). These lists were obtained as a convenience in helping fellows get confirmation from some of the hard-to-get-cards-from countries. We don't send out QSL's for the above stations. The only other way we can help you get confirmation on some of the tough ones is from the DX Contest log of the station, if he sent in one. You can check that by taking a look at the results of the Contest — if your DX station has a score listed, he sent in a log.

One more ray of sunshine: the SARRL returned 5SSF's SARRL DX Contest log to him (his cards, records and stuff had been destroyed in a fire), and if you write to ZS3F direct you can probably get a card from him, if you worked him in the Contest.

Where:

There isn't any doubt now about VS3OL, in case you were holding out hope. VS2AG, the BERU rep in Malaya, says there isn't no Cerabanga, and suggests that the guy was operating somewhere in W4 or W5, from an examination of the cards sent for QSP. . . . 1LLD worked ZC4EB (14,320 T6), who said he could be heard by the radio station at Nicosia, Cyprus . . . . W2CMY, who checked XC4A (14,290 T9), says the guy is quite OK, that he uses a HRO and 180 watts to an 803, and wants to brand screwy calls in the near future . . . . Yes, there was an EP5SO actually on the air for a short while. He was quite legit, but got scared and quit before he worked any W's. Some BL these rambling lines is to tell you, if you're a W, that you may have better luck. W4ERD grabbed some cream for himself when he worked VQ5KLB (7350) on Thursday. That's the only station in Uganda, you know . . . . W8DHE scoured up Q3GF (14,360) for an Isle of Man contact . . . . CN5MI says that all CN cards should be sent via the A.A.E.M., Box 50, Casablanca, Morocco . . . . Good bets, picked at random: H8LR (14,035 T9), V81AA (14,030 T9), V81AL (14,360 T9), LZ1HD (14,380 T7) QSL via HB9CE, USIB (14,320 T9), U9AB (14,410 T9) and CR6AI (14,410 T7) who, by the way, QSL's. . . . if you hear any "I" calls ending in "W", they'll be ex-EO stations.

When:

G2PL is still pounding away on 1730 kc. Sundays from 0430-0600 GT. So far W1BB and VE1EA are the only ones trying to work him, but they tell us there's room for one or two more on the band.

The 3,5-Mc. band isn't as good yet as we thought it would be, or else our ears need overhauling, but there's a gang on every Saturday night trying to get across. W8FWU, who did some swell work there last year, made up a table for 50, which shows that 04-08 GT should be the best time for Europe, and 08-12 GT the best for Oceania . . . . W6AM raised ZL2BN on 75 phone during the SS . . . . The USKA advises that several HB stations are active daily on the low end of 80, between 08 and 10 UTC.

On 40, J2P (7140 T50) is on regularly from 12-14 GT, and was 88 when W5AVF in Mississippi worked him . . . . W7GZN reports T16RR (7100 T5) and ZF2AY (7100 T9) around midnight EST.

Ten looks fair, with W3CBT reporting V4QCRE (28,040), VQ7TOM, SU1MW (28,360), SU1AM (28,260) and U9BE . . . . There are a lot of ZL and CN 'phones on 10, in case you're interested.

There seems to be a difference of opinion on 20 — some argue that conditions are swell and others say punko. We'll present the evidence and you can be the judge . . . . The rotary at W8OJP accounted for JSCG (14,420 T5), J2J (14,390 T9), VQ3HJP (14,410 T9) and VQ2FL (14,10 T9) and VQ2MI (14,330 T9) . . . . Among the chasers at

The antenna system at VS2AE, Perak, F.M.S., is a rotatable half-wave W8JK flat-top directional job on top of an 80-foot tower. Four hundred quarter-wave radials are buried 6 inches underground at the base of the tower, and the node point of the antenna link is grounded to the center of the radial system. The transmitter runs 100 watts to the final pair of suppressor-modulated RK20's; the receiver is an HRO.
The transmitter line-up at J9CA is 59x-59-210, running 20 watts to the final. The receiver is a 1-2 a.c. homemade affair, the antenna a full-wave Zepp. Look for J9CA on 14,310, T9, from 13-15 CT.

W2HIF are CR7AF (14,275), VU2LK (14,020), VU2FX (14,330 T9), ZE1JT (14,310), ZE2EU (14,340), VS4JS (14,050), XU7CK (14,380 T9), VSTAR (14,380 T9), XU5CM (14,300), XU8DI (14,410), VU2PO (14,320 T9), VWKBW (14,430), T83C (14,350 T9), UV8IA (14,335 T9) and J8CA (14,330 T9). At W9WJD it's ZD2H a.c. homemade affair, the antenna a full-wave Zepp, running 20 watts to the final. The receiver is a l-V-2 log: ZEIJS (14,370), CR7 AG (14,300 T9), HR2ON (14,410 TS), XU8CM (14,300), XUSDI (14,410 T9), VU2FO (14,350 TS), ZE1JT (14,310), VU2EU (14,340), VS4JS (14,050), XU7CK (14,380 T9), VSTAR (14,380 T9), XU5CM (14,300), XU8DI (14,410 T9) and VWKBW (14,430). From WA9IWF's log: ZEIJS (14,370), OR7AG (14,200 T9), HR2ON (14,410 TS) and XBV1SM (14,420 T9). The new lazy H at W2IFV adds HC1PZ (28,065 T9), VPI1DM (14,270 T9) and OY4C (14,405 T9) in the late evening, and J3FK the early yawning ... .

What:

If, like the poor, o.c.o.'s are going to be with us, we might as well give you a few tips on how to get a half-way decent note with them. The sweetest sounding one we've heard (and, unfortunately, we've heard plenty) is the one W6CUH finished recently. Instead of just slapped the thing together and sliding it into the band the same evening, he went to the trouble of completely shielding it, filtered all power leads in it, removed it some distance from the transmitter (to minimize the r.f. pickup) and included the stabilizing part of a stabilized power supply in the cabinet. A 6L7 tube is used for the oscillator. Listening to it, it's hard to believe that it isn't crystal. Too bad that isn't crystal. Too bad that pride doesn't enter into it, removed it some distance from the transmitter (to minimize the r.f. pickup) and included the stabilizing part of a stabilized power supply in the cabinet. The transmitter line-up at J9CA is 59x-59-210, running 20 watts to the final.

Who:

It's nice to know that some of the HII stations have friends at court. Some time back we cracked that HH2B and HH4AS were the only QSLing-HII's, with the result that the more fair-minded lads took up the cause and informed us that H85MC, H92LD and H95X also send the pasteboards. OK, we'll start impeaching the construction of more of them.

ZD4AB has gone up the coast to Takoradi but will be back on from Accra about Dec. 20th. He's going back to England in March, so you'd better grab him before then. DX stations on the prowl for Mississippi will do well to look for W8AYT (14,300) and W8AFB (14,080, 14,293, 28,100). W8HLP skeds VU2FX (14,350 T9) daily, and will be glad to help anyone get a VU QSO ... . F8AC needs Nevada, R. I., S. D., N. M., Alabama and Arkansas for WAS. Incidentally, F8AC deserves an orchid or something for the swell way he keeps up with his QSL's, which sort of disproves any moans that "it can't be done." He has warmed many a cockle by his prompt answers.

Things aren't so bad in W7, according to W7FMX. PK4KS was up the coast to Takoradi but will be back on from Accra about Dec. 20th. He's going back to England in March, so you'd better grab him before then ... . DX stations on the prowl for Mississippi will do well to look for W8AYT (14,300) and W8AFB (14,080, 14,293, 28,100). W8HLP skeds VU2FX (14,350 T9) daily, and will be glad to help anyone get a VU QSO ... . F8AC needs Nevada, R. I., S. D., N. M., Alabama and Arkansas for WAS. Incidentally, F8AC deserves an orchid or something for the swell way he keeps up with his QSL's, which sort of disproves any moans that "it can't be done." He has warmed many a cockle by his prompt answers.

Further Operating News on Page 84
SAFETY CAMPAIGN

Rapid City, S. Dak.

Editor, QST:

... I wish to tell you about a safety campaign which our club has decided to launch here in the Black Hills territory, for better fused and shielded power supplies, and in so doing hope to eliminate the possibility of such an accident as Ross Hull had a short time ago. His death has been truly a great lesson to all of us, and we think it would be a great benefit to all amateurs to become more conscious of such a danger.

We have worked out a seal and have named it the "Hull Safety Seal" in memory of him, which we are planning on using in our club. A committee has been appointed whose duty it is to inspect all equipment of each amateur who is a member of our club, and when such equipment has been passed upon as being satisfactorily safe according to the rules set up by the club, the member is then entitled to use the "Hull Safety Seal" on his QSL cards and on other correspondence with amateurs.

After we had our own plan worked out it was suggested that we submit it to the League, hoping that they would be interested in our project and perhaps turn it into a nationwide campaign. The seal has been copyrighted, as you will notice. We did this to prevent anyone from commercializing it, and in case the League should wish to adopt our plan as a national project we should be very glad to turn over the copyright to them. . . .

— Gerald F. Lee, W9YKY
Pres., Black Hills Amateur Radio Club

Editor's Note. — This is an admirable project. Its success necessarily depends on local inspection and control, and it seems therefore to be a matter best handled by the individual local affiliated clubs. QST heartily endorses the application of this idea on the part of amateur groups generally, and will welcome reaction and response.

A LETTER FROM DIRECTOR MATHEWS

100 E. Ohio St., Chicago, Ill.

Editor, QST:

As you know, I have not been a candidate for re-election to the office of director of the Central Division of the League. The reason for this, as you also know, is that, prior to my original election two years ago, I had allowed my operator's license to lapse. At the first meeting of the Board which I attended, the constitutional provisions covering directors' eligibility were changed to provide that a candidate for this office must have held an operator's license continuously for a period of four years prior to his candidacy. Obviously this was impossible in my case, as it is physically impossible to do something in two years that requires four for its accomplishment.

I was amazed to receive the notification that, due to the ineligibility of all the other candidates nominated in the Central Division, the by-laws provide that I should serve another term as director for the next two years. While it certainly was not my intention to occupy this position again, I want to assure the members of the League in the Central Division that I will do my best to continue to represent them to the best of my ability and to try to accomplish through the Board the things which they tell me they wish done.

I believe the situation brought about by the present wording of the by-laws covering eligibility is a most unfortunate one. It is my understanding that there were five candidates for the office of director, all ineligible for various technical reasons and any one of whom, I am sure, would have made an excellent director for the division. (While I myself voted for the eligibility rules mentioned, I did so in the belief that they were satisfied by any continuous term of four years as a licensed amateur operator and not necessarily the four years immediately preceding nomination.) It will be my first concern at the next Board meeting to do my best to see to it that the Board alters these provisions in such manner that this situation can never occur again. Our League is, and must continue to be, a democratic institution whose directors are elected by the members. I do not consider it proper to have restrictions so severe that mem-

(Continued on page 78)
In spite of the commercial air lines and high-speed streamlined trains, it is still quite impractical for anyone to make much of a dent in the job of getting around this country of ours and personally contacting, even with a fleeting greeting, an appreciable percentage of our customers, friends and "over-the-air" acquaintances. Even so, we do make the attempt as frequently as possible. In addition to making new friends, renewing old friendships and, of course, doing a little business, we inevitably in our travels learn of many interesting and, to us, unthought of applications for our products as well as changes and improvements that can be made to them. Of course, many of our friends also write to us when they feel that they have an interesting idea. Many of these items have been presented in this page in the past.

Thus, just recently Jack Thorpe, W8IDG, suggested a jack to fit the top of our GS-3 and 4 insulators. It is similar to the one now used in the GS-8 but designed to screw into the tapped hole on the Isolantite body. When ordering, just add the symbol "T" to the stand-off type number. The net cost is but six cents more.

Then, just a few days ago, we received a letter from Willard Minton, W5FVE, calling to our attention the fact that the new line of "air-wound" buffer coils could be easily mounted on the back of the TMS type condensers. Just enlarge the two small holes in the condenser end-plate and mount one of the PB-16 sockets. The holes in the condenser end-plate don't quite line up with the coil socket mounting holes but the "enlarging act" takes care of that situation in a quite practical way.

Herb Hollister, W9DRD, has been after us for quite some time to change the electrodes of the "4-in-1" crystal holder from the straight pressure type to the fixed air-gap type, by providing three small raised points on each plate. The activity of the crystal when thus mounted is increased considerably and of course the necessity for having spotlessly clean plates is eliminated. When the crystal is so mounted, however, it is likely to have a slightly different operating frequency than when mounted between flat plates or in a different type holder. Therefore, whether the holder be one of our new "4-in-1" or of some other make, frequency checks should be made under normal operating conditions. Of course, the new regulations also make this compulsory.

Incidentally, Herb also had some other ideas on crystals, particularly on extremely simple and practical methods of using them for fixed frequency reception in connection with the control of the high frequency oscillator of standard communications receivers. The whole thing is a little involved to present on this page, however, and we hope QST will want to describe the affair in more expansive editorial space in the near future — and in the meantime,

Merry Christmas and Happy New Year!

JAMES MILLEN
Transmitter Band Switching Made Easy

with MALLORY-YAXLEY "HamBand" Switches

Convenient terminal arrangements, wide spacing of current carrying parts, heavy silver-plating on contacts, and low-loss magnesium silicate ceramic insulation especially designed for high frequency application... make hand switching a reality for every amateur... and almost as easy as changing hands on a modern communications receiver. Mallory-Yaxley 160C HamBand Switches are rated for use in transmitter plate circuits using up to 1000 Volts DC with power up to 100 watts inclusive. Your Mallory-Yaxley distributor can give you complete information.

P. R. MALLORY & CO., Inc. INDIANAPOLIS INDIANA
Cable Address — PELMALLO

Use MALLORY APPROVED RADIO PRECISION PRODUCTS

Use YAXLEY APPROVED RADIO PRECISION PRODUCTS

Correspondence Dept.

(Continued from page 76)

bers in the Central Division are deprived of their opportunity to cast ballots, as they were this year. Insofar as my personal feelings are concerned I want to promise them here and now, as I said earlier in this letter, that it will be my first concern to remedy the conditions which brought this situation about.

-- R. H. G. Mathews Central Division Director

Error's Note.—A League by-law provides that a director is elected for a term of two years, "or until his successor is duly elected and qualified." This is a customary provision and is deliberately made to prevent a situation wherein a division, through failure to name eligible candidates, would be left without a vote and representation at Board meetings. Because not one of the Central Division nominees complied with the new eligibility requirements, there was no election in the Central this year and Mr. Mathews remains in office, so that the division is not deprived of its vote. See By-Law 21. As to the eligibility provisions themselves, members will be interested in knowing that the Executive Committee is recommending to the Board that it make a further study of its rules so as to prevent the disqualifying of so many otherwise desirable candidates.

HQ SALARIES

Editor, QST:

The quarterly statement of revenues and expenses for the three months ended June 30, 1938, is worthy of our notice. It is even interesting as compared to similar statements published in QST during the years of 1935 and 1936.

A casual comparison of such statements will show net revenues taken in by A.R.R.L. are remaining comparatively constant. It will also show salaries paid to officers and employees are steadily mounting. To-day $24,091.76 is paid out every three months in salaries. In 1934-35 that total was $19,252.68, or a net difference of $4,839.68. We see an increase in salary expenditures by 25 per cent.

As a struggling A.R.R.L. member I would like to know what has necessitated this handsome increase. How is the increase made up — more employees?

Do you in Hq. hold up your hands in horror at the thought of affecting every possible economy "with the point in mind of eventually lowering membership dues? The nearly $5000 used for increases in salaries every three months would go a long way toward making possible the reduction in price of QST to 15¢ per copy (remember, there would then be some increase in circulation).

Perhaps I am all wrong, but I do not find the idea of $1.50 per year for A.R.R.L. dues an appalling aversion. A.R.R.L. publications to-day are not essentially bigger or better than in 1935. May I ask why the great increase in salaries?

-- Stanley L. Grimes

For an answer, three factors contribute toward the apparent disparity in the figures cited by Mr. Grimes: The League's pay-roll at the end of 1934 totaled 29 full-time employees, as against 37 in mid-1938; a general pay-cut of approximately 10 per cent was in effect in 1934 as a result of depression conditions; the purely clerical employees of the League (stenographers, shipping clerks, etc.) receive overtime wages for extra work evenings during busy seasons.

With the growth of amateur radio the business affairs of the League have increased also, necessitating more clerical overtime and so raising this content of the pay-roll as well. When these corrective factors are applied, the average salary paid employees is slightly less in 1938 than in 1934.

Incidentally, the percentage of total salaries to total expenses has been reduced slightly each year for the past several years. At the same time the proportion paid for the production of QST (now in excess of $5.00 per member) and for general membership services (Communications De-
FOR ECONOMICAL OUTPUT

RK11- 25 W Plate Dissipation $ 2.50
RK20A- 40 W Plate Dissipation 15.00
RK25- 10 W Plate Dissipation  4.50

RK12- 25 W Plate Dissipation $2.50
RK20A- 40 W Plate Dissipation 15.00
RK25- 10 W Plate Dissipation  4.50

RK51- 60 W Plate Dissipation $8.00
RK52- 60 W Plate Dissipation  8.00
RK57-125 W Plate Dissipation 13.50

BEAM TUBES
EASY TO DRIVE
RK48-100 W Plate Dissipation $27.50
RK47-60 W Plate Dissipation 17.50
RK49-21 W Plate Dissipation  2.10

RK63-200 W Plate Dissipation $22.00
RK38-100 W Plate Dissipation 13.50
RK37- 50 W Plate Dissipation  7.75

TANTALUM U. H. F. TUBES
EFFICIENT at the ULTRA HIGHS
RK63- 200 W Plate Dissipation $22.00
RK38-100 W Plate Dissipation 13.50
RK37- 50 W Plate Dissipation  7.75

RECTIFIERS
For A LONG LIFE POWER SUPPLY
RK60—Full Wave 600 volts 250 ma  $ 2.75
RK86-25 amp, 7,500 volts inverse  1.50
RK87A—1.25 amp, 10,000 volts inverse 11.00

TRIODES
FOR ECONOMICAL OUTPUT
RK11- 25 W Plate Dissipation $ 2.50
RK12- 25 W Plate Dissipation 2.50
RK51- 60 W Plate Dissipation 8.00
RK52- 60 W Plate Dissipation  8.00
RK57-125 W Plate Dissipation 13.50

RAYTHEON TRANSMITTING TUBES
NEWTON, MASS. • NEW YORK • CHICAGO • SAN FRANCISCO • ATLANTA

"WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS"
As up-to-date as a NEW CAR

A new 1939 model, the Harvey 75-T Transmitter combines dependability, power and low cost in a convenient table model. A powerful CW signal on 5 bands plus sufficient Phone output to work great distances make this the "buy of the year."

Coil changing for the 3 simplified circuits is made easy by the hinged cover cabinet. The main power supply is external to the transmitter itself and may be installed in any convenient position where space is available. The power chassis is housed under a grille cover for safety as well as ventilation. Our new catalogue, which contains complete information on the 75-T as well as other NEW transmitting units, is now ready. Information on HARVEY Police 2-way Radio and HARVEY Marine Radio-Telephone equipment is also available if you write to Harvey Radio Laboratories, Inc., 25 Thorndike Street, Cambridge, Massachusetts. Export: 25 Warren Street, New York City. Cable: "Simontrice."

THE AMATEUR IS BALANCED

West Middletown, Ohio

Editor, QST:

I don't know when I have read an editorial that touched me more than yours in October QST.

I am an old Morse telegrapher and have seen some hard service in my time, but in the past twenty years I have been in the grocery business where I spend about seventy-five hours every week, so you see most of my time is spent with my business. Outside of several hours in the evenings and Sundays, I haven't much time for amateur radio, but I have been abusing myself by staying up too late at night and spending too many hours at it on Sundays. Therefore I haven't been getting the proper amount of sunshine and exercise needed by a man of my age, and I am not rugged physically.

I have caused blinking of the lights, key clicks in our b.c. receiver and maybe am not always in the best of humor when told about it, so have been a general nuisance around the house for the past three years — but, say, it's hard to stop when those VE's and ZL's are coming through Q59X! But when I read that creed of the amateur I feel awful guilty.

That editorial of yours sure did set me to thinking and I want to thank you from the bottom of my heart for it, and I hope it has the same effect on thousands of hams and may be the cause of saving them their health and much money in doctor bills in later life.

— John G. Hunt, W8QIE

ABOUT CORRESPONDENCE

4450 N. Mozart St., Chicago, Ill.

Editor, QST:

I found this poem in a magazine and I think that if some of the hot air fiends who release their steam through this column read it they might think first before they let loose. Here it is:

ANOTHER'S FAULTS

In speaking of a person's faults,
Pray don't forget your own;
Remember, those in a house of glass
Should never throw a stone.
If you have nothing else to do
But talk of those who sin,
'Tis better you should look at home
And from that point begin.

— J. H. Grigg, W9ZQ1

53 East 7th St., Holland, Mich.

Editor, QST:

The Correspondence Section should be doubled in space allotment in QST. Some of the articles are very long and drawn out and there should be a minimum length of two or three inches per article.

I also suggest that the fellows all get together and urge QST to publish a full page or even two full pages of nothing but photographs of some of the most active "hams" in the country. This should include station pictures as well as ops' pictures. Foreign stations also should be included. Also antenna systems that deserve publication.

This will greatly increase the average ham's interest in the magazine we all like, QST.

— Rus Sakkas, W8DBD
THE NEW "HQ-120" with its "full range" crystal filter (see page 33 of December QST) splits crowded amateur phone bands wide open. This exclusive Hammarlund feature solves the phone­man's age-old problem of QRM from heterodynes and side-band splashover. The selectivity curves shown in the drawing were taken on a production model receiver. Labeling of these curves corresponds to the markings of the selectivity switch on the panel. In practice, curve No. 1 is not only wide enough to permit excellent voice reception, but fairly good quality music as well. Curve No. 2 is intended for voice reception where quality is a consideration even though QRM may be very heavy. Number 3 is for extreme conditions of interference where "getting the message through" is more important than quality. Positions 4 and 5 are for CW code reception. Unlike most crystal filters, the output of this one is uniform throughout its selectivity range, and there is no interlocking of controls.

Special consideration has been given to the R.F. gain of the receiver in order that it will not require a stronger signal on 20 meters than on 80, for example, to read "S-9" on the meter. The "HQ-120" is also equipped with a noise limiter which follows the strength of the incoming signal and suppresses automobile ignition interference and similar disturbances. In order to maintain high efficiency with various types of antennas, the "HQ-120" has an antenna compensating control which assures maximum image rejection, maximum signal-to-noise ratio, and perfect circuit alignment at all times. There is a spread of 310 degrees for each amateur band from 80 to 10 meters, and the dial is calibrated in megacycles for these amateur bands. This means you no longer have to guess at the frequency of your own transmitter or of the one at the other end of the QSO. Write Dept. Q-1 for complete descriptive literature.

SEND FOR 16-PAGE BOOKLET!

HAMMARLUND MFG. CO., INC.
424-438 WEST 33rd ST., NEW YORK

CANADIAN OFFICE: 41 WEST AVE., NO., HAMILTON, ONT.
Ganged Neutralizers for Single Control Neutralization of Push Pull Amplifiers

Long in use by commercial designers, ganged neutralizing capacitors are becoming more and more widely used by progressive amateur designers. Essentially conventional in natural layout, the push pull triode class "C" amplifier lends itself most fittingly to further simplicity achieved by use of Cardwell ganged neutralizing condensers.

Medium power amplifiers in particular are readily adapted to their use. We illustrate two new units, the ES-7-SDI trim-air dual neutralizer, and the ET-15-ADI, which have been requested by numerous progressive amateur designers.

**NEW Type ES-7-SDI — Dual Neutralizer**

For push-pull T-40's, HY-40, HY-57, RK-19's etc. Maximum Capacity each section 7 mmfd. Minimum Capacity each section 4 mmfd. Airgap — 0.040" thick, buffed and polished aluminum. Size — 4¾" x 1 ¼" x 1 ¼", Insulation — Lsolanlite end plates, with Alsimag 196 Insulated coupling between rotor sections.

LIST PRICE, $4.10

**NEW Type ES-4-SDI — Dual Neutralizer**

Similar to ES-7-SDI except maximum capacity per section is 4 mmfd. and minimum 1.5 mmfds. For push pull amplifiers using tubes such as 316-A, UH-35, 800, RK-30, 834, RK-32, 30-4-A and UH-50.

LIST PRICE, $3.50

**NEW Type ET-15-ADI — Dual Neutralizer**

For push pull RK-59, 841, 10, 801, T-20, 809, RK-11, RK-19, 805, 750, 830, 316-A. Maximum Capacity each section — 15 mmfd. Minimum Capacity each section — 1.5 mmfd. Airgap — 0.070". Peak Volt — 2500. Plates — 0.050" thick aluminum — unbuffed. Size — 3½" x 1 ½" x 1 ½", Insulation — isolantile end plates, with Alsimag 196 insulated coupling between rotor sections.

LIST PRICE, $4.10

**Type ET-30-ADI — A Dual Neutralizing Unit**

Similar to ET-15-ADI except for push pull tubes with grid to plate capacities higher than the capacity range of the ET-15-ADI. If plate modulation is used, plate voltages in excess of 600 V. should not be used. Maximum Capacity per section is 30 mmfd. Minimum Capacity per section is 4 mmfd.

LIST PRICE, $4.10

**Type NA-12-NDI — Dual Neutralizer**


LIST PRICE, $15.00

**Standard Frequency Transmissions**

<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule</th>
<th>Station</th>
<th>Date</th>
<th>Schedule</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 6</td>
<td>BR</td>
<td>W6XK</td>
<td>Feb. 3</td>
<td>BR</td>
<td>W6XK</td>
</tr>
<tr>
<td>Jan. 7</td>
<td>RX</td>
<td>W6XAN</td>
<td>Feb. 4</td>
<td>RX</td>
<td>W6XK</td>
</tr>
<tr>
<td>Jan. 8</td>
<td>C</td>
<td>W6XK</td>
<td>Feb. 5</td>
<td>G</td>
<td>W6XK</td>
</tr>
<tr>
<td>Jan. 13</td>
<td>A</td>
<td>W6XK</td>
<td>Feb. 10</td>
<td>A</td>
<td>W6XK</td>
</tr>
<tr>
<td>Jan. 20</td>
<td>A</td>
<td>W6XAN</td>
<td>Feb. 17</td>
<td>A</td>
<td>W6XAN</td>
</tr>
<tr>
<td>Jan. 27</td>
<td>R</td>
<td>W6XK</td>
<td>Feb. 24</td>
<td>A</td>
<td>W6XAN</td>
</tr>
</tbody>
</table>

**STANDARD FREQUENCY SCHEDULES**

<table>
<thead>
<tr>
<th>Time</th>
<th>Sched. and Freq. (kc)</th>
<th>Time</th>
<th>Sched. and Freq. (kc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a.m.)</td>
<td></td>
<td>(p.m.)</td>
<td></td>
</tr>
<tr>
<td>6:00</td>
<td>3800 7100 1400</td>
<td>8:00</td>
<td>3800 7100 1400</td>
</tr>
<tr>
<td>8:08</td>
<td>3600 7100 1400</td>
<td>10:08</td>
<td>3600 7100 1400</td>
</tr>
<tr>
<td>10:16</td>
<td>3700 7200 1420</td>
<td>12:16</td>
<td>3700 7200 1420</td>
</tr>
<tr>
<td>12:24</td>
<td>3800 7300 1430</td>
<td>14:24</td>
<td>3800 7300 1430</td>
</tr>
<tr>
<td>14:40</td>
<td>4000</td>
<td>16:40</td>
<td>4000</td>
</tr>
</tbody>
</table>

The time specified in the schedules is local standard time of the transmitting station. W6XAN uses Central Standard Time, and W6XX, Pacific Standard Time.

**TRANSMITTING PROCEDURE**

The time allotted to each transmission is 8 minutes divided as follows:

1 minute — Announcement of next frequency.
2 minutes — Statement of frequency in kilocycles and announcement of next frequency.
3 minutes — Characteristic letter of station followed by call letters and statement of frequency. The characteristic letter of W6XAN is "O" and that of W6XX is "M."
4 minutes — Statement of frequency in kilocycles and announcement of next frequency.
5 minutes — Time allowed to change to next frequency.
6 minutes — Time allowed to change to next frequency.
7 minutes — Time allowed to change to next frequency.
8 minutes — Time allowed to change to next frequency.

**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 5000 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 = M440 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.
Eimac is not “just another good tube.” It represents a great step forward for the entire field of radio communications. Progressive radio engineers who refuse to cling to precedent ... who wish to obtain outstanding results ... to be ahead of the crowd ... have found Eimac tubes to be a requisite. Even those who are satisfied with the old way of doing things find definite improvement when they change to Eimac. The point is: Eimac tubes are capable of far greater performance than the average equipment in use today is capable of producing.

With Eimac tubes, emission failure is almost a thing of the past. High voltages; high temperatures; gas will never affect an Eimac tube. That is why it is possible to get such extremely high power output from a comparatively small Eimac tube.

An example of Eimac's super performance is to be found in a group of new transmitters recently completed by the Thos. L. Siebenthaler Mfg. Co. to the design and specifications of TWA and Eastern Air Lines. In these transmitters, a pair of Eimac 450T tubes give an output of 4 KW while being operated well within their ratings. This kind of performance can easily be yours.

Eimac TUBES

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

Eimac is not "just another good tube." It represents a great step forward for the entire field of radio communications. Progressive radio engineers who refuse to cling to precedent ... who wish to obtain outstanding results ... to be ahead of the crowd ... have found Eimac tubes to be a requisite. Even those who are satisfied with the old way of doing things find definite improvement when they change to Eimac. The point is: Eimac tubes are capable of far greater performance than the average equipment in use today is capable of producing.

With Eimac tubes, emission failure is almost a thing of the past. High voltages; high temperatures; gas will never affect an Eimac tube. That is why it is possible to get such extremely high power output from a comparatively small Eimac tube.

An example of Eimac's super performance is to be found in a group of new transmitters recently completed by the Thos. L. Siebenthaler Mfg. Co. to the design and specifications of TWA and Eastern Air Lines. In these transmitters, a pair of Eimac 450T tubes give an output of 4 KW while being operated well within their ratings. This kind of performance can easily be yours.

Eimac TUBES

EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA
THROUGH-FRAME CONTACTS

GOOD CONTACTS are one of the most important features of transmitting condenser design. Hammarlund engineers have paid particular attention to this point in designing the new "TC". The illustration shows the one piece, direct-to-rotor contact of the new "TC". Notice that metal-to-metal contact through the frame is not depended upon to carry the high current usually associated with tank condensers. The contact is of silver plated Beryllium, noted for its low resistivity and great physical strength. This contact is bent so that it passes through the end plate forming two soldering lugs so the connection will be short and direct. This is only one of the many features of the new "TC" which also embodies the non-magnetic principle of rotor assembly. See these outstanding condensers at your dealer's or write for complete details.

October '38 O.R.S.-O.P.S. Parties

The October O.R.S. and O.P.S. get-togethers were "humdingers," with splendid turn-outs and scores of unprecedented magnitude. New highs were established in both parties. Active qualified operators should get in on these enjoyable activities by lining up their stations with the O.R.S. or O.P.S. group. Write your S.C.M. to-day, if interested. W8BES leads the O.R.S. gang for the second consecutive time and W8MBW "dittos" in the O.P.S. group—take a look at their records! W2JZX moved up into second place among O.P.S., with W1C011 third. W8KUN, second high O.R.S., gave W8BES a close race, followed by W4NC with W4ABT operating. The next O.R.S. and O.P.S. Parties will be on January 28th-29th. Make your plans accordingly!

Official Relay Station Scores

<table>
<thead>
<tr>
<th>Station</th>
<th>Score</th>
<th>Dist. Sec.</th>
<th>Sec. Radios</th>
<th>Power</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>W3BES</td>
<td>16,279,922</td>
<td>56</td>
<td>150-200 Pa.</td>
<td>100 W. Pa.</td>
<td></td>
</tr>
<tr>
<td>W8KUN</td>
<td>16,115,132</td>
<td>57</td>
<td>41</td>
<td>100 W. Pa.</td>
<td></td>
</tr>
<tr>
<td>W8MBW</td>
<td>13,585,500</td>
<td>56</td>
<td>42</td>
<td>800 N. C.</td>
<td></td>
</tr>
<tr>
<td>W8FCF</td>
<td>13,522,711</td>
<td>56</td>
<td>18</td>
<td>100 Ariz.</td>
<td></td>
</tr>
<tr>
<td>W8JTT</td>
<td>12,707,533</td>
<td>55</td>
<td>39</td>
<td>300 Conn.</td>
<td></td>
</tr>
<tr>
<td>W8HJM</td>
<td>10,150,864</td>
<td>53</td>
<td>43</td>
<td>250 W. N. Y.</td>
<td></td>
</tr>
<tr>
<td>W8BES</td>
<td>8,820,690</td>
<td>47</td>
<td>5</td>
<td>50-100 Ariz.</td>
<td></td>
</tr>
<tr>
<td>W4AGE</td>
<td>7,162,538</td>
<td>48</td>
<td>5</td>
<td>500 Ohio</td>
<td></td>
</tr>
<tr>
<td>W2JZX</td>
<td>7,346,922</td>
<td>51</td>
<td>26</td>
<td>100 N. N. J.</td>
<td></td>
</tr>
<tr>
<td>W9FNF</td>
<td>6,715,912</td>
<td>49</td>
<td>27</td>
<td>200 E. Mass.</td>
<td></td>
</tr>
</tbody>
</table>

The score of W1AW, not competitive with any of the above, is recounted for the information of Members: W1AW (W1JTD opr.): 16,878,980; 210; 58; 31; 1,000.

Official 'Phone Station Scores

<table>
<thead>
<tr>
<th>Station</th>
<th>Score</th>
<th>Dist. Sec.</th>
<th>Sec. Radios</th>
<th>Power</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>W3GDI</td>
<td>6,251,265</td>
<td>46</td>
<td>48</td>
<td>4,833,222 131 40</td>
<td></td>
</tr>
<tr>
<td>W8CMH</td>
<td>5,971,149</td>
<td>44</td>
<td>44</td>
<td>4,920,200 116 57</td>
<td></td>
</tr>
<tr>
<td>W8JIY</td>
<td>5,708,083</td>
<td>44</td>
<td>40</td>
<td>4,465,724 102 41</td>
<td></td>
</tr>
<tr>
<td>W8JYK</td>
<td>5,701,200</td>
<td>44</td>
<td>40</td>
<td>4,073,067 95 45</td>
<td></td>
</tr>
<tr>
<td>W8HHN</td>
<td>5,644,211</td>
<td>44</td>
<td>40</td>
<td>3,957,464 127 39</td>
<td></td>
</tr>
<tr>
<td>W6BON</td>
<td>5,365,801</td>
<td>44</td>
<td>47</td>
<td>3,968,085 118 47</td>
<td></td>
</tr>
<tr>
<td>W8JWI</td>
<td>5,338,888</td>
<td>125</td>
<td>47</td>
<td>3,301,704 115 35</td>
<td></td>
</tr>
<tr>
<td>W8DDM</td>
<td>5,253,363</td>
<td>147</td>
<td>40</td>
<td>3,169,063 108 39</td>
<td></td>
</tr>
<tr>
<td>W3BBR</td>
<td>5,107,973</td>
<td>136</td>
<td>47</td>
<td>2,112,156 120 40</td>
<td></td>
</tr>
<tr>
<td>W9FNP</td>
<td>4,834,700</td>
<td>117</td>
<td>47</td>
<td>2,996,716 108 38</td>
<td></td>
</tr>
</tbody>
</table>

The score of W1AW, not competitive with any of the above, is recounted for the information of Members: W1AW (W1JTD opr.): 16,878,980; 210; 58; 31; 1,000.

Operating News (Continued from page 76)
Cross-sectional sketch of Centralab Resistor

Conducting core and jacket are fired together at 2500 degrees F. into a solid unit, hard and durable as stone, providing mechanical strength and protection against humidity.

Copper contact to the resistance material at the extreme ends only provides uniform resistance and load distribution over ENTIRE length. End contacts do not short circuit part of the resistance as in other types.

Because resistance is small in diameter and uniformly distributed for entire length, Centralab's specific resistance per unit length is low. The result is low noise level and constant value over a wide range of frequency and voltage.

CENTRALAB • Division of Globe-Union Inc., Milwaukee

Television Circuits

frequently require fixed resistors whose values remain uniform at high frequencies.

Centralab Fixed Resistors because of their relatively small cross section conductor area plot a comparatively flat resistance-frequency curve...as shown in the graph above.

In charting the future -- in Television broadcast and reception, Centralab will continue to give satisfactory service...just as it is now doing with its performance record of more than 80,000,000 units in all parts of the world.

Engineers send for Resistor Data Bulletin 647.

SPECIFY CENTRALAB

Centralab

FIXED RESISTORS
From Power Line to Antenna

**OHMITE parts improve your Rig!**

**DUMMY ANTENNA** New Ohmite Vacuum-Type. Used to easily, accurately measure actual transmitter output, for tuning up to peak efficiency, and for many other purposes.

**RHEOSTATS** Time-proved Ohmite all-porcelain vitreous-enamedled Rheostats keep power tube filaments at exact rated value for actual transmitter output, for tuning up to peak efficiency. Increase tube life.

**BAND SWITCH** Provides instant, easy change from one frequency to another with really low-loss efficiency. For all transmitter stages.

**BROWN DEVILS** Popular, economical, dependable Resistors for voltage dropping, bias units, bleeders, etc. 10 and 20 watt sizes.

**DIVIDOHMS** Handy vitreous-enamedled Adjustable Resistors for quick, accurate change of resistance value or replacement. 10 to 20 watts sizes.

**FIXED RESISTORS** Ohmite vitreous-enamedled Resistors used by eminent designers and manufacturers of amateur and commercial transmitters and receivers.

**R.F. PLATE CHokes** High frequency solenoid chokes designed to avoid either fundamental or harmonic resonance in the amateur bands.

**POWER LINE CHokes** Keep R.F. currents from going out over the power line — lessen interference with BCL receivers.

---

**OHMITE MANUFACTURING CO.**
4931 West Flournoy Street * Chicago, U.S.A.

---

**MEMBERS, DX CENTURY CLUB**

<table>
<thead>
<tr>
<th>Call</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>G6WY</td>
<td>114</td>
</tr>
<tr>
<td>WITW</td>
<td>113</td>
</tr>
<tr>
<td>WISZ</td>
<td>112</td>
</tr>
<tr>
<td>WBDHF</td>
<td>111</td>
</tr>
<tr>
<td>W4CWW</td>
<td>110</td>
</tr>
<tr>
<td>W4GRL</td>
<td>109</td>
</tr>
<tr>
<td>W2G7</td>
<td>108</td>
</tr>
<tr>
<td>G2ZQ</td>
<td>107</td>
</tr>
<tr>
<td>W2G7Z</td>
<td>106</td>
</tr>
<tr>
<td>W4GCH</td>
<td>105</td>
</tr>
<tr>
<td>W2TS</td>
<td>104</td>
</tr>
<tr>
<td>W2GW</td>
<td>103</td>
</tr>
<tr>
<td>W64U</td>
<td>102</td>
</tr>
<tr>
<td>W11Z</td>
<td>101</td>
</tr>
<tr>
<td>W1BUX</td>
<td>100</td>
</tr>
<tr>
<td>W1elho</td>
<td>99</td>
</tr>
<tr>
<td>W164</td>
<td>98</td>
</tr>
<tr>
<td>W1ESL</td>
<td>97</td>
</tr>
<tr>
<td>W1MP</td>
<td>96</td>
</tr>
<tr>
<td>W1UK</td>
<td>95</td>
</tr>
<tr>
<td>W16L</td>
<td>94</td>
</tr>
<tr>
<td>W1DF</td>
<td>93</td>
</tr>
<tr>
<td>W16QF</td>
<td>92</td>
</tr>
<tr>
<td>W16PT</td>
<td>91</td>
</tr>
<tr>
<td>W16V</td>
<td>90</td>
</tr>
<tr>
<td>W64I</td>
<td>89</td>
</tr>
<tr>
<td>W16J</td>
<td>88</td>
</tr>
<tr>
<td>W16K</td>
<td>87</td>
</tr>
<tr>
<td>W16L</td>
<td>86</td>
</tr>
<tr>
<td>W16M</td>
<td>85</td>
</tr>
<tr>
<td>W16N</td>
<td>84</td>
</tr>
<tr>
<td>W16O</td>
<td>83</td>
</tr>
<tr>
<td>W16P</td>
<td>82</td>
</tr>
<tr>
<td>W16Q</td>
<td>81</td>
</tr>
<tr>
<td>W16R</td>
<td>80</td>
</tr>
<tr>
<td>W16S</td>
<td>79</td>
</tr>
<tr>
<td>W16T</td>
<td>78</td>
</tr>
<tr>
<td>W16U</td>
<td>77</td>
</tr>
<tr>
<td>W16V</td>
<td>76</td>
</tr>
<tr>
<td>W16W</td>
<td>75</td>
</tr>
<tr>
<td>W16X</td>
<td>74</td>
</tr>
<tr>
<td>W16Y</td>
<td>73</td>
</tr>
<tr>
<td>W16Z</td>
<td>72</td>
</tr>
<tr>
<td>W16A</td>
<td>71</td>
</tr>
<tr>
<td>W16B</td>
<td>70</td>
</tr>
<tr>
<td>W16C</td>
<td>69</td>
</tr>
<tr>
<td>W16D</td>
<td>68</td>
</tr>
<tr>
<td>W16E</td>
<td>67</td>
</tr>
<tr>
<td>W16F</td>
<td>66</td>
</tr>
<tr>
<td>W16G</td>
<td>65</td>
</tr>
<tr>
<td>W16H</td>
<td>64</td>
</tr>
<tr>
<td>W16I</td>
<td>63</td>
</tr>
<tr>
<td>W16J</td>
<td>62</td>
</tr>
<tr>
<td>W16K</td>
<td>61</td>
</tr>
<tr>
<td>W16L</td>
<td>60</td>
</tr>
<tr>
<td>W16M</td>
<td>59</td>
</tr>
<tr>
<td>W16N</td>
<td>58</td>
</tr>
<tr>
<td>W16O</td>
<td>57</td>
</tr>
<tr>
<td>W16P</td>
<td>56</td>
</tr>
<tr>
<td>W16Q</td>
<td>55</td>
</tr>
<tr>
<td>W16R</td>
<td>54</td>
</tr>
<tr>
<td>W16S</td>
<td>53</td>
</tr>
<tr>
<td>W16T</td>
<td>52</td>
</tr>
<tr>
<td>W16U</td>
<td>51</td>
</tr>
<tr>
<td>W16V</td>
<td>50</td>
</tr>
<tr>
<td>W16W</td>
<td>49</td>
</tr>
<tr>
<td>W16X</td>
<td>48</td>
</tr>
<tr>
<td>W16Y</td>
<td>47</td>
</tr>
<tr>
<td>W16Z</td>
<td>46</td>
</tr>
<tr>
<td>W16A</td>
<td>45</td>
</tr>
<tr>
<td>W16B</td>
<td>44</td>
</tr>
<tr>
<td>W16C</td>
<td>43</td>
</tr>
<tr>
<td>W16D</td>
<td>42</td>
</tr>
<tr>
<td>W16E</td>
<td>41</td>
</tr>
<tr>
<td>W16F</td>
<td>40</td>
</tr>
<tr>
<td>W16G</td>
<td>39</td>
</tr>
<tr>
<td>W16H</td>
<td>38</td>
</tr>
<tr>
<td>W16I</td>
<td>37</td>
</tr>
<tr>
<td>W16J</td>
<td>36</td>
</tr>
<tr>
<td>W16K</td>
<td>35</td>
</tr>
<tr>
<td>W16L</td>
<td>34</td>
</tr>
<tr>
<td>W16M</td>
<td>33</td>
</tr>
<tr>
<td>W16N</td>
<td>32</td>
</tr>
<tr>
<td>W16O</td>
<td>31</td>
</tr>
<tr>
<td>W16P</td>
<td>30</td>
</tr>
<tr>
<td>W16Q</td>
<td>29</td>
</tr>
<tr>
<td>W16R</td>
<td>28</td>
</tr>
<tr>
<td>W16S</td>
<td>27</td>
</tr>
<tr>
<td>W16T</td>
<td>26</td>
</tr>
<tr>
<td>W16U</td>
<td>25</td>
</tr>
<tr>
<td>W16V</td>
<td>24</td>
</tr>
<tr>
<td>W16W</td>
<td>23</td>
</tr>
<tr>
<td>W16X</td>
<td>22</td>
</tr>
<tr>
<td>W16Y</td>
<td>21</td>
</tr>
<tr>
<td>W16Z</td>
<td>20</td>
</tr>
<tr>
<td>W16A</td>
<td>19</td>
</tr>
<tr>
<td>W16B</td>
<td>18</td>
</tr>
<tr>
<td>W16C</td>
<td>17</td>
</tr>
<tr>
<td>W16D</td>
<td>16</td>
</tr>
<tr>
<td>W16E</td>
<td>15</td>
</tr>
<tr>
<td>W16F</td>
<td>14</td>
</tr>
<tr>
<td>W16G</td>
<td>13</td>
</tr>
<tr>
<td>W16H</td>
<td>12</td>
</tr>
<tr>
<td>W16I</td>
<td>11</td>
</tr>
<tr>
<td>W16J</td>
<td>10</td>
</tr>
<tr>
<td>W16K</td>
<td>9</td>
</tr>
<tr>
<td>W16L</td>
<td>8</td>
</tr>
<tr>
<td>W16M</td>
<td>7</td>
</tr>
<tr>
<td>W16N</td>
<td>6</td>
</tr>
<tr>
<td>W16O</td>
<td>5</td>
</tr>
<tr>
<td>W16P</td>
<td>4</td>
</tr>
<tr>
<td>W16Q</td>
<td>3</td>
</tr>
<tr>
<td>W16R</td>
<td>2</td>
</tr>
<tr>
<td>W16S</td>
<td>1</td>
</tr>
<tr>
<td>W16T</td>
<td>0</td>
</tr>
</tbody>
</table>

---

**Emergency Preparation Demonstrations**

T. J. De Laasus, A.R.R.L. Emergency Coordinator, San Francisco Section, is sponsoring demonstrations of the availability of amateur radio for emergency communication. On Sept. 24, 1938, in connection with the celebration of the opening of a new strip of highway, a fixed station was set up in the office of Marvelous Marin, Inc., and a portable emergency-powered transmitter and receiver was on the scene of the celebration. This made it possible for state and other civic officials to participate with full assurance that they could be reached at any time. In addition, the State Police Highway Patrol had its receiver tuned to the frequency used...
The words "CUSTOM BUILT" which are printed on each TAYLOR TUBES carton, guarantee YOU better all around tube performance. Longer hours of efficient operating service can only come as a result of individualized and skillful "CUSTOM BUILT" tube manufacture. Every Taylor Tube, from the smallest to the largest, is individually built. The slogan, "MORE WATTS PER DOLLAR," is more than a boast — it is the true performance standard by which all Amateur Transmitting Tubes are gauged. Yes, with TAYLOR TUBES it's "How Many" AND "How Good."

NEW 1939 TAYLOR TUBES MANUAL AND CATALOG NOW READY
by the amateurs (in the 1.75-Mc. band) in the event additional men were needed to handle the traffic situation. Those participating were W6SG, W6LQW, W6OMC, W6QGN and W6OBK.

On Oct. 22, another demonstration was given for the disaster committee of the American Legion in Marin County. Portable equipment was set up in the three A. L. posts, one at Mill Valley, Ross and San Anselmo. The three posts held a joint meeting by means of the hook-up, 1804 kc. was assigned, with the cooperation of the American Legion Net, which monitored the frequency, there was little QRM. The demonstration was a success and there is a probability that the A. L. group will underwrite the securing of an emergency power supply, transmitter, and receiver for each of the 10 sections of the county having a population of from 5000 to 10,000 inhabitants. Participating in this demonstration were W6FYK, W6FHY, W6KZ, W6LQW, W6PAZ, W6QGN, W6SG. Also present and assisting were W6OBJ, Emergency Coordinator, East Bay Section, together with his two assistants, W6BF and W6OMC.

Wisconsin-Minnesota Sleet Storm

A sleet storm beginning the night of Oct. 21, 1938, and lasting through the 22nd, struck the most northerly sections of western and northern Wisconsin and southeastern Minnesota without power and communication facilities. Again amateur radio filled the breach. At 10:00 A.M. on the 22nd, the Northern States Power Company asked W9DCM, Minneapolis, to contact Eau Claire, Wis., W9DCM made contact with W9IXR, Rice Lake, Wis., who made a long-distance telephone call on the last line that was standing, notifying the power company at Eau Claire to secure the aid of local amateurs. In a short time W9BQJ, Cannon Falls, Minn., W9KZ and W9SKX, both of Eau Claire were in communication with W9BN and W9DCM of Minneapolis. W9AN, St. Croix, Wis., was also on the air giving service to the power company, contacting W9SKX. W9BQJ and W9USA to handle traffic in that area, Red Wing, Minn., was entirely out of communication and power service. W9DCM raised W9ORL of Red Wing and furnished that city with its sole contact through the 22nd and 23rd until regular service was restored. W9KZ placed W9ORL of Red Wing, plus W9USK of Eau Claire, W9OKS, W9OBH, W9SKX and W9ORL on the air giving service to the power company, handling traffic in that area. Red Wing, Minn., was entirely out of communication and power service. W9DCM contacted W9USK of Eau Claire, who was set up with a line crew to patrol ninety miles of transmission lines which were down in the stricken area, reporting breaks as they came to them. W9ORS acted as key station to keep the dispatcher at Eau Claire advised of the progress of the crew. On the morning of the 24th, W9DTW went into action with a line crew to patrol another section of line, approximately 100 miles in length. The two portables were on the job with the crews until the repairs were completed and the crews sent home. W9ORL was powered with a Malory power pack, and W9DTW with a generator, each using a storage battery for primary power. Each portable had an output of about 7 watts, crystal-controlled and operated 3.5-Mc. c.w., as did the key station, W9ORS. These operators are all members of the Northern Wisconsin Radio Club and welcomed the opportunity to show the value of amateur radio in emergencies.

With Cannon Falls, Minn., still without telephone service on the 23rd, W9BN and W9DCM took portable equipment from W9BN, Minneapolis, to that city. Enroute over poor roads their receiver went bad and they called upon W9BQJ, Cannon Falls, who assisted them in locating another set. With the cooperation of W9BQJ, W9DCM portable was set up about twelve miles out on the power company's line, reporting breaks as they came to them. The a.c. portable transmitter consisting of a single 6A6 on 3890 kc was powered by a six volt storage battery and a 350-volt generator. W9USK of Eau Claire was also on the air. The Michigan QMN Net on 3890 kc. was active throughout the emergency period, ready to assist in every way possible.

— W9DCM, W9BN and W9ORS.
WE ARE only human, full in love, have grousches, and are bitten by bugs like anyone else. At the moment it's Q. and A. with us, so read on:

Q. What is a Metallised Resistor?
A. A Metallised Resistor consists of a very thin film of fine conducting particles bonded together on the surface of an insulating base.

Q. How thick is this film?
A. About as thick as the seat of our 2nd-best pants — one to three thousandths of an inch.

Q. How fine are these particles?
A. Of colloidal size — they are ground fine enough to float in air.

Q. Of what are these conducting particles made?
A. Carbon and other conducting materials.

Q. How are they bonded to this insulating base?
A. The conducting particles are deposited in a controlled film on the surface of the insulator. Successive treatments in high temperature conveyor ovens bond the particles together and to the insulating base. This stabilizes the film to prevent changes in resistance after the unit is completed. Needless to say, these processes have been continually improved and refined during the fifteen years we have made resistors.

Q. What is the insulating material on which this film is applied?
A. Glass, Isolantine or Steatite, and Bakelite. A special glass rod or tube, about the diameter of a pencil lead, is used in the High Frequency “F” Type and the Insulated “BT” Type Low-Power Resistors. The same is also used in the Types “FH” and “MG” Ultra High Range Resistors (up to 100,000 megohms). Isolantine or Steatite tubes are used as the base material for the Type “MP” High Frequency Power and the “MV” High Voltage Resistors.

A high grade bakelite is the material to which the metallized film is applied for volume controls.

Q. Wherein do these Metallized Resistors differ from the common carbon units?
A. The Metallized Resistor has a conducting film of minute cross-section compared to the solid body of the molded or extruded carbon resistor.

Q. And so . . . ?
A. The Metallized Resistor uses a conducting element of much lower specific resistance, or the proportion of conducting to non-conducting material is much greater. This is the direct reason for the low noise level, and low voltage and temperature coefficients noted here in November.

Q. Will such a thin film carry power?
A. This is a matter of design. We manufacture Metallized Resistors that will handle anything from an earthworm’s sigh up to 20 K.W. of R.F. (These latter units are water cooled, of course, and are about 3” diameter x 20” long.) Other low range Type “MP’s” handle momentary surges of several thousand amperes.

Q. Will it handle voltage?
A. The standard rating on the Type “MVR” Resistor is 100,000 volts. There are high voltage generators in various Universities using multiple units at a million volts upwards.

Q. How about the frequency characteristic? Does the impedance stay constant from D.C. up to ultra high frequencies?
A. The “MP” Resistors are a close approach to a pure resistance. They are used up to a hundred megacycles. As a dummy antenna load they may be coupled to the final tank in your transmitter without requiring retuning. This same characteristic makes them most suitable for terminating Rhombic antennas, measuring non-resonant lines, etc.

Q. Why do you have so many types?
A. There are six different types of Metallized Resistors, each designed for maximum performance in certain characteristics. One of the virtues of the metallized process is this flexibility in design.
W1AW Operating Schedule
(Effective Dec. 27, 1938)

OPERATING-Visiting Hours:
3:00 p.m.-3:00 a.m. daily, except Sat. & Sun.
Saturday — 8:30 p.m.-2:30 a.m.
Sunday — 7:30 p.m.-1:30 a.m.

GENERAL OPERATION:
W1AW devotes the following periods daily, except Saturday and Sunday, to GENERAL work with all amateurs in the following bands:

<table>
<thead>
<tr>
<th>Band</th>
<th>Frequency</th>
<th>Time — Eastern Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.8 Mc.</td>
<td>1938-1800-kc.</td>
<td>6:30 — 8:30 p.m.</td>
</tr>
<tr>
<td>3.5 Mc.</td>
<td>3800-kc.</td>
<td>8:30—11:30 p.m.</td>
</tr>
<tr>
<td>3.9 Mc.</td>
<td>3950-kc.</td>
<td>10:00—11:00 p.m.</td>
</tr>
<tr>
<td>7 Mc.</td>
<td>7100-kc.</td>
<td>1:00—2:00 a.m.*</td>
</tr>
<tr>
<td>14 Mc.</td>
<td>14,254-kc.</td>
<td>6:00—7:00 p.m.</td>
</tr>
<tr>
<td>14 Mc.</td>
<td>14,240-kc.</td>
<td>4:00—5:00 p.m.</td>
</tr>
<tr>
<td>DAILY except Sun. &amp; Mon.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On Saturdays W1AW is operated from 8:30 p.m. to 2:30 a.m. E.S.T., and on Sundays from 7:00 p.m. to 1:00 a.m. E.S.T. On these days operation will be devoted to the most profitable use of bands for general contacts and to participation in special week-end operating activities and contests. The station is not operated on legal national holidays.

OFFICIAL BROADCAST SCHEDULE (for sending addressed information to all radio amateurs):

Frequencies
C.W.: 1800-3800-7150-14,254 kcs. (simultaneously)
SSTV: 1808, 3950, 14,240 kcs.

1.75-Mc. Trans-Atlantic Tests, February 1939
The Annual 1.75-Mc. Trans-Atlantic Tests will be held this year in February under the guidance of G6FO. The object of the tests is to continue the observations and tests originally started in 1934 by G2II (now GW6A), to endeavor to effect G-W QSO's on 1.75 Mc., to observe conditions obtaining on the band at the time, and to show the period which previous experience shows to be the best for contacts between U.S. A. and Europe, and to focus interest on the DX possibilities of our lowest frequency band.

A number of G stations, as well as many listeners, are interested in these tests. It is hoped that W operators using 1.75 Mc. will participate and keep the following schedule: 0430-0440, W calls, G listens; 0440-0450, G calls, W listens; 0450-0500, W calls, G listens; 0500-0515, W calls, G listens; 0515-0530, W calls, G listens; and so on, ten-minute intervals until 0730 G.T. Accurate time-keeping is essential. All W stations will operate in the region 1720-1800 kcs., listening for W c.w. and 'phone stations in the complete "160-meter" band. Any QSO established should be kept short to give other stations an opportunity to make contact. All American participants are asked to send a log and report as soon as possible after the Tests to G6FO, 84-86, Tabernacle St., London, E. C. 2, England. Reports should also be sent to A.R.R.L. headquarters.

BRIEFS

1.75-Mc. Trans-Atlantic Tests, February 1939
The Annual 1.75-Mc. Trans-Atlantic Tests will be held this year in February under the guidance of G6FO. The object of the tests is to continue the observations and tests originally started in 1934 by G2II (now GW6A), to endeavor to effect G-W QSO's on 1.75 Mc., to observe conditions obtaining on the band at the time, and to show the period which previous experience shows to be the best for contacts between U.S. A. and Europe, and to focus interest on the DX possibilities of our lowest frequency band.

A number of G stations, as well as many listeners, are interested in these tests. It is hoped that W operators using 1.75 Mc. will participate and keep the following schedule: 0430-0440, W calls, G listens; 0440-0450, G calls, W listens; 0450-0500, W calls, G listens; and so on, ten-minute intervals until 0730 G.T. Accurate time-keeping is essential. All W stations will operate in the region 1720-1800 kcs., listening for W c.w. and 'phone stations in the complete "160-meter" band. Any QSO established should be kept short to give other stations an opportunity to make contact. All American participants are asked to send a log and report as soon as possible after the Tests to G6FO, 84-86, Tabernacle St., London, E. C. 2, England. Reports should also be sent to A.R.R.L. headquarters.

Addenda, Field Day Results
Received too late to make the December QST story on the 1938 A.R.R.L. Field Day was the report of the Jacksonville (Fla.) Radio Club. Operating W4D1Q-4 on 7 and 14-Mc. c.w. and 28- and 3.9-Mc. 'phone, the "Jax" gang made 601 points (36 QSO's). Operators were W4CRB, W4BNK, W4EDW, W4QB, W4EEO, W4ESO and W4EEW.

The call of the Saskatoon Amateur Radio Club was erroneously listed in the F.D. scores as VE4AAW. The correct
THORDARSON QUALITY AT PRICES YOU WILL APPRECIATE

THE

"19"

SERIES

"19" SERIES PLATE SUPPLY TRANSFORMERS
Primary 115 Volts, 50-60 Cycles

Transistors rated in D.C. volts from two section filter
Electrostatic shield between primary and secondary

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Sec. A.C. Volts</th>
<th>D.C. Volts</th>
<th>D.C. M.A.</th>
<th>Your Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-19P55</td>
<td>600-0-600</td>
<td>500*</td>
<td>250</td>
<td>$4.80</td>
</tr>
<tr>
<td>T-19P56</td>
<td>900-0-900</td>
<td>750</td>
<td>225</td>
<td>4.80</td>
</tr>
<tr>
<td>T-19P57</td>
<td>1075-0-1075</td>
<td>1000**</td>
<td>125</td>
<td>6.00</td>
</tr>
<tr>
<td>T-19P58</td>
<td>1200-0-1200</td>
<td>1000**</td>
<td>200</td>
<td>7.80</td>
</tr>
<tr>
<td>T-19P59</td>
<td>900-0-900</td>
<td>750</td>
<td>150</td>
<td>6.00</td>
</tr>
<tr>
<td>T-19P60</td>
<td>1560-0-1560</td>
<td>1500</td>
<td>300</td>
<td>11.10</td>
</tr>
<tr>
<td>T-19P61</td>
<td>2125-0-2125</td>
<td>1750</td>
<td>300</td>
<td>12.60</td>
</tr>
<tr>
<td>T-19P62</td>
<td>2420-0-2420</td>
<td>2000</td>
<td>300</td>
<td>12.90</td>
</tr>
<tr>
<td>T-19P63</td>
<td>1560-0-1560</td>
<td>1250</td>
<td>500</td>
<td>13.80</td>
</tr>
<tr>
<td>T-19P64</td>
<td>1265-0-1265</td>
<td>1000</td>
<td>300</td>
<td>13.80</td>
</tr>
<tr>
<td>T-19P65</td>
<td>1600-0-1600</td>
<td>1250</td>
<td>300</td>
<td>17.70</td>
</tr>
<tr>
<td>T-19P66</td>
<td>2425-0-2425</td>
<td>2000</td>
<td>300</td>
<td>17.70</td>
</tr>
<tr>
<td>T-19P67</td>
<td>2125-0-2125</td>
<td>1750</td>
<td>300</td>
<td>22.50</td>
</tr>
<tr>
<td>T-19P68</td>
<td>2425-0-2425</td>
<td>2000</td>
<td>500</td>
<td>25.50</td>
</tr>
<tr>
<td>T-19P69</td>
<td>3000-0-3000</td>
<td>2500</td>
<td>500</td>
<td>30.00</td>
</tr>
</tbody>
</table>

*This transformer has a bias tap at 30V. **These transformers designed for double rectifiers and will deliver both secondary ratings simultaneously.

"19" SERIES SWINGING AND FILTER CHOKES
Inductance listed is that actually measured at rated current
All adequately insulated

SWINGING CHOKES

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Gap, M.A.</th>
<th>Inductance, Henrys</th>
<th>D.C. Res., Ohms</th>
<th>Volts Insulation</th>
<th>Your Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-1C35</td>
<td>200</td>
<td>5-20</td>
<td>100</td>
<td>3000</td>
<td>$2.85</td>
</tr>
<tr>
<td>T-1C36</td>
<td>300</td>
<td>5-20</td>
<td>105</td>
<td>3000</td>
<td>3.90</td>
</tr>
<tr>
<td>T-1C37</td>
<td>400</td>
<td>5-20</td>
<td>90</td>
<td>4000</td>
<td>5.40</td>
</tr>
<tr>
<td>T-1C38</td>
<td>500</td>
<td>5-20</td>
<td>75</td>
<td>4000</td>
<td>6.90</td>
</tr>
</tbody>
</table>

SMOOTHING CHOKES

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Gap, M.A.</th>
<th>Inductance, Henrys</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-1C42</td>
<td>200</td>
<td>12</td>
</tr>
<tr>
<td>T-1C43</td>
<td>300</td>
<td>12</td>
</tr>
<tr>
<td>T-1C44</td>
<td>400</td>
<td>12</td>
</tr>
<tr>
<td>T-1C45</td>
<td>500</td>
<td>12</td>
</tr>
</tbody>
</table>

THORDARSON QUALITY FOR THE "HAM" IN THE POPULAR-PRICE FIELD!

Compare!

Shown at the left is catalog information on the plate transformers and chokes in this new series of transformers. Complete information on the full series in Catalog No. 400-C, from your parts distributor or write factory for Free copy.

THORDARSON ELECTRIC MFG. CO.
500 W. HURON ST., CHICAGO, ILL.

Demand "Power by Thordarson"
TO OUR READERS

who are not

A.R.R.L. MEMBERS

WOULDN'T you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only amateur association that does things. From your reading of QST you have gained a knowledge of the nature of the League and what it does, and you have read its purposes as set forth on page 6 of this issue. We should like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio. You will have the membership edition of QST delivered at your door each month. A convenient application form is printed below — clip it out and mail it today.

A bona fide interest in amateur radio is the only essential qualification for membership

AMERICAN RADIO RELAY LEAGUE

Hartford, Connecticut, U.S.A.

I hereby apply for membership in the American Radio Relay League, and enclose $2.50 ($3 in foreign countries) in payment of one year's dues, $1.25 of which is for a subscription to QST for the same period. Please begin my subscription with the . . . . issue. Mail my Certificate of Membership and send QST to the following name and address.

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may send him a sample copy of QST?

Thanks

Brass Pounders' League

(October 16th—November 16th)

Call Orig. Del. Rel. Extra Del. Credit Total
W2CCG 32 318 1554 363 2304
W2DB 391 410 973 473 3507
W6P 480 421 927 2760
W6Q 15 19 782 11 823
W6SQA 29 55 1042 6 737
W6CIZ 19 47 587 47 700
W7DHE 65 132 394 132 642
W7EML 63 86 239 74 643
W8YFT 21 314 49 254 627
W8XKJ 138 21 473 92 683
W9CIC 90 157 282 90 608
W9DLH 58 82 399 60 359
W9GHI 541 123 278 90 554
W9DZK 125 132 266 132 521
W9CQK 30 73 366 94 504
W9ERM 25 142 338 18 521
W9QFL 18 35 442 16 511
W8WJJ 66 35 409 0 509
W8LLW 9 40 494 22 505

MORE-THAN-ONE-OPERATOR STATIONS

Call Orig. Del. Rel. Extra Del. Credit Total
K1ARR 709 490 800 0 2079
W3N 134 168 135 2 84 1743
W6XY 901 40 0 0 841
W2BRT 54 147 306 17 596
W8GM 68 83 341 0 573

These stations "make" the B.P.L. with over 500 deliveries. Del. Credits also rate in L. standings. The following one-operator stations make the B.P.L. on deliveries. Deliveries count!

New jersey stations outside the "Africas" will base their multipliers on the call of the station. Two stations in one country count as one multiplier.

Call Orig. Del. Rel. Extra Del. Credit Total
W4CNW, 130 348 2297 74 3409

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

Third Annual South African DX Contest

Amateurs throughout the world are invited to participate in the third S.A.R.R.L. International DX Contest to be held on the first and second week ends of January, 1959.

Dates: January 7th (1600 GMT) to January 8th (2200 GMT) and January 14th (1600 GMT) to January 15th (2200 GMT).

Bands: Any or all bands can be used. A station can be worked once per band, per week end. Stations worked on the first week end can be worked on the second week end.

Exchange: As usual, a six-figure group will be exchanged. The first three numbers will be the signal report; the last three numbers will be a self-assigned figure used throughout the contest.

Points: Two points may be claimed for "two-way" exchange, one point for "one-way" exchange.

Zone: Stations outside the "African" will base their multipliers on the following zones: ZS1, ZS2, ZS3, ZS4, ZS5, ZS6, ZS7, ZS8, ZS9, ZS10, ZS11, ZS12, ZS13, ZS14, ZS15.

Scoring: DX stations outside of the African Zone will compute their scores by multiplying the total number of contacts by the total number of African zones by the total number of points. For example: W3AIW contacts 86 sta-
Shown above is a one-meter parallel rod oscillator which is capable of delivering more than 25 watts of radio frequency power to its load. Constructional information on this transmitter will be forwarded on request.

**TYPE 24 GAMMATRON**

$350

**HOW IT WORKS**

The phenomenal power output of the Type 24 Gammatron at ultra high frequencies is due to its scientific design. The use of a long, capped Tantalum plate prevents the escape of stray electrons from the ends of the plate structure which greatly reduces the efficiency in ordinary U. H. F. tubes. The use of a tantalum grid permits very close spacing to the filament, thus providing a very short time of electron flight and resultant high efficiency at very short wave lengths. Write for the U. H. F. data on the Type 24 Gammatron.
The law requires that every amateur station shall regularly check and measure transmitter frequency. Frequency measuring apparatus is required to be external to transmitter frequency control. For precise frequency measurement a stable and dependable frequency meter-monitor is indicated. Guthman is proud to offer the precision frequency meter and amplified monitor illustrated above and parts for its construction.

This instrument provides features heretofore available only in precision laboratory equipment. Designed for precise measurement, it offers a 7 1/4", 324 degree dial, accurately calibrated for 5 to 150 meter bands. Zero adjuster for use with 50 precision calibration frequencies available, A.C. or D.C. operation with voltage and temperature stabilization of electron coupled oscillator and amplified monitoring. It is styled to "dress up" any station priced extraordinarily low designed for precision laboratory equipment. Designed for only in precision laboratory equipment.

A.C. offers a

0.03%, Price, $4.50. 402 S. Peoria St. CHICAGO, U.S.A.

There are 10 African zones for 76 points. His score = 38 x 10

402 S. Peoria St. CHICAGO, U.S.A.

Edwin I. Guthman & Co., Inc.

402 S. Peoria St. • CHICAGO, U.S.A.

S. C. tornado Emergency

A tornado hit Charleston, S. C., about 8:20 A.M., September 29, 1938. Leaving the city without power and with but one telephone line that was highly overtaxed by folks who were trying to communicate with their loved ones, friends, or places of business. The city being without power naturally handicapped the community. The tabulation following shows score, stations worked and section worked in each case:

W3FKF 38480-306-65

W9SHE 38312-256-65

W5KE 38112-256-65

W9AET 38031-263-61

W5GMN 37864-257-61

W5GIL 37581-262-61

W4K4R 37420-253-61

W5GIL 37050-245-61

W9FTW 36790-316-60

W9WXL 36490-304-60

W9YXF 36280-314-60

W9AA 36090-304-60

W9WXL 35890-314-60

W9WXL 35690-314-60

W9WXL 35490-314-60

W9WXL 35290-314-60

W9WXL 35090-314-60

W9WXL 34890-314-60

W9WXL 34690-314-60

W9WXL 34490-314-60

W9WXL 34290-314-60

W9WXL 34090-314-60

W9WXL 33890-314-60

W9WXL 33690-314-60

W9WXL 33490-314-60

W9WXL 33290-314-60

W9WXL 33090-314-60

W9WXL 32890-314-60

W9WXL 32690-314-60

W9WXL 32490-314-60

W9WXL 32290-314-60

W9WXL 32090-314-60

W9WXL 31890-314-60

W9WXL 31690-314-60

W9WXL 31490-314-60

W9WXL 31290-314-60

W9WXL 31090-314-60

W9WXL 30890-314-60

W9WXL 30690-314-60

W9WXL 30490-314-60

W9WXL 30290-314-60

W9WXL 29990-314-60

W9WXL 29790-314-60

W9WXL 29590-314-60

W9WXL 29390-314-60

W9WXL 29190-314-60

W9WXL 28990-314-60

W9WXL 28790-314-60

W9WXL 28590-314-60

W9WXL 28390-314-60

W9WXL 28190-314-60

W9WXL 27990-314-60

W9WXL 27790-314-60

W9WXL 27590-314-60

W9WXL 27390-314-60

W9WXL 27190-314-60

W9WXL 26990-314-60

W9WXL 26790-314-60

W9WXL 26590-314-60

W9WXL 26390-314-60

W9WXL 26190-314-60

W9WXL 25990-314-60

W9WXL 25790-314-60

W9WXL 25590-314-60

W9WXL 25390-314-60

W9WXL 25190-314-60

W9WXL 24990-314-60

W9WXL 24790-314-60

W9WXL 24590-314-60

W9WXL 24390-314-60

W9WXL 24190-314-60

W9WXL 23990-314-60

W9WXL 23790-314-60

W9WXL 23590-314-60

W9WXL 23390-314-60

W9WXL 23190-314-60

W9WXL 22990-314-60

W9WXL 22790-314-60

W9WXL 22590-314-60

W9WXL 22390-314-60

W9WXL 22190-314-60

W9WXL 21990-314-60
### HY25
**$1.45 Net**
R.F. Power Amplifier, Oscillator, Class "B" Modulator, Frequency-Doubler, Ceramic Base and Insulation.
- **Plate Dissipation**: 25 watts max.
- **Plate Voltage (D.C.)**: 800 max.
- **Filament Voltage**: 7.5
- **Filament Current**: 2.25 amp.
- **Average Amp. Factor**: 55
- **Grid to Plate Cap**: 4.6 μf

### HY51A-HY51B **$5.00 Net**
R.F. Power Amplifier, Oscillator, Class "B" Modulator, Frequency-Doubler, Graphite Anode, Lava Insulation, Ceramic Base.
- **Plate Dissipation**: 65 watts max.
- **Plate Voltage (D.C.)**: 1000 max.
- **Filament Voltage**: 7.5 on HY51A, 10.0 on HY51B
- **Filament Current**: 2.25 amp. on HY51A, 3.5 amp. on HY51B
- **Average Amp. Factor**: 25
- **Grid to Plate Cap**: 7.5 μf

### HY60 **$2.50 Net**
Beam-Tetrode, R.F. Amplifier, Oscillator, Frequency-Doubler, Ceramic Base. NO NEUTRALIZATION REQUIRED FOR USE AT RADIO FREQUENCIES.
- **Heater Voltage (A.C. or D.C.)**: 6.3
- **Heater Current**: 0.5 amp.
- **D.C. Plate Voltage**: 425 max.
- **Plate Current**: 60 mA. max.
- **Grid Current**: 4 mA. max.
- **R.F. Output (Class "C")**: 16 watts approx.

### HY40 **$2.75 Net**
R.F. Power Amplifier, Oscillator, Class "B" Modulator, General Purpose High-Efficiency Triode, Graphite Anode, Lava Insulation, Ceramic Base.
- **Plate Dissipation**: 40 watts max.
- **Plate Voltage (D.C.)**: 1000 max.
- **Filament Voltage**: 7.5
- **Filament Current**: 2.25 amp.
- **Average Amp. Factor**: 25
- **Grid to Plate Cap**: 6.3 μf

### HY57 **$3.50 Net**
R.F. Power Amplifier, Oscillator, Class "B" Modulator, Frequency-Doubler, Graphite Anode, Lava Insulation, Ceramic Base.
- **Plate Dissipation**: 40 watts max.
- **Plate Voltage (D.C.)**: 800 max.
- **Filament Voltage**: 6.3
- **Filament Current**: 2.25 amp.
- **Average Amp. Factor**: 25
- **Grid to Plate Cap**: 5.1 μf

### HY61 **$3.00 Net**
Beam-Tetrode, R.F. Amplifier, Oscillator, Class AB1 Audio Amplifier, Frequency-Doubler, Ceramic Base. NO NEUTRALIZATION REQUIRED FOR USE AT RADIO FREQUENCIES.
- **Heater Voltage (A.C. or D.C.)**: 6.3
- **Heater Current**: 0.9 amp.
- **D.C. Plate Voltage**: 600 max.
- **Plate Current**: 100 mA. max.
- **Grid Current**: 5 mA. max.
- **R.F. Output (Class "C")**: 37.5 watts approx.

### HY615 TRIODE **$2.00 Net**
Ultra-High Frequency Oscillator, R.F. Amplifier, Detector, Plate and Grid leads are brought out to caps in the dome of the bulb. The HY615 features short connection leads, small internal elements and low inter-electrode capacities resulting in efficient operation at ultra-high frequencies, Ceramic Base.
- **Heater Voltage (A.C. or D.C.)**: 6.3
- **Heater Current**: 10 mA.
- **D.C. Plate Voltage**: 800 max.
- **Plate Current**: 250 max.
- **Plate Dissipation**: 3.5 watts max.

### 866 JR. **$1.05 Net**
Half-Wave, Mercury Vapor Rectifier, Ceramic Base.
- **Filament Voltage**: 2.5
- **Filament Current**: 2.5 amp.

### 866 **$1.50 Net**
Half-Wave, Mercury Vapor Rectifier, Heavy Duty.
- **Filament Voltage**: 2.5
- **Filament Current**: 5 amp.
W4DFC, W4EXP and W4FNJ. CUS then went to the home of FFR and, with W4CYT, aided FFR in the delivery of messages and collection of those to be transmitted. W4CYS later took control of his station which he had left with the N.C.R. group. At about 10:00 p.m. contact had been made and traffic started moving over the South Carolina 1.75-Mc. Phone Net. This work continued until 3:30 a.m., when time was taken out for a little shut-eye and a return to the air early in the day to complete the job of delivering and transmitting the rest of the traffic. CUS was aided by FFR and CYT in his late hour operation.

South Carolina amateurs taking part in the 1.75-Mc. circuit were W4EOZ, W4EDQ, W4BZ, W4DQY, W4ETF, W4EQH, W4EEF and W4EJH. These 1.75-Mc. fellows had been guarding the frequency of W4CUS in Charleston a long time before he was able to get his station on the air, keeping the channel clear.

3.5-Mc. operations: As soon as the fact that the tornado had almost isolated Charleston was known the 3.5-Mc. c.w. gang began a movement to construct an emergency circuit. Efforts to contact the Charleston fellows on 3.5 Mc. proved futile until about 7:00 p.m., when W4CWN at Fort Moultrie came on and was immediately contacted by W4BQE (with W4DNRI, E.C.) at the key. CWN was aided by W4BNB and the following fellows about the fort who aided in the deliveries, etc.: George C. Monte, Erwin Cathcart, R. E. Wenta, Jr., Paul McMichen, J. D. Bradley, Jake Lee Garbadie, Robert E. Harring and A. B. Wentz. CWN is a government operator and, after about two or three hours of operation, it was necessary for him to return to the government frequency. W4BRF set about to secure the necessary batteries to enable W4CZN to put his portable rig on the air and continue the good work of CWN. CZN was aided in his operation by W4CZA. South Carolina fellows known to have taken part in the emergency work on 3.5 Mc. were W4BDT, W4CQU, W4EWB, W4BQE, W4EXJ and W4DNRI. W4IR of College Park, Ga., also assisted. W5DAQ of New Orleans, Louisiana Emergency Coordinator, put some traffic into Charleston via W4CZN and made deliveries of replies within a few hours.

Ted Ferguson, W4BQE.
O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 71): W2CHK, W3JZX, W4BMM, W5FDR, W5GDU, W6GO, W6GEO, W6ID, W6CJF.

BRIEFS

Flea Power Defined

"A new type of high power is now becoming prevalent in the Chicago and nearby town areas. Kilowatt stations are becoming numerous, and a new club has been formed. It is called 'The Flea Power Club' and at this writing there are twenty-one members, each of whom operates a rig at an input of five watts or less. Perhaps you have wondered about the high power heretofore mentioned. Well, you have it . . . one watt is the equivalent of 200 flea-power watts; therefore, five watts makes a kilowatt flea-power station!"


W6USA

W6USA, amateur station at the Golden Gate International Exposition, on Treasure Island, San Francisco Bay, will be in operation soon. A very attractive souvenir QSL card will be sent for each QSO.

Broadcast station KPAB, Laredo, Texas, plans a series of DX programs directed to radio amateurs, running from January 15th to February 7th at around 2:00 to 3:00 a.m. CST. In addition to the usual acknowledgments KPAB will send to each individual reporting reception a souvenir of the Mexican border. These souvenirs will consist of such items as Mexican Sombreros, Mexican Sarapes, pottery, dressed fleas, jumping beans, leather pictures, miniature figures and many other characteristic Mexican handiwork pieces.
One of the greatest 'Ham' kits ever assembled!

14-TUBE
5 BAND
TRAFFIC MASTER
COMMUNICATIONS RECEIVER

Man! Here is a 14-tube, 5-band communications receiver that has practically every major circuit improvement known to radio engineers! In sensitivity, selectivity and signal-to-noise ratio on the amateur bands it is outstanding—and one of the greatest 'ham' kits ever assembled!

The TRAFFIC MASTER comes to you in complete, easily-assembled form—everything except tubes and speaker—with completely assembled all-wave Tuning Unit ready for mounting.

A built-in Noise Silencer—and a dozen other excellent features make it an outstanding receiver in amateur radio. Your Parts Jobber has this and other Meissner Kits. If not, write Dept. Q-1 at the factory. Ask for FREE 44-page catalog.

FEATURES
14 Tubes • 5 Band Pre-Aligned Tuning Unit covering 9.25 to 565 meters • Better than 1 M.V. Sensitivity on all Ham Bands • Large 9" Linear Scale Dial accurately calibrated • Flywheel Tuning on main and Band Spread Dials • "Align-Aire" (Air-Tuned) Coils • Built-in Noise Silencer Circuit • B.F.O. with Pitch Control • 3 Gang Precision Tuning Condenser—Ceramic-Insulated • Mono-Unit-Crystal Filter Assembly with Phasing Control and Shorting Switch • Electrical Band Spread Condenser.

NEW! 120-PAGE COMPLETE INSTRUCTION BOOK

Packed with theory and technical data. Easy-to-understand graphs, charts, pictorial and schematic diagrams, alignment data, constructional data and operating instructions for 20 new Meissner receiver kits. Also information on adapters, converters. At your Parts Jobber—or order direct. Address Dept. Q-1.

$81.90 LESS TUBES AND SPEAKER PANEL AND CABINET AVAILABLE

MT. CARMEL, ILLINOIS

"A FAMOUS NAME FOR TWO DECADES"
Ward Leonard Break-In Relays are especially suitable on phone transmitters where the operator merely presses a button while transmitting and releases it while receiving. For full details and prices get Circular 507B.

WARD LEONARD ELECTRIC COMPANY
41 South St., Mount Vernon, N. Y.

Please send FREE Bulletin 507B.

Name ................................................
Street ................................................
City and State ......................................
Call Signal ...........................................

CONTROL WHEELS
The Choice Throughout the World of the Discriminate in Both the Amateur and Commercial Fields.

2¼" Complete
with Scale & Indicator Plate
$1.20 net

3" Complete
with Scale & Indicator Plate
$1.50 net

COVERED BY
U. S. DESIGN PATENT NO. 110995

COTO-COIL CO., INC.
71 Willard Ave.
Providence, R. I.

The South Florida Radio Association of Miami held its annual Portable Field Contest on October 16th. Winners were W4AII, W4PBP and W4DUW. Operation was in the 3.9- 3.6- and 1.75-Me. bands, c.w. and "phone, with portable-emergency equipment. Scoring was based upon points received for contacts at no less than one-mile distance and exchange of number groups with other portables and the two base stations, W4EDD and W4DRD. Power inputs ranged from 3 to 50 watts, and net scores were obtained by the division of the gross score by the square root of the input power.

The first meeting (in person) of the Susquehanna Emergency Net was held at the Safe Harbor Power Plant of the Pennsylvania Water & Power Co., on Labor Day, 1938. Arrangements were in charge of A.R.R.L. Emergency Coordinator Charles Landis, W3UA, Mrs. Landis acting as host for the ladies. The gathering was addressed by Mr. Walter Wesselius, Aat. Director Relief, American Red Cross (Washington, D. C.), and Mr. Francis Farquhar of York, Pa., Chapter of the Red Cross on the necessity for communications, accuracy, etc., during emergencies. Other speakers were Mr. C. P. Merriam of Pennsylvania Water & Power, and A.R.R.L. Atlantic Division Director "Brad" Martin, W3QV, W3ZD and W8AYD demonstrated emergency equipment and told of their experiences in operating A.E.C. gear. An open forum discussion of net matters led to a better understanding of problems. Dinner was served, and a trip through the power plant made for an enjoyable and instructive day for all present.

Amateurs again were called upon to provide communication in the North Park Boat Races, Pittsburgh, in connection with the Allegheny County Sesqui-Centennial Celebration. The number of entrants and drivers being doubled over the previous year, more time was necessary and more work for the radio crew. To eliminate some difficulties of previous experiences, the bulk of the work between the judges' stand and the boat house was carried on cross-band on 3.9- and 14-Me. "phone. The races covered two days, September 3rd-4th, 1938, with an attendance of over 250,000 people. M-Me. "phone was used to provide communication between the crash boats and the judges' stand and boat house. This frequency was also kept as an emergency stand-by channel. Amateurs participating were W801W, OC, PTY, ONW, OFO, GUG, UK, BSO, CPR, AMP and NDP.

Lloyd M. Demrick, W6IIJX, in charge of radio with the Andean Anthropological Expedition, Inc. The small unit pictured is one of two portable rigs to be used for contact between field parties and the base station. The transmitter runs 35 watts input on c.w. and uses a 6CS for grid-leak modulation; oscillator is an 802 e.o.a. The receiver is a two-tube regenerative using a 817 and 6CS. Plug-in coils are used throughout. For further details on the Expedition see page 46, December QST. Call letters probably will not be issued until the preliminary party arrives in Ecuador. Frequencies applied for include all the amateur bands and three channels for "phone, one each in the neighborhood of 19, 35 and 50 meters. Further information will be presented in QST as available.
"How's the weather up there?" ask scientists working with the Weather Bureau and M.I.T.

And out of the ether comes a faint signal. It is the voice of the "RaySonde" or radiometeorograph. "Up there" perhaps three, six, twelve, fifteen miles into the stratosphere where a thin latex balloon has taken this sensitive instrument.

Thus we have a new and more efficient means of foretelling weather conditions. The small broadcasting station in the RaySonde carries its power right with it in the form of a small Burgess battery. Its famous manufacturer, J. P. Friez & Sons, has found that Burgess batteries have proved themselves utterly dependable again in this, another unusual service.

The same quality and dependability that make Burgess the choice of leaders are built into all Burgess batteries. They are available to you in standard and special purpose types for all your radio and experimental work.

BURGESS BATTERY COMPANY
FREEPORT, ILL.
ROANOKE DIVISION

NORTH CAROLINA — SCM, H. S. Carter, W4QG — The Charlotte gang put on a swell meeting for the Floating Club, and a good time was had by all. Thanks, fellows, for setting aside the DLX leads the way in this traffic this month. FB, BFX is doing a good job with the Emergency Corps in Charlotte, BHR got on long enough to handle some traffic, FJS has his rig on 1.75-Mc., phone, BRR is rebuilding his time vacated by working on 5.5 and 7-Mc. DW copied the Navy and Armistice Day messages, and gets on for A.A.R.S. drills. The Raleigh gang is busy on plans for the Floating Club meeting to be held there in January, and promises a big time for all that attend. ALT, back at his location, is active in A.A.R.S. The University Radio Club is active again with the following members: DYW, FKS, DBW, FQV, FAL, EPI, CZC, CXM, 1JBW and 2IZS. The station call is WE, and they will be operating on 14-Mc. phone soon, EYA, EXX and D8M passed Class A exam. DSM is putting up a pair of 3ST's on 14 and 1.9-Mc., phone. A unit of the N.C.R. is being organized at Salisbury-Spencere, DCQ is working portable in N.J. with a pair of 609's on 3.5-Mc. phone. DCW is working 28 Mc. mostly. CQU is heard regularly on 7 Mc. ABT is active in A.A.R.S. AIF continues to add countries to his list, OG has a pair of 52's to replace the ones that went west. There is a vacancy on the San Francisco Club, due to the resignation of a member. GGG is attending school. He is interested in filling this vacancy, please get in touch with the S.C.M. in Virginia, for new countries, making 96. JG is 11-19 fing '10 for new DX. DX is looking for DX on 14-Mc., and would like schedules with 50's. New stations in 40 sections in the first week-end of SS. IICQ worked XU8NC, XU4XA and J2KG and other good DX. Activities in. Virginia: W4DLX 49 FCB 33 FJS 13 ALT 12 DGV 9 DW-ABT 5 BRR-BX-BRT 4 DCQ-3/EYA-OG 3.

SOUTHERN CAROLINA — SCM, Ted Ferguson, W4QG — W4QG, which carries a number of schedules. FPO on 9.9-Mc., phone schedules DMY, COL and TJ, COL is operating portable at Clemson. EPJ is working 3.9-Mc. phone. BMN will soon have new rig on 28 Mc. COQ has three new antennas to make up his present 4 half-wave antenna; he and AUW are working on emergency equipment. EJK has worked all stations on 7.5-Mc. AAV has rebuilt his 7.5-Mc. c.w. and 1.75-Mc. phone, EJK is working 7-Mc. c.w. and 1.75-Mc. phone. EJK is working 7-Mc. c.w. and 1.75-Mc. phone, and has been appointed E.C. for the Palmetto Club. ETF schedules CUS. FMZ is operating 5.5 Mc. COA's "QSL 40" works FB. MN is back on 5.5-Mc. ECI, GVS and JNT are making 56. JG is rebuilding his rig. CQU is working 3.9-Mc. AIF is working 5.5-Mc. S.C. is growing. CQU has 98 verified. New O.P.S.: JM and RJG. JM is an old-timer. MOL and AFB. MOL moved and is putting up 67-ft. high antenna. KIU was on in O.R.S. Contest and DSJ in O.P.S. Contest from W.V.U. MIP is teaching at W.V.U., EYV couching athletics. W3V was High School Station, K.R. got his Radio Telephone First. RDC reports SLE new Romney station: SDU and SNT, NEU lost his 804's and is back to the old 70. New Fairmont station: SWV. The Mountaineer A.R.A. had a fish fry, Dec. 9th. New officers: OXO, pres.; ABT, 1st. JG ifl 11-19 fing '10 for new DX. DX is looking for DX on 14-Mc., and would like schedules with 50's. New stations in 40 sections in the first week-end of SS. IICQ worked XU8NC, XU4XA, and J2KG and other good DX. Activities in Virginia: W4DLX 49 FCB 33 FJS 13 ALT 12 DGV 9 DW-ABT 5 BRR-BX-BRT 4 DCQ-3/EYA-OG 3.

WEST VIRGINIA — SCM, S. W. William, W3UVA — New猕s included KAI, J2NF, VU2FO, PKBO, JFJP, Y3TR, K1AI, UX4A, PKAIC, J2MI, PKIT, UI2B, UX8F and PK7M. GSR schedules CMQ, FJS, JYV and DVL. FJS is working 3.9-Mc. phone. RJS is preparing to invade 7 Mc. FQO worked 75 stations in 40 sections in the first week-end of SS. IICQ is looking for DX on 28 Mc.; he got a good start with WV4CRE. HFD spends his time rag-chewing. CNY has new phone and rotary because he is a "talker" on 28-Mc.; phone, GRV has P.P. 805's ready to start as soon as he moves from QINfested downtown apartment. FWT is on 1.75, 4 and 14-Mc., phone. CTV has been on vacation to W.V.U. VM. EPL worked the Navy and Armistice Day schedules in the new O.P.S. CZA and FNT. FEH likes his new home, which he now owns. New Huntingdon station: W3AUX, BTV worked YS:LR for country No. 137; other good DX is looking for DX on 14-Mc., and would like schedules with 50's. New stations in 40 sections in the first week-end of SS. IICQ worked XU8NC, XU4XA, and J2KG and other good DX. Activities in Virginia: W4DLX 49 FCB 33 FJS 13 ALT 12 DGV 9 DW-ABT 5 BRR-BX-BRT 4 DCQ-3/EYA-OG 3.

ATLANTIC DIVISION

beresetublished 56 Mc., stations on Hawk Mt. and Lookout Mt., one mile apart, and assisted a survey group in measuring the speed of various species of birds. 3AQH has been handling traffic exclusively for eleven years. 3BES was at the table with 75 watts. 3BAC is now operating a new rig for 7, 14 and 28 Mc. 3BV has been installed at 3AOC, 3EEW, 3QG and 80ML. 100-kc. ess. and multivibrators are in use at 3DXX and 8ASW. 3FXX installed an 805 final for some 14-Mc. DX. 3GQ is covering Europe well with 100-watt 'phone. On 3.5 Mc. with 5600,'s and the Key Club organizing emergency corps with portable 8118's.

'test with Hartley rig of 1922 vintage with 100 watts; and Key Club organizing emergency corps with portable 8118's.

Layer at CAB! playing Saxton in Pittsburgh. The same son, W3BEI-BZX replaces BYR as eastern terminus of West Coast, K6 and K7. GKN entered Oct. 3R.S. net. A.KR is doing a complete rebuild. GWY is making fine score and got T9 reports. FEG is setting lots of fun on tie Id for super-regenerators still available on 112 and 224 Mc. BIA - SCM, Edgar L. Hudson, W3BAK - SCXL, 3GYY is one of the finest in this part of the state and many of the Society held annual hamfest Nov. 12th. This "get-together" was on 3.5 Mc. with 6L6G crystal ess. 8FLA has been appointed Radio Aide, Third Corps Area A.A.R.S. Traffic totals continue healthy with 334 originals against 468 deliveries, total points 3153. There has been too much interest shown in the possibility of 'phone on 7 and 3.5 Mc. with 5600, 's.

M. E. is on the air with 125 watts, handling traffic exclusively for eleven years. RXG is back on 3568 kc, handling traffic. IWV has nice luck with DX on 14 Mc. QJE keeps the 3568 kc. open. Of course it would be nice to know about ten more countries for his Century Club membership.

1C4B is getting under way after summer "lay off." QGM is on 3630 kc, and gets a kick out of playing checkers via radio with 3HLL, RAU on 3560 kc. RAU using his new skywire up and with help of FC.M and RKA is back on the air, NJN entertained Mr. and Mrs. CGU, Mr. and Mrs. FFN, Mr. and Mrs. O. Anderson of Lowville and Bob Reynolds of Oneida at a private hamfest on Nov. 9th. DHI took time out to work D4ORF, PA0QQ and F5CW on 3.5 Mc. with 50 watts to final. EJH handles a little traffic.

RBW has a report from Washington's youngest ham, HTW, 15 years old. Her 4TH: Bill Taubenschmidt, ham, HTW, 15 years old. His QTH: Bill Taubenschmidt, has been appointed D.N.C.S. for Pa. A.A.R.S. QBK of Rehoboth, Del. EUK has new field station. HVO. DNU is building new receiver and code practice. 8GN is the same son, W3BEI-BZX replaces BYR as eastern terminus of West Coast, K6 and K7. GKN entered Oct. 3R.S. net. A.KR is doing a complete rebuild. GWY is making fine score and got T9 reports. FEG is setting lots of fun on tie Id for super-regenerators still available on 112 and 224 Mc.

QGM is on the air with 125 watts, handling traffic exclusively for eleven years. RXG is back on 3568 kc, handling traffic. IWV has nice luck with DX on 14 Mc. QJE keeps the 3568 kc. open. Of course it would be nice to know about ten more countries for his Century Club membership.

1C4B is getting under way after summer "lay off." QGM is on 3630 kc, and gets a kick out of playing checkers via radio with 3HLL, RAU on 3560 kc. RAU using his new skywire up and with help of FC.M and RKA is back on the air, NJN entertained Mr. and Mrs. CGU, Mr. and Mrs. FFN, Mr. and Mrs. O. Anderson of Lowville and Bob Reynolds of Oneida at a private hamfest on Nov. 9th. DHI took time out to work D4ORF, PA0QQ and F5CW on 3.5 Mc. with 50 watts to final. EJH handles a little traffic.

RBW has a report from Washington's youngest ham, HTW, 15 years old. Her 4TH: Bill Taubenschmidt, ham, HTW, 15 years old. His QTH: Bill Taubenschmidt, has been appointed D.N.C.S. for Pa. A.A.R.S. QBK of Rehoboth, Del. EUK has new field station.

M. E. is on the air with 125 watts, handling traffic exclusively for eleven years. RXG is back on 3568 kc, handling traffic. IWV has nice luck with DX on 14 Mc. QJE keeps the 3568 kc. open. Of course it would be nice to know about ten more countries for his Century Club membership.

1C4B is getting under way after summer "lay off." QGM is on 3630 kc, and gets a kick out of playing checkers via radio with 3HLL, RAU on 3560 kc. RAU using his new skywire up and with help of FC.M and RKA is back on the air, NJN entertained Mr. and Mrs. CGU, Mr. and Mrs. FFN, Mr. and Mrs. O. Anderson of Lowville and Bob Reynolds of Oneida at a private hamfest on Nov. 9th. DHI took time out to work D4ORF, PA0QQ and F5CW on 3.5 Mc. with 50 watts to final. EJH handles a little traffic.

RBW has a report from Washington's youngest ham, HTW, 15 years old. Her 4TH: Bill Taubenschmidt, ham, HTW, 15 years old. His QTH: Bill Taubenschmidt, has been appointed D.N.C.S. for Pa. A.A.R.S. QBK of Rehoboth, Del. EUK has new field station.

M. E. is on the air with 125 watts, handling traffic exclusively for eleven years. RXG is back on 3568 kc, handling traffic. IWV has nice luck with DX on 14 Mc. QJE keeps the 3568 kc. open. Of course it would be nice to know about ten more countries for his Century Club membership.

1C4B is getting under way after summer "lay off." QGM is on 3630 kc, and gets a kick out of playing checkers via radio with 3HLL, RAU on 3560 kc. RAU using his new skywire up and with help of FC.M and RKA is back on the air, NJN entertained Mr. and Mrs. CGU, Mr. and Mrs. FFN, Mr. and Mrs. O. Anderson of Lowville and Bob Reynolds of Oneida at a private hamfest on Nov. 9th. DHI took time out to work D4ORF, PA0QQ and F5CW on 3.5 Mc. with 50 watts to final. EJH handles a little traffic.

RBW has a report from Washington's youngest ham, HTW, 15 years old. Her 4TH: Bill Taubenschmidt, ham, HTW, 15 years old. His QTH: Bill Taubenschmidt, has been appointed D.N.C.S. for Pa. A.A.R.S. QBK of Rehoboth, Del. EUK has new field station.

M. E. is on the air with 125 watts, handling traffic exclusively for eleven years. RXG is back on 3568 kc, handling traffic. IWV has nice luck with DX on 14 Mc. QJE keeps the 3568 kc. open. Of course it would be nice to know about ten more countries for his Century Club membership.

1C4B is getting under way after summer "lay off." QGM is on 3630 kc, and gets a kick out of playing checkers via radio with 3HLL, RAU on 3560 kc. RAU using his new skywire up and with help of FC.M and RKA is back on the air, NJN entertained Mr. and Mrs. CGU, Mr. and Mrs. FFN, Mr. and Mrs. O. Anderson of Lowville and Bob Reynolds of Oneida at a private hamfest on Nov. 9th. DHI took time out to work D4ORF, PA0QQ and F5CW on 3.5 Mc. with 50 watts to final. EJH handles a little traffic.

RBW has a report from Washington's youngest ham, HTW, 15 years old. Her 4TH: Bill Taubenschmidt, ham, HTW, 15 years old. His QTH: Bill Taubenschmidt, has been appointed D.N.C.S. for Pa. A.A.R.S. QBK of Rehoboth, Del. EUK has new field station.
MODEL D-104 MICROPHONE

Time has proven the merits of this crystal microphone for "speech range" performance under all conditions. "Hams" still think of it as "tops.

Complete with interchangeable locking connector and 8-ft. cable. List Price $22.50

MODEL T-3
Another Favorite

General purpose microphone with high quality performance. Designed with self-locking, tilting head, adjustable to directional or non-directional position. Chrome finish. Equipped with interchangeable locking connector and 25-ft. cable. List Price $25.00

ASTATIC Microphone Laboratory, Inc.
Youngstown, Ohio
Licensed Under Brush Development Co. Patents

GORDON HEAVY RF RELAY

- Takes 1 Kw. Easily
- Husky ¼" Silver Contacts
- ¼" Contact Spacing
- Astatic 19% RF Ins.
- Especially suited for Beam Antennas

This sturdy RF relay is designed for Antenna Changeover, Multi-band Transmitter Tank Switching and 60 cycle Power Switching. No chatter. For 110 volt AC. Very reasonably priced at $9 net.

See Your Jobber or Write for Details

GORDON HAND WHEELS
FOUR SIZES
(3½", 2½", 1½", 1¼" dia.)

Here is a sweet line of tuning controls. Be sure to see all sizes and combinations at your jobber's. Available with chrome metal pointers, with scales or dial plates. Give your panels that professional touch by standardizing on GORDON Hand Wheels and Name Plates.

* Write for listing of 120 GORDON Name Plates. Also data on World DX Clock and other GORDON accessories.

WRITE DEPT. 9 FOR GORDON CATALOG

GORDON SPECIALTIES COMPANY
1104 SOUTH WABASH AVENUE
CHICAGO, ILLINOIS

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. 10 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.

W1—J. T. Steiger, W1BGY, 35 Call Street, Willimansett, Mass.
W2—H. W. Yahnke, W2SN, Lake Ave., Hel- mena, N. J.
W3—Aurice Downes, W3WU, 1811 Sheridan St., N. W., Washington, D. C.
W4—G. W. Hoke, W4DBY, 323 Mell Ave., N. E., Atlanta, Ga.
W6—Horace Greer, W6LT, 414 Fairmount Ave., Oakland, Calif.
W7—Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
VE1—L. J. Fader, VE1FQ, 125 Henry St., Hallifax, N. S.
VE2—C. W. Skarsstein, VE2DR, 236 Elm Ave., Westmount, P. Q.
VE3—Bert Knowles, VE3QB, Lanark, Ont.
VE4—George Behrends, VE4RO, 186 Oakdean Blvd., St. James, Winnipeg, Manitoba.
VE5—H. R. Hough, VE5HR, 1755 First St., Victoria, B. C.
K4—F. McCown, K4RJ, Family Court 7, San- turce, Puerto Rico.
K5—Norman F. Miller, K5AF, 15th Air Base Squadron, Albrook Field, Canal Zone.
K6—James F. Pa, K6LBH, 1416D Lunalilo St., Honolulu, T. H.
K7—Dean Williams, K7ELM, Box 2373, Juneau, Alaska.
KA—George L. Rickard, KA1GR, P. O. Box 840, Manila, P. I.
U. S. Auto Alarms
Approved by F.C.C.
Mackay type 101-A and Radio-Auto Alarm Model AD-3000 are described in minute detail with complete operating instructions, circuit diagrams and photographs.

Electron Tube
Various types, characteristics and applications, explained by Robert Kupe, internationally known expert and radio engineer and technical editor.

Vacuum Tube Amplifiers and Oscillators
Class A and B audio amplifiers; Class A and B radio frequency amplifiers; Oscillator circuits, etc., etc.

Modulation and Modulation Analysis
Classification of systems and full explanation of each. Analysis by component method and by use of Cathode ray oscilloscope.

Latest Broadcast Transmitters
R.C.A. types 100-T, 250-D, 5-KW type 5-D; installations, adjustments, operation, and maintenance. High fidelity and new equalized feedback circuits.

Marine Radio — Telegraph Transmitters

F.C.C. Rules and Regulations
covering broadcast, ship, aviation, and police services. All important radio provisions of Communications Act.

DUTIES of the Radio Operator
at ground stations of commercial transport companies. Operation, adjustment, maintenance of transmitters and receivers and radio beacon receivers.

Latest 1938 Data!
A complete revision, of this standard handbook, greatly enlarged, up to the minute. Complete information covering the entire field of Radio — all arranged for ready reference.

The Radio Manual
A Handbook for Students, Amateurs, Operators and Inspectors
Here's the only complete Handbook for students, amateurs, operators, and inspectors. It covers the entire field of radio in 1,000 pages with hundreds of illustrations and diagrams. It is actually a complete course of training in radio operation and a complete reference book for everyone in the field. It gives instantly the answer to every question about principles, methods, and apparatus of radio transmitting and receiving.

New Information
Never Before Available
This new edition is packed with up-to-the-minute information much of which is available in no other book and all of which is essential to any man whose work or hobby is radio in any of its branches.

Prepared by F.C.C. Expert
The author, G. E. Sterling, is Assistant Chief, Field Section, Engineering Dept., Federal Communications Commission and nationally known as an outstanding authority.

Sent on Approval
Mail This Coupon Today!

D. VAN NOSTRAND CO., 250 Fourth Avenue, New York
Send me on approval THE RADIO MANUAL. Within 5 days after I receive the book, I can return it and owe nothing. If I keep it, I will send you $2.00 as first payment and I will pay $2.00 monthly thereafter for 2 months — $6.00 in all. (5% discount for cash.)

QST 1-39

Name:—
Address:—
City: — State:—
Reference:—
Address:—

For Free Catalog of best books of practical instruction and technical information, check here. If you do not want The Radio Manual cross out paragraph above.

103
modulators. PDP is working on 28-M. 'Rh' OSI is using his "QSL 40" on 7 Mc. ROA is building T40 final and 809's prize. A HY25, to drive P.D. 809's. RBD uses an RK37 final, 2J6 DNX 226 FUW 20:l NDE 95 TOH 53 YA 42 PFW 38.


HUDSON DIVISION

EASTERN NEW YORK -- SCM, Robert E. Haig, W2ULI -- XEF, high traffic man for the month, reports FB line-up of schedules. LU handled traffic for Scrarsdale Business Men's Show, LU keeps Feura Bush on the air. ITK reports for Kingston's boys. OTW is doing a good job on 10, C. C. KOU enjoyed the SS. DVER octet. O.P.S., party, making score of 3328, BNR is on 7 Mc, with pair of 809's, HUB sports and FB homemade super, 1KBY reports GSB (Union College Radio Club) all set for lots of traffic, KEX, JQF, HRP, SMMH and 1KBY keep the air hot but both are on 5648 Kg. LSI reports the following N.O.S. from his Section made cruises this past summer: CUA to Guantanamo Bay, Cuba on U.S.S. Fairfax; LDS to Guantanamo Bay on U.S.S. J. Fred Talbot; ISJ to Havana and Key West for QSL and the hunt for P.P. 35T's. New amateurs: Gooseburis- SMX and Key West on U.S.S. 21 KPX.

Traffic: W6KEF 80 LU 50 LNU 44 ITK 16 GTW 14 KOI.

NEW YORK CITY AND LONG ISLAND -- SCM, Ed L. Baunach, W2AZY -- Appointments this month: GDF, E.C. for Queens County; KUY, JGY, HJY, O.P.S.; CHK, O.B.S. on 14 Mc, and JGQ, O.B.S. on 3.0-Me., phone. JRE and JUX are working for O.P.S. appointments. DUV is moving to Montclair. BVO is back on 7200 Mc, after being off since 1960. ELK vacationed in Florida. JVK passed the 1st Class Telephone and 2nd Class Telegraph exams. IXQ is studying for 1st Class Telephone ticket. JH'B's YL and IXQ are operating smoothly on 3640 kc. at Far Rockaway. Henry's still on hand as often as possible, he is working on his new antenna.

Traffic: W6KEF 80 LU 50 LNU 44 ITK 16 GTW 14 KOI.

NORTHERN NEW JERSEY -- SCM, Fred C. Read, WJBM -- 'Phone nets, same as used in battlewagon. ISJ would like to have touch with the net, they are right. The Connecticut Brass Pounders are interested in emergency operation should get in touch with SCM.


NORTHERN NEW JERSEY -- SCM, Fred C. Read, WJBM -- 'Phone nets, same as used in battlewagon. ISJ would like to have touch with the net, they are right. The Connecticut Brass Pounders are interested in emergency operation should get in touch with SCM.

Club, Nov. 6th. A cordial invitation is given to come and sit in with the gang, IEEE joined the P.T.N. NYX is now O.P.S. The boys at the U. of M. have reconized the Amateur Radio Club, JCP was elected pres., ISM sec'y. Monthly meetings are held on the third Wednesday of each month, at 8:00 P.M. in the KMM 54 LF 57 IEE 09 CPT 80 BTA 69 HSE 76 HSD 111 CFI 155 KOU 221 INW 394 JOG 573.

EASTERN MASSACHUSETTS -- SCM, Sam D. Gross, W1WEC -- P.A., L.R. Mitchell, WH111. K7T finds WRX real quiet this month, with just 12 W's heard on the local broadcast station WGAN. More about this later. Best wishes to all of you for a Very Happy and Prosperous New Year.

O.R.S. GMD is new O.P.S. TE, Emergency Coordinator for the Worcester County contact, Nov. 17. A Mrdial invitation is given to come and sit in with the fellows at the Radio Club, at least 25 W's are heard on 14 Mc. at one time.

FBJ 40 KCO 42 KMM 54 L.JF 57 IIE 60 CPT 80 BTA 69.

strengthen the Central Mass. A.A.R.S. set-up, are urged to keep in touch with the gang. 2BAQ-1 has been appointed Asst. Coordinator for the St. Albans area. CBW siims WLGX in the Worcester area on 2745 kc. at 7:00 P.M. GST on Wednesday. WlKIN 796.


RHODE ISLAND -- SCM, Clayton C. Gordon, W1HRC is the new O.R.S. is now C.A.N.C. (Ct.) DX meeting. HKK for next time; may it be far away!! EOB is now C.A.N.C. coders are picking up a new QTH. BDU was active in SS. JGQ is undergoing extensive rebuilding. JVT is back in his 14 Mc. EHB is installing an HFI-100. LPL is sending tape code practice on 1.8 Mc. will cover the entire band on QRZ's. A.A.R.S. check in on their own 3735 kc. net, APK on 3020 kc. will contact 3.9 Mc. 'phones at 5:00 p.m., 2-Mc. 'phones at 6 p.m, from 1000 kc. A general bulletin will be sent out the latter part of January with further details.

O.R.S. GMD is now O.P.S. TE, Emergency Coordinator for the Worcester County contact, Nov. 17. A Mrdial invitation is given to come and sit in with the fellows at the Radio Club, at least 25 W's are heard on 14 Mc. at one time.


Rhode Island Field Day was held out front October in Westerly, with a special visiting party from N.Y. (Lark nearest to Rhode Island). Traffic total shows. EAK is on the air in Derry after a two-year lay-off. ADR built a portable gas-engine-driven generator from an old Dodge generator; AXL has one under construction. Highest N. H. SS score reported to date, 4900 points, was made by a new member, using an HFI-100, a Signal Spinner. FB1 JSL is on 56 kc. with high power from his new QTH. ASQ-1 is on from Manchester. LLJ has a new 55 and 25-Mc. crystal-controlled rig. KSL is active on 25 Mc. The Nashua, Concord, and Key Club have a permanent meeting place and an emergency power unit. The M.V.A.R.A. has authorized construction of a vibraphone emergency power unit. APK is putting A.R.R.L. Official Broadcasts on 3030 and 1560 kc. simultaneously. DUK is all set with complete emergency outfit that gets out fine. JNC and HQE have new rating 9 receivers.

You can step ahead into a better radio job!

You can make more money—and get ahead faster with CREI technical training

Don't say you never had the opportunity to get ahead—for here it is! Radio wants you—and needs you—for those important jobs that new equipment and methods have created. But, you must have training first. CREI courses in Practical Radio Engineering will give you the ability to qualify for a better job. Today's your chance to send for our important story.

TEAR OUT COUPON AND MAIL FOR FREE BOOK

Please send me your new illustrated book, “A Tested Plan for a Future in Radio”

Name: __________________________
Address: ________________________
City: ___________________________

BRAZILIAN QUARTZ CRYSTAL

Largest and most varied stock of Brazilian quartz crystals in the United States. Finest quality suitable for manufacturing piezoelectric crystals, lenses, and prisms. Shipments received regularly from our Brazilian Branch. Also in stock tourmalines for making crystals to control the higher frequencies and quartz for tuning purposes.

BRAZILIAN TRADING CO., INC.
377 Fourth Ave., New York City

CREI Radio Engineering Institute
Dept. Q1, 3224 16th St., N.W., Washington, D.C.

The New TURNER Model 99 Dynamic Microphone

Gives You Dependable Performance Regardless of Climate or Temperature

Indoors or Out!

MODEL 99 gives you sure-fire operation under even toughest conditions. Crisp reproduction, no low frequency boom. The 99 has trustworthy response range, 60 to 9000 cycles; high level, -57 DB. Not sensitive to mechanical shock, or affected by dampness or sal air. Cable connector insures quick easy cable changes. Saddle is adjustable. Available in all impedances. HIGH IMPEDANCE. Weighs 2½ lbs. Professional style. Write for free literature now!

THE TURNER CO.
CEDAR RAPIDS, IOWA

Ham at 30° Below

(Continued from page 18)

even your duffie bag of clean clothes mildews through, when the tubes collect “blizzard blanks” and the cartons become moist and damp, when your tools and other metallic objects rust in the damp salt air—then you begin to appreciate the precautions required.

Then, too, you must have power to operate. We used a gasoline engine for generating our power. One after another, replacement coils and condensers would go out. We finally had to revert to old Model “T” spark coils, reducing the primary power to lessen burning. Another point is to make sure that your lubricants will function at the temperatures you will encounter. Ours would not, and it was some chore to drain the coil and water immediately after each run, and then reheat it on the stove before starting up again!

Yes, there are two sides to the picture, all right. I certainly had plenty of illusions shattered on this trip. Don’t you believe all the bunk they paint about the glory and glamour of expedition life! Just salt it down that expeditions are about nine-tenths good, hard work and about one-tenth bunk. My private opinion, after having spent a little time “up North,” is that it is not worth while for an amateur to want to waste a year of his life out in the great unknown, away from the warmth of his family fireside, from clean rooms and hot baths and three square meals a day, from friends and companions, from all that one has come to enjoy and appreciate of civilization. True, it will be different from the humdrum of everyday life. You can be sure of that! You have to rough it and take life as it comes. Whether it be in the tropical heat with insects and jungle fever and vegetation impeding your progress and endless rain to soak up your cheery disposition, or whether it be in the chill of the Arctic with winds biting your serene self and freezing this and that part of your anatomy, snow blowing into your eyes and freezing out visibility so that you cannot help but stumble and fall—wherever it may be, remember that it simply means long, discouraging hours of hard labor under conditions that would be intolerable at home.

Think of having to put up an antenna that has blown down, when it is pitch dark twenty-four hours a day and the temperature is from 10° to 30° below zero, with a howling Arctic wind so strong it almost bowls you over—or think of starting an engine so cold you can barely turn it over every time you have a schedule to keep—or of living closely confined with a group of men with whom you continually rub elbows all day and night for months on end, or of monotonous meals providing the same scanty fare every day, day after day. Think of having to do with and put up with things that are far worse than anything you could expect at home, of doing everything the “hard way”—and then, if you still want to go, this is all I have to say:

More power to you!
**HOWARD DOES IT AGAIN!**

With the advent of the world famous 430, many have asked for a larger receiver—here it is.

**Model 438** embodies professional features never before associated with equipment in this price class... real "DX" with R-9 reception.

- Ceramic Coil Forms...
- R. F. Stage on all Bands...
- Separate Coils for each Band...
- Xtal Filter...
- Complete Coverage 540 KC...
- 43 mc ... Electric Band Spread with vernier control...
- 2-stage Iron Core I. F. ... Accurately Calibrated Slide Rule Dial...
- R-9 reception:
- Built-in 6" Dynamic Speaker...
- Head Phone Jack...
- Doublet or Marconi Antenna Connections...
- Provision for External Speaker...
- Provisions for Howard tube type 'R' Meter.

**Models to Suit the Individual Tastes of the Most Exacting Amateur and Professional**

<table>
<thead>
<tr>
<th>Model</th>
<th>Tubes</th>
<th>Bands</th>
<th>Frequency Coverage</th>
<th>Ceramic Coil Forms</th>
<th>Dual I. F. Channels</th>
<th>Two S. L. F. Ceramic Insulated Tuning Condensers</th>
<th>47 inches of electric bandspread</th>
<th>Crystal Filter</th>
<th>Calibrated 'R' Meter</th>
<th>Accurately calibrated direct reading dial</th>
<th>Price, with Tubes, less Speaker, less Crystal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 450A</td>
<td>12</td>
<td>6</td>
<td>54 to 65 MC</td>
<td>Ceramic Coil Forms</td>
<td>Dual I. F. Channels</td>
<td>Two S. L. F. Ceramic Insulated Tuning Condensers</td>
<td>47 inches of electric bandspread</td>
<td>Crystal Filter</td>
<td>Calibrated 'R' Meter</td>
<td>Accurately calibrated direct reading dial</td>
<td>$87.50 Net</td>
</tr>
<tr>
<td>Model 438</td>
<td>6</td>
<td>4</td>
<td>54 to 40 MC</td>
<td>Ceramic Coil Forms</td>
<td>B. F. O. with pitch control</td>
<td>Iron Core I. F. transformers</td>
<td>Electric band spread</td>
<td>Built-in Dynamic Speaker</td>
<td>Headphone Jack</td>
<td>Accurate direct reading straight line dial</td>
<td>$29.95 Net</td>
</tr>
<tr>
<td>Model 440</td>
<td>9</td>
<td>5</td>
<td>54 MC to 40 MC</td>
<td>Ceramic Coil forms, S. L. F. Ceramic Insulated Tuning Condensers, Electric Bandspread, R. F. on all bands, Iron Core I. F. transformers</td>
<td>Electric band spread, Calibrated 'R' Meter, Crystal Filter</td>
<td>Price with tubes less Speaker, less Crystal</td>
<td>$66.50 Net</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Howard Radio Company**

1731-35 West Belmont Ave., Chicago, Ill.

Please send me more information on...

- Model 438
- Model 430
- Model 450-A
- Model 440

CABLE ADDRESS: "Howardco" Q

Name__________________________
Address________________________
City__________________________State________________________
Vertical Antennas

(Continued from page 17)

the old single-wire feed method. The information covering this form of feed which is given in the A.R.R.L. Handbook may be applied to almost any of the foregoing antenna systems and will bring about a certain amount of simplification of the mechanical details. It would be hard to think of a simpler way of feeding almost any of the vertical systems which are made up of single or stacked half-wave units. More or less as an added starter and just to show how easy it is, we have added Fig. 7, which will be recognized as a simplification of Fig. 4-E. As a rule, single-wire feed is not suitable for rotary systems, for reasons which are strictly mechanical, so we have omitted previous mention of it.

Almost any of the quarter-wave Marconi aerials described in the first part of this text may be single-wire fed. Theoretically each of the quarter-wave units has for its other quarter-wave section either the building on which it has been erected or the ground. Many of those that we have used have been on high buildings, and possibly that is the reason for our having secured almost as good results with quarter-wave aerials as with center-fed half-wave units.

The quarter-wave antenna may be single-wire fed by considering the vertical portion as only half the antenna, and the feed line may be attached at a point approximately two-thirds the distance down from the top. It is sometimes thought that it is impossible to use single-wire feed without having standing waves on the transmission line. This need not be true because single-wire feed may be considered in exactly the same light as two-wire feed, the ground itself forming the other half of the line. Therefore the single-wire line may be used as a resonant feed system having standing waves or a non-resonant system without standing waves. Where vertical aerials are to be used on apartment houses in localities where a great many broadcast receivers are in use, it is desirable to use the non-resonant line to avoid interference.

In the quarter-wave vertical, the point of highest current is at the base of the antenna. The point of lowest voltage is also at the base. This means that there is no need for an insulator at the base at all, and if care is taken in the selection of the feed system there is no reason why a vertical quarter-wave radiator cannot be mounted directly on the steel frame of a building without using insulation of any kind.

Combinations of Vertical Antennas

In all the antennas considered up to now, simplicity has been the keynote. It is perfectly possible to make combinations of vertical ele-

---

7 Resonant operation is inadvisable in practically all cases because under such circumstances the line radiates practically as well as the antenna and is not, therefore, really a transmission line in the usual sense of the term. With non-resonant operation the radiation is low because the line current is low, but the cancellation effect of the two-conductor line is lacking.—Ed. Erickson.
NEW YEAR'S GREETINGS from
The RADIO SHACK

5-10 HALLICRAFTER
SKYRIDER
Cash Price or $12.50 Down
$69.50 and 5.23 for 12 mos.
Better signals on 5-10 meters calls for the outstanding ultra high frequency receiver.

MAIL ORDERS PROMPTLY FILLED
• Write for Free
72 Page Catalog

S-17 HALLICRAFTER
SUPER SKYRIDER
Cash Price
$125.50 or $25.50 Down
$9.00 for 12 mos.
Designed for the amateur who wants exacting performance and superior reception.

NEW HAMMARLUND “HQ 120”
Continuous range from 31 to .34 mc—12 tubes; antenna compensating control; 310° band spread; noise limiter follows A.V.C. for quiet reception; variable band width crystal filter for phone reception; calibrated “S” meter on all models.
CASH PRICE
$117.00
less crystal filter
$23.40 down
and $8.41 for 12 mos.

SICKLES IRON CORE PERMEABILITY TUNED I.F.
TRANSFORMER
As specified in low cost single signal receiver by George Grammer, on page 14 October QST. Permeability tuned. 436 Kc.
L.F. Transformer 6504, Net $1.18
Beat Frequency Oscillator 6577, Net $1.18

PREMAX VERTICAL RADIATORS
Fully telescoping and adjustable: quick, easy to install; no long sizes to handle; simply erect ft. unit and extend to height desired: special design 23,000 volt insulator to 800-foot Tower type.
19 meter, adj. $ 6.17
to 17 ft. Net 20 meter, adj. $10.67
to 24 ft. Net $16.76

STANDARD RACK PANELS
Made in accordance with standard specifications. Constructed of 1/2” steel, finished in fine black crackle.
1 3/4” $ .39 12 1/4” .79
2 1/2” .49 14” .99
3 1/4” .59 15 1/2” 109
3 3/8” .69 16 1/2” 119
4 1/2” .89 18” 129

Steel Brackets
Black crackle finish, 1/2” steel.
8” base (per pair) 44c
11” base (per pair) 59c
13” base (per pair) 69c

Crackle Finished and Electro Zinc Plated Chassis

THE RADIO SHACK
46 Brattle St., Boston, Mass.

109
DOES FAST CODE GET YOU DOWN?

Write for CANDLER'S FREE Book of Facts!

THERE'S no need to let fast code lick you! If you are having trouble learning code, if you can't develop the speed you need, if you can't get your license — call on Candler! He has trained thousands of operators with the unique Candler System, fellows who were stuck, who couldn't get over the "hump."

In a few weeks with Candler, learning sound-consciousness, getting the proper mental training, you will be able to read code as easily as you read print, without strain or effort. Ask any skilled operator!

Learn about the Candler System! Send for Candler's FREE "Book of Facts" today!

CANDLER SYSTEM CO.
BOX 331, DEPT. Q-1
ASHEVILLE, NO. CAROLINA
BRITISH ADDRESS: ROOM 56, CRAVEN HOUSE,
KINGSWAY, LONDON, W. C. 2.

SICKLES COILS
SECURE A COPY OF OUR NO. 939 CATALOG FROM YOUR JOBBER
F. W. SICKLES COMPANY
300 Main Street
Springfield, Mass.

TYPE HFM TRANSMITTER
"THE TRANSMITTER OF THE FUTURE"
• SW Bands 1715 — 60,000 K.C. on two crystals
• All Frequencies Crystal Controlled
• Instantly Changeable Mobile or Portable
• Final Tube Input 21 to 36 Watts
Net to Amateurs...$57.60
Write for bulletin listing complete, new and approved line for amateurs.

RADIO TRANSCEIVER LABS.
8627 115 Street • Richmond Hill, New York City
CABLE ADDRESS: "RATRALAB"

RADIO COURSES
New Classes Now Starting
RADIO OPERATING • BROADCASTING • CODE
RADIO SERVICING • TELEVISION
• ELECTRONICS — 1 year day course; 2 years eve.
Day and Evening Classes — Booklet upon request
NEW YORK YMCA SCHOOLS
6 West 66th Street, New York City

ments to provide some very interesting effects. An outstanding example of the use of two half-wave verticals which could be made to transmit endfire or broadside by the simple expedient of altering the connection between the transmission line and the feeding stubs was described by Dana Griffin, W2AOE, in QST for October, 1935. The spacing which Griffin used between the vertical elements was quite different from the close spacing which is now so popular, and the advantages of the close spacing will be immediately recognized. A more recent outline of what is essentially the same idea will be found in QST for May 1938, under the title "Simple Directional Arrays using Half-Wave Elements," by Nicholas C. Stavrou, W2DFN.

Some very interesting information on the application of three vertical elements for use on 10 meters, as shown diagrammatically in our Fig. 6-B, will be found in an article entitled "A Continuously Rotatable 28-Mc. Beam," by A. F. Neuenhaus, W2BSF, and M. E. Schreiner, W2AJF, which appeared in QST for March, 1938.

The most outstanding example that we have seen of the way in which verticals can be used in a rotary beam is now in operation at the station owned by Frank Carter, W2AZ, at East Rockaway, Long Island. On top of a 60-foot telephone pole, which is ungued, he has set up a pivoted crossarm made of two 2 x 10 planks mounted edgewise. On the top side of this crossarm are mounted two of the new Premax self-supporting 36-foot vertical telescopic radiators. Two similar radiators extend downward from the bottom. The four units have been worked into a vertical two-section "8JK" beam. Since the beam is bidirectional it is only necessary to provide 180 degrees of rotation for 360-degree coverage.

Using about 600 watts input, W2AZ has worked 100 countries on 'phone, using a single frequency in the 20-meter band. Some indication of the superiority of his vertical beam over the three similar horizontal beams that he has been using may be gleaned from the fact that VU2CQ in Bombay, India, can be received SS on the vertical, whereas he is just audible on the horizontal beam. On a recent weekend W2AZ made WAC 100 countries on 'phone, and he now reports PK6XX in Dutch New Guinea 87 on the vertical beam, when he could not be heard on the horizontal beam. VQ3HJP in Tanganyika and TF5C in Iceland have been workable with this new vertical, after they had faded out completely on the horizontal beams.9

9 D. A. Griffin, "Shifting Antenna Directivity by Phase Switching," QST, October, 1935.

9 These results are interesting in view of the fact that the only obvious explanation is that the signals were arriving with vertical polarization, since antenna systems having practically the same gain were used. Long-time observations on high-frequency waves have shown that on the average the polarization at the receiving point is horizontal although, of course, there are frequent exceptions. A possible alternative explanation is the difference in vertical characteristics of the systems; the vertical array is broader in the vertical plane than the horizontal array, so that the vertical might show large gain if the signals were arriving at relatively high angles. — Eds.
**NEWARK OFFERS THE LATEST IN ANTENNA EQUIPMENT**

Neither snow, nor rain, nor ice, nor sunshine, nor the gloom of the “XYL” can stay these husky cables from the efficient transfer of radio frequency power from transmitter to antenna.

Newark has a **BASSETT CONCENTRIC FEEDER** or **BASSETT CONCENTRIC TRANSFORMER** for every type antenna and for every power requirement. Order today direct from this ad.

<table>
<thead>
<tr>
<th>Type</th>
<th>Power Rating</th>
<th>Surge Impedance</th>
<th>Price Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCF-64-5000</td>
<td>5000 Watts</td>
<td>64 Ohms</td>
<td>$0.40</td>
</tr>
<tr>
<td>BCF-64-1000</td>
<td>1000 Watts</td>
<td>64 Ohms</td>
<td>$0.17</td>
</tr>
<tr>
<td>BCF-64-600</td>
<td>600 Watts</td>
<td>64 Ohms</td>
<td>$0.10</td>
</tr>
<tr>
<td>BCF-64-200</td>
<td>200 Watts</td>
<td>64 Ohms</td>
<td>$0.05</td>
</tr>
<tr>
<td>BCF-54-1000</td>
<td>1000 Watts</td>
<td>34 Ohms</td>
<td>$0.16</td>
</tr>
<tr>
<td>BCF-28-1000</td>
<td>1000 Watts</td>
<td>28 Ohms</td>
<td>$0.11</td>
</tr>
<tr>
<td>BCF-13-1000</td>
<td>1000 Watts</td>
<td>13 Ohms</td>
<td>$0.07</td>
</tr>
</tbody>
</table>

Factory moulded and attached end seal, any length.......................... $1.50

50-75-100 ft. lengths with end seal on above carried in stock. All other lengths to order only.

**Bassett Concentric Transformers**

For feeding 3-element rotary beams. Both ends sealed at the factory. One end connects direct to center of antenna and other end direct to open wire line consisting of pair of No. 12 wires spaced four inches apart. Open wire to transmitter may be any length desired. BCT-40 for 10-meter band, BCT-20 for 20-meter band. Three power ratings as indicated.

<table>
<thead>
<tr>
<th>Type</th>
<th>Power Rating</th>
<th>Surge Impedance</th>
<th>Price Per Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCT-10-1000</td>
<td>1000 Watts</td>
<td>18 Ohms</td>
<td>$4.15</td>
</tr>
<tr>
<td>BCT-20-1000</td>
<td>1000 Watts</td>
<td>18 Ohms</td>
<td>$5.00</td>
</tr>
<tr>
<td>BCT-10-500</td>
<td>500 Watts</td>
<td>18 Ohms</td>
<td>$3.75</td>
</tr>
<tr>
<td>BCT-20-500</td>
<td>500 Watts</td>
<td>18 Ohms</td>
<td>$4.25</td>
</tr>
<tr>
<td>BCT-10-200</td>
<td>200 Watts</td>
<td>18 Ohms</td>
<td>$3.45</td>
</tr>
<tr>
<td>BCT-20-200</td>
<td>200 Watts</td>
<td>18 Ohms</td>
<td>$3.75</td>
</tr>
</tbody>
</table>

Prices include factory attached seals at both ends.

All Items Carried in Stock

Write for the latest Bassett Handbook of Rotary Beam Design.

**FREE CATALOG**

Illustrations, prices and full details on thousands of separate items, sets, tubes, parts and supplies! MAKE UP A $60 ORDER and Buy All the supplies you need at present low prices. AND PAY ON EASY TERMS. Write for this big 76-page Catalog Today.
"TWIN" SERVICE

POPULAR PRICES plus
HELPFUL SUGGESTIONS

If you want more than the usual "counter service" or mailed "catalog" ... if you want sincere and helpful suggestions and the benefit of whatever experience we may have ... you'll always get it at HARVEY'S ...

THE NEW RME-70 IS IN STOCK

Come in and see it on display

SPECIAL!

EXCEPTIONAL VALUE! LIMITED QUANTITY!

POWER TRANSFORMER

Made by one of the Country's Leading Manufacturers

- Hum Bucking Type Coil Structure
- Completely Poured with Humidity Proof Compound
- Designed to deliver 1500 or 2000 volts D.C. at 500 MA.
- Dimensions 10½ x 8½
- Gross Weight 85 lbs.

$16.95

The Cairo Regs

(Continued from page 80)

signals or a code word, and will be used for the transmission of information that may be used only by persons so authorized, such as the subscribers to a press service.

Remember the scheme for classifying types of emissions, wherein A3 is telephony, etc.? There are a few changes there worth noting. The basic uninterrupted carrier, of course used only in special cases such as standard-frequency emissions, is now spoken of as a Type AO continuous wave. Type A1 remains c.w. telegraphy, Type A2 modulated telegraphy, Type A3 telephony. Facsimile is now to be designated Type A4 and television becomes Type A5 emission.

There are a few changes in the prefix letters assigned nations for their calls, but these have been reported as current news as they went into effect, and they appear in detail in the periodical revisings of the I.A.R.U. country list, the prefix listings in the Handbook, etc.

That's the works, as far as things interesting to us are concerned.

Another Method of Keying

(Continued from page 51)

cycle and the grid can regain control. If a controlled rectifier is placed between the center-tap of the plate transformer and the filter, the current through the tube will look like Fig. 1-A if choke input is used, but it will look like Fig. 1-B if condenser is used. Thus with condenser input the current from the transformer center-tap flows in only one direction but is reduced to zero 120 times every second, and a single controlled rectifier can be used to key the circuit. The keying will still be through the filter and will retain the characteristics of rectifier keying with a saving of one special rectifier tube. Since condenser input and a minimum of filter are normally used with primary or rectifier keying, no changes are necessary in the circuit other than the introduction of the keyed rectifier tube and its control circuit.

In Fig. 2, an adaptation of the primary-keyed system described by W6CUH, the driver and final amplifier are both keyed, and no bleeder is used on the final power supply (except a voltmeter or very high resistance so that the filter will gradually discharge and prevent accidental shock). This system has the advantage that with the key up the voltage on the final amplifier is a little below what it is with the key down, and no thumps are introduced by regulation of the final amplifier power supply. If the keyed driver stage put no "tails" on the characters the final amplifier supply voltage would always remain exactly the same, key up or key down, but with the keying described the voltage will drop somewhat in the "key up" position, depending on the storage in the driver stage supply. Any of the usual methods can be used to control the rectifier tube.

* QST, March, 1937, p. 31.
Improper adjustments or incorrect operating conditions can bring about off-frequency radiation in any type of transmitter. The new F.C.C. regulation which requires every amateur station to incorporate an independent means for measurement of the transmitter frequency now places full responsibility squarely on each operator. Play safe—use a standard frequency oscillator in conjunction with your station receiver. You then will have a reliable monitor at low cost.

Where high precision is essential, the type SOCIOO low-drift 100kc. Standard Frequency Crystal Unit priced at $15.50 should be used. The SOCIOOX, X-cut, mounted 100kc. bar offers economical accuracy at $9.50. When operation is well within the band limits, a flexible inexpensive frequency standard can be constructed with the type SMCIOO Dual-Frequency Crystal Unit (100kc. and 1000kc.) priced at only $7.75.

Ask your Bliley distributor for a copy of Bulletin A-6, which describes these and other Bliley Crystal Units.

BLILEY SF CRYSTAL UNITS

QSL Cards

Individual QSL Cards printed as you want them, at reasonable prices. Samples gladly submitted on request.

HINDS & EDGARTON, INC., Ex. W9WR
19 South Wells Street, Chicago, Illinois

VERTICAL RADIATORS

BEAM AND MOBILE ANTENNAS

The original self-supporting Vertical Radiator that stands up in all kinds of weather. Fully adjustable from 25 to 34 ft. Order Direct.

Type HF 38. 35-ft. Radiator. (20-40-80-160 Bands) ......... $19.50
Type HF 10. 16-ft. Radiator. (10-20-40-80 Bands) ........ $13.50

Remit with order or C. O. D. on receipt of $5.00 deposit

ACE PRODUCTS CO.
2645 2nd Avenue, Seattle, Wash.

• TELEGRAPHY—TELEVISION—TELEPHONY •

AVIATION

TRANS RADIO
PRESS

TELETYPING

TYPEWRITING

The major technical training equipment owned by Port Arthur College and in operation on the college campus consists of the 500-Watt Commercial Broadcast Transmitter of Station KPAQ, two-way Television Transmitter and Receiver, Latest Type RCA Marine and Airways transmitter installation complete, SOS Automatic Alarm/Marine Direction Finder, Trans-radio Press Receiving Equipment, and Laboratory complete where students assemble composite transmitters, amplifiers, audio amplifiers, R. F. amplifiers, etc.

Port Arthur College pioneered the teaching of Radio with classes in 1909, and for thirty years has maintained an active Employment Bureau for the placement of its graduates.

If interested in details about Radio Course, write for Bulletin R

PORT ARTHUR COLLEGE • PORT ARTHUR (World-Known Port), TEXAS
Selectivity With the 2-Tube Regenerative Receiver

(Continued from page 37)

parison between receivers is to take a case when two incoming signals are so close in frequency that the difference is well down in the audio range, then to see which receiver makes copy of one of them possible. This comparison was made between the pee-wee and a well-known superhet with a crystal filter and repeated day after day. It is still uncertain whether the super shows much, if any, superiority. This would indicate rather unexpected selectivity.

WSQBW, located in a suburb of Detroit, is in the basement, practically underground. The "ground" is a galvanized pipe passing through the floor into permanently damp earth. To this pipe is bolted a piece of half-inch brass pipe which runs along the edge of the shelf so that ground is brought right up to the receiver. The ground wire from the set is only a few inches long. This may be an important point, but the set was also tested on the second floor, with a steam radiator ground, and they came rolling in just the same.

The power supply for a regenerative receiver needs some attention. The one here has three chokes and three condensers and is satisfactorily quiet.

Referring to the photographs, on the left side are the power-supply and 'phone plugs, in front are the band-spread and band-set dials and on the right side are the antenna and ground posts and the potentiometer knob. On top the arrangement is self-explanatory. In the underside view, with the condenser dials at the left, will be seen the two midget variables; in the center is the audio choke, in the corners condensers C6 and C7 (with R3), at the tube—a tube used because the well-insulated bias-supply transformer was on hand.

The system is in use at W1JPE, and the 150-ma., 1700-volt, driver supply and 350-ma., 2800-volt, final supply are handled easily by any of the control tubes available.

1 QST, Feb., 1938, p. 34.
2 QST, Sept., 1938, p. 42.

* This particular superhet is of the type without a selectivity control, and depends upon the phasing control for variation of effective selectivity. The crystal input circuit is normally factory-adjusted to a relatively broad setting, so that the audio peak on a c.w. signal is not nearly so sharp as it would be on a set having the crystal selectivity adjusted to a high value. Under these conditions the comparison is not so far-fetched as it might seem at first glance, since with both receivers separation of signals having nearly the same frequency is mostly a job for the selectivity of the ear rather than that of the receiver. The regenerative set's selectivity is higher than usual because it is dealing with signals of small amplitude compared with those furnished by the conventional antenna. It is therefore working under considerably more favorable conditions than it would be with a large antenna, or if it had been preceded by an r.f. amplifier. Of course, the "other side of zero beat" is not eliminated, as it is in the crystal super. — Electron.
The new 1939 edition of the "Radio Amateur's Handbook" is a thorough revision of the standard manual of amateur communication. A tremendous quantity of new equipment was constructed exclusively for this Edition. The important transmitter chapter has been enlarged and has complete constructional data for units now described for the first time. It includes new diagrams with particular attention to determination of optimum L/C ratios and tank-condenser plate-spacings. Unit designs permit the construction of complete transmitters of any power up to the maximum allowed by amateur regulations. The radiotelephony section was rewritten with the thought of increasing its value to the practical amateur who wants to know more about the adjustment and operation of 'phone transmitters. Modulator data (particularly for the grid-bias and plate systems) will be found for each of the lay-outs featured in the transmitting chapter. Power supplies are of course fully covered so that you may pick the most suitable one. The antenna chapter has been expanded to give complete dope on all varieties from the simpler types to the more elaborate arrays. New treatment of feeder systems and the various antennas will make the operation of these more readily understood. Multi-band operation, antennas for restricted space, as well as complete information on rotary beams, is also to be found in this chapter. Other chapters have received equally thorough treatment. The fundamentals chapter has been simplified. The tube chapter has five pages of new tables to make this complete and up-to-date. New kinks will be found in the chapter on workshop practice. Four receivers have been added to the receiver section, including simple regenerative sets as well as superhets. As in the rest of the book, the emphasis is on proven circuits, with performance and economy foremost. Simple pre-selector and antenntuning units are described, together with material on tuning and signal-strength indicators. The transmitters to be found in the ultra-high-frequency chapters are of course designed to comply with the new regulations regarding stability; and the receivers to take advantage of this new set-up on 56 Mc. The still higher u.h.f. bands have not been forgotten, both receiving and transmitting gear having been built and described for the first time in this edition. Apparatus designed and constructed and actually used for the purpose, is included in the chapter on emergency and portable equipment. More effective laboratory equipment, practical for the amateur, is included in the instruments and measurements chapter. Of course the new amateur regulations are to be found in that ever useful source of information, the Appendix. With the extensive index, the reader can locate easily and quickly the information on the subject in which he is interested. Following the form of the previous Editions, putting in all information that is pertinent to the design, construction and operation of proven equipment, the 1939 "Handbook" is the most complete and comprehensive yet. Packed with practical information helpful to the old-timer and youngest beginner alike, concisely written in simple, understandable style, it is more than ever before the greatest dollar's worth in radio.

$1 postpaid in Continental U.S.A. — $1.25 postpaid elsewhere
Buckram bound edition, $2.50

American Radio Relay League
West Hartford, Conn.

115
Merry Christmas
and a
Happy New Year

Make This Christmas a More Joyous One!
Don't wait, but get the radio equipment you need — now!
Prices are lowest, quality is highest, always, at TERMINAL! You can obtain all your radio requirements at either of Terminal's completely stocked radio supply houses!

Enjoy the "hamfest" atmosphere at the TERMINAL store most conveniently located to you — both stores open evenings until 8:00 P.M.

VISIT THE TERMINAL STORE NEAREST YOU!

TERMINAL
Radio Corporation
2 STORES IN NEW YORK CITY
80 CORTLANDT ST. • 68 WEST 45th ST.
Cable Address: TERMRADIO

Television Receiver
(Continued from page 50)

control is set to give a suitable average illumination of the entire picture. Further adjustments of the tuned circuits, a.g.c. control, and focusing controls will aid in bringing up the picture detail, until optimum settings are found for all adjustments and controls.

For locations where the signal level from the antenna is apt to be low, the final steps in the alignment of the picture receiver can be helped along by means of a calibrated "5-meter" oscillator, provided with sound modulation. The oscillator, tuned to 46.5 Mc., is loosely coupled to the receiver, which can be tuned to the oscillator frequency by observing the moving, unsynchronized band pattern on the Kinescope. The number of dark (or light) bands observed corresponds to the ratio of the sound modulation frequency (of the test oscillator) to the vertical scanning frequency. The set is tuned by adjusting $C_{12}$, $C_9$, $C_3$, and $C_8$, in the order named. Maximum sensitivity for a specific setting of the a.g.c. and background controls will be indicated by the least average illumination of the Kinescope screen. The oscillator signal, however, should be kept small enough so that the Kinescope pattern never becomes excessively dark. When the picture signal is applied, the settings of $C_3$ and $C_8$ may have to be readjusted for best picture definition. Maximum sensitivity and optimum definition are not ordinarily obtained simultaneously, because the pass band may not be wide enough at maximum sensitivity to pass the full video band — that is, to give best picture definition.

The modulated test oscillator may also be used in the tuning of the sound receiver. If, after the picture receiver is aligned for maximum sensitiv-
In the January, 1920, issue of *QST* there appeared an editorial requesting suggestions for the design of an A.R.R.L. emblem—a device whereby every amateur could know his brother amateur when they met, an insignia he could wear proudly wherever he went. There was need for such a device. The post-war boom of amateur radio brought thousands of new amateurs on the air, many of whom were neighbors but did not know each other. In the July, 1920, issue the design was announced—the familiar diamond that greets you at the top of this page—adopted by the Board of Directors at its annual meeting. It met with universal acceptance and use. For years it has been the unchallenged emblem of amateur radio, found wherever amateurs gathered, a symbol of the traditional greatness of that thing which we call Amateur Spirit—treasured, revered, idealized.

---

Do You Wear the A.R.R.L. Pin?

**THE LEAGUE EMBLEM.** in heavy rolled-gold and black enamel, is available in either pin or button type. In addition, there are three special colors for Communications Department appointees.

- Red background for the SCM
- Blue background for the ORS
- Green background for the RM and PAM

(Blue may be had in either pin or button style.)

**THE EMBLEM CUT:** A mounted printing electrotype, ¾" high, for use by members on amateur printed matter, letterheads, cards, etc.

---

**AMERICAN RADIO RELAY LEAGUE, WEST HARTFORD, CONNECTICUT**

---

**RELIABLE FREQUENCY CONTROL WITH VALPEY CRYSTALS**

Commercial • Amateur • Special Applications

Types CMA, CBC, LCH, VCH, VS, VM2, LW90, and others described in our catalog, obtainable from your dealer or by writing direct.

**AMATEUR RADIO LICENSES**

Day and evening classes in code and theory. Home study courses. **THERE IS NO QRM IN THE INSPECTOR'S PHONES!** When you go up for your exam you will hear a clean, clear note without any interference, from a punched tape prepared by an expert. Study for your license the same way; by listening to a clean, clear note in our classrooms sent to you by a commercial operator and instructor of twenty years' experience, or through code machines at home with tapes prepared by an expert. Hundreds of licensed students now on the air. Results guaranteed.

**AMERICAN RADIO INSTITUTE**

1123 Broadway

**Ken-Rad Tubes** have earned their good name through the use of honest materials, skilful precision workmanship and advanced technical knowledge.

**Ken-Rad Radio Tubes**

KEN-RAD TUBE & LAMP CORPORATION - OWENSBORO, KY.

Manufacturers of all types of radio tubes and Ken-Rad Electric Lamp Bulbs
SOLAREX Oil Impregnated TRANSMITTING CAPACITORS

Catalog upon request
SOLAR MFG. CORP.
599-601 BROADWAY, NEW YORK

NEW HAMMARLUND MODEL HQ-120
Described on Page 21
Down Payment Only $9.55
COMPARE THESE LOW TERMS
And Send Your Order Direct to W3DQ

Receiver and Model Cash Price & 12 Mo. Pay't
New No. 44 ............... $49.50 $44.54
New RME-79 .............. 138.60 11.30
New NG100XA ....... 142.80 11.70
Super Skyvender .......... 99.00 8.58
Sky Challenger II ......... 77.00 6.95
NG101X ................. 129.00 10.33
New HQ-120 complete ....... 177.00
Also Super Pro, HRO, Patterner, Breting, Sargent and Others
Lowest Terms on Harvey—RCA—Temp—National—Thordarson—Transmitters & Kits

DELAWARE RADIO SALES COMPANY
WILLARD S. WILSON
405 Del. Ave. — W3DQ—Wilmington, Del.
*For U. S. A. only. Subject to change without notice.

USE B-L RECTIFIERS

In your rig wherever you need low voltage direct current, as for relays, filaments, and similar applications.

The new B-L Rectifier Manual gives helpful information about circuits, filters, output capacities, etc.

Write today for your free copy of Bulletin No. R-38

The B-L Electric Mfg. Co., St. Louis, Mo.

After reading this, ‘phone ops with di ficult call letters should end their complaining: W9YVZ and W9YZV, both in Chicago, recently had a 160-meter ‘phone QSO!
My Creed

To give you specialized personal service of genuine value that is not available from other jobbers.

To sell all equipment on terms financed by myself so you can buy with less cost and more convenience.

To take your equipment in trade at a fair value on other equipment.

To allow you to try any receiver for ten days without obligation and to cooperate with you in every way I can, to see that you are entirely satisfied.

Compare Bob Henry's Terms with others

<table>
<thead>
<tr>
<th>Model of Receiver</th>
<th>Cash Price</th>
<th>Down Payment</th>
<th>12-Month Payments</th>
</tr>
</thead>
<tbody>
<tr>
<td>The NEW RME-70</td>
<td>$138.60</td>
<td>$27.72</td>
<td>$9.79</td>
</tr>
<tr>
<td>Hammarskold HQ-120</td>
<td>117.00</td>
<td>23.40</td>
<td>8.26</td>
</tr>
<tr>
<td>Howard 450A</td>
<td>87.50</td>
<td>17.50</td>
<td>6.18</td>
</tr>
<tr>
<td>NC80X and NC81X</td>
<td>99.00</td>
<td>19.80</td>
<td>6.99</td>
</tr>
<tr>
<td>Improved NC101X</td>
<td>129.00</td>
<td>25.80</td>
<td>9.11</td>
</tr>
<tr>
<td>The NEW NC100A</td>
<td>120.00</td>
<td>24.00</td>
<td>8.48</td>
</tr>
<tr>
<td>Latest RME-69</td>
<td>152.88</td>
<td>30.57</td>
<td>10.80</td>
</tr>
<tr>
<td>Sky Champion and NC-44</td>
<td>49.50</td>
<td>9.90</td>
<td>3.49</td>
</tr>
<tr>
<td>Breting 49 and Super Skyrider</td>
<td>99.00</td>
<td>19.80</td>
<td>6.99</td>
</tr>
</tbody>
</table>

Similar terms on Super Pro, Howard, HRO, PR-15, Breting 9, Sargents, others. And on Hallicrafter, National, Harvey, RME, Temco, RCA transmitters and National, Thoradson, UTC, Utah kits.

You can reach me by letter, telegram, phone, or visit nearly 24 hours a day, 365 days a year. Write me for any information and for help in getting the best receiver or transmitter for your use. Your inquiries invited. Foreign orders solicited.

HENRY RADIO SHOP
211 North Main St.
Butler, Missouri

NEW HOLDER DESIGN

15 SECONDS TO INSTALL CRYSTAL FOR ALL BANDS

GREATER STABILITY
Plugs in 5 prong tube socket

BEAUTIFUL APPEARANCE

MODEL AH HOLDER $1.00

HIPOWER LOW DRIFT CRYSTALS:
within 10 kc. Choice of stock
AH-10, 1700-3500 Kc. bands $2.35
AH-10, 7000-7300 " bands 3.90
WRITE FOR NEW LITERATURE

Hiowerlow--“Low Drift” Broadcast and Commercial Crystals Are Approved by F.C.C.

Hiower Crystal Co., 2035 Charleston St., Chicago

Eliminate KEY CLICKS
without Loss of Power

Gardiner-Levering Mercury Vapor Keyer gives perfect keying on all CW transmitters — hand key, "bug," or machine sender — at all speeds, without loss of power output. Practically no voltage drop. Uses only one type 83 mercury vapor tube. Separate filament supply built in unit. Only 4½" long and 3½" wide. Merely insert in keying line and plug cord into AC outlet.

FULLY GUARANTEED

If your dealer can’t supply you, write us

GARDINER-LEVERING CO.
Haddon Heights, N. J.

LOW COST STEEL ANTENNA TOWER
Used and Endorsed by
FEDERAL, STATE, COUNTY, CITY GOV'TS., FORESTRY, HIGHWAY PATROLS and HAMS everywhere!

ONLY 60¢ PER FOOT Complete!
This remarkable low price is possible only because we produce many thousands of these towers each year for use with our Wincharger. Price includes necessary guy wires and tower sections of 10 or 20 ft., lengths with 5 ft. tapered stub top.

LIGHT, STURDY, RIGID
Thousands in use as vertical radiators and horizontal antenna supports. Scientifically braced. No points of undue strain. Both vertical angles and cross braces now hot dip galvanized.

SAFELY ERECTS TO 200 FT.
Quickly and easily erected, without skilled assistance, to heights of from 25 ft. to 200 ft. Enthusiastically used and recommended by police and broadcasters for thoroughly satisfactory service.

READ U.S. FORESTRY LETTER!

Our tower was installed on Signal Peak, a Lookout Station on the Yakima Indian Reservation, at an elevation of 5,111 ft. Above sea level. We have found the Wincharger tower 100% satisfactory and it has stood up under 70 mile winds, snow and ice which are severe at almost a mile up from sea level."—Thomas L. Carter, Forest Supervisor, Office of Indian Affairs, U.S. Department of the Interior, Toppenish, Wash.

Order Direct From
WINCHARGER CORPORATION
Sioux City, Iowa
GREETINGS
1939!

• We take this occasion to thank the thousands of Radio Amateurs, technicians, broadcast station engineers and experimenters who have contributed to the continued success of our business.

We like to feel that you have come to us not only because we stretch our ingenuity in an endeavor to give you the finest possible service but because you like us, because we understand your most intimate technical requirements and are able to assist you ably and well.

We greet the New Year, confident that we will be in a position to better serve your needs than ever before. May we have the opportunity to serve you?

SUN RADIO CO.
SAMUEL SCHWARTZ
Pres.

300-watt gasoline-driven a.c. generator for emergency use.

The Connecticut Brass Pounders Association, W1GCA, has obtained an air-cooled gas engine to drive its a.c. generator, and plans to have a permanent emergency power supply.

In recognition of the service rendered the city of Hartford, Conn., during the hurricane and flood, the Hartford County Amateur Radio Association now has a permanent meeting place in the Chamber of Commerce Rooms, 805 Main Street, Hartford, through the cooperation of the C. of C. and support of the local amateur parts distributors. Plans are under way for a permanent club house on the outskirts of the city. A 300-watt 'phone and c.w. transmitter is about to be constructed for all-band operation and suitable receivers purchased. A drive is to be made for the construction of many emergency transmitters and receivers, operating independently of the 110-volt a.c. mains. A suitable emergency power unit is to be obtained to furnish power for the club station. When all plans materialize, H.C.A.R.A. will have its own club house with plenty of room for beam antennas, etc., the 300-watt rig on all bands, emergency power, and a radio link with the club rooms in downtown Hartford.

Visit Your Local Club

Clubs are excellent places to get acquainted with radio amateurs and to participate in interesting discussions on our hobby. At A.R.R.L. headquarters there are recorded the addresses of several hundred amateur radio clubs affiliated with the League, their places and times of meeting. Why not drop in at your local club and "meet the gang"? Address the Communications Manager (enclosing 3¢ stamp, please) for data on affiliated clubs in your vicinity.

General Club News

June 19, 1938, was an outstanding day for hams of Eastern Ontario and adjoining districts. Under the auspices of the Ottawa Amateur Radio Transmitting Association, a hamfest was held on Shieek's Island in the St. Lawrence River. Over sixty hams from VE2, VE3 and W8 districts, together with YL's, YF's and Jr. ops, spent an enjoyable day. Among the events were hidden transmitter hunts on the 3.9- and 50-Mc. bands, relay race, rag-chewing contest, spelling bee in which DX prefixes had to be identified, nail-driving contest for the ladies, left-foot sending contest, treasure hunt, etc. The A.R.R.L. Canadian General Manager, VE2BE, was in attendance. The usual prize drawing brought activities to a close. The success of the affair was due to the efforts of the committee: VE3MX, VE3ABH, VE3AIB, VE3AJB, VE2GP and VE3BY ... The Westlake Amateur Radio Association is now meeting at the Harding Junior High School, Lakewood, Ohio, every other Thursday, 8:00 P.M., and invites nearby hams to drop in. At the October 28th meeting the Olney Amateur Radio Club, Philadelphia, enjoyed a talk on radium by Dr. Henny of the Temple University Hospital. ... The 56-Megacycle Minutemen officers are now as follows: G. R. Cogswell, W1AJW, president; R. F. Burditt, W1MJ, vice-president; A. H. Downer, W1DMS, secretary. Correspondence should be addressed to the secretary at 60 Willow Ave., Somerville, Mass. ... VE3QB sends an interesting item which appeared
A directory of suppliers who carry in stock the products of these dependable manufacturers.

<table>
<thead>
<tr>
<th>Location</th>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALBANY, N. Y.</td>
<td>Uncle Dave's Radio Shack</td>
<td>356 Broadway</td>
</tr>
<tr>
<td>ATLANTA, GEORGIA</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>69 Forsyth Street, N. W.</td>
</tr>
<tr>
<td>BOSTON, MASS.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>110 Federal Street</td>
</tr>
<tr>
<td>BRONX, N. Y.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>542 East Fordham Rd.</td>
</tr>
<tr>
<td>BUTLER, MISSOURI</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>211-215 N. Main Street</td>
</tr>
<tr>
<td>CHICAGO, ILL.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>833 W. Jackson Blvd.</td>
</tr>
<tr>
<td>COLUMBUS, OHIO</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>203 N. Fourth St.</td>
</tr>
<tr>
<td>DETROIT, MICH.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>325 E. Jefferson Ave.</td>
</tr>
<tr>
<td>DETROIT, MICHIGAN</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>11800 Woodward Ave.</td>
</tr>
<tr>
<td>HARTFORD, CONNECTICUT</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>227 Asylum Street</td>
</tr>
<tr>
<td>HOUSTON, TEXAS</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>625 East 14th Street</td>
</tr>
<tr>
<td>JAMAICA, L. I.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>90-08 166th Street</td>
</tr>
<tr>
<td>KANSAS CITY, MO.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>1012 McGee Street</td>
</tr>
<tr>
<td>NEW ORLEANS, LA.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>902 Poydras Street</td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>12 West Broadway</td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>100 Sixth Ave.</td>
</tr>
<tr>
<td>NEWARK, N. J.</td>
<td>Wholesale Radio Service Co., Inc.</td>
<td>219 Central Ave.</td>
</tr>
<tr>
<td>OAKLAND, CAL.</td>
<td>Offenbach Electric Co.</td>
<td>2085 Broadway</td>
</tr>
<tr>
<td>POTTSVILLE, PENN.</td>
<td>Jones Radio Company</td>
<td>E. Norwegian &amp; George Sts.</td>
</tr>
<tr>
<td>READING, PENN.</td>
<td>Jones Radio Company</td>
<td>George D. Barbey Company</td>
</tr>
<tr>
<td>READING, PENN.</td>
<td>Jones Radio Company</td>
<td>104 North Ninth Street</td>
</tr>
<tr>
<td>SAN FRANCISCO, CAL.</td>
<td>Offenbach Electric Co.</td>
<td>1452 Market Street</td>
</tr>
<tr>
<td>SPRINGFIELD, MASS.</td>
<td>T. F. Cushing</td>
<td>349 Worthington St.</td>
</tr>
<tr>
<td>WASHINGTON, D. C.</td>
<td>Sun Radio &amp; Service Supply Co.</td>
<td>928 F Street, N. W.</td>
</tr>
</tbody>
</table>

Listings on this page do not necessarily imply endorsement by QST of the dealers or other equipment sold by them.
Wireless Practice Sets

R-68 PRACTICE SET

Designed for those who want a well made instrument to learn the code. Set consists of a key and high frequency buzzer mounted on a mahogany finished wood base equipped with binding posts. The code is printed on a plate and fastened to the base between the key and buzzer. Buzzer is adjustable. List $3.40.

SIGNAL LINE OF Wireless Keys, Telegraph Instruments and Wireless Practice Sets is complete. Send for our bulletin.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan, U.S.A.

Learn Code Right

Always ready — no weather interference — beats having someone send to you. Speed range 5 to 40 W.P.M. Radio or Morse.

STANDARD with 10 tapes and book of instructions ...................... $20.35
JUNIOR with 5 tapes and book of instructions (not rented) ........... $12.00
Complete oscillator equipment less battery ...................... $6.50
Rental Standard with 10 tapes and book of instructions $1.00 first month, $2.25 each additional month.
With transformer and tube socket 25¢ per month more. With key and head phones 50¢ per month extra. $10 deposit or business references required.

INSTRUCTOGRAPH COMPANY
Dept. Q-1, 913 Lakeside Place, Chicago, Illinois
Representatives for Canada:
Radio College of Canada, 863 Bay Street, Toronto

Learn Radio - Television

500 licensed graduates placed in past 7 years in shipping, broadcasting, aviation, police, etc.; we also teach radio servicing and repairing; new term Sept. 12th, Nov. 7th day or every, 52-page catalog free; oldest, largest and best equipped.

MASS. RADIO SCHOOL
18 Boylston Street, Boston
G. R. Entwistle, Pres.
R. F. Trop, Tres.
Established 1899
Hancock 8184

New Apparatus

Concentric Cable Kit

Kits for assembly of ½-inch diameter coaxial cable for lengths of 10, 25, or 50 feet, including inner conductor, outer shield, clips, screws, nuts, eyelets, and assembly instructions are now available from the Transducer Corporation, 30 Rockefeller Plaza, New York City. Ceramic spacers are used to maintain a flexible wire centrally located in a braid outer covering. Different wire sizes may be substituted to obtain various impedances, the size of the wire being limited only by the diameter of the spacer openings.

In the assembly process, the spacers are first strung on the length of inner conductor to be used. The braid is then opened in just the same manner as used for putting flexible braid shielding on hook-up wire, and the inner conductor and spacer assembly is pulled through the outer shield. After the outer conductor is tightened firmly on the spacers, screw clamps are used to secure the ends and complete the assembly.

Dummy Load Resistor

A new 100-watt constant-resistance dummy load resistor is now made available for amateurs by the Ohmite Manufacturing Company. Available in either 73 ohms or 600 ohms resistance, this unit is practically non-inductive for frequencies as high as 15 megacycles. The two resistances in which the resistor is made available match it to standard concentric, twisted-pair, and open transmission lines. Because the resistance of the unit remains almost constant at varying power up to 100 watts load dissipation, the resistors are well suited to use in series with r.f. ammeters for approximate measurement of r.f. output power of stages in the transmitter and of the power actually delivered to the antenna through the feed line.

The resistance element is enclosed within a glass globe which is evacuated and gas filled. The assembly is finished by addition of a ceramic 4-prong tube base, with the resistance element connected between the filament pins, so that a single dummy resistor may be made readily useful for a variety of applications by inclusion of 4-prong sockets at desired points in the transmitter.

— T. M. F.
HAM-ADS

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

(2) No display of any character will be accepted, nor can any advertisement display purely alphabetical, numerical or part capital letters be used which would tend to make one advertisement look prettier than any other.

(3) The Ham-Ad rate is 15¢ per word, except as noted in paragraph 6.

(4) Remittance in full must accompany copy. No cash or contra orders will be accepted. Full payment will be allowed.

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

(6) The pace of 76 per word will apply to advertising which, in our judgment, is obviously non-commercial in nature. Advertising carried by members of the American Radio Relay League. Thus, advertising of bona fide products of the member's own manufacture or of the products of a member-owned concern. Individual sets or apparatus offered for exchange or advertising amounting forthwith (6) below. 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 are unable to vouch for their integrity or for the grade or character of the products advertised.
Building
An Amateur Radio Telephone Transmitter

Absolutely the first requisite in either building or operating a 'phone transmitter is a solid understanding of what we are attempting to do when we accomplish voice transmission. Understanding the functions of the various parts, we shall avoid difficulties. The saddest thing in amateur radio is a 'phone amateur who does not understand the operation of his apparatus. The book begins, therefore, with a discussion of the principles involved and makes every effort to make this discussion perfectly clear so that the reader can easily make it a part of his own knowledge. It then goes on to the actual construction and operation of an inexpensive but efficient 'phone transmitter.

PRICED AT
25 CENTS PER COPY
POSTPAID

American
Radio Relay League
West Hartford
Connecticut
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.

<table>
<thead>
<tr>
<th>Location</th>
<th>Company Name</th>
<th>Address</th>
<th>Tel. Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATLANTA, GEORGIA</td>
<td>Wholesale Radio Service</td>
<td>265 Peachtree Street</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Company, Inc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;The World’s Largest Radio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply House&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BOSTON, MASS.</td>
<td>Wholesale Radio Service</td>
<td>110 Federal Street</td>
<td>20301</td>
</tr>
<tr>
<td></td>
<td>Company, Inc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;The World’s Largest Radio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply House&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRIDGEPORT,</td>
<td>Hatry &amp; Young, Inc.</td>
<td>177 Hannon Street</td>
<td></td>
</tr>
<tr>
<td>CONNECTICUT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRONX, NEW YORK</td>
<td>Wholesale Radio Service</td>
<td>542 East Fordham Road</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Company, Inc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;The World’s Largest Radio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply House&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BUFFALO, NEW YORK</td>
<td>Dymac Radio</td>
<td>216 E. Genesee Street</td>
<td>2080</td>
</tr>
<tr>
<td></td>
<td>Ham and BCL Equipment</td>
<td>W80BR, W80LB, W8GJ</td>
<td>Cl. 2080</td>
</tr>
<tr>
<td>BUFFALO, NEW YORK</td>
<td>Radio Equipment Corp.</td>
<td>326 Elm Street</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>W80BK — Ham, service and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>sound equipment</td>
<td></td>
</tr>
<tr>
<td>HARTFORD,</td>
<td>Hatry &amp; Young, Inc.</td>
<td>203 Ann Street</td>
<td></td>
</tr>
<tr>
<td>CONNECTICUT</td>
<td></td>
<td>Trade Your Old Communication</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Receiver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JAMAICA, L. I.</td>
<td>Wholesale Radio Service</td>
<td>90-08 166th Street (Merrick</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Company, Inc.</td>
<td>Road)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;The World’s Largest Radio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply House&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MONTREAL, Canada</td>
<td>Canadian Elec. Supply Co., Ltd.</td>
<td>285 Craig St., W.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality parts and equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>for discriminating buyers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEWARK, N. J.</td>
<td>Wholesale Radio Service</td>
<td>219 Central Avenue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Company, Inc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;The World’s Largest Radio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply House&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEW HAVEN,</td>
<td>Hatry &amp; Young, Inc.</td>
<td>86 Meadow Street</td>
<td></td>
</tr>
<tr>
<td>CONNECTICUT</td>
<td></td>
<td>National, Taylor, Triplet,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radiotron, RME, Howard, etc.</td>
<td></td>
</tr>
<tr>
<td>NEW YORK, N. Y.</td>
<td>Wholesale Radio Service</td>
<td>100 Sixth Avenue</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Company, Inc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;The World’s Largest Radio</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supply House&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHILADELPHIA,</td>
<td>Eugene G. Wile</td>
<td>10 S. Tenth Street</td>
<td></td>
</tr>
<tr>
<td>PENNSYLVANIA</td>
<td></td>
<td>Complete Stock of Quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Merchandise</td>
<td></td>
</tr>
<tr>
<td>RICHMOND, VIRGINIA</td>
<td>The Arnold Company</td>
<td>Broad at Harrison St.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>W3EOQ — &quot;The Virginia Ham</td>
<td>W3FL</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Headquarters&quot;</td>
<td></td>
</tr>
<tr>
<td>ROCHESTER,</td>
<td>Radio Parts &amp; Equipment Co.</td>
<td>944 Clinton Avenue, North</td>
<td></td>
</tr>
<tr>
<td>NEW YORK</td>
<td></td>
<td>Complete stock amateur-BCL</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>parts. Standard discounts</td>
<td></td>
</tr>
<tr>
<td>TORONTO, CANADA</td>
<td>A &amp; A Radio Service Supply</td>
<td>101 Queen Street, West</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Canada’s Foremost Radio Supply</td>
<td></td>
</tr>
<tr>
<td>TORONTO, ONTARIO</td>
<td>Wholesale Radio Company, Ltd.</td>
<td>1133-37 Bay Street</td>
<td></td>
</tr>
<tr>
<td>CANADA</td>
<td></td>
<td>Canada’s Largest Radio Parts</td>
<td>VE-3XB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Distributor — VE-3XB</td>
<td></td>
</tr>
<tr>
<td>WINNIPEG, CANADA</td>
<td>Electrical Supplies, Ltd.</td>
<td>306-10 Ross Avenue</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Western Canadian Amateur</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Headquarters for Leading Lines</td>
<td></td>
</tr>
</tbody>
</table>
“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.

<table>
<thead>
<tr>
<th>Index to Advertisers</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ace Products Company</td>
<td>113</td>
</tr>
<tr>
<td>Aeronav Corp.</td>
<td>90</td>
</tr>
<tr>
<td>American Radio Institute</td>
<td>117</td>
</tr>
<tr>
<td>Astantic Microphone Laboratory, Inc.</td>
<td>102</td>
</tr>
<tr>
<td>B.L. Electric Mfg. Company, The</td>
<td>118</td>
</tr>
<tr>
<td>Barker &amp; Wilkenson</td>
<td>90</td>
</tr>
<tr>
<td>Biley Electric Company</td>
<td>115</td>
</tr>
<tr>
<td>Brazilian Trading Company</td>
<td>106</td>
</tr>
<tr>
<td>Burgess Battery Company</td>
<td>99</td>
</tr>
<tr>
<td>Candler System Company</td>
<td>110</td>
</tr>
<tr>
<td>Capitol Radio Engineering Institute</td>
<td>100</td>
</tr>
<tr>
<td>Cardinal Mfg. Corp., Allen D</td>
<td>82</td>
</tr>
<tr>
<td>Centralab</td>
<td>85</td>
</tr>
<tr>
<td>Collins Radio Company</td>
<td>108</td>
</tr>
<tr>
<td>Cornell-Dubilier Electric Corp.</td>
<td>98</td>
</tr>
<tr>
<td>Cote-Coil Company, Inc.</td>
<td>118</td>
</tr>
<tr>
<td>Dodge’s Institute</td>
<td>114</td>
</tr>
<tr>
<td>Eitel-McCullough, Inc.</td>
<td>84</td>
</tr>
<tr>
<td>Gardiner-Levering Company</td>
<td>119</td>
</tr>
<tr>
<td>Gordon Specialties Company</td>
<td>104</td>
</tr>
<tr>
<td>Guthman &amp; Company, Edwin T</td>
<td>94</td>
</tr>
<tr>
<td>Halleratone, Inc., The</td>
<td>1, 1</td>
</tr>
<tr>
<td>Hammond Mfg. Company, Inc.</td>
<td>81, 84</td>
</tr>
<tr>
<td>Harvey Radio Company</td>
<td>112</td>
</tr>
<tr>
<td>Harvey Radio Laboratories</td>
<td>90</td>
</tr>
<tr>
<td>Heintz &amp; Kaufman, Ltd.</td>
<td>74</td>
</tr>
<tr>
<td>Henry Radio Supply</td>
<td>119</td>
</tr>
<tr>
<td>Hinds &amp; Edgarston</td>
<td>113</td>
</tr>
<tr>
<td>Hippower Crystal Company</td>
<td>110</td>
</tr>
<tr>
<td>Howard Radio Company</td>
<td>107</td>
</tr>
<tr>
<td>Hydrocnic Laboratory, Inc.</td>
<td>105</td>
</tr>
<tr>
<td>Instructograph Company</td>
<td>118</td>
</tr>
<tr>
<td>International Resistance Company</td>
<td>89</td>
</tr>
<tr>
<td>Ken-Ray Tube &amp; Lamp Corp.</td>
<td>117</td>
</tr>
<tr>
<td>Kenyon Transformer Company, Inc.</td>
<td>5</td>
</tr>
<tr>
<td>Mallory &amp; Company, Inc., P. R.</td>
<td>28</td>
</tr>
<tr>
<td>Massachusetts Radio School</td>
<td>172</td>
</tr>
<tr>
<td>Melander Manufacturing Company</td>
<td>97</td>
</tr>
<tr>
<td>National Company, Inc.</td>
<td>Cov. 3, 77</td>
</tr>
<tr>
<td>New York YMCA Schools</td>
<td>110</td>
</tr>
<tr>
<td>Newark Electric Company</td>
<td>111</td>
</tr>
<tr>
<td>Ohmite Manufacturing Company</td>
<td>86</td>
</tr>
<tr>
<td>Port Arthur College</td>
<td>113</td>
</tr>
<tr>
<td>Precision Apparatus Company</td>
<td>88</td>
</tr>
<tr>
<td>Precision Piezo service</td>
<td>94</td>
</tr>
<tr>
<td>Promax Products</td>
<td>96</td>
</tr>
<tr>
<td>RCA Institutes, Inc.</td>
<td>114</td>
</tr>
<tr>
<td>RCA Manufacturing Company, Inc.</td>
<td>Cov. 9, 10</td>
</tr>
<tr>
<td>Radio Mfg., Engineers, Inc.</td>
<td>127</td>
</tr>
<tr>
<td>Radio Shack, Inc.</td>
<td>108</td>
</tr>
<tr>
<td>Radio Transceiver Laboratories</td>
<td>110</td>
</tr>
<tr>
<td>Raytheon Production Corp.</td>
<td>79</td>
</tr>
<tr>
<td>Scientific Radio Service</td>
<td>108</td>
</tr>
<tr>
<td>Sieckle Company, F. W.</td>
<td>110</td>
</tr>
<tr>
<td>Signal Electric Mfg. Company</td>
<td>122</td>
</tr>
<tr>
<td>Solar Manufacturing Corp.</td>
<td>118</td>
</tr>
<tr>
<td>Sun Radio Company</td>
<td>120</td>
</tr>
<tr>
<td>Taylor Tubes, Inc.</td>
<td>87</td>
</tr>
<tr>
<td>Teleplex Company</td>
<td>114</td>
</tr>
<tr>
<td>Terminal Radio Corp.</td>
<td>116</td>
</tr>
<tr>
<td>Thomas &amp; Electric Mfg. Company</td>
<td>91</td>
</tr>
<tr>
<td>Trifflett Elec. Instrument Co., Inc.</td>
<td>114</td>
</tr>
<tr>
<td>Turner Company, The</td>
<td>106</td>
</tr>
<tr>
<td>United Transformer Corp.</td>
<td>128</td>
</tr>
<tr>
<td>Valpey Crystals, Ltd.</td>
<td>117</td>
</tr>
<tr>
<td>Van Neukard Company, Inc.</td>
<td>118</td>
</tr>
<tr>
<td>Valoplex Company, Inc.</td>
<td>109</td>
</tr>
<tr>
<td>Ward Leonard Electric Company</td>
<td>98</td>
</tr>
<tr>
<td>Wilson, Willard S.</td>
<td>118</td>
</tr>
<tr>
<td>Wincharger Corporation</td>
<td>119</td>
</tr>
<tr>
<td>Vaxley</td>
<td>78</td>
</tr>
</tbody>
</table>
RME Precision

RME precision in manufacture, test and assembly has been instrumental in building a reputation, known the world over.

When RME receivers were recently specified by a foreign Army Department, as the only sets which would meet their rigorous requirements of stability and performance in field maneuvers, RME was "put on the spot" in also building some special equipment for direction-finding purposes. We built the direction-finders — and with them went the RME-69's.

RME receivers are performers, yet are moderate in cost.

The new 70's are on display. After you've seen one, heard one perform, and if you've ever hankered to own one — well, we know you'll not wait much longer.

WRITE for RME-70 BULLETIN

RADIO MFG. ENGINEERS, INC.
One Eleven Harrison St. Peoria, Illinois
Television — audio, power, filter  •  Aircraft — ouncer audios  •  Audio equalizers and filters  •  Varimatch Modulation transformers  •  Varitrans voltage controls  •  Commercial plate and distribution transformers  •  Linear Standard, Hiperm Alloy transformers  •  Amplifier and transmitter kits.

Ask your local distributor for the new PS403 UTC bulletin.
ESPECIALLY EFFECTIVE on 28 mc!

Such features as the high frequency I.F. (1560 kc.) and the continuously variable wide range (200 c. to 7 kc.) crystal filter circuit used in the NC-81X amateur band receiver, contribute much to its excellent performance on all amateur bands. Among the many other outstanding features of this unusual receiver are the cast aluminum inductance catacomb and the sturdy, specially designed, straight frequency line tuning condenser that, in combination, result in an unusually high degree of stability, permanence of calibration, and freedom from tuning backlash.

Net Price — Complete with Speaker and Cabinet..............$99.00

NATIONAL COMPANY, INC.
Introducing the new RCA-906-P4, a 3-inch television Kinescope. Similar to the present RCA-906 Cathode-Ray Tube, this new tube features a white fluorescent screen—and an unusually low cost! In addition to its low initial cost, this new tube provides low circuit cost because of its low voltage operation. Has conductive coating which minimizes deflecting-plate loading and prevents drifting of the pattern with changes in bias.

1802-P4—WHITE SCREEN... $27.50
Introducing the 1802-P4, a 5-inch television Kinescope having electrostatic deflection and white screen. This tube provides excellent quality television pictures. The deflection sensitivity is such that the beam may be deflected across the entire screen with no more voltage than is required for full deflection on 3-inch tube. Separate terminals are provided in the new Magna 11-pin base for each deflecting plate.

1802-P1—GREEN SCREEN... $24.75
Introducing the 1802-P1, a new 5-inch oscillograph tube which is similar to the 1802-P4 except for its green screen. In oscillographic application the 1802-P1 represents extremely high quality because it is capable of providing excellent television pictures. For television purposes the 1802-P1 operates well with an anode potential of only 1200 volts.

RCA presents the Magic Key every Sunday, 2 to 3 P.M., E.S.T., on the NBC Blue Network

RCA Radio Tubes—first in metal, foremost in glass, finest in performance