AT LAST! -- A DIRECT-READING STANDING WAVE METER
This transformer was designed for laboratory apparatus requiring a frequency range previously unheard of... flat within 2 DB 2 cycles to 20,000 cycles, this unit handles 25 watts output.

A manufacturer had the problem of changing his equipment from 400 cycle to 60 cycle power supply, but discovered that 60 cycle transformers are twice as large. UTC developed a unit, hermetically sealed, that fit his existing chassis, eliminating the need for a complete rebuilding of the equipment.

Narrow band filters are a common requirement for multiple channel telecontrol purposes. To effect a maximum number of channels in the audio range, filters made by UTC employ toroid high Q coils of unique structure. A typical special filter with 1500 cycle pass band is down 40DB at 1400 and 1600 cycles.

Low power 115 volt appliances such as electric razors, fluorescent desk lamps, etc. are sometimes required to operate on 220 volts. For simplicity of installation in the application of one manufacturer, a 15 watt plug-in unit was developed incorporating both plug and receptacle.

The UTC engineering department is available for consultation on your design problem.
You old-timers have had thousands of QSO's as a result of the solid power-performance of triodes like these. Hams newly on the air, once they've plugged in a GL-35T or GL-100TH, soon will discover why both tubes are held in such high respect.

Being triodes, they do their job with no fuss or bother, and will stand up under plenty of punishment. Clean cut design helps to make the GL-35T and GL-100TH dependable. In addition, the tubes have certain outstanding design characteristics:

- Interelectrode capacitances are low.
- Grids are the non-emitting type.
- The tantalum anodes operate at "glow" temperatures.
- There is no gassing, even under momentary overload conditions.

The GL-35T may be used to drive a high-power rig, or—in push-pull—as the final for your medium-power transmitter. Type GL-100TH is ideal for your final stage, either singly or in push-pull—also a topnotch Class B modulator tube.

General Electric's line of ham tubes is complete, backed by performance responsibility that makes every G-E tube investment a sound one. See your nearby G-E tube distributor for prices and detailed information. Or write Electronics Department, General Electric Company, Schenectady 5, New York.

### ELECTRICAL CHARACTERISTICS

<table>
<thead>
<tr>
<th>GL-35T</th>
<th>GL-100TH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament voltage</td>
<td>5 v</td>
</tr>
<tr>
<td>Current</td>
<td>4 amp</td>
</tr>
<tr>
<td>Grid-plate capacitance</td>
<td>1.8 mmfd</td>
</tr>
<tr>
<td>Grid-filament capacitance</td>
<td>4.1 mmfd</td>
</tr>
<tr>
<td>Plate-filament capacitance</td>
<td>0.3 mmfd</td>
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### PLATE RATINGS, TYPICAL OPERATION, CLASS C TELEGRAPHY

<table>
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<tr>
<th>Voltage</th>
<th>Current</th>
<th>Input</th>
<th>Dissipation</th>
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<tr>
<td>2,000 v</td>
<td>125 ma</td>
<td>250 w</td>
<td>50 w</td>
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<tr>
<td>3,000 v</td>
<td>165 ma</td>
<td>500 w</td>
<td>100 w</td>
</tr>
</tbody>
</table>

Electronics Department, General Electric Company, Schenectady 5, New York.
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Check these features:

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- **"QUICK AS A WINK"**
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### Atlantic Division **ATA**

<table>
<thead>
<tr>
<th>State</th>
<th>SCM Name</th>
<th>Address</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>Charles W. Pepper</td>
<td>537 W. 77th St.</td>
<td>New York</td>
</tr>
<tr>
<td>New Jersey</td>
<td>Roy W. Haise</td>
<td>2772 Washington St.</td>
<td>New Jersey</td>
</tr>
<tr>
<td>Maryland</td>
<td>Joseph M. Allen</td>
<td>7903 Pender Dr.</td>
<td>Maryland</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>William B. Halsey</td>
<td>1290 Coolidge Ave.</td>
<td>Pennsylvania</td>
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### Midwest Division **MTD**

<table>
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<th>Address</th>
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<tbody>
<tr>
<td>Illinois</td>
<td>Gene H. Gardner</td>
<td>937 South St.</td>
<td>Illinois</td>
</tr>
<tr>
<td>Indiana</td>
<td>John E. Dickey</td>
<td>2044 Lexington Parkway</td>
<td>Indiana</td>
</tr>
<tr>
<td>Michigan</td>
<td>John H. Beltrami</td>
<td>2654 S. Main St.</td>
<td>Michigan</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Walter G. Hasskamp</td>
<td>123 Elm St.</td>
<td>Minnesota</td>
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### Great Lakes Division **GLD**

<table>
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<th>State</th>
<th>SCM Name</th>
<th>Address</th>
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<tbody>
<tr>
<td>Wisconsin</td>
<td>Joseph P. Colvin</td>
<td>2034 E. 82nd St.</td>
<td>Wisconsin</td>
</tr>
<tr>
<td>Michigan</td>
<td>Robert W. Bullington</td>
<td>57 Howell Ave.</td>
<td>Michigan</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>William R. Bullington</td>
<td>57 Howell Ave.</td>
<td>Wisconsin</td>
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### Pacific Division **PAC**

<table>
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<tr>
<th>State</th>
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<th>Address</th>
<th>City</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>Joseph E. Hiebert</td>
<td>750 Kearny St.</td>
<td>California</td>
</tr>
<tr>
<td>Oregon</td>
<td>Ernest A. Munkres</td>
<td>2136 Albert St.</td>
<td>Oregon</td>
</tr>
<tr>
<td>Nevada</td>
<td>Lloyd Norberg</td>
<td>P. O. Box 281</td>
<td>Nevada</td>
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Way back in the prewar era Billey pioneered “harmonic” crystals for amateur frequencies in the 10 and 20-meter bands. Nowadays we know that such crystals should be correctly termed “overtone” oscillators because the crystal does not oscillate at the exact mathematical harmonic of its fundamental frequency. The present Billey AX2 unit for 20-meter operation contains an overtone crystal designed to oscillate at approximately three times the fundamental mode.

When using overtone crystals the following considerations should govern circuit design:

1. **Grid Anode Crystal Oscillators**—In normal circuits of this kind crystals will usually oscillate at the fundamental mode instead of the overtone frequency desired because the plate impedance is usually capacitively reactive at the fundamental mode. To insure operation only at the overtone frequency the plate coil and the plate capacity must be selected so that the equivalent plate impedance is capacitively reactive at the overtone frequency of the crystal but not at its fundamental frequency.

   Optimum conditions should be such that the plate tank will be broadly resonant about half way between the fundamental and third overtone frequency. Since these conditions are sometimes difficult to establish when using choke coils the grid anode circuit is not recommended for use with overtone crystals.

2. **Grid Cathode Crystal Oscillators**—In most of these circuits the plate tank impedance must be inductively reactive and maximum output with good stability is obtained when the plate tank circuit is approximately tuned to the crystal frequency. Proper selection of the coil and condenser values for tuning to the desired overtone frequency is straightforward procedure.

   Write for Bulletin 31

BLILEY ELECTRIC COMPANY • UNION STATION BUILDING, ERIE, PENNSYLVANIA
THE AMERICAN RADIO RELAY LEAGUE, INC.

is a noncommercial association of radio amateurs, bonded for the promotion of interest in amateur radio communication and experimentation, for the reeying 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 fraternalmism and a high standard of conduct.

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

"Off, 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 requisite, although full voting membership is granted only to licensed amateurs.

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

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The American Radio Relay League, Inc.
THE WORLD CONFERENCE

It is early March as we write, in between the two halves of the DX Contest. On what otherwise could be relatively placid evenings, the phone hands have been resounding with rumors of the dire fate that is directly ahead of amateur radio because of the coming world telecommunications conference. If all the things we've heard these last few nights were true we'd have a very black world indeed, with our 10-meter band closed down a few days back, our 75-meter phone band being withdrawn until after the conference, the State Department conducting its U.S.S.R. programs in our 14-Mc. band, United Nations reaching for most of our bands for its communications and broadcasting needs, European amateurs already piped down on all useful frequencies, and the United States committed to close us down on all frequencies below 50 Mc. the day the conference ends! We would also judge from what we hear on the air that the coming conference is to be in Moscow or Cairo and that the sole voice of the United States is going to be a single FCC representative who doesn't know anything about amateurs. Let us say in plain words that there is no truth to any of these things and that there never has been. It is perhaps understandable that amateurs should be nervous and apprehensive about our privileges as a world conference approaches, somewhat in the position of an expectant father chewing his fingernails in the anteroom. But it is difficult to understand why phone operation, with its vaunted superiority in the quick exchange of intelligence, should have fallen such easy prey to such misapprehensions and misinterpretations.

It is the duty of members of the League to have a better understanding of these matters and of the place their organization has played and is playing in them. In this issue we begin a two-part article on the background of international radio conferences and how they work, which we commend to those who wish to learn something of the subject. DX radio is governed by agreements between nations, signed at world conferences. There have been several such: London in 1912, Washington 1927, Madrid 1932 and Cairo 1938. The next one is to begin at Atlantic City on May 15th, under the auspices of our own Government. It is not being held in Moscow. The United States will be represented by a bang-up Government delegation of about forty persons drawn from such agencies as FCC, the State, War, Navy and Commerce Departments, etc. It will be divided into teams or task forces each specially skilled and prepared on particular topics.

The United States preparation for this conference has been going on for a long time. The studies began in the middle of the war and have been extensively reported in QST: the IRAC postwar plan, the formation and work of RTPB with ARRL as one of its contributing sponsors, the comprehensive FCC hearings which lasted for months, the joint FCC-IRAC reviews and recommendations, the public meetings held by the State Department, the inter-American conference at Rio, the preliminary exchange of views between the major allies at Moscow, and the months of work by the select preparatory Government-industry committee at Washington. Those who wish to be informed on the development of the preparations for this conference will find the whole story displayed in frequent QST articles over these years, including the suggested allocation tables, the verbatim testimony of League officers at the hearings, the brief of the position of ARRL in the 160-meter matter, the reports of ARRL’s representative at Rio and Moscow. For it is a fact that the League has been an active participant in all this work and has maintained constant contact with every facet of the scene, under the direction of its Board of Directors.

At this moment, and as reported elsewhere in this issue, the United States has transmitted to the Bern Bureau for distribution to the other nations of the world its proposals for frequencies, which include exclusive amateur bands at 3500–4000, 7000–7300, 14,000–14,400, 21,000–21,500, 28,000–29,700 kc. and in all the bands which are at present assigned to us above 50 Mc. Only the 160-meter band, still required for loran, is missing from our hopes. In an ac-
companying explanation of all its frequency proposals, the United States takes a very strong position in our protection. It wasn't easy to reach this decision. Despite the efforts our country has made for the amateur service, it is itself so great a user of the spectrum that it has immense difficulty finding places for all its services. Most of them have had to give up space rather frequently to permit the creation of needed new services. As it is well known that there have been no changes in the major amateur bands since 1929, there were frequent feelings that we too ought to share in the remaking of the world by giving up something, despite our great congestion. Even in a country as friendly as our own, there were great pressures and narrow escapes. In this long and careful preparation by our country the constant work of the League has brought us, through these many difficulties, to current U.S. decisions, supported by every U.S. interest in radio, including IRAC and FCC, that reflect the expectations and instructions of our Board.

Except for Canada, we do not yet know what the amateur proposals of any other country will be. None has been announced; we only speculate on their possible content. It will not be surprising if some of them propose some narrowing of amateur bands. That would be the traditional view of some countries. Any international conference of course is a hazard, since all the cards are on the table and you have to play to pick up your aces again, but there would be nothing new about hostile recommendations from some countries and no reason for becoming jittery over them; they always try it on. Proposals themselves mean very little. The United States naturally expects to have to fight, not only for amateurs but against similar attacks on practically every one of its services. That is why it is making such extensive and careful preparations.

Our country, for the nation as a whole, now takes the ball. The League goes along to Atlantic City to assist. There is little that the anxious expectant father in the anteroom can do at this stage. Since the attitude and announced intentions of our Government are satisfactory, all of us can have only applause for the currently-announced proposals; and as to urging our Government not to listen to foreign restrictive proposals, it isn't necessary. The preparatory phase is now successfully over. To review the work to date and to make any further plans that are found desirable, our Board of Directors is having a special meeting in middle March, to deal solely with this subject. We'll report it in our next issue, along with all available conference news.

Meanwhile don't let anybody tell you that the battle is lost before it starts and that your League — directors, committees, officers and headquarters — hasn't been in there pitching these many years. You have only to read the record and see the results to date.

New WWV Schedules

Standard-frequency transmissions are made available as a public service by the National Bureau of Standards over its standard-frequency station, WWV, on the following expanded schedules and frequencies:

<table>
<thead>
<tr>
<th>Mc.</th>
<th>EST</th>
<th>Power Output</th>
<th>Audio Freq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>7:00 P.M.-9:00 A.M.</td>
<td>1.0</td>
<td>440</td>
</tr>
<tr>
<td>5.0</td>
<td>7:00 P.M.-7:30 A.M.</td>
<td>10.0</td>
<td>440</td>
</tr>
<tr>
<td>5.0</td>
<td>7:00 P.M.-7:00 P.M.</td>
<td>10.0</td>
<td>440 and 4000</td>
</tr>
<tr>
<td>10.0</td>
<td>continuously</td>
<td>10.0</td>
<td>440 and 4000</td>
</tr>
<tr>
<td>15.0</td>
<td>continuously</td>
<td>10.0</td>
<td>440 and 4000</td>
</tr>
<tr>
<td>20.0</td>
<td>continuously</td>
<td>0.1</td>
<td>440 and 4000</td>
</tr>
<tr>
<td>25.0</td>
<td>continuously</td>
<td>0.1</td>
<td>440</td>
</tr>
<tr>
<td>30.0</td>
<td>continuously</td>
<td>0.1</td>
<td>440</td>
</tr>
<tr>
<td>35.0</td>
<td>continuously</td>
<td>0.1</td>
<td>440</td>
</tr>
</tbody>
</table>

A 0.005-second pulse may be heard as a faint tick every second, except the 59th second of each minute. These pulses may be used for accurate time signals, and their one-second spacing provides an accurate time interval for physical measurements.

The audio frequencies are interrupted precisely on the hour and each five minutes thereafter, resuming after an interval of precisely one minute. This one-minute interval is provided to give Eastern Standard Time in telegraphic code and to afford an interval for the checking of radio-frequency measurements free from the presence of the audio frequencies. Ionospheric disturbance warnings applicable to the North Atlantic path are given at 20 and 50 minutes past each hour. If a disturbance is in progress or is anticipated within 24 hours, the time announcement is followed by 6Ws; if conditions are quiet or normal, the time announcement is followed by 8Ns. The announcement of the station's services and of the station's call (WWV) is given by voice at the hour and half hour.

The accuracy of all the frequencies, radio and audio, as transmitted, is now better than a part in 50,000,000. Transmission effects in the medium may result in slight fluctuations in the audio frequencies as received at a particular place; the average frequency received, however, is as accurate as that transmitted. The time interval marked by the pulse every second is accurate to 0.000001 second. The beginnings of the periods when the audio frequencies are off are synchronized with the basic time service of the U. S. Naval Observatory,
The "Micromatch"

A Device for Measuring Standing Waves and R.F. Power

BY MACK C. JONES,* WIPNX, AND CARL SONTHEIMER**

One of the difficult and important problems in any amateur station is that of properly terminating r.f. transmission lines. This problem comes up in the adjustment of a fixed or rotary beam, of an antenna tuner, in the adjustment of interstage link-coupled circuits, and in many other places around the ham station. The Micromatch is a new and very valuable tool in the adjustment of transmission-line terminations. When connected in a transmission line of any impedance from 70 to 300 ohms and properly calibrated it will read the standing-wave ratio (s.w.r.) of the transmission line beyond it, and when its terminals are reversed it will read the r.f. power being fed down the transmission line. It will operate on any frequency, 3 to 30 Mc., and with any power from 10 to 1000 watts.

Using the Micromatch indicator it is possible to adjust any impedance-matching network far more rapidly than with existing methods. Tuning an impedance-matching network by this means is no more complicated than adjusting the final-tank tuning condenser for minimum plate current by means of a plate milliammeter.

Proper adjustment of any matching device or load to the correct value free of all reactance is not possible without some means for measuring the standing-wave ratio along the transmission line connecting to the transmitter. Improper termination of the transmission line connecting the antenna or tuner results in the poor performances with which we all are familiar. The following advantages result from correct matching:

1) Losses in the transmission line are minimized.
2) Voltage on the transmission line is reduced, thereby reducing danger of voltage break-down.
3) The antenna system may be operated over a much wider band of frequencies without retuning.
4) Receiver sensitivity is increased, if the receiver operates from the same antenna.

Another of the problems which the Micromatch helps to solve is that of proper adjustment of interstage link-coupling circuits. By adjusting the loading and coupling on the grid circuit of an r.f. amplifier it is possible to produce a perfect match to the link line connecting to the driver tank circuit. This results in all but the last of the above advantages.

* M. C. Jones Electronics Co., 96 N. Main St., Bristol, Conn.
** 7 Leonard Street, Riverside, Conn.

Our Cover

It has been a long time since the QST technical staff has been so enthusiastic about a new device as it is about the "Micromatch" pictured (WlEER-WLJKQ beam in background) this month. Here is an article describing the simply astonishing "little black box" that can be inserted in a transmission line at any point to read directly the standing-wave ratio! For the thousands of amateurs who have played with neon bulbs and "detuning-of-the-tank" methods for approximating the degree of match between antenna and line, it will be unnecessary to point out the convenience of such a device, but the gadget is equally useful in the adjustment of any form of link coupling, from final amplifier to antenna tuner or between stages of the transmitter. Further, the Micromatch will measure r.f. power in the line up to the amateur limit. This new development seems to be destined to become as popular as the familiar plate milliammeter because, once having seen it perform, you can't imagine not having one for the shack.

Theory of Operation

All the useful properties of the Micromatch obtain because of its ability to measure energy flow separately in either direction on the transmission line. Since a transmission line is a one-dimensional affair, energy can flow from the generator to the load, or from the load to the generator. If the line is terminated in a matched load equal to the surge impedance of the line, then this load will absorb all the energy that the generator sends down the line; but if the load does not match the line, then part of this energy will be reflected back toward the transmitter. It is the interference between the transmitted wave and the reflected wave that gives rise to the standing-wave pattern.

Let us call the transmitted wave $E_t$ and the reflected wave $E_r$. At some points on the line $E_t$ and $E_r$ will be in phase; at other points (a quarter wavelength away from the preceding) the two waves will be exactly out of phase, and there results a minimum voltage $E_t - E_r$. At all other points on the line the voltage will be somewhere between these two.
extremes. Now the standing-wave ratio is by definition the ratio of the maximum to the minimum line voltage, i.e.

\[ \text{s.w.r.} = \frac{E_t + E_r}{E_t - E_r} \]  

We see immediately that the s.w.r. can be unity only if the reflected wave, \( E_r \), is zero, and this condition is obtained if and only if the line is terminated in a pure resistance equal to \( Z_0 \), its surge impedance.

It is possible to express the voltage and current at each point on the transmission line in terms of \( E_t \) and \( E_r \); the expressions are:

\[ E = k_1 E_t + k_2 E_r \]
\[ I = \frac{1}{Z_0} (k_1 E_t - k_2 E_r) \]

where \( k_1 \) and \( k_2 \) are parameters that express the phases of \( E_t \) and \( E_r \) at each point on the line; all we need note about them is that their r.m.s. value is 1.0.\(^1\)

Fig. 1 - A simplified schematic of the Micromatch standing-wave meter. It is inserted in the transmission line between the load and the r.f. source.

Turning now to the circuit of Fig. 1, let us assume that \( C_2 \) is much larger than \( C_1 \), and that the reactance of \( C_1 \) is much greater than the surge impedance of the transmission line. Let us choose \( R_1 \) so that \( R_1/Z_0 = C_1/C_2 \). We see that the voltmeter reads the r.f. voltage between points \( D \) and \( B \), that is, the difference between the voltage across \( C_2 \) and the voltage across \( R_1 \). The voltage across \( C_2 \) is

\[ E_C = \frac{C_1}{C_2} E_t = \frac{C_1}{C_2} (k_1 E_t + k_2 E_r) \]

and the voltage across \( R_1 \)

\[ E_R = R_1 I = \frac{R_1}{Z_0} (k_1 E_t - k_2 E_r) \]

The voltmeter reading is the difference between these two voltages:

\[ V_1 = E_C - E_R \]

\[ = k_1 E_t \left( \frac{C_1}{C_2} - \frac{R_1}{Z_0} \right) + k_2 E_r \left( \frac{C_1}{C_2} + \frac{R_1}{Z_0} \right) \]

The coefficient of \( E_t \) is zero, since we have chosen \( R_1 \) so as to make \( C_1/C_2 \) equal to \( R_1/Z_0 \), and remembering that the r.m.s. value of \( E_2 \) is 1.0, we have

\[ V_1 = \frac{2R_1}{Z_0} E_r \]

\[ \text{Fig. 2} - \text{Standing-wave ratio plotted against meter reading of the Micromatch. The meter has a full-scale reading of 1.0.} \]

We see that with the Micromatch connected as shown in Fig. 1, the meter reading is proportional only to the reflected wave \( E_r \), and is not influenced by the transmitted wave \( E_t \). Since \( E_r \) is zero only when the line is properly matched, this shows us the first and perhaps most important property of the Micromatch; the meter will read zero if and only if the transmission line is properly terminated in \( Z = \text{its surge impedance} \), so as to have unity standing-wave ratio.\(^2\)

If we reverse the position of the generator and the load in Fig. 1, and again compute the meter reading, we find that the coefficient of \( E_t \) is zero, and that we have

\[ V_2 = \frac{2R_1}{Z_0} E_t \]

When thus connected, the Micromatch reads the transmitted-wave voltage only, and does not respond to the reflected wave.

Referring back to Equation 1, we find that by measuring \( V_1 \) and \( V_2 \) we can compute the s.w.r., since

\[ \text{s.w.r.} = \frac{E_t + E_r}{E_t - E_r} = \frac{V_2 + V_1}{V_2 - V_1} \]

This computation may be avoided by making the meter direct reading, as follows: When measuring \( V_2 \), adjust the sensitivity of the voltmeter so that

\[ V_2 \text{ is full-scale reading} \]

The complete expressions of \( k_1 \) and \( k_2 \) are:

\[ k_1 = \sqrt{2} \cos \left( \omega t - \frac{\omega x}{c} \right), \quad k_2 = \sqrt{2} \cos \left( \omega t + \frac{\omega (x - 2a)}{c} + \alpha \right) \]

\( x \) is the distance between the generator and the point where the measurements are made, \( c \) is the velocity of light, \( \omega \) is 2\( \pi \) times the frequency, \( z \) is the length of the line, and \( \alpha \) is the phase shift which the transmitted wave undergoes when reflected from the load. \( E_t \) and \( E_r \) are both r.m.s. values.\(^3\)

This result is obvious when Fig. 1 is considered as a bridge, but the other properties of the Micromatch cannot be well understood unless the traveling-wave picture is considered.
it just reads full scale, then measure $V_1$ without changing the voltmeter sensitivity. Then, since $V_2 = 1.0$,

$$\text{s.w.r.} = \frac{1 + V_1}{1 - V_1}$$

and the meter scale may be calibrated to read directly the s.w.r. corresponding to any voltage $V_1$. The calibration curve in Fig. 2 shows the standing-wave ratio in terms of meter deflection.

Now consider the use of the Micromatch as a wattmeter. Obviously, the net power delivered to the load is the difference between the transmitted power and the reflected power. For any load impedance, this is given by

$$P = \frac{E_1^2 - E_2^2}{Z} = K (V_2^2 - V_1^2)$$

where $K$ is a constant which depends on the line impedance and circuit values, but not on frequency.

Thus the power delivered to the load may be found by measuring $V_1$ and $V_2$ and taking the difference of their squares. The squaring may be done automatically by drawing on the meter the calibration curve shown in Fig. 3. Full scale on the meter is arbitrarily selected as 10. This power scale is of course only relative, and the meter must be calibrated at one point on its scale for each value of line impedance used. Note that with the calibration curve of Fig. 3, the Micromatch will indicate 1 per cent of full-scale power with good accuracy, while with the conventional r.f. ammeter it is not possible to read accurately below about 30 per cent of full scale, giving a power range of 10 to 1 against 100 to 1 with the Micromatch.

In using the Micromatch as a wattmeter, it is frequently possible to omit measuring $V_1$. This can be done if the s.w.r. on the line is small enough. For example, if the s.w.r. is 2, $V_1$ is one-third as large as $V_2$, and $V_1^2$ is consequently 10 per cent of $V_2^2$. Neglecting $V_1$ thus introduces a 10-per-cent error on lines with an s.w.r. of 2; the error introduced by this simplification for other values of s.w.r. is shown in Fig. 4.

**Construction**

The circuit diagram of the Micromatch indicator is shown in Fig. 5. The constants have been selected to operate at frequencies from 3 to 30 Mc., and for transmission lines from 70 to 300 ohms. The capacitor $C_1$ is made variable to allow the Micromatch indicator to be adjusted for various values of transmission-line impedance. The maximum capacity corresponds approximately to 70 ohms line impedance, while the minimum capacity will correspond to about 300 ohms line impedance. The resistor $R_1$ and the capacitor $C_3$ should be selected so that the above.

![Fig. 5 — Circuit diagram of the Micromatch standing-wave indicator.](image)

$C_1 = 3-15-\mu\text{fd. midget variable.}$

$C_2 = 820-\mu\text{fd. silver mica.}$

$C_3 = 0.0047-\mu\text{fd. mica.}$

$R_1 = \text{Special four-terminal 1-ohm 20-watt resistor.}$

See text.

$R_2 = 5000$-ohm potentiometer.

$MA = 0-1$ d.c. milliammeter.

$RFC_1, RFC_2 = 2.5$-mh. r.f. choke.
range is obtainable on the variable capacitor $C_1$. The instrument is calibrated for impedance by attaching various noninductive load resistors to the load terminals and adjusting $C_1$ until the meter reads zero. The scale on $C_1$ should then be marked for the particular value of load resistance used. Another value of load resistance should be substituted and the procedure repeated. Sufficient points should be taken to obtain a smooth calibration curve. It should be emphasized here that the load resistors must be noninductive or an incorrect calibration will be obtained. The meter should be calibrated at about a 20-watt level. The load resistors may be made up of several carbon resistors connected in parallel to dissipate this amount of power. Care should be taken to determine that the resistors are actually carbon and not wire-wound.

The resistor $R_1$ is made up of ten 2-watt 10-ohm resistors connected in parallel, as shown in the photograph. Two leads are brought out at each end of the composite resistor, one set to carry the transmission-line current, and one set to connect to the crystal and capacitor $C_2$.

There are a few precautions to take in the construction of this instrument to prevent the loop formed by $R_1$, $C_2$ and the 1N34 from having voltage induced in it from the field of the line. This loop is made small by running the lead from $R_1$ to the crystal inside the resistor assembly $R_1$. The crystal is mounted directly against the capacitor $C_2$ and they are both mounted perpendicular to the line. If these precautions are not taken, serious errors may be encountered at high frequencies.

Since the entire range of the capacitor $C_1$ is used in this instrument, care should be taken to see that a minimum of capacitance from the wiring is added in shunt with it. The stator side of the capacitor is connected to the capacitor $C_2$ and the crystal rectifier. This connection should be short and far removed from the rotor side of $C_1$ or the side of the transmission line to which it connects. This helps to keep the minimum capacity small. Since there is line voltage on the rotor of the capacitor $C_1$ it must be insulated, and an insulated knob should be put on its shaft. It is usually not necessary to adjust this capacitor while the instrument is in use, so this should present no problem.

When used as a wattmeter, with the potentiometer set for maximum sensitivity, full scale on the meter corresponds very roughly to 10 watts with a 70-ohm line and to 40 watts with a 300-ohm line, at all frequencies within its range and depending on the sensitivity of the particular crystal used.

When used at a power level near the minimum values indicated above, the nonlinearity of the crystal may introduce a slight error in both the wattmeter and standing-wave-ratio readings.

**Uses for the Micromatch**

Many uses have been found for the Micromatch indicator. Probably its most popular function is that of enabling the operator to determine the standing-wave ratio on his antenna transmission line and hence to adjust the matching network for minimum reflection. The Micromatch is inserted in the line, as shown in Fig. 6, and the s.w.r. read as previously described. The effect of any adjustment at the antenna matching network or of a change in element length, in the case of a rotary beam, can be observed immediately. By adjusting the elements and the matching network for minimum reading of the Micromatch, one is assured that the s.w.r. is minimized. These adjustments can be made with loose coupling at the transmitter end, if a high-powered transmitter is used. When the s.w.r. has been minimized, it will be found that the coupling can

Fig. 6 — To check a "flat" transmission line, the Micromatch is connected in the line near the transmitter, although it can be used anywhere along the line. The matching network is then adjusted for minimum reading of the Micromatch.
and adjusting the tuning and coupling of the antenna transmitter end can have no effect on the s.w.r. but only on the power level through the Microductance introduces some slight reactance. It of the final tank circuit will be observed, except loading must be remembered that any adjustments at the tuner for minimum reading of the Micromatch. The

In any two-wire line, a discrepancy in the s.w.r. may appear depending upon how the Micromatch is connected in the line. If this discrepancy appears, it indicates that the feeder currents are not balanced. This will almost invariably occur with unbalanced systems like the "J" end feed, and it will often occur when the feed line to the center of an antenna is not brought away at right angles to the antenna. In the latter case, there is usually no solution but to lead the feed line away in the proper manner.

One striking application of the Micromatch was the adjustment of an antenna tuning system for a 7-Mc. Zepp that was coupled to the transmitter by about 20 feet of 70-ohm line, as shown in Fig. 7. The Micromatch was first connected as a wattmeter and the potentiometer adjusted until the meter read just full scale. Reversing the Micromatch indicated an s.w.r. of 10! This particular antenna tuner had been adjusted by all of the usual rules of thumb to what was considered to be the correct adjustment.

The antenna tuner was then adjusted until the Micromatch read a minimum. It became immediately evident that the antenna tuner was not capable of properly matching the antenna to the transmission line. It was necessary to add a few turns to the adjustable link of the antenna-tuner coil. It also became very evident that this adjustable link at the antenna tuner was an impedance-matching adjustment and should not be used to vary the loading on the transmitter. When the antenna tuner was properly matched, and the standing-wave ratio was less than 1.1, the r.f. voltage on the transmission line was reduced so that a neon bulb could not be lighted off the line, and the coupling at the transmitter had to be increased.

The transmitter could now be operated over the entire 40-meter band and still maintain fair loading at the transmitter, without readjusting the antenna tuner. The standing-wave ratio rose at each end of the band, but at no point was it nearly as bad as before proper adjustment. Before proper matching, the antenna tuner required adjustment every 100 kc. to maintain proper loading of the transmitter.

The Micromatch soon dispelled the common fallacy that the antenna system should tune up with a minimum amount of coupling at the link in the transmitter. With the transmission line properly matched, the link was adjusted for proper loading of the transmitter. The setting of the link under this condition was much farther into the tank coil than the incorrect adjustment which existed prior to the proper matching. When the line is properly matched, moving the link in and out of the tank coil does not change the position of the final tank tuning condenser for minimum plate current.

It might be noted here that cut-and-try methods of antenna tuning can produce the condition of no change in the final tank condenser tuning when the link is moved in and out. This condition represents a resistance load at the link, but there is no simple means, except of course with the Micromatch, which will produce the proper value of resistance load at the link.

Another very important use of the Micromatch indicator is for adjustment of interstage link coupling. The diagram in Fig. 8 shows the Micromatch connected between the driver tank circuit and the final-stage grid circuit of a typical transmitter.

In this adjustment, the Micromatch is set to the impedance of the line or twisted pair connecting the two coupling loops. The amplifier grid circuit is then adjusted until unity standing-wave ratio is obtained. This should be done at the normal operating power level and with the plate voltage on the loaded driven amplifier. The adjustments are made by changing the value of the grid leak, $R_2$, and by the coupling of the loop at the driven amplifier. The grid circuit is, of course, maintained in resonance, as indicated by maximum grid current. In some in-
stances it may be necessary to add a loading resistor, \( R_1 \), across the circuit. The amount of drive is kept constant during the tests by changing the position of the loop at the driver end. If desired, the driving power can be measured by reversing the meter. It is of course necessary to calibrate the wattmeter scale for each setting of the potentiometer, but this can be done by comparing a light-bulb load with one of known wattage connected to the a.c. line. The meter need be calibrated at only one place on its scale to read power over quite a wide range.

Proper adjustment of this link-coupled circuit caused the driving power to be maintained essentially constant without retuning over a wider range than obtained by conventional matching methods.

In any transmitter, the Micromatch could be used to adjust all of the interstage couplings, and then left in the antenna feed line to monitor the standing-wave ratio.

A 25-watt light bulb was measured by this method on the Micromatch. It had an r.f. resistance of approximately 300 ohms and a standing-wave ratio of near unity at 7 Mc.

After using the Micromatch it may be removed from the line without disturbing the impedance match, or it may be left in the line to monitor either the standing-wave ratio or the power output. The instrument should be very useful in monitoring an antenna during wet weather to determine the effect of dampness on the feeders and insulators. Two instruments may be connected in series, one to read power and the other to read standing-wave ratio.

To review briefly the use of the Micromatch, the following steps should be taken each time a reading is taken:

1) Connect the Micromatch as a standing-wave-ratio meter, and adjust the load for minimum standing-wave ratio, i.e., minimum meter reading.

2) Reverse the connections, and connect the Micromatch as a wattmeter. Adjust the potentiometer until the meter reads just full scale.

3) Reconnect the Micromatch as a standing-wave-ratio meter and read the standing-wave ratio of the transmission line. Readjust the load-impedance matching network if desired to obtain a better standing-wave ratio.

4) The meter may be left in the circuit either as a standing-wave-ratio meter or as a wattmeter.

After using the Micromatch for a few weeks, it doesn’t seem possible that an amateur station could be operated without it. It seems as indispensable to tuning r.f. systems as a plate milliammeter is in tuning a Class C amplifier.

The Micromatch is a very useful device even if the only calibration is the essential one of \( C_f \) for various impedance levels, since all of the s.w.r. applications can be used without knowing the magnitude, the meter serving as a “minimum” indicator.

**Silent Keys**

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

- Ex-W2DJ, Edwin B. Lant, Larchmont, N. Y.
- Ex-W3BL, Floyd Rice, Bethlehem, Pa.
- W5FIIJ, Henry W. Hart, Ruleville, Miss.
- W5FQ, Burt Stuart, Meridian, Miss.
- W6GMU, Robert M. Ryan, La Habra, Calif.
- W8WF, Charles A. Wise, Detroit, Mich.
- W9DCV, Joseph G. Grant, Harrisburg, Ill.
- GW4KQ, Hugh H. Phillips, Cardiff, Wales
Predicting Amateur "Conditions"
A New Method of Using CRPL Charts for DX Work

BY NEWELL A. ATWOOD, * W3KTR

While the prediction methods outlined in this article differ from those heretofore recommended the theory underlying each method is identical. Briefly, this theory is that for distances in excess of 2500 miles (4000 kilometers), propagation is controlled by the $F_2$ layer of the ionosphere at two control points along the great-circle path between the two stations, each point being 1250 miles (2000 kilometers) from each station toward the other station.

For prediction of maximum usable frequency by the method recommended by CRPL, the $F_2$-4000 charts contained in the monthly CRPL publication are used with a world chart (also contained in the same publication) upon which the control points have been plotted. The condition of the ionosphere for each hour of the day at each control point is obtained in terms of maximum usable frequencies, the lowest of which is the maximum usable frequency for communication between the selected two stations at the designated hour, based upon reflections from the $F_2$ layer at the two control points.

To predict amateur "conditions," as outlined in this article, the same charts are used but in a somewhat different manner. A transparent chart, upon which has been traced curves or "contour" lines representing amateur frequencies, is used with a world chart upon which there appear a control area surrounding the amateur's location and great-circle paths to all parts of the world from the control area. By moving the transparent chart horizontally, the hours of the day at which the periphery of the control area and the contour area coincide can be determined and the areas of the world that can be worked at those hours can be ascertained at a glance. "Conditions" on 10 meters, for example, can be determined by observing what land areas are covered by the 30-megacycle shadow of the $F_2$-4000 "cloud" as it drifts from east to west during the twenty-four-hour day. The contour of this "cloud" differs from month to month and differs slightly over three zones of the world but a single transparent chart can be used to obtain a fairly accurate picture for any one month.

An amateur interested in predicting "conditions" should subscribe to Basic Radio Propagation Predictions, CRPL-D, published monthly by the Government Printing Office, Washington, D. C. (Single copies 15 cents; $1.50 per year.)

* Methods previously outlined for using CRPL m.u.f. charts have been principally useful for determining the best working frequency between any two points at any given time of day. Here is a way to find at a glance where you can work, from a given location, at any hour. A small amount of preliminary work sets you up for rapid determination of probable DX conditions months in advance.

** Publication since the war of articles in QST, and elsewhere describing propagation prediction methods has no doubt caused many an amateur, particularly the DX ham, to attempt to predict the best hours for DX QSOs. Such attempts have probably not yielded results commensurate with the efforts expended, in view of the fact that the prediction methods heretofore recommended are based on the location of the desired remote station and the time of the day that it is desired to work that station. Additionally, the answer obtained by such methods is in terms of maximum usable frequency or optimum working frequency at a given hour of the day. To the average ham, the term "conditions" means "What is the best time of the day to make DX contacts?" or "What DX can I expect to work with my rig during the hours I can spend in the radio shack?"

The monthly publications giving basic radio-propagation predictions three months in advance, and originating with the Central Radio Propagation Laboratory of the National Bureau of Standards, can be used to permit an amateur to predict "conditions" with fair accuracy in a usable form and with little effort after the initial spadework is done. In the present period of the sunspot cycle these predictions will be found most useful for 10-meter operation, although the techniques here described should be equally applicable to 6- and 20-meter operation in the future.

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April 1947
Fig. 1 — The basic map will resemble this one constructed for Washington, D.C., by the author. Each of the heavy curves (including the vertical line) represents a great-circle path, intervals between curves being 30 degrees of azimuth at the home location. The short double-arrowed vertical line marks the EST meridian.

Fig. 2 — The 30-megacycle $F_a$-4000 m.u.f. contour lines traced from the CRPL prediction charts for April, 1947. The contours for the three zones are superimposed on the same chart so that 10-meter predictions the world over can be observed at a glance.
Fig. 3 — Conditions, as predicted by the charts, at 8:40 A.M. EST, during April, 1947. The white area that also encloses the lower portion of the home-station control area represents the part of the world that is "open" for 10-meter communication. Shaded areas cannot be worked over the short great-circle route, but are "possible" by the long path.

Fig. 4 — Corresponding to Fig. 3, but for 5:50 P.M. during April.
parent chart in the manner outlined below. These figures correspond with those shown as Figs. 5, 6, 7 and 9 of the February, 1946, QST article, except in size.

**Constructing the Basic Map**

Upon the world chart, Fig. 1 of the CRPL publication, draw in heavy black lines a series of six great-circle paths passing through the location of your station and extending from this location to the borders of the chart in each great-circle direction at 30-degree angles around the compass. This is done by means of the great-circle graph, Fig. 2 in each issue of the CRPL publication (see Fig. 6 of the February, 1946, QST article), as follows: Upon a sheet of tracing paper or thin transparent paper approximately the size of the CRPL Fig. 2, trace from that chart the Equator and three perpendicular lines corresponding to the points of convergence of the great circles on that figure. On the center vertical line, from the world chart, CRPL Fig. 1, mark as accurately as possible the location of your station. Using a 30-60-90-degree triangle, draw short lines passing through the location of the station at 30-, 60- and 90-degree angles to the perpendicular line. Great-circle paths are next drawn in by moving the tracing paper horizontally (maintaining coincidence of your station tangent to the short 30-, 60- and 90-degree lines previously drawn in, using the closest great-circle paths of CRPL Fig. 2 as guides. The perpendicular lines represent the sixth great circle running due north and south through the location of your station. From right to left, these great-circle curves, including the perpendicular lines, represent bearings from the station location of zero through 360 degrees at 30-degree intervals.

Next, on each great-circle path, distances 2000 kilometers each side of the home-station location are spotted from the dot-dash lines of Fig. 2 of the CRPL publication. These points are then connected by a smooth curve to outline the control area, 2000 kilometers (1250 miles) in radius.

The curves and the control area are next transferred to your basic world chart, making certain that the locations of the home station and the Equator are properly positioned during the transfer.

Because of the type of world-chart projection used, the periphery of the control area will not be a circle but will take the shape of an egg or a spinning top with its point toward the Equator. The Equator on this world chart should be drawn in as a heavy horizontal black line from border to border. Also, the central meridian of the time zone in use at the amateur’s station, e.g. 75, 90, 105 or 120 degrees for Eastern, Central, Mountain or Pacific Standard Time, respectively, should be drawn in as a short, heavy vertical black line at the Equator, for use in reading time from the time scale on the transparent chart to be described later. It will be found convenient to color the land areas on the world chart using different colors (light red, green and blue are recommended) for the land areas falling in the E, I and W portions of the world chart. The chart thus constructed can be used as a basic chart for predictions from month to month thereafter at various amateur frequencies, and for these reasons it is best to mount this basic chart upon heavy cardboard or upon a piece of smooth wood, using vegetable glue or similar adhesive.

Incidentally, this basic world chart with its great-circle paths will be a good guide to the direction in which that rotary beam should be pointed to make the DX contacts predicted from the charts.

**Prediction Charts**

To be used with the basic chart, a transparent chart is prepared, preferably upon a roughened cellulose (although thin white tracing paper may be used), by tracing in part from Figs. 6, 8 and 10 of the CRPL publication. A permanent horizontal line representing the Equator is traced in ink on the transparent chart and a permanent horizontal scale of hours, also obtained from the same figures, is entered on the chart, most conveniently along the Equator line. Upon the transparent chart there are traced, from the $F_2$-4000 charts of the CRPL publication for the month for which predictions are desired, “contour” lines corresponding to the amateur frequency which is in use, or the high frequency of the band in use (e.g. 30 megacycles for 10 meters). These “contour” lines should be traced from the $E$, $I$ and $W$ $F_2$-4000 charts, preferably in colors corresponding to those used upon the basic chart for the land areas lying in the $E$, $I$ and $W$ zones respectively. Contour lines for succeeding months can be transferred to the transparent chart after erasing such lines for the previous month, if traced with pencil. Or, if it is desired to know “conditions” for several months in advance, several transparent charts can be prepared for use with the one basic world chart.

**Making Predictions**

Once constructed, the charts are easily kept current and easily used. In use, the two charts are always positioned vertically so that their horizontal Equator lines coincide. For this purpose guides may be associated with the basic world chart which will permit the transparent chart to be moved only in a horizontal direction.

The transparent chart is slid horizontally so that the contour area outlined thereupon first touches, then overlies and later passes out of contact with the periphery of the control area on the world chart. The proper $E$, $I$ or $W$ contour
areas for the zone in which the control areas lie should be used, of course. The band begins to open up at the time of first contact between the contour area and the control area, and remains open until there is no further contact between these two areas; time is read from the transparent chart, using the time scale along the Equator at the point which coincides with the vertical line on the world chart corresponding to the central meridian of the time zone at the amateur’s location.

World areas that can be contacted during the period that the band is open, as worked out above, can be read directly from the charts. Since radio signals travel by great-circle paths, and since propagation is primarily controlled by the condition of the $F_2$ layer at the control points, it is only necessary to ascertain when the control points along these paths, i.e., a first point on the periphery of the control area and any other second point along that great-circle path, become effective at the desired frequency, to ascertain what can be worked along that path 1250 miles beyond the second control point. In other words, by means of the two charts, the time at which the first control point on any great-circle route becomes effective, and the location of all second control points along that great-circle route, are presented visually to permit a quick answer to the question “What are present conditions?”

Allowance should be made for the zones in which the control points are located, using the proper contour areas for each zone (e.g., the control points for red, blue and green land areas should fall within the red, blue and green contour areas). Additionally, it should not be overlooked that land areas 1250 miles beyond the contour areas along great-circle paths may be worked as long as both control points fall within the proper contour areas for each zone.

The use of the charts is much simpler than any instructions as to how they are used, and Figs. 1, 2, 3 and 4 of this article may illustrate this. Fig. 1 shows the basic world chart constructed as outlined above for an amateur station located in Washington, D. C. The control area is shown in close-rulled lines and great-circle paths at 30-degree intervals are shown. A vertical line corresponding with the 75th Meridian West is used for reading time along the time scale on the transparent chart. Fig. 2 shows the transparent chart with 30-megacycle contour lines for the $E$, $I$ and $W$ zones for the month of April, 1947.

The numerals along the Equator constitute a “local-time” scale, and can be read directly as Washington time using the 75th-meridian vertical line on the basic chart. Fig. 3 shows the basic and transparent charts superimposed at 8:40 A.M. while Fig. 4 shows the same charts superimposed at 5:50 P.M. From these figures, “conditions” on ten meters at these hours can be easily observed and DX contacts can be predicted readily. With the actual charts, the times at which various world areas come in and go out can be predicted with considerable accuracy.

Areas falling within the contour lines and designated by horizontal rulings are “visible” but not “workable,” since great-circle paths passing through these areas do not enter the home-station control area at a point falling within the contour lines. However, it may occasionally be possible to work these areas by the long great-circle paths, as may be seen by a study of the charts, and it is probable that this accounts for statements occasionally heard over the air going something like this: “I worked into the Philippines off the back of my beam, and at 8:30 in the morning! Imagine that!”

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General correlation of predicted “conditions” and stations heard or worked on 10 meters over a period of several months late in 1946 is shown in the accompanying table. This table compares predictions made in the manner described above with actual observations from the author’s amateur station located near Washington, D. C. Differences in predicted “open” periods from

<table>
<thead>
<tr>
<th>Date (1946)</th>
<th>Station</th>
<th>Location</th>
<th>Predicted Open Period</th>
<th>Time (EST) Heard or Worked</th>
</tr>
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<tbody>
<tr>
<td>Oct. 5</td>
<td>OAY</td>
<td>Birmingham, England</td>
<td>0730 - 1240</td>
<td>0736</td>
</tr>
<tr>
<td>5</td>
<td>D4A1W</td>
<td>Germany</td>
<td>0720 - 1200</td>
<td>0631</td>
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<tr>
<td>5</td>
<td>F4AWJ</td>
<td>Holland</td>
<td>0730 - 1310</td>
<td>0638</td>
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<tr>
<td>6</td>
<td>Z2AU</td>
<td>East London, S. Africa</td>
<td>0600 - 1350</td>
<td>0675</td>
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<tr>
<td>4</td>
<td>Z2AV</td>
<td>Capetown, S. Africa</td>
<td>0600 - 1350</td>
<td>1208</td>
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<td>Bombay, India</td>
<td>0930 - 1020</td>
<td>1010</td>
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<td>1105 - 1340</td>
<td>1216</td>
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<tr>
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<td>0710 - 1510</td>
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<tr>
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<td>Algeria, N. Africa</td>
<td>0630 - 1290</td>
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<td>Frankfort, Germany</td>
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<td>0700 - 1200</td>
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<td>Cape town, S. Africa</td>
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<td>0638</td>
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<tr>
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<td>Dutch Guinea</td>
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<td>0703</td>
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<tr>
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<td>Paris, France</td>
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<tr>
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<td>0740 - 1140</td>
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<td>FNO</td>
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<td>0740 - 1140</td>
<td>0790</td>
</tr>
<tr>
<td>28</td>
<td>BM7SV</td>
<td>Sweden</td>
<td>0810 - 0850</td>
<td>0825</td>
</tr>
</tbody>
</table>

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A Low-Cost 2-Meter Transmitter

Improved Transmitter Performance for the Beginner and Low-Power Enthusiast

BY EDWARD P. TILTON, * W1HDQ

- It's a workaday world, and many amateurs can only dream their designs of crystal-controlled or MOPA 2-meter rigs to come, while at the same time they must struggle along with low power and modulated-oscillator budgets. In this day of v.h.f. refinement there is, however, a ray of hope for this deserving and well-intentioned group—the stabilized modulated oscillator. The little job described puts out a vastly better signal than the majority of the simple rigs now in use on 144 Mc., and its war-surplus tubes and low-cost components keep the total cost under $20.00, down to the last nut and bolt.

INSTEAD of berating the modulated oscillator, and complaining about the admittedly poor quality of many of the signals heard currently on 144 Mc., why not give us some simple rigs that will put out the kind of signal you want to hear on the band?" This query, in various forms, has been cropping up with increasing frequency in correspondence received at Headquarters recently. Many ask for descriptions of simple MOPA rigs using low-cost tubes, while others would like to know how to stabilize the modulated oscillator, but nearly all have a common aim: something simple and inexpensive which will sound better than the you-know-whats that are cluttering up the band today in most locations.

The answer is not easy; the construction of a good MOPA, for instance, requires a lot more than merely the construction of a simple triode oscillator driving a triode amplifier. Even back in the pre-1938 days on 56 Mc. this technique was found to be ineffective. It is utterly useless on 144 Mc. In such a set-up, where no buffer stage is employed, the oscillator must be lightly loaded. There must be an excess of drive, so that the final stage can be coupled only loosely to the oscillator, otherwise the degree of frequency modulation will be, to all intents and purposes, just as bad as though the oscillator were modulated directly. Only by using a high-C oscillator employing a good-sized tube, loosely coupled to a beam-tetrode amplifier requiring only a small amount of grid drive,” can a reasonable degree of stability be attained. This method is just about as costly as crystal control, and the latter is much to be preferred.

What Makes a Signal Bad?

Frequency modulation, in itself, is not particularly harmful in moderate amounts, for properly-controlled f.m. can be copied on even the sharpest receivers. It is the tendency of most modulated-oscillator rigs to jump frequency when the audio is applied, which renders them unreadable on selective receivers. Many oscillators also suffer from excessive a.c. hum, resulting from the use of a.c. on the filaments of instant-heating tubes. The greatest evil in most oscillator rigs in use on 144 Mc. is their inability to maintain oscillation at low plate voltages. Many which run

Front view of the simple 144-Mc. transmitter. The jacks at each side of the antenna terminals are for insertion of a meter in the oscillator grid (left) and plate (right) circuits. The microphone jack is at the lower left and the on-off switch is at the right. The calibration scale is drawn with India ink on heavy white paper.

QST for
at 300 volts on the plate stop oscillating when the voltage is reduced to 150 or less. It is easy to see what happens in such a set-up when anything over 50-per-cent modulation is attempted! This condition results from insufficient excitation, as evidenced by low grid current when the oscillator is coupled to a load. Grid current, not plate current, is the important reading, in oscillators as well as amplifiers, but how many 2-meter oscillators will show the grid current recommended for the tubes used? Try it on yours, and see for yourself!

The Remedies

The cure for all these ills is crystal control. Let us start out on the assumption that there is no really satisfactory substitute, if one is interested in radiating a first-class signal. But for the man who wants to get on 2 "quick and easy," there certainly is something better than the barely-intelligible lopsided gurgles currently heard on the band!

Modulation is simply a process by which the plate voltage of a radio-frequency stage (oscillator or r.f. amplifier) is varied at an audio rate. It is obvious, therefore, that the oscillator must not change frequency too greatly when its plate voltage is varied, if it is to put out a readable signal. A frequency-voltage run on a low-C oscillator may show a frequency change of a megacycle or more with only moderate changes in supply voltage. The cure for this is the high-C oscillator, with some provision for keeping the excitation up to a value sufficient to maintain strong oscillation under load. The disadvantage of the high-C set-up is, of course, its lowered output, but by employing push-pull we can use a lower value of $C$ than with single-ended stages and still get moderately-good stability, and the output comes up noticeably compared to single-ended rigs in the same power class.

A.c. hum is bound to result when filament-type tubes are operated from an a.c. source, unless an adjustable center-tap resistor is placed across the tube filaments and the a.c. potential carefully balanced to ground. Even this is not a complete cure, and it has the further disadvantage that it renders the oscillator unsuitable for portable or mobile operation from a storage battery. The simplest cure is the use of heater-type tubes for the oscillator, and the little 2C22s employed are a very inexpensive solution. They are available in tremendous quantities, at low cost, on the surplus market. The 2C22 (also known as the 7193) was produced for i.f.f. equipment that operated in a frequency range just below 200 Mc. It has an element structure similar to the 6J5, but its plate and grid leads come out of the top of the envelope, making it especially suitable for v.h.f. applications.

The excitation problem was solved by resurrecting an old friend of the early days on 5 — the "unity-coupled" oscillator. There is grid excitation to spare, as a result of the grid coil being run inside the plate coil, and this push-pull oscillator shows the rated Class O operating conditions for the tube, as to grid current and bias, when the oscillator is loaded for maximum output. It remains in oscillation until the plate potential is reduced to 22 volts, and over a voltage range equivalent to 75-per-cent modulation the frequency change is only about 100 kc. The frequency stability under high positive-voltage peaks is very good, and though the frequency changes rapidly below 50 volts, the power radiated on negative modulation peaks is so low that the resultant frequency modulation is of little consequence. The result is a signal that is readable on any receiver having a pass-band of 100 kc. or more.

Constructional and Circuit Details

This transmitter is designed for use with a plate supply of 250 to 300 volts, making it ideal for portable and mobile operation with the popular sizes of vibrator or generator supplies. For home-station use, a small power supply, capable of delivering 275 volts at 100 ma. and 6.3 volts at 1.5 amperes, is required. The unit is housed in a utility cabinet 5 X 6 X 8 inches in size. Its design is characterized by rugged mechan-
Fig. 1 — Schematic diagram of the simple 114-Mc. transmitter.

C1, C4 — 10-µfd. 25-volt electrolytic.
C2 — 8-µfd. 450-volt electrolytic.
C3, C5 — 0.01-µfd. 660-volt paper.
C6 — Butterfly variable (Cardwell EF-14-BFS modified; see text).
L1, L2, L3 — Midget filter choke.
L4 — Unity-coupled grid and plate coils. See text and Fig. 2.
L5, L6 — Unity-coupled grid and plate coils.
RFC1 — Cardwell EH-J-L-FIFS modified; J1, J2, J3 — Closed-circuit jack.
RFC2 — No. 28 d.s.c. wire, close-wound on 1-watt resistor, %×% inch long.
RFC3, RFC4, RFC5 — 20 turns No. 20 d.s.c. wire close-wound on %×% inch polystyrene rod.
S1 — S.p.s.t. toggle switch.
T1 — Single-button microphone transformer (UTC "Ounce" — surplus).

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The plate leads may be of ¼-inch copper braid, or of copper ribbon, which is even better. These are fastened to the two other stator terminals of the butterfly condenser. If braid is used, it may be made solid at the end by flowing solder over the last half inch, after which a hole may be drilled in the solder-impregnated portion, to pass the stator terminal screw.

The butterfly tuning condenser, C6, is a standard unit, and may be used in its original form, provided the tank circuit is made exactly correct.

Fig. 2 — Detail drawing of the oscillator plate inductance. It is made from ¼-inch copper tubing, bent into a "U" shape. Ends of the "U" are made into spade lugs, as shown in Fig. 2, the slotted ends providing a means of inductance adjustment in case the tank circuit turns out to be other than exactly the correct length. The lug ends are fastened directly to the terminals of the butterfly-type tuning condenser, C6, being held in place by the nuts which are a part of the condenser terminal assembly. Part of the "U," at the curved end, is cut out with a hack saw or file, to provide an opening for the center-tap of the grid coil. An easy way to make the grid coil is to cut two pieces of insulated wire (it should have good quality insulation) about four inches long, and feed them into the "U" through the center opening. The center-tap is made by twisting the cleaned ends of the wires together before insertion into the "U." The protruding center-tap should be covered with household cement after the grid resistor is soldered on, to keep it in position and prevent its shorting to the plate tank. Note in Fig. 1 that the grid leads are transposed as they come out of the open ends of the "U." The 2C22s will not oscillate if the polarity of these leads is wrong.

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Machine construction, making for good stability under mobile conditions.

Four tubes are employed: a 6C4 speech amplifier, a 6V6GT modulator, and two 2C22s as oscillators. The only elements of novelty are the means of obtaining the microphone current, and the mechanical construction of the oscillator tank circuit. No battery is needed for microphone current, this being obtained by running the cathode current of the speech amplifier through the microphone transformer. The 604 cathode is by-passed with a large electrolytic condenser. The plate circuit of the speech amplifier is decoupled and by-passed with a large-value electrolytic, C2, to reduce hum. Since the 604 stage is used principally as a means of providing current for the microphone, resistance coupling is employed, this providing more than adequate gain for a single-button microphone.

The unity-coupled tank circuit is made of ¾×% inch copper tubing, bent into a "U" which is two inches long over all. The ends of the "U" are made into spade lugs, as shown in Fig. 2, the slotted ends providing a means of inductance adjustment in case the tank circuit turns out to be other than exactly the correct length. The lug ends are fastened directly to the terminals of the butterfly-type tuning condenser, C6, being held in place by the nuts which are a part of the condenser terminal assembly. Part of the "U," at the curved end, is cut out with a hack saw or file, to provide an opening for the center-tap of the grid coil. An easy way to make the grid coil is to cut two pieces of insulated wire (it should have good quality insulation) about four inches long, and feed them into the "U" through the center opening. The center-tap is made by twisting the cleaned ends of the wires together before insertion into the "U." The protruding center-tap should be covered with household cement after the grid resistor is soldered on, to keep it in position and prevent its shorting to the plate tank. Note in Fig. 1 that the grid leads are transposed as they come out of the open ends of the "U." The 2C22s will not oscillate if the polarity of these leads is wrong.

The plate leads may be of ¼-inch copper braid, or of copper ribbon, which is even better. These are fastened to the two other stator terminals of the butterfly condenser. If braid is used, it may be made solid at the end by flowing solder over the last half inch, after which a hole may be drilled in the solder-impregnated portion, to pass the stator terminal screw.

The butterfly tuning condenser, C6, is a standard unit, and may be used in its original form, provided the tank circuit is made exactly correct.
an additional butterfly rotor plate, making the minimum capacity somewhat lower. The result is a tuning range of about 142.5 to 150 Mc., with the 2-meter band approximately in the middle of the range. The condenser rotor shaft is equipped with a tension-adjusting nut which may be set tight enough so the rig will not be jarred off frequency in the course of any normal handling.

Heater-circuit chokes were found to be necessary, the stability and output being far better after they were installed. They are not critical, however, and may be made readily by winding No. 20 wire on a 1/2-inch form, which may be either polystyrene or bakelite. The forms are drilled at each end with a hole just large enough to pass the wire, and the leads themselves are stiff enough so that no mounting brackets are required, the chokes being mounted directly on the tube sockets.

Provision is made for reading both plate and grid current, two meter jacks being mounted on the panel, at each side of the plate tank. Their terminals make convenient mounting places for the grid resistor, $R_7$, and the plate-circuit r.f. choke, RFC. Note that the jacks are connected so that the meter leads need not be reversed, when changing from one jack to the other. The plate-meter jack must, of course, be insulated from the metal panel.

**Watch That Grid Current!**

Since the grid is the controlling element in the operation of a vacuum tube, it stands to reason that the grid current is a most important reading in a Class C stage, whether it be amplifier or oscillator. This is particularly true of oscillators, though this fact is overlooked by many workers and ignored by most texts. The plate current is a fair indication of the operation of a Class C amplifier, but it is almost entirely useless in the case of an oscillator. It is impossible to tell, from the plate current, when the antenna loading is adjusted properly on most oscillator rigs, but the grid current will provide a sensitive indication. It also shows plainly whether the oscillator is functioning correctly. If the grid current and bias are normal under load, the plate current can be ignored, except to see that the input is not excessive for the tubes used.

When this transmitter was first tried it was found to be drifting badly when anything over 200 volts was applied to the plates of the oscillator. A check of the grid current showed that it was running excessively high, so the 5000-ohm grid resistor originally employed at $R_7$ was replaced with a 10,000-ohm resistor. The grid current was then about 8 ma., with a dummy load connected across the antenna terminals. Drift was then very low, at plate voltages up to 300, and twice the input could be run without serious frequency drift. The grid current serves as a sensitive indication of antenna loading, and the position of the “U”-shaped coupling loop should be adjusted so that the grid current is approximately 8 ma. for best stability and output. The plate current need be measured only to determine how much input is being run; it is of little or no value in determining the correct loading. It will run about 60 ma. with a 275-volt supply.

The oscillator frequency may be checked with Lecher Wires, or by listening to the signal in a calibrated receiver. In either case there should be a load across the antenna terminals, as the frequency may be appreciably different between loaded and unloaded operation. A rough calibration is shown in the front-view photograph. The approximate pointer settings for the two edges and the middle of the band are indicated, and the maximum and minimum settings of the butterfly condenser are shown by the two marks which are separated by 90 degrees. This calibration scale was made in rough form in pencil and then drawn over with black India ink. It is glued to the panel, and further held in place by the condenser mounting nut and two small screws.

Several members of the Headquarters staff, when looking over this little rig for the first time, have asked, “Where is the gain control?” The answer is, of course, that there isn’t any. With a single 6V6 used as a modulator for an input of 10 to 18 watts, there is no occasion for backing off on the gain, and a half-watt carbon resistor, $R_2$, across the microphone transformer, is much cheaper.

(Continued on page 180)
Gain vs. Element Spacing in Parasitic Arrays
An Experimental Study of Three- and Four-Element Beams

BY R. G. ROWE,* W2FMF

Antenna measurements, to be of any significance, require a great deal of care, special equipment, and knowledge of the factors that can cause the measurements to be in error. This article gives the results of measurements intended to bring out the relationship between gain and spacing in parasitic arrays, under controlled conditions and with a technique that is completely described. Wider spacing than is commonly used is shown to give greater gain.

Recently a limited amount of data has been published on the advisability of using wide vs. close spacing in multielement parasitic antenna arrays in order to realize maximum forward-gain capabilities.1, 2 In the prior art, an article by G. H. Brown develops the theory of parasitic arrays and gives gain figures for combinations employing a single parasitic element in cooperation with the driven element.3 This article has formed the basis for the design of the close-spaced parasitic arrays that have been so enthusiastically received by the amateur radio fraternity.

A graph has been published showing the maximum realizable gain of an array comprising a single parasitic element either as a director or reflector.4 According to this, maximum forward gain may be attained in a two-element beam (driven element plus single parasitic element) when the parasitic element is acting as a reflector and is spaced 0.15 wavelength from the driven element, or when the parasitic element is acting as a director and spaced 0.1 wavelength from the driven element. With the parasitic element as a director, power gains in the order of 5.4 db. are indicated; whereas, with the parasitic element acting as a director, power gains of 5.7 db. are shown.

Upon the last two references has been based the assumption that the published design data may be applied exactly to three-element parasitic arrays (driven element plus single reflector and single director) for maximum forward gain, whereas the references properly avoid any such claim. For years many amateur radio operators have retained close spacing, believing that it will provide the highest forward gain. A certain percentage has used wider spacing, feeling that the so-called disadvantages of high Q, narrow bandwidth and difficult adjustment of the close-spaced array were not worth the claimed additional gain. Some of the earlier articles concerned with three-element beams showed spacing of 0.1 wavelength for the reflector and 0.15 wavelength for the director. Later articles showed reversed parasitic-element spacing, but of the same order of magnitude.

Because the theory of parasitic arrays having more than one parasitic element has not been developed -- or, at least, published -- for the cases of most interest to the amateur, experimental results apparently constitute the only available source of information on the question of wide vs. close spacing. While a few scattered results initially may be viewed with skepticism, more and more published data eventually will resolve the question for practical purposes. It is

The antenna element with its coupling link. The center of the link is grounded to the amplifier chassis by means of the flexible braid at the center of the turn.

with the thought of adding to the fund of empirical information that the present article is written.

To aid, rather than confuse, contemporary experimenters, any published information should include details of the experimental apparatus and procedures employed. The imaginary or real weaknesses of the apparatus and procedures should be pointed out and discussed in order to set the limits of validity and to simplify the job.


QST for
of subsequent experimenters. With this in mind, the writer will outline apparatus, procedures and results in experiments concerned only with the forward gain of wide vs. close spacing in parasitic arrays.

Method of Signal Generation

In the following described experiments a self-excited oscillator coupled to a neutralized power amplifier with a parallel-rod tank circuit was utilized as the signal source. The rod tank circuit was shunted at its high-impedance end with a butterfly capacitor for resonance adjustment. The 815 power amplifier was operated at a constant plate power input of some 35 watts and at constant grid current. Plate power input was controlled by load coupling adjustment. In initial experiments a General Radio Type 857-A 95- to 525-megacycle oscillator was used to excite the antenna arrays, but the plate-current rise with load was negligible in this oscillator, making the determination of plate power input impracticable. While an attempt was made to use a grid-dip meter, which was more sensitive to oscillator loading, direct oscillator-to-load coupling was abandoned because of the added difficulty of adjustment and the instability of frequency with variation in reactive loading. Because the General Radio oscillator output is limited, it was found necessary to substitute an 815 parallel-rod oscillator to provide sufficient power-amplifier grid excitation.

After a period for thermal stabilization, the output frequency was continuously monitored and held constant at approximately 140 megacycles by use of a General Radio Type 720-A heterodyne frequency meter.

Method of Antenna Coupling

The antenna was coupled directly to the parallel-rod tank circuit of the shielded power amplifier by a loop at its center, as shown in one of the photographs. The loop was cut from 3/16-inch-thick copper sheet and made one-half inch wide. This method was decided upon to minimize standing-wave losses which probably would have occurred in a feed line, as well as to eliminate impedances-matching problems. Originally it was believed that this method of feed was desirable in that a variety of low driving-point impedances is encountered.

To permit this method of feed it was necessary to construct the power amplifier vertically in a 2 3/4 X 2 3/4 X 2 7/8-inch copper shield box, as shown in the photograph. The long dimension of the box is at right angles to the plane of the array. This configuration minimizes the amount of metallic conductor spanning the plane of the electric vector of the field and minimizes the required change in antenna length resulting from the introduction of the metal box. However, it is believed that the metal shield box has no effect on the length of the parasitic elements, as might have been the case had the long dimension of the
box been lying in the plane of the array at right angles to and bisecting all of the elements. Because of the possibility that the metal shield might affect the required length of the antenna element in the array, and because the coupling-loop reactance will affect the antenna-element length, no attempt has been made to correlate the length of the parasitic elements with that of

The Twin-Lead folded-dipole receiving antenna mounted on a wooden frame above the indicating meter. In each case parasitic-element lengths have been adjusted for maximum forward gain at predetermined spacings.

The vertical power amplifier mounted on its wooden supporting stand, to which in turn was fastened the wooden boom for the array, is shown in another photograph. The parasitic elements were clipped to wooden collars that could be slid lengthwise along the boom to adjust the spacing. All of the elements were made of ¾-inch o.d. brass rod and provided at each extremity with friction-fit adjustable ends to permit variation in over-all length. Each brass rod was scribed at half-inch intervals near each end to facilitate length measurement.

**Signal-Strength Measurement**

For reception, a folded-dipole antenna 39 inches long made from 300-ohm Twin-Lead feed line was used. A ¼-wavelength section of the same line coupled the antenna to a 300-ohm 1-watt carbon load resistor across which measurements were made. In initial experiments the circuit shown in Fig. 1 was used, with the series circuit comprised by the 15,000-ohm carbon resistor, the 0–200 microammeter and the IN34 germanium crystal diode functioning as a voltmeter across the 300-ohm load resistor. Initial db.-gain calculations, based upon voltage ratios in accordance with the formula

$$\text{db.} = 20 \log \frac{E_2}{E_1},$$

where $E_2$ is the measured voltage produced by

![Fig. 1 — Circuit diagram of field-strength indicating receiver using crystal-diode rectifier.](image)

![Fig. 3 — Circuit diagram of receiver using vacuum thermocouple.](image)

the array and \( E_1 \) is the measured voltage produced by a half-wave dipole, were abnormally large, as expected, because of the approximately square-law characteristic of the germanium diode at low impressed voltages, as shown in Fig. 2.

The measuring circuit finally employed, shown in Fig. 3, metered a constant fraction of the current in the terminating resistor through the 1-watt 1000-ohm carbon isolating resistors and the small vacuum thermocouple shown in the photograph. The thermocouple and its associated 0-100-scale meter were calibrated and shown to follow the square law on direct current. This relationship was not measured at the operating frequency of 140 Mc.

Thus the meter reading was proportional to the square of the current in the terminating resistor, and thus directly proportional to power. Hence, db. gain was calculated according to the formula

\[
db = 10 \log \frac{P_2}{P_1},
\]

where \( P_2 \) may be the meter indication produced by the array and \( P_1 \) that produced by a half-wave dipole or reference antenna. The receiving apparatus is shown in another photograph.

Fig. 4 shows a plot of power ratios, \( P_2/P_1 \), against db. for convenience in interpreting the db. gain from the two meter readings or the power ratios. To determine the db. power gain of a particular array over a half-wave antenna, the reading of the meter of Fig. 3 produced by the array is divided by that produced by the half-wave reference antenna. For example, if the dividend were 10, corresponding to a power ratio of 10, inspection of the graph of Fig. 4 indicates a power gain of 10 db.

For the convenience of those not possessing the thermocouple arrangement of Fig. 3, the meter of Fig. 1 has been standardized against that of Fig. 3. This standardization was performed by shunting both metering circuits across the 300-ohm line-terminating resistor and taking readings on the thermocouple meter as the microammeter reading was advanced in 10-unit steps by increasing the field strength. The resulting plot appears in the graph of Fig. 5. As a first approximation the circuit of Fig. 1 may be employed as the field-strength meter. From the graph of Fig. 5 the relative readings of the 0-200 microammeter may be interpreted in terms of current squared, or power. The resulting power ratio will give db. gain directly from the graph of Fig. 4. Because the thermocouple receiver was not im-

![Fig. 4 - Conversion chart, decibels to power ratio.](image)

![Fig. 5 - Comparison between readings of the receivers shown in Figs. 1 and 3.](image)
### Table I

<table>
<thead>
<tr>
<th>Directors</th>
<th>Reflector</th>
<th>Spacing of Parasitic Elements, Wavelengths</th>
<th>Diode-Type Receiver Readings</th>
<th>Db. Gain</th>
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<td>1st</td>
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<td>43</td>
<td>0.2 0.2 0.2</td>
<td>170</td>
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</tr>
</tbody>
</table>

Immediately available, many of the readings were taken on the crystal-diode receiver and later converted as explained under "Experimental Results."

### Locale

The measurements were made within a reinforced concrete building in a room 32 feet by 16 feet, with the transmitting and receiving arrays spaced three wavelengths apart. The room contained several large metal cabinets along the walls and a large amount of conduit-enclosed wiring. While it is planned to repeat the measurements out-of-doors when weather conditions permit, employing the several modifications in the apparatus later to be described, it is believed that the present results are reasonably accurate, indicative and worthy of publication at this time, particularly because they fall in line with earlier published results.

### Experimental Results

Table I is a chart of field-strength meter readings taken with the diode-type receiver of Fig. 1, with reference to various spacings, number of parasitic elements and length of parasitic elements. Only the highest meter readings for each particular spacing have been converted to indicate db. power gain over the half-wave radiator. This chart represents the results of one test run; other similar runs show a close correlation.

Table II is a chart of field-strength meter readings taken with the vacuum-thermocouple receiver of Fig. 3, with reference to various spacings and number of elements. Only the highest meter readings for each particular spacing are shown. Included in this chart is a column headed "Db. Gain From Table I." This has been inserted to indicate the correlation between these two separate series of measurements. The greatest variation, appearing in the four-element 0.2-wavelength spaced array, is only 0.8 db., or well within experimental error and indicative of the magnitude of the correlation experienced in these measurements.

In order to check the apparatus against the published results on arrays using a single parasitic reflector in combination with a driven element, the field-strength reading of the thermocouple metering apparatus of Fig. 3 was set at 8 on the 0–100 scale of the meter by adjusting the coupling to the reference half-wave radiator alone and noting the amplifier plate power input. A single reflector, spaced 0.15 wavelength behind the radiator, was adjusted in length until a maximum field-strength reading of 24 was obtained at the identical plate power input. This

![Fig. 6 — Proposed feed system to provide a resistive load on the power amplifier through a coaxial transmission line.](image-url)
shows a power ratio of 24/8, or 3, which, from the graph of Fig. 4, may be interpreted as a power gain of 4.8 db. The published data for this array show a theoretical gain of 5.4 db. (neglecting element resistance, which would make the actual gain lower), indicating a close correlation between the theoretical and measured power gains.\(^4\)

It is worthy of note that in a separate series of tests with two-element beams, employing a single parasitic element either as a reflector or a director, the measured gains correlated closely with theoretical gains in both cases. With the parasitic element as a reflector, the forward gain of the array peaked at a parasitic spacing of approximately 0.15 wavelength; whereas, with the parasitic element as a director, the forward gain of the array peaked at a parasitic spacing of approximately 0.1 wavelength.

However, in this particular series of experiments with three- and four-element beams, the highest forward gains were obtained with wider parasitic-element spacing, as indicated in the accompanying tables.

While it is somewhat outside the scope of this article to view the present results in terms of signal improvement, it is well to bear in mind that an increase of 3 db., while representing only a small change in the S-meter reading on a modern communications receiver, may be sufficient to render a signal intelligible through heavy interference. There is another expedient for securing such signal improvement, however, in which an additional advantage obtains. By vertically stacking two close-spaced arrays, such as the Premax RB-6109 beam for example, over-all power gains in the order of 10 db. or more may be realized. By feeding each beam in phase through separate feed lines of equivalent length, 2- to 3-db. gain in addition to the 6- or 8-db. gain of a single beam will result when the top beam is 0.5 wavelength above the bottom beam. Increasing this spacing to approximately 0.8 to 0.7 wavelength will result in somewhat higher forward gain. The added advantage obtains from the fact that either one or both of the beams may be excited, effectively changing the height of the antenna above ground and enabling control of the vertical lobe of the array over a limited angle.

**Projected Tests**

As previously mentioned, it is expected that a similar series of experiments will be performed out-of-doors in the future, incorporating several modifications. Parasitic-element spacings greater than 0.2 wavelength will be investigated in an effort to determine the spacing at which forward gain begins to drop off.


\[^6\] A third possibility is the variation in screen current with plate current. Where the screen is fed from the plate supply through a dropping resistor the screen voltage changes with plate-current variations, resulting in a shift in operating conditions that frequently causes the optimum screen voltage to be reached at a plate-current value higher than that representing resonance. Screen-current variations also cause a change in grid impedance. — Ed.
Atlantic City—1947

Part I—How We Got Our Present Amateur Bands

BY A. L. BUDLONG,* W1BUD

*For the amateur who desires to keep himself well informed, this series of articles is must reading. Part I, in this issue, sets forth briefly the facts, figures and dates in the history of amateur frequency assignments, a subject of vital interest to ARRL members as we enter upon the period of another world telecommunications conference. Part II, to follow in May QST, will describe how an international conference does business and outline the preparations taken in the U. S. for the Atlantic City Conference, which starts May 15th.

Atlantic City is the 1947 location of that periodic nightmare known as an international radio conference, a place where the “commercials” always triumph and where the amateur always gets gypped out of some more frequencies. There is no question about the gypping business because we now have to operate in certain narrow bands whereas once—as the fable goes—we had everything from 200 meters down, all for our very own.

These ideas are firmly implanted in the amateur mind; they are almost universally accepted as basic fact. Were we to say that the international treaty under which we now operate affords U. S. amateurs precisely the same frequency bandwidths as our very first international allocation, in 1927; that no U. S. law ever gave amateurs an exclusive assignment of all the territory from 200 meters down; and that neither any U. S. law nor international treaty so much as mentioned amateurs or amateur radio until 1927 . . . were we to assert that these are the facts, it would appear that explanations are in order.

And indeed we think they are. Certainly it is true that the average amateur has only a hazy idea of what we ever had, how we got it, why we have international conferences, and how they do business. What we propose to do here, there-fore, is to give a brief factual account of amateur frequency assignments, both domestic and international, from the very first days, and to follow with a short description of the hows and whys of an international conference. This is being written in the belief that the information will be valuable to all amateurs and because it is felt it would be more widely read now than at some time when interest in such subjects is not so high.

A History of Amateur Assignments

Why do we have to have international agreements on radio? Broadly speaking, there are three reasons:

1) Since stations of one nation are frequently in communication with stations of another nation, it is necessary to have agreements on such operating details as calling procedure, distress signals, call assignments, methods of collecting tolls on radiograms, etc., unless utter confusion is to be encountered when any two stations try to do business over the air.

2) Because it is possible to operate radio stations throughout a wide range of frequencies, it is necessary to agree in advance where the various services will locate themselves in the spectrum, so that stations will know where to find each other.

3) Since radio signals are not confined to the borders of the country in which they originate, international agreements on allocations to services are also necessary in order to prevent chaotic conditions on the air and hopeless interference between services.

The first two were probably the major considerations in the early radio conferences. The third was not so vital in the early days of radio but

QST for
today is extremely important.

Pursuant to the international agreements, each
nation, both as a matter of common sense and
agreement, arranges its own domestic laws so
that they conform to the international commit­
ments. Obviously, it would be silly if the various
nations, after carefully working out solutions to
their problems, disregarded the remedies by per­
mitting the stations within their borders to oper­
one on entirely different basis.

Now let us trace the course of all the interna­
tional conferences and all our own national laws
to see how the amateur got taken care of as the
laws came along. We'll cover the international
treaties first, and then cover our domestic (U. S.)
radio laws set up under these international treaty
provisions.

International Regulation

The very first international radio conference,
though it doesn't really belong in this story, was
held in

1903

It was held in Berlin. It didn't say anything
about wavelengths, operating procedure or any­
thing of this sort and was held primarily for one
reason: there was getting to be considerable
trouble because of the fact that stations using
Blotto Co.'s equipment would communicate only
with other Blotto-equipped stations and would
turn studiously deaf ears to calls from stations
using Blifsky or other gear. Such nonsense ob­
viously had to be stopped and this first confer­
ence, participated in by eight nations (including
the United States, which was to participate in all
subsequent conferences) was called mainly for
the purpose of putting an end to such short­sightedness. A few clauses regarding charges for
messages and priority of distress calls completed
the brief document.

The next conference, resulting in the first
actual treaty, was the one that really started
things off. It was held in

1906

Like the first, it took place in Berlin. Twenty­
seven nations participated. Perhaps it would be
well to say right now that the principal objec­tive
was the setting up of arrangements to deal
with ship-to-shore work, that being the main
thing radio was then used for. In fact, the only
services defined in the treaty regulations were
coastal stations and shipboard stations — a sta­
tion, presumably, was either one or the other!

Judged by present standards, the conference
resulted in a pretty simple treaty and an even
simpler set of regulations to go along with it.
However, it is of interest to us because it was here
that we see the very first agreements of any kind
on wavelength assignments. These agreements
were exceedingly simple: coastal stations open
to general public service had to be able to use
both 300 and 600 meters; ship stations were to
use 300 meters for a normal wavelength but could
use others if they did not exceed 600 meters;
small boats unable to "get up" to 300 meters
were authorized to use "a shorter wavelength";
and finally — get this! — coastal stations, apart
from their two specified waves, could use any
wavelength, so long as it was either below 600
meters or above 1900 meters. Had coastal stations
in those days wished to use any of the territory
represented by our present amateur bands, they
were free to do it.

There was no mention of amateurs in the
treaty and no provision for them except that if
any nation had licensed amateurs at that time
(none did, including our own United States) it
presumably would have had to see to it that they
stayed below 600 or above 1900 meters.

In addition to these matters, the treaty and
regulations specified three-letter calls, limited
shipboard power, normally, to a kilowatt, out­
lined details of hours of service for coastal sta­
tions, the posting of "wireless" telegrams, rates,
collection of charges, etc., specified the use of the
International Morse code for radio work, desig­
nated SOS as a distress call and outlined some
very rudimentary regs on methods of calling
and working.

This second Berlin gathering also decided on
the principle of holding similar conferences from
time to time and, as a matter of fact, the next was
held six years later in London. So we come to

1912

Forty-three nations from all over the world
participated in this London conference; our
radio gatherings were beginning to amount to
something! Not much was done to change the
1906 treaty and regulations but they were en­
larged on somewhat. As before, general public
service stations had to be able to use 300 and 600
meters, but now they could also use 1900 meters.
Ship stations were 300 and 600 meters. A curious
addition to wavelength specifications was one

April 1947
prohibiting stations used exclusively for sending signals designed to determine the position of ships from using a higher wavelength than 150 meters. Here was the first “short-wave” assignment, as such, and it was to radio-bearing stations! However, this was by no means an exclusive assignment, because, just as in the 1906 treaty, any station could use any wavelength (except that the compass stations had to stay under 150) as long as it stayed under 600 or over 1600 meters.

Ship power was still limited, normally, to a kilowatt; additional power could be used if needed, however, for distances over 200 miles or under unusual circumstances. The Q signals came into being. Revisions and additions were made to other operating details but not a great deal of change shows up in this treaty in these matters as compared with the earlier one. Our old friends, the coastal stations and shipboard stations, were still the only defined services.

At this gathering it was agreed to hold the next conference in 1917, but the first World War and its aftermath upset things so badly that it was fifteen years before another radio conference took place.

1927

The 1927 conference was held at Washington. Nearly eighty nations participated; as of that time, this was the largest international gathering ever held on any subject and the first since the advent of “short waves.”

The delegates were confronted with a perfectly stupendous task because of the tremendous strides made in radio development since the previous gathering. All the old concepts of radio had been discarded and new theories evolved; new uses for radio had been found with a resulting terrific enlargement in the number of services; telephony had been developed and had given birth to the broadcasting industry; the short waves had found use. As may be imagined, the conference regulations were numerous and detailed, bearing but little resemblance to those in the former documents.

Radio services had segregated themselves into dozens of different distinct classes by this time, so the services mentioned in the list of definitions were considerably more detailed. One of the definitions was that of “private experimental stations.” There were two subheads to this definition: the first explained that the definition included stations of the kind we now recognize as “experimental”; the second stated that the definition applied also to “a station used by an amateur.” We had arrived. Here, for the first time, we find ourselves mentioned in an international radio document.

More than that, the radio spectrum — heretofore virtually wide open to everybody — was now split up into channels, from 10 kilocycles to 23,000 kilocycles, and the various services allotted certain specified channels or groups of channels for their use. And in this table, we amateurs were allocated the following bands: 1715–2000 kc., 3500–4000 kc., 7000–7300 kc. and 14,000–14,400 kc. Since the regular table of allocations did not go above 23,000 kc. and since we amateurs urged assignments still higher, special assignments were designated at 28–30 Mc. and 56–60 Mc. jointly for the use of the amateur and experimental services. All these bands are the same width specified as available to American amateurs in the international regulations under which we are now operating (Cairo 1938).³

Licenses were required of all amateur operators and it was further stipulated that each such licensee would have to demonstrate ability not only to transmit the Continental code but to receive it — “by ear.” The code speed required of licensees was left to each country to determine for itself, however.

Of course, the regulations also went into great detail on all other matters such as revision of the Q-signal list, calling procedure, rates, methods of collection, license requirements (commercial), etc., but we take it for granted that by now our readers are aware that each set of regulations in the international treaties includes these matters and we will not refer to them further. From now on we will treat only those portions of the treaties that deal with amateurs and amateur radio.

Following the Washington Conference, came a five-year interval, and then the second of the really “modern” conferences, in

1932

This was held in Madrid. Very little change

³ Readers about to take pen in hand to point out that the current U. S. amateur band at 28 Mc. is not the full width indicated here, and that the 1.7-Mc. band has not been available for amateur operation in this country since the war, are reminded that we are talking here of the international regulations, not U. S. regulations of the moment. The current international regulations do make provision for the amateur bands shown; the reasons for our temporary postwar U. S. assignments will be dealt with in the second half of this article.
was made in the previous treaty or its annexed regulations. Our amateur frequency bands were continued intact. However, we had not been satisfied with the Washington regulations with having the definition of an amateur included only as part of a definition of the “private-experimental-station” class; at Madrid, therefore, we sought to have amateurs recognized as a separate and distinct class. The effort was successful and at Madrid, for the first time in an international treaty, we see the amateur service recognized strictly as such.

The next international meeting, which produced the regulations under which we are now operating — and which will be revised at Atlantic City beginning May 15th — was in 1938.

The location was Cairo, Egypt. By now, the increasing pressure on the high-frequency spectrum brought about by expansion of existing services and the introduction of new ones was creating serious problems in the allocations table. The spectrum between 3 and 25 Mc., once thought to be of virtually limitless extent, was full to overflowing — with more customers clamoring for admission every day. As might be expected, those countries having little interest in amateur radio regarded our amateur bands as legitimate areas for the spotting in of some of the overflow, and the aggregate initial proposals of the other countries (particularly those in Europe) for a revised allocation table cut heavily into all our bands. Only the unswerving stand of our neighbors and sister republics in the Americas, saved all our previous bands for amateurs in this region — we in North and South America emerged without the loss of a kilocycle. Elsewhere, however, amateurs did not fare so well: in the European region, the 3.5-Mc. band was severed, and amateurs permitted only in the portions 3500-3635 kc. and 3855-3950 kc.; outside the American continents, too, amateurs no longer enjoyed exclusive rights to the entire 7-Mc. band, and both amateurs and broadcasting could be permitted to use the territory between 7200-7300 kc.; in Europe, the 5-meter band was reduced, at least in practical effect, to less than half its original width of 4 Mc.

Aside from these allocations matters, there were few other developments of even passing interest to amateurs, and all the other strictly amateur provisions were continued without change.

**National Regulation**

We have now shown, very briefly, what has happened from the early days up to the present time in terms of international regulation. During all this time, however, we were confronted with changing laws and regulations on amateur radio here in the United States under the terms of the United States laws, so let us go back now, see what those laws were and what kind of domestic treatment we got under them.

The outstanding thing about early radio law in this country is that it was an awfully long time before we got the first one.

There was no United States radio law in 1903 at the time of the first Berlin international conference already mentioned, nor was there one in 1906, at the time of the second Berlin affair. It might be thought that this country was obligated to have some sort of national law or regulations after the 1906 conference, in order to carry out the agreements made there to which the U. S. had been a party. The reason there wasn’t is that, although we had signed the treaty, we didn’t ratify it until six years later; there had been quite a lot of squabbling and disagreement about that treaty, anyway.

So we see the years dragging on through 1906, ’07, ’08, ’09 — and still no U. S. law on radio. This doesn’t mean that no law was needed; indeed, by the latter part of this period “wireless” was assuming considerable proportions in the daily life of the world. But with no laws here all stations, whether amateur, government or commercial, could operate with whatever call, wavelength and power they wished, subject to no regulations whatsoever — and that is precisely what they all did!

In 1910 a very brief law was passed requiring ships of a certain size to carry radio equipment, but it said nothing more than that and has no real bearing in the present discussion. The act was subsequently modified slightly by another similar act in 1912 but that, also, is of no concern to us.

Nevertheless, the year 1912 is highly significant from our standpoint, for in that year three things happened: first, our Senate finally ratified the 1906 Berlin agreement; second, we participated in the 1912 London Radio Conference and signed the resulting treaty (it was promptly ratified early in 1913); third, the United States wrote its very first radio legislation. This was the so-called 1912 Law, under which we were to operate for the next fifteen years.

Now, we want to direct particular attention to this law because this is the one of which it has been said that it granted amateurs all the territory from 200 meters down, for their own exclusive use. Did it? Let us examine that law and see.

To begin with general considerations, it may be said that the law required that henceforth all transmitting stations in the United States must be licensed. Authority to issue licenses was delegated to the Secretary of Commerce and Labor. There were sections calling for the use of a pure and a sharp wave, etc., one requiring listeners to observe the secrecy of messages.
provision for punishment of violation of the regulations or the transmission of false distress calls. No individual services were defined except our old familiar stand-bys from international treaties, the coastal stations and ship stations.

This is all fine, but what about wavelength assignments, and particularly that part of the law giving amateurs 200 meters and down? All right, here goes for the wavelength assignments: the 300-meter wavelength was specified for general public-service work, per the international agreements of 1906 and 1912. Furthermore, with one exception, all stations were authorized to use any wavelength they chose, provided they stayed below 600 or above 1600 meters — this again being simply a duplication of the international specification of the time. Now, some readers have by this time noticed that phrase “with one exception.” Yes, that exception is the one about which there has been so much controversy; all stations, except our old familiar stand-bys from international treaties, the coastal stations and ship stations were “private stations.” So were many of what we now think of as “experimental” stations. Stations set up by a firm to enable it to conduct its own business between its various branches were private stations. About this time, it becomes apparent that between the broad interpretation of “private station” and the inclusion of that “or commercial” the Fifteenth regulation was meant to apply to virtually every station, unless it was conducting commercial business (or developing apparatus in that connection). Correct! It was!

Nor is that all; we point again to the fact that the section says only that the specified types of station cannot go above 200 meters (or over 1 kw.) without special authority. Well, how about the regular commercial stations that were allowed to operate above 200 meters; could they also go below 200 if they wished? The answer is that they could. The authority is contained in the second regulation, which we quote:

Second. In addition to the normal sending wavelengths, all stations, except as provided hereinafter in these regulations, may use other sending wavelengths: Provided that they do not exceed 600 meters or that they do exceed 1600 meters . . . [there then follows some dope on use of pure and sharp wave].

The only “except as provided hereinafter” contained in the law was the Fifteenth section already quoted.

Let this, then, be said: the 1912 law, to the extent that it gave amateurs the territory from 200 meters down, assigned precisely the same privileges, by law, to every other class of station in the country.

Except for a period during World War I, when all radio stations were closed down, this is the law which we operated under for fifteen years. Incidentally, since another part of this law stated that stations should specify their operating wavelengths in their applications, practically all amateurs gave “200 meters” as their operating wavelength, and then tried to edge up higher than that if they could get away with it! As a matter of interest, no amateur license issued in the United States ever stated that the licensee was entitled to use all the territory from 200 meters down.

Although not affecting any very large group of amateurs, special arrangements were effected section; it will be seen that the restriction applies equally to private and commercial stations. If this section can be interpreted as granting amateurs “200 meters and down,” it also grants certain classes of commercial station precisely the same privilege. However, it is important to note about this time that “private station” and “amateur station” are not the same. As we have already pointed out, the section doesn’t mention amateurs as such. To be sure, amateurs at that time were classified as “private stations” — but so were a number of other classes! School and training stations were “private stations.” So were many of what we now think of as “experimental” stations. Stations set up by a firm to enable it to conduct its own business between its various branches were private stations. About this time, it becomes apparent that between the broad interpretation of “private station” and the inclusion of that “or commercial” the Fifteenth regulation was meant to apply to virtually every station, unless it was conducting commercial business (or developing apparatus in that connection). Correct! It was!

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1 The third regulation required the use of a “pure wave.”
2 The fourth regulation required the use of a “sharp wave.”
during this time between the ARRL and the Department of Commerce whereby certain “above-200” wavelengths were made available to outstanding relay stations.

We have said that the 1912 law was the only one we had until the Communications Act of 1927 was passed. Now, it is apparent that nothing in the 1912 law creates special bands for the various services (we have quoted all the 1912 law which applied to wavelength grants or limitations), yet it is a fact that, three years before the 1927 international conference, amateurs in the U. S. were operating in specific bands of frequencies in the short-wave spectrum.

Here's the story:

Following the 1912 law, nothing much happened to disturb the tranquility of two-hundred-meter operation until around 1923, when a small group of amateurs (and commercials, too, if we are to be truthful) began going to the wavelengths well below two hundred, to see if they were feasible for communicating purposes. As we now know, they most certainly were, but it took a transatlantic QSO to make the average ham believe it, at that time. An interesting sidelight here is that since all amateur stations at that time were required to specify their operating wavelengths, and since these were invariably of the order of 150, 175 or 200 meters, it was necessary for the first short-wavers to get special permission to operate on such wavelengths as 100, 90 and 60 meters — these not having been specified in the licenses!

At any rate, when the short waves began to demonstrate their worth around 1924, everybody in creation made a headlong rush for them. Remember: under the ancient 1912 law, still in effect at that time, every single service in the United States had equal rights with everyone else for the use of the short waves!

Now, keep a firm grip on everything up to this point while we backtrack a couple of years to 1922 to pick up some dope that is going to constitute part of our 1924 picture, when we finally unveil it.

Around 1922 it was apparent to the then Secretary of Commerce (Hoover), who was charged under the 1912 law with the duty of administering radio, that the law was hopelessly inadequate for existing conditions. A new law was badly needed, but Congress, with the same slowness which characterized its belated enactment of the original law, simply couldn't seem to get around to making one. So Secretary Hoover called the first of what came to be known as the “Hoover Conferences” at Washington, participated in by representatives of all the radio interests in the country, to see if some mutual agreements couldn't be worked out and some recommendations for the legislators evolved.

The first of these advisory conferences, in 1922, didn't do very much so far as we are concerned, except that it recommended enactment of proper legislation to deal with radio, suggested certain amateur frequencies (of no interest to us, at the moment, since they were around 200 meters), suggested a definition for amateurs (the 1912 law had no such definition), and recommended that amateur status be defined by law and amateur wavelength assignments ditto. Another recommendation was for the creation of amateur deputy inspectors, possibly at a dollar a year, to help out in amateur regulation! Unfortunately, although a number of radio bills were subsequently introduced in Congress, nothing was actually done in the way of legislation to carry out any of these recommendations. Perhaps it was for this reason that the recommendations of the succeeding Hoover conferences actually became regulations by reason of their adoption as such by the Department of Commerce — not with authority of law, however, but purely on the basis of mutual agreement among services. This curious regulatory status lasted until the “blowup” of 1926, of which we shall speak shortly.

The second conference took place in 1923; the short waves had not yet opened up, and the conference recommendations for amateurs were all in the vicinity of 150-200 meters. Amateur radio would have kicked like the dickens if they had been anything else.

The third conference was in 1924; between it and the second the short-wave business had split radio wide open! The 1924 conference was tremendously important, therefore. However, bear in mind that nothing any of these Hoover conferences did had any actual legal status. The recommendations were nothing more than recommendations; such agreements as were reached were on the basis of mutual understandings between services, temporarily (and illegally) incorporated into the regulations by mutual consent and thereafter observed by all until a new law came along. Actually, by this time everyone in radio realized that the wording of the 1912 law was such that the Secretary of Commerce had been given no authority whatsoever to enforce any wavelength assignments other than those set forth in the law.

(Continued on page 188)

4 1MO-XAM (U. S.) with S4B (France), Nov. 27, 1923.
A 40-Watt Modulator with Cathode-Coupled Driver

Four Stages in a Compact Unit

BY WILLIAM J. LATTIN,* W4JRW

Type 6L6G tubes in push-pull Class AB2 operation require a driver of low impedance and good regulation, because the tubes draw grid current on the positive signal peaks. When a transformer-coupled driver is employed, a fixed-bias source is needed which must have such excellent regulation that battery bias often is used. An excellent coupling transformer having fairly high inductance and low-resistance windings is required. Since it was desired to build a 40-watt modulator as compactly as possible, the use of a cathode-follower driver was investigated and found to be quite practical.1

The circuit shown in Fig. 1 was set up in the laboratory and measurements of power output and distortion were made. The results are shown by the curves plotted in Fig. 2. It will be seen that an output of 40 watts was obtained with about 3-per-cent total distortion. The total "B" current drawn by the sections of the 6SN7GT cathode followers remains constant at about 13 milliamperes for all signal voltages applied, which indicates that the regulation of the negative supply voltage is unimportant. This was verified by using a negative-voltage source applied through a 10,000-ohm resistor without by-passing to obtain −67.5 volts at the cathode return of the 6SN7GT. The power output and distortion readings were the same as shown in Fig. 2.

A graphical analysis of the cathode follower which was made in order to estimate the values of cathode resistors and operating voltages may be of interest. This is shown in Fig. 3. The solid-line curves are plate-current vs. grid-cathode voltage (Eg) characteristics obtained from a tube handbook. An axis of RkIp, which shows the cathode-follower output voltage, is shown for Rk = 5000 ohms. The operating characteristic of the cathode follower is shown by the dash-line curve (only for Rk = 5000 ohms). This operating curve may be drawn easily because when Ip = 0, Ek = 0 and Epk = 300; when Ip = 10 ma., Ek = 50 and Epk = 250, etc.

A line having a slope of 5000 ohms (for Rk) is drawn from Ip = 0 and Ek = 0 through the point at −10 volts Epk and 2 milliamperes, since −10 volts divided by 2 milliamperes is 5000 ohms. Now with no signal, Ek will be about 13.5 volts as shown by the arrow drawn horizontally from the intersection of the 5000-ohm solid line with the operating characteristic to the Ek axis. Since Ek cannot be made negative but can go only to zero on the negative swing of a sine-wave signal applied to the grid, about 13.5 volts peak is the largest sinusoidal output that can be obtained before clipping on the negative half-cycle starts. It may be seen that clipping on the positive side will not start until the peak grid voltage is much higher. This may be determined by sliding a ruler parallel to the 5000-ohm line along the Eg and Ek axes and extending the line to the right until it again crosses the Ek axis. To obtain higher voltage from the cathode follower the grid may be returned to a positive point. For instance if the grid-to-ground voltage is +20 and Ek = +30, a peak output of about 30 volts can be obtained without clipping on the negative side.

This driver circuit was used in the 40-watt modulator shown in Fig. 4. The negative supply voltage was obtained by means of a half-wave rectifier using the same transformer as the main "B" supply. It was found that the 10-µfd. by-pass on the screen supply for the 6L6Gs, C11, was quite worth while since it resulted in about 10

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The cathode-coupled modulator is built into a compact unit which includes power supply. The output transformer is mounted externally in the r.f. unit.
Fig. 1 — Circuit used for measuring power output and distortion in the cathode-coupled Class AB2 modulator.

per cent more power output than is normally obtained with an unby-passed screen-voltage divider.

The possibility of returning the cathode-follower resistors to ground and using self-bias on the 6L6Gs with a VR-75 voltage regulator across the self-bias resistor was considered. However, this would have required a “B” supply 75 volts higher, and also several VR-75 tubes in parallel would probably have been necessary, because the plate-and-screen current of the 6L6Gs rises to over 200 ma. under full drive. Since the negative voltage supply was so readily obtained, it was used in preference. If a selenium rectifier with a high-enough peak-inverse-voltage rating were available, it would further simplify the negative-voltage supply, since the use of a separate filament winding is advisable with the 6X4 because

of the high a.c. voltage from cathode to ground.

In the cathode-follower driver, the grid return was made to a point 34 volts positive with respect to the cathode return, resulting in a value of $E_k$ of about 45 volts. Since the return for $R_k$ is made to -68 volts, the potential at the cathodes of the 6SN7GT, which is applied to the grids of the output tubes, is -23 volts with respect to ground. This provides the correct bias on the output tubes as well as a large

margin of safety in the signal voltage which may be applied to the cathode-follower grids before clipping can occur.

A Type 6SJ7 is used in the first amplifier stage which is followed by a 6SC7 phase inverter. The only requirement for these two stages is that they provide sufficient gain to obtain about 55 volts r.m.s., from grid to grid, at the 6SN7GT.

Construction

The photographs show most of the constructional details of the modulator unit. One small chassis contains all of the components except the modulation transformer, $T_1$, which is mounted in the unit containing the r.f. amplifier, and is not shown.

The power supply occupies the rear half of the chassis with the filter choke, $L_1$, to the left, the power transformer, $T_2$, to the right and the 5V4G rectifier tube and filter condenser in be-

April 1947
Fig. 4 — Circuit diagram of the 40-watt modulator using a cathode-coupled driver.

- **C1, C9** — 25-µfd. 50-volt electrolytic.
- **C2** — 0.1-µfd. paper.
- **C3** — 0.02-µfd. paper.
- **C4** — 8-µfd. 450-volt electrolytic.
- **C6, C7, C8** — 0.05-µfd. paper.
- **C10, C11, C12, C13** — 10-µfd. 450-volt electrolytic.
- **C15** — 0.01-µfd. mica, 1000 volts.
- **R1, R8, R10** — 1 megohm, 1/2 watt.
- **R9** — 680 ohms, 1/2 watt.
- **R5, R6, R10** — 0.22 megohm, 1 watt.
- **R6** — 47,000 ohms, 1 watt.
- **R8** — 1-megohm variable.
- **R7** — 1500 ohms, 1 watt.
- **R11** — 0.33 megohm, 1/2 watt.

Points to be by-passed. The short lead between the microphone connector and the grid terminal of the 6SJ7 is covered with shield braid to prevent hum pick-up and instability.

This modulator has been in use for several months and has proved to be capable of modulating one hundred per cent an 829 running at about 80 watts input, as checked on an oscilloscope.

Bottom view of the cathode-coupled modulator showing the general location of small parts.
Happenings of the Month

CONFERENCE PREPARATIONS

The United States has issued invitations for the convening in Atlantic City on May 15th of a world conference to revise the international radio regulations of Cairo. At this conference the post-war planning of the various countries of the world will come to fruition. The meeting may last as long as six months.

On the part of the United States, preparation for this conference has been under way for some years back. The very extensive hearings of FCC and the work of IRAC, reported in QST the last several years, have been part of it. Ever since the preliminary Moscow conference the U.S. has had a special Government-industry committee at work in Washington, under the Department of State, polishing up the United States' proposals to their final form. ARRL Assistant Secretary A. L. Budlong has been a member of this special committee, in daily session for three months, in addition to the League's usual Washington activities. The proposals of the U.S. have now been completed and at this writing have been reviewed and approved by FCC, on behalf of civilian services, and by IRAC, on behalf of Government services, and submitted to the Department of State's Telecommunications Coordinating Committee, on the way to the Bern Bureau for publication in the formal Book of Proposals of the conference. These proposals incorporate our amateur bands as they now exist above 3.5 Mc. and continue to provide for a new amateur band at 21-21.5 Mc. They propose also a 50-kc. widening of the 11-meter band.

The U.S. proposal for the 160-meter region provides for the assignment of 1800-2000 kc. jointly to navigational aids (loran) and to amateur, fixed and mobile services. This band consists of two regional loran channels of a width of 100 kc. In any average area, only one channel is required and it is proposed that the amateur, fixed or mobile services in any area may employ the band not required for loran on the condition that they do not cause harmful interference. But in the United States both channels are in use and the arrangement contemplates no amateur assignment here so long as loran remains at that part of the spectrum. The question of sharing between amateur and loran in this country, as sought in the ARRL brief, still remains to be solved as a domestic matter on the basis of technical investigations. That idea is receiving separate study but there is no news on it yet.

Meanwhile, of course, the League keeps in close touch with the developing situation at Washington and will continue to participate in the country's preparations for the conference.

Canadian General Manager Reid has attended a series of meetings at Ottawa at which the Canadian position for the world conference was formulated. Canada will propose the present bands except making the 10-meter band 28 to 30 Mc., plus a new band from 21 to 21.45. The Canadian meetings also determined the amateur regulations for the new licensing year beginning April 1st, with the decision to retain all present Canadian amateur allocations, including 'phone assignments extending 50 kc. beyond the U.S. ones in both the 3.5- and 14-Mc. bands.

Many countries are believed to be planning to press at the conference for an expansion of h.f. broadcasting assignments and also for increased allocations for "tropical broadcasting." (In the tropical countries, static prevents the use of the usual "standard" broadcasting frequencies and the service is commonly conducted on frequencies between 4 and 6 Mc.) There is encouraging indication from many of the member-societies of the IARU that their governments will support and defend the amateur allocations, including the new band at 21 Mc. The views of the United Kingdom, as they existed in middle January, included a new amateur band from 21.25 to 21.45 Mc. but proposed shaving our lower bands to a harmonic family: 3.5-3.6, 7.0-7.2, 14.0-14.4 Mc.; also retaining the band 1715-2000 kc. on a shared basis with restricted power. The British thinking at that time included no band in the vicinity of 5 or 6 meters and involved a shifting of the 2-meter band and a narrowing of the 400-Mc. band. The 28-30-Mc. band would be cut off at 29.7 as in the U.S.A. While these are not necessarily the final British views, the indication is that U.K. is building up a "trading position" based on the Moscow understanding between some European countries.

RSGB advises that it will send three representatives to the world conference. We expect to have further conference news each month.

BOARD MATTERS

Throughout the final years of the war, and since, the officials of the League, operating under the directions of the Board of Directors, have actively looked after the interests of the amateur
at Washington as plans were perfected for the postwar world, and have fully participated in the preparations for the coming world conference. Everything is believed to be in readiness. The ARRL Board itself holds its annual meeting in the month of May, the same month that the conference opens. To review and perfect the arrangements for the protection of our rights, the Board is holding a special meeting at West Hartford on March 14th to deal solely with such matters. It is expected that every division will be represented. The meeting occurs too late in the month to report in this issue of QST but we shall have an account of it and its minutes, in our next issue.

Meanwhile we want to tell you about the known items of business to come before the regular annual meeting of the Board in May. These topics are outlined to you so that, in advance of the meeting, you may have an opportunity to state to your director your opinion on any of them that interest you. You are invited to do this; your director will welcome your views.

You are of course already familiar with the proposal for a Class D license, on which your opinion has been sought on cards printed in our last issue. You are also familiar with a proposed plan for a rearrangement of the 10-meter band by types of emission, as published at page 26 of December QST, on which you were invited at the time to write to your director. The directors comprising the Board's Planning & Regulations Committees at a recent meeting in New York transmitted seven additional recommendations to the Board, which will be considered at the May meeting, and these we now describe to you as follows:

1) As recently explained, it is believed desirable to postpone further proposals about 'phone frequencies until after the world conference, so that we may waste none of our energies meanwhile. The conference is expected to end by November. It seems desirable, though, to get along with the study of the 'phone matter as soon as things are in the clear, and this means that the subject should be worked on before the 1948 meeting of the Board. The Board's committee therefore proposes that the Board issue no new proposals this year but that the committee be authorized to study the question as soon as the world conference ends and to originate proposals which, with the approval of the Board, would then be presented to the membership in QST and a poll taken of amateur opinion thereon. The Board would then be able to act finally on the proposals, in the light of the opinion expressed by amateurs, at its 1948 meeting.

2) There is great unevenness in the memberships of the various ARRL divisions. They vary in size from about 700 members to about 7000. This is unfair and makes for injustices, since each director has only one vote. It would be much better for us, and we would come closer to our ideals, if our division memberships were of more nearly the same size. This question was before the Board last year and was referred to this committee for study. The committee now endorses the project and recommends to the Board that our organization be changed to ten divisions coinciding with FCC's ten amateur call areas. The call areas were deliberately planned to effect such a distribution of amateurs as was practically possible and the committee believes that the observance of those boundaries in ARRL affairs would make for convenience and for a much better proportionate representation of amateurs in the affairs of our Board. At our present membership the ten divisions would vary from about 3000 to about 6000 members, a great improvement over the 10:1 ratio that now exists. These figures include associate memberships, the percentage of which is nearly uniform over the country. It is also proposed that the division names be changed to Division One, Division Two, etc., so that any amateur, member or no, will instantly know in which ARRL division he lives.

3) The Board asked the committee to study various methods of referring questions to the membership to learn what was acceptable to them on the most questions of the day. The committee after its study responds to the Board that in its opinion the Board already has on its books a mechanism for this purpose which it believes is wholly suited to the League's needs and which it recommends be continued in use whenever needed. This is the method with which you are already familiar in QST polls of amateur opinion on stated subjects, with a detachable postcard. The Board's existing rules provide that questions may be thus addressed to all amateurs or just to the members of the League, as the case may require, and that the Board in finally considering the matter shall take into account the opinions thus expressed. There are also safeguarding rules that the headings and type sizes used in QST shall be as prominent as those used for articles in the same issue, etc., so that all questions so referred to the membership for opinion will be fairly presented.

4) Ten-meter amateurs are having second-harmonic BCI trouble with Television Channel No. 2. When the v.h.f. spectrum was rearranged a couple of years back, the League made it plain that it was desirable to retain the harmonic relationship between amateur bands but FCC found it expedient to convert our 5-meter band to a 6-meter one. The Board last year referred to its committee a suggestion that the League ask FCC to shift the 10-meter band to 25 Mc. to escape this television BCI. The committee responds that the steps already taken by the United States are such that it is not considered feasible to contemplate a shift in the location of our band, nor does it believe that would solve the problem of inter-
5) Considering the increasing interest in n.f.m. 'phone and its advantages in reducing BCI, the committee proposed that it be given a wider trial in some of our other bands. It looks good but we are not sure that it is as good as it looks, the committee said in effect, and it therefore proposed that only part of the 'phone bands be opened to this mode now, and that the subject be reviewed after we have had some practical experience. Specifically it recommends that the Board request FCC to authorize narrow-band frequency- and phase-modulated 'phone operation on 3850–3900 kc. and 14,200–14,250 kc. for an experimental period ending June 30, 1948, under the condition that the bandwidth shall not exceed the bandwidth occupied by an amplitude-modulated signal of the same audio characteristics, the Board to re-examine the question at its 1948 meeting in the light of experience to that date.

6) The committee strongly felt that the present Class A licensing arrangement has outlived its usefulness. Nearly half of all amateurs hold Class A and 'phone work represents about half of amateur activity. It would seem that any amateur of a year's experience who desires to work the Class A 'phone bands readily gets that privilege, so that the licensing arrangement is meaningless as concerns its original function of confining Class A rights to a relative few. Viewed in the light of present-day conditions, the committee therefore strongly urges the Board to adopt a proposition that was before it last year, that it request FCC to make the Class A license available to a Class B licensee (but not Class C) after one year's experience, by an endorsement to be given upon application, but without additional technical examination.

7) In the 6-meter band we now have A1, A2, A3 and A4 emission authorized, and f.m. 'phone (including wide-band) on the part above 52.5 Mc. Most of the occupancy is confined to the low end, and it's the truth that there isn't much of it for a band that wide. It is desirable to encourage greater occupancy of this splendid band and to make it worth a fellow's while to work in the higher reaches of that band. One way to do that would be to permit n.f.m. to come down lower in the band and another excellent way, it is thought, would be to permit "duplex" or carrier-on operation in some higher part of the band. Many amateurs greatly esteem the privilege of "duplexing" but it's a luxury that we can't afford in more congested bands. The committee recommends that the Board ask FCC to authorize narrow-band frequency- and phase-modulated 'phone on 51–54 Mc., and that both wide-band f.m. 'phone and A9 duplex be authorized on 52–54. This would eliminate the present odd figure of 52.5 and leave only two figures to remember.

Several other proposals or probable proposals are known as we go to press:

While portable equipment may be operated on any amateur frequency, mobile operation is permitted only above 27 Mc. One reason for the League's opposition to mobile work on lower frequencies in past years was the well-warranted fear of the invasion of the amateur bands by small-boat owners looking for utilitarian communication. With FCC's provision of adequate facilities for this service, this hazard seems removed. Vice-President McCargar has given notice of his intention to sponsor a proposal to request FCC to permit mobile operation on the lower amateur bands. No further details are known at this time.

It may be necessary to propose an increase in ARRL membership dues, including QST, to $3. The rates to foreign countries have already been substantially increased and the price of QST on the newsstands has necessarily been raised to 35 cents a copy but the domestic membership dues, being specified in the By-Laws, have not been increased. The expenses of the League these days are enormous and we have heavy tasks ahead. QST costs half again as much to produce as it did a few years ago and the costs of every activity have similarly risen. There is reason to expect some dropping off in the other revenues of the League. While ARRL is currently in excellent financial condition, it must remain that way and its ability to hold together must not be impaired by some sudden loss of other income. It is hoped that, if it becomes necessary to ask for an increase, the members will know from their experience in other departments of life that some rise in dues is a reasonable thing and will feel that the even figure of $3 is little enough to pay for QST and what the League does for amateur radio.

The Chicago Area Radio Club Council reports that the hotel situation in Chicago is such that it is unable to stage the national convention authorized for the autumn of this year. The Board will have before it a request that they now be authorized to put on the convention over the Labor Day weekend of 1948.

This clears the hook up to the moment. If additional agenda items develop in the coming month, they will be outlined to you in our next issue. Your directors' address is to be found in the front of this issue.

THE U.S. AMATEUR PROPOSALS

The American proposals for the revision of the Madrid convention and the Cairo regulations comprise an enormous mimeographed book. The United States proposes many changes throughout

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the texts of the treaties. In an earlier item in this department we have reported the substance of the U.S. proposals for amateur allocations. The allocation table itself is of course one article in the text of the regulations. The State Department government-industry committee which has been doing this job, and on which as reported in our March issue ARRL’s Assistant Secretary Bud­

large has been in daily attendance, decided that the allocation table should be accompanied by an explanatory document giving the reasons for its frequency proposals, service by service, with an explanation of the U.S. philosophy on each.

Amateurs will be greatly interested in reading what is said of our service, for all the world to see. Following is the text:

In the United States there is a tremendous public interest in the amateur service, which is comprised of more than 90,000 radio amateurs whose interest in radio communica­

The United States is recommending a new band exclusively for amateurs in the high-frequency harmonic series to start at 21,000 kc. During this higher part of the sun-spot cycle, which now is approaching, it is expected that amateurs will find this band most useful, as it bridges the gap of frequencies lying between the bands at 14,000 and 25,000 kc.

In summary, the exclusive amateur bands recommended by the United States are:

<table>
<thead>
<tr>
<th>Band, kc.</th>
<th>Spectrum space, kc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.0-29.7</td>
<td>1.7</td>
</tr>
<tr>
<td>29.0-30.5</td>
<td>4</td>
</tr>
<tr>
<td>144-148</td>
<td>4</td>
</tr>
<tr>
<td>220-225</td>
<td>5</td>
</tr>
<tr>
<td>1215-1295</td>
<td>80</td>
</tr>
<tr>
<td>2300-2450</td>
<td>150</td>
</tr>
<tr>
<td>3300-3500</td>
<td>200</td>
</tr>
<tr>
<td>5650-5850</td>
<td>200</td>
</tr>
<tr>
<td>10000-10500</td>
<td>300</td>
</tr>
<tr>
<td>21000-22000</td>
<td>1000</td>
</tr>
</tbody>
</table>

Total 2144.7 Mc.

* The 11-meter band does not appear in this tabulation because it is not exclusively amateur. The U.S. proposal is for widening the band, to be 27.10 to 27.48 Mc., with the center frequency 27.32 designated for industrial, scientific and medical devices and with the whole band shared by amateurs, fixed and mobile services subject to “diathermy QRM.” The fixed and mobile use in this country will be only incidental, mostly special noncommunicating devices. The band 420–450 Mc., omitted in the above tabulation, is not exclusive, dully appears outside the U.S. proposals in its present status, temporarily shared with altimeters, to be ours alone when no longer needed for altimeters. — Ed.
ARE YOU LICENSED?

• When joining the League or renewing your membership, it is important that you show whether you have an amateur license, either station or operator. Please state your call and/or the class of operator license held, that we may verify your classification.

CANADIAN ELECTIONS

In the first ARRL election held in Canada since before the war, Dominion members of the League returned Alexander Reid, VE2BE, to office as the ARRL Canadian General Manager for the unexpired remainder of the current director term and for the following full two-year term, 1948-1949. The balloting:

Mr. Reid ........................................... 406
Thomas Hunter, Jr., VE3CP ........................ 308

With very similar figures the incumbent Alternate CGM, Leonard W. Mitchell, VE3AZ, was returned to office for the same term:

Mr. Mitchell .........................•............... 413
Charles H. Harris, VE6HM .................•. 306

Thus the team of Reid & Mitchell has been selected by the Canadian membership to carry on. Mr. Reid has been CGM since 1930, Mr. Mitchell his alternate since 1940.

TO FORMER A.A.C.S. MEN:

The Headquarters of the Airways & Air Communications Service of the ATC of the Army Air Forces contemplates the early distribution of a station directory listing all amateur stations operated by AACS personnel throughout the world. Major General H. M. McClelland, the commanding general, wishes also to include ex-AACS members who are presently active amateur operators, to further the possibilities of contact between wartime buddies via the amateur airways. All former AACS men who have active stations are requested to register the following data immediately for inclusion in the directory: name, call, mailing address, location of station, power, frequencies worked, type of emission, identity of A.ACS unit to which once assigned.

Address: Commanding General, Headquarters AACS, ATC, Washington 25, D.C., Attn: A-3, Operations Division. You are also requested to spread this word to all former AACS members.

EVIDENCE OF OLD CALLS

Amateurs eligible for a change in station call, particularly old-timers who believe themselves eligible for a two-letter call, are requested when filing FCC application to attach any handy documentary evidence they may have of the prior holding of such call. This saves a lot of FCC checking; in fact, FCC's record of the old days of Department of Commerce licensing is pretty sketchy. The best evidence is a canceled license but even a "Grand-Island QSL!" would help. Such evidence will be returned when the license is granted.

KZ5 CIVILIAN AMATEURS

The only amateur operation that has ever been permitted in the Panama Canal Zone has been that of stations owned by military organizations and operated by military personnel for training purposes. American amateurs working as civilians in the Zone, as employees of the Government, about a year ago petitioned for the establishment of civilian amateur radio there. The project was endorsed by the Headquarters Panama Canal Department and approved by the War Department. Detailed amateur regulations were drafted by H.P.C.D. and went into effect February 14th. The regulations are a close paraphrase of FCC's amateur rules, being identical as to classes of license, frequencies, power and technical requirements. Calls will be from the KZ5 series. Licenses are confined to citizens of the United States residing in the Canal Zone. There is a provision for the recognition of FCC licenses. Provision is made for the licensing of amateur stations to the commanding officer of a military organization, in the same manner as obtains in the United States. International messages emanating from third persons are prohibited except that such communications may be transmitted to amateur stations licensed by FCC. All communications must be in clear. There are a few special rules concerned with the security and defense of the Canal.

This is a big step forward. There will now be many more KZ5 calls on the air. They are assured of a warm welcome!

NOTICE—Your Change of Address

should reach Headquarters at least 30 days before the issue date of the QST with which it is to take effect. Please send us your old address along with the new, OM. The Post Office Department will not forward QSTs mailed to your old address — copies we cannot duplicate — unless you provide the extra postage. May we have your cooperation? Thanks!

SWITCH TO SAFETY!

April 1947
February, as usual, was a quiet month for v.h.f. enthusiasts. There was little DX activity of any sort on 50 Mc., and the coldest weather of the year brought little of interest in the way of propagation conditions for the occupants of 144 Mc. and higher. It was a good month for fence mending, and a lot of this was going on. One needed only to mention v.h.f. on any lower-frequency band to find a kindred spirit, and 10 and 11, particularly, were being used by members of the v.h.f. fraternity to discuss their problems and plans for the coming summer.

Round tables were organized all over the country to keep activity alive in face of the lack of DX opportunities, and new stations were showing up for these sessions almost everywhere. There was a heartening interest in improved gear for 144 Mc., with more and more fellows going to crystal control and superhet receivers. There were even a few hardy souls braving winter’s blasts to get started on beam antennas. Everywhere there was a note of optimism, and there was little question that the spring and summer of 1947 were going to provide a new high in v.h.f. interest and activity.

The possibilities for international work on 50 Mc. were getting more attention, but, except for certain areas where activity is low, the peak had passed and there was little likelihood of anything happening before next fall. Prospects for a North Atlantic crossing were low, and daily checks on the W1-G path indicated that the peak for the month was about 45 Mc., except for a brief period on Feb. 24th, when G6DH heard WQR on 48 Mc. F.m. stations in this country were still being heard daily by G6DH, PA9UN, and PA8UM, and they were hearing stations from the southeast up to about 50 Mc., indicating that amateur signals might have been heard from that direction, had any been on the air.

There is still plenty of opportunity for 50-Mc. DX in the right places — if only there are stations active. Working south from Latitude 20 in South America, or east and west along Latitude 30 to 40, South, should be easy in April and fair in May, but there is little prospect that anyone will be on to take advantage of it. The only candidate we know of, in addition to CE9FV, previously reported, is PZ1A, at Paramaribo, Surinam, who has promised to be on soon. Similarly, there are strips of high m.u.f. about 15 degrees either side of the Equator in Africa — if that will do anyone any good. North-south hops from Southern Europe to Africa are promising, and east-west paths around Latitude 20, North, are still good in the Pacific Ocean areas, though the VK and ZL territory tapers off after April.

The record-breaking contact between J9AAK, 50 Mc.: KH6DD — J9AAK
4600 Miles — January 25, 1947
144 Mc.: W3HWN — W1MNF
390 Miles — September 29, 1946
235 Mc.: W9OAW/6 — W6WQN/6
110 Miles — December 15, 1946
420 Mc.: W6FZA/6 — W6IUUD/6
170 Miles — September 20, 1946
2300 Mc.: WIJSM/1 — W7LIL/1
1.6 Miles — June 23, 1916
3250 Mc.: W2LGF/2 — W7FQF/2
31 Miles — December 2, 1915
10,000 Mc.: W4HFP/3 — W6IPK/3
7.65 Miles — July 11, 1946
21,000 Mc.: WINVL/2 — W9SAD/2
800 Feet — May 18, 1916

were still being heard daily by G6DH, PA8UN, and PA9UM, and they were hearing stations from the southeast up to about 50 Mc., indicating that amateur signals might have been heard from that direction, had any been on the air.

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The record-breaking contact between J9AAK,
The four-element arrays used for 28 and 50 Mc. at J9AAK have their forward directors mounted below the plane of the other elements.

Okinawa, and KH6DD, Oahu, reported last month, has not been repeated at this writing, though both parties were on the watch for the anticipated peak about 27 days following the January 25th work. Contacts between KH6DD and W6VDG/KW6 on Wake Island continued on a crossband basis for several days after January 25th, and are believed to have been made two-way when W6VDG/KW6 got his 50-watt rig going on 6. Another station on Wake, W60NP/KW6, is reported ready to go on 6 with a 500-watt job. J9AAK has been heard on Wake, but no contact has yet been made. Another prospect for 50-Mc. DX in Honolulu is KH6DW. He is the former W4AUU, Macon, Georgia, a v.h.f. man from way back, so he should know how it's done. He heard both ends of the J9AAK-KH6DD QSO.

In the Netherlands, at least two stations were making regular use of their special licenses for 50-Mc. operation. PA0UM in Rotterdam and PA0UN in Eindhoven were working daily on 50 Mc., with strong signals over this 60-mile path. Another European prospect, worked recently on 28 Mc. by numerous Ws, is SHF-1, experimental station at the Chalmers Institute of Technology, at Goteborg, Sweden. They expect to be going on 50 Mc. soon.

It appears unlikely that our friends in Britain will be able to obtain even temporary permission for 50-Mc. transmission, so it behooves us all to remember them, pounding away on 58.5 to 60 Mc., whenever conditions appear to offer a possibility of international work. It is probable that next fall will see the m.u.f. rising high enough to open that band for trans-Atlantic work, and there is at least a possibility of our making it during sporadic-E peaks this summer. At least we should not forget to tune that range now and then when things are hot.

Here and There on 6

With the supply of aluminum and dural being what it is these days, not many of us have given much thought to substitutes, but here is an idea for those who may be situated in places remote from the junk yards where such materials can be picked up. In a recent issue of Break-In, the magazine of our brother society in New Zealand, ZL1AO describes a 50-Mc. array in which he uses wooden doweling which has been sprayed with metal paint. The rods were given two coats, one of copper and one of zinc. Copper straps were used for making contact for attaching the feeders, and then the whole assembly was given a coat of clear lacquer to reduce electrolysis effects.

April 1947
a washout) there was nothing to be heard from the United States on 28 Mc. at 1200 GCT, the customary opening time for 10 in England, but WGTR on 44.3 Mc. came in at 1250, reaching S9 by 1300. Other f.m. stations were heard with good strength until after 1600, although no Ws were heard on 28 Mc. until 1535. This is not the first time that G6DH has noticed what appears to be an opening "from the top down." On several days recently he has heard the f.m. stations with good strength when no other signals have been heard from this country down to about 36 Mc. On other days the services around 40 to 42 Mc. will be heard before the f.m. stations appear.

Those f.m. stations can fool you. They run a lot of power, and they have mountain-top locations and high-gain antennas. Their reception at distances from 1500 to 4000 miles or more may indicate a possibility of 50-Mc. DX, but not necessarily. Harmonics of other services are a more certain indication, since their power is apt to be more like that of most amateur stations. If harmonics or other signals are heard above 47 Mc. it's time to "get cracking." There has been quite a bit of transcontinental reception of f.m. stations recently, which has stirred the interest of 50-Mc. workers on both coasts. W6HZ and W6QG have heard WGTR, Boston, and WNNE, Mt. Washington, N. H., very well, between 8 and 10:30 A.M. PST. They would be glad to arrange c.w. tests with interested stations in the East. It will probably be too late for P2 work by the time this appears in print, but we should be on the lookout for transcontinental sporadic-E skip in May, June, and July.

The best f.m. DX reception is reported by K7IU, Anchorage, Alaska. He has heard Chicago, St. Paul, Milwaukee, Detroit, Ft. Wayne, Alpine, and Boston, and he wonders why he is unable to hear any 50-Mc. stations.

A glance at the frequency listings we've been running for several months will show that there is a marked concentration of activity below 50.5 Mc. This is OK during the winter months, but we predict that there is going to be some real QRM when the band begins to open. Not everyone is on the low end, however, and it behooves us all to watch the frequencies above 52 Mc. for those hardy souls who are up there. They include numerous f.m. stations (those phase-modulated rigs sound OK) and a few nets, not to mention stations scattered around the country who operate above the middle on general principle.

Several old-timers from prewar days on 5 are now on 6 in Shreveport, La. and vicinity. These include W5ZS, Dixie, with 50 watts to an 829 and a 3-element rotary; W5DXB, Vivian, with 85 watts to a pair of 809s and a 3-element beam; W5BFX, Shreveport, with 90 watts to a T-40, a.m. and f.m., and a 3-element array; and W5ML, Oil City, 110 watts to an 829 and a 3-element array. Note their frequencies in the box — no low-enders here! W5s AKI, IOP, AEN, JFF, and KXO are now getting set. These fellows are interested in extended-local as well as DX work, and to further this end they are active each evening between 6:30 and 8:00 P.M.

Need Nevada — and who doesn't? W2NCR/7 says that the Las Vegas Amateur Association is interested in 2 and 6, and that he and other members will be going before the spring DX season gets under way.

With the aid of a little weather observation you can get a good idea of the degree of atmospheric bending to be expected for the next 24 hours or so. Some fellows watch the sun for evidence of increased sunspot activity and resulting high m.u.f. Now here is W9HXY, St. Cloud, Minnesota, with a device for measuring earth currents, and he is able to warn the boys of impending aurora DX on 6. One instance when it worked well was on Feb. 16th, when W0DZM and W0QIN worked W0USI. W9PK, Downers Grove, Ill., worked W0QIN, W9DWU, and W8QYD during this session. There was a mild flurry of aurora in the East that night, but we have no reports of anyone working stations he could not work by ordinary propagation, though the aurora

\[\text{This is "the works" at KH6DD, Ewa, Oahu, coholder with J9AAK of the world's record for 50-Mc. work. At the operating position are the Super-Pro and S-36. The r.l.f. section of the S-36 is used as a converter, feeding the Super-Pro for r.f. reception. In the driver is the BC-610 used on 20, 10 and 80. At the left, top deck, is the 10-meter rig, which uses a 6L6-6L6-813 p.p.-100TH line-up, antenna is the 100TH driver and p.p. VT-127As used on 50 Mc. Both rig operate from an 1800-volt supply and 810 modulator at the bottom and at the right of the open rack. Antennas include a rhombic and a W8JK "Twin-Three" for 50 Mc.}\]
distortion was plainly in evidence whenever beams were aimed North.

The Eager Beavers of Kansas and Missouri are losing a member, but they are hoping it is for a good cause. Little Beaver, W0JCQ, Ft. Riley, Kansas, is off for Yokohama. Being an incurable v.h.f. enthusiast Bill is taking along a rig for 6 and 2 meters.

**Stabilization Gaining on 144 Mc.**

A year ago crystal control was practically unknown on 144 Mc. We had made the jump from 112 Mc. not long before, and operation on 2 was confined almost entirely to the use of rigs which had been employed in WERS work during the war. Working on 144 Mc. meant listening to a mess of hash compounded of radiating receivers and splashing transmitters. A lot has happened in a year; probably more advancement than was ever crammed into one year in all the history of v.h.f. endeavor. The availability of surplus gear which could be adapted to amateur use had a lot to do with it. Tubes like the 882 and the 829, star performers in the v.h.f. range, became cheap and plentiful. The 6AK5, capable of real gain in 144-Mc. r.f. stages, made possible the construction of converters having performance approximating that to be expected of lower-frequency units. Beam antennas, simple to build and adjust at this frequency, became almost standard equipment.

In many populous areas it is now possible to use a selective receiver without sacrificing contacts, since most of the more active stations are crystal-controlled; yet the boys with the simple gear can still have fun on 2. The presence of many selective receivers has given most of the users of oscillator rigs an opportunity to learn just how badly they sound, however, and one listen on a superhet has often been enough to start a fellow on the construction of a crystal rig. The SCR-522 and the ARC-3 have provided a solution for many who think the construction of a crystal-controlled transmitter too difficult.

That there are plenty of stations to work is evidenced by the showings of some of the contestants in the 1947 Marathon, notably W2ZD, Maplewood, N.J., who worked 134 different stations during the first reporting period. The use of phase modulation, with a frequency multiplication of 27 times, helped to boost his total score to 620 points, the highest ever recorded by a 144-Mc. entrant.

One of the first things one notices when he first uses a selective receiver on 144 Mc. is the tremendous amount of room on the band. Where a superregen seems loaded when the band has more than five or six signals at the most, the selective receiver makes it possible for hundreds of signals to be present at one time without severe QRM. W2BYH and W2SVI have been having some fun working c.w. on 2, and it turned up the fact that

(Continued on page 186)

### Who’s Where on Six?

<table>
<thead>
<tr>
<th>Call Sign</th>
<th>City, State (f.m.)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1CBB</td>
<td>Lincoln, Mass.</td>
<td>50.6 Mc.</td>
</tr>
<tr>
<td>W1CQB</td>
<td>Enfield, Conn. (f.m.)</td>
<td>52.6 Mc.</td>
</tr>
<tr>
<td>W1CCTW</td>
<td>Arlington, Mass.</td>
<td>51.35 Mc.</td>
</tr>
<tr>
<td>W1CJZ</td>
<td>Greenbush, N. Y.</td>
<td>56.18 Mc.</td>
</tr>
<tr>
<td>W1CZL</td>
<td>West Englewood, N. J.</td>
<td>50.2 Mc.</td>
</tr>
<tr>
<td>W1CQF</td>
<td>Baltimore, Md.</td>
<td>50.1 Mc.</td>
</tr>
<tr>
<td>W2CENZ</td>
<td>Washington, D. C.</td>
<td>50.7 Mc.</td>
</tr>
<tr>
<td>W2CZJ</td>
<td>Takoma Park, Md.</td>
<td>50.93 Mc.</td>
</tr>
<tr>
<td>W2CZK</td>
<td>Silver Springs, Md.</td>
<td>51.45 Mc.</td>
</tr>
<tr>
<td>W2CJOA</td>
<td>Bethesda, Md.</td>
<td>50.7 Mc.</td>
</tr>
<tr>
<td>W2CJUL</td>
<td>Washington, D. C.</td>
<td>50.2 Mc.</td>
</tr>
<tr>
<td>W2CJOM</td>
<td>Baltimore, Md.</td>
<td>51.1 Mc.</td>
</tr>
<tr>
<td>W2CJPO</td>
<td>Timonium, Md.</td>
<td>51.54 Mc.</td>
</tr>
<tr>
<td>W3CDEK</td>
<td>Baltimore, Md.</td>
<td>50.15 Mc.</td>
</tr>
<tr>
<td>W3CJRE</td>
<td>Bethesda, Md.</td>
<td>50.73 Mc.</td>
</tr>
<tr>
<td>W3CJLF</td>
<td>Avondale Terrace, Md.</td>
<td>50.23 Mc.</td>
</tr>
<tr>
<td>W3CMBM</td>
<td>Baltimore, Md.</td>
<td>50.15 Mc.</td>
</tr>
<tr>
<td>W3CNG</td>
<td>Hyattsville, Md.</td>
<td>50.4 Mc.</td>
</tr>
<tr>
<td>W3CWA</td>
<td>Catonsville, Md.</td>
<td>51.2 Mc.</td>
</tr>
<tr>
<td>W3LJUM</td>
<td>Washington, D. C.</td>
<td>50.45 Mc.</td>
</tr>
<tr>
<td>W3LJUX</td>
<td>Washington, D. C.</td>
<td>50.10 Mc.</td>
</tr>
<tr>
<td>W3LJUJ</td>
<td>Luxembourg, Va.</td>
<td>50.12 Mc.</td>
</tr>
<tr>
<td>W3LJ5</td>
<td>Arlington, Va.</td>
<td>50.15 Mc.</td>
</tr>
<tr>
<td>W3LJAF</td>
<td>Alexandria, Va.</td>
<td>51.2 Mc.</td>
</tr>
<tr>
<td>W3LJFP</td>
<td>Arlington, Va.</td>
<td>50.15 Mc.</td>
</tr>
<tr>
<td>W3LJGF</td>
<td>Arlington, Va.</td>
<td>50.15 Mc.</td>
</tr>
<tr>
<td>W3LJRX</td>
<td>Shreveport, La.</td>
<td>52.3 Mc.</td>
</tr>
<tr>
<td>W3LJRC</td>
<td>Vincennes, La.</td>
<td>51.0 Mc.</td>
</tr>
<tr>
<td>W3ML</td>
<td>Oil City, La.</td>
<td>53.4 Mc.</td>
</tr>
<tr>
<td>W3LZC</td>
<td>Shreveport, La.</td>
<td>52.6 Mc.</td>
</tr>
<tr>
<td>W3LZU</td>
<td>Ft. Worth, Texas</td>
<td>50.45 Mc.</td>
</tr>
<tr>
<td>W3LZO</td>
<td>N. Hollywood, Cal.</td>
<td>50.1 Mc.</td>
</tr>
<tr>
<td>W3LZL/6</td>
<td>(mobile)</td>
<td>51.0 Mc.</td>
</tr>
<tr>
<td>W3LZN</td>
<td>Griffin, Indiana</td>
<td>51.8 Mc.</td>
</tr>
<tr>
<td>W3LZJ</td>
<td>Paramaribo, Suriname</td>
<td>50.2 Mc.</td>
</tr>
<tr>
<td>W3LZI</td>
<td>Paramaribo, Suriname</td>
<td>50.2 Mc.</td>
</tr>
<tr>
<td>W3LZL</td>
<td>Paramaribo, Suriname</td>
<td>50.2 Mc.</td>
</tr>
<tr>
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<tr>
<td>W3LZL</td>
<td>Paramaribo, Suriname</td>
<td>50.2 Mc.</td>
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April 1947
Modernizing the Old Receiver

*Simple Means of Improving Gain and Image Rejection*

BY WILLIAM L. NORTH,* W7BHE

AFTER having heard the performances of some of the new receivers, the author was rather discouraged with the one in his ham shack. Regardless of the fact that ten years ago it performed along with others in the same general price bracket, it just didn't have the "sock" of the newer ones. Furthermore, images on ten and twenty meters were sometimes bothersome. Consequently, the "old friend," which had done its job in an excellent fashion all of these years, had fallen into disrepute. A new receiver was out of the question, so it was decided to find out just what might be done in the way of improving the performance of the old. It might be well to mention here that the receiver concerned is an RME-69, but it is felt that the improvements to be described are not peculiar to this particular receiver and may be duplicated in others. The original r.f. amplifier circuit is shown in Fig. 1.

In looking over the field, no major improvements in circuits could be found on newer receivers outside of such things as noise suppressors, etc. Fundamentally the new receivers remain superheterodynes and the improvements in sensitivity and selectivity have been brought about mainly by the use of better components. Better tubes account for improved performance in many of the receivers, and it was with this in mind that the author set about investigating how the old one could be improved. Incidentally, several other things equally important were overlooked in the first analysis and this necessitated remodeling the receiver twice.

**Choice of Tubes**

The selectivity (determining image rejection) and sensitivity of a superheterodyne are dependent, for the most part, on the Q of the tuned r.f. circuits. Although the Q of ordinary unloaded circuits is high enough for good selectivity, precautions must be taken or the tube following the first tuned circuit will so greatly load it that the effectiveness of the entire amplifier will be largely lost. This is particularly important at the higher frequencies, where loading is many times that exhibited at lower frequencies. It is for this reason as well as the fact that it becomes more difficult to keep up the Qs of the unloaded circuits, that image rejection, gain and sensitivity fall off on ten and twenty meters in nearly all receivers. Furthermore, it may serve to little avail merely to substitute a tube with a higher transconductance, because even in a good circuit, the loading may be so increased as to largely offset the additional gain of the tube. Full advantage of a better tube may be realized only where other defects of the amplifier can be remedied, if such defects are present. The term "better tube" does not mean merely a tube of higher transconductance because so many tubes with large transconductance have such high input admittance that their substitution results in small increased gain and a considerable loss in image rejection.

In surveying the newer tubes, it became ap-
Fig. 2—Modified r.f. circuit for the 6AK5 r.f. amplifier.

- $C_1, C_t, C_a, C_6, C_o$: 0.1-µfd. paper.
- $C_s$: 500-µfd. mica.
- $R_1$: 200 ohms.
- $R_2$: 50,000 ohms.
- $R_s$: 7500 ohms.
- $R_4$: 300 ohms.

parent that the 6AK5 was by all means the tube to use in the r.f. amplifier of a receiver. Its input admittance is fairly low at 28 Mc. and, in addition, its transconductance is in the order of 5100 compared to around 1500 for tubes such as the 6K7, 6D6, etc. What could be simpler? An adapter was made from an old 6-prong tube base and a 6AK5 was substituted for the 6D6 in the r.f. stage of the RME-69. The results were far from startling; in fact, the only improvement noticeable was at frequencies lower than about 10 Mc.

**Circuit Modifications**

In view of the fact that the 6AK5 and 6D6 are not designed to operate at the same values of bias, screen and plate voltages, the failure of the experiment was attributed to this. The receiver was taken out of the cabinet and by the use of several resistors and associated by-pass condensers, voltages were adjusted to those rated for the new tube. The other components in the r.f. amplifier stage were left as found. An immediate improvement in gain was measured on all frequencies, varying from 18 db. at 2 Mc. to 4 db. at 30 Mc., with several frequencies showing gains in the order of 25 db. The resulting increase in gain was so startling to the author, and the receiver had so much “sock,” that it was left in this condition for several weeks, and once again it seemed like a new receiver rested on the operating desk.

However, being a true ham, and considering that in spite of the improved gain at the lower frequencies there had been relatively little increase in gain and image rejection on ten meters, it was decided to carry the investigation further.

In attempting to bring up the gain at 30 Mc., it was considered possible that degeneration was entering into the picture — that the length of the cathode lead external to the tube, in particular, was introducing inductive reactance at the higher frequencies, thereby reducing the gain at 30 Mc. Accordingly, it was decided to discontinue use of the adapter and install the miniature socket in place of the old 6D6 socket, thus shortening the leads considerably. Furthermore, upon studying the receiver, it was found that grid, screen, and plate by-passes were brought to the chassis rather than to the cathode terminal of the socket. The control-grid ground return could not be connected to this terminal because the tuning-condenser rotor was grounded. Since lifting the condenser from ground would have involved a major construction job, it was left as originally installed. All other by-passes were returned to the 6AK5 cathode terminals. This tube has two such terminals, one for grid returns and the other for plate returns. The decision to alter these by-pass connections ultimately made the r.f. stage work.

Immediate improvement in gain at 30 Mc. was noted, amounting to some 12 db. over that obtained before work on the receiver was started. Simultaneously the signal-to-image ratio was increased to better than 30 db. Since this is considerably greater than would be expected from the tuned circuits even if there were no loading, it seems evident that regeneration contributes to this sort of performance; in fact, the stage had a tendency to oscillate at certain spots within the two higher-frequency ranges. This instability was eliminated completely by the use of $C_s$ as shown in Fig. 2. It may not be required in all receivers.

A comparison of the original of Fig. 1 and the modified circuit of Fig. 2 will show the change in the original by-passing. Some of the condensers were originally located several inches away from the r.f.-tube socket and were common to either

**Fig. 3** — Curve showing increase in gain obtained by altering the input stage of the RME-69.

(modified r.f. stage, using the gain of the original receiver as a basis.)

A comparison of the original of Fig. 1 and the modified circuit of Fig. 2 will show the change in the original by-passing. Some of the condensers were originally located several inches away from the r.f.-tube socket and were common to either

(Continued on page 130)
VE-W Contest
April 4th–5th–6th

The calls “CQ VE” and “CQ W” will be heard for the first time since 1939 on April 4th as revival of this great contest gets under way. The all-time high of 574 participants will be topped if precontest interest is any indication. Leaders in 1939, VE3SF and W2IOF, will have to look to their laurels to maintain supremacy.

Sponsored by the Canadian Amateur Radio Operators’ Assn., the first postwar VE-W get-together promises to be a highlight among operating activities in 1947. A “CQ VE” to raise Canadians and “CQ W” to raise United States stations will provide you with operating thrills from the opening gun right down to the finish line! The Contest Rules follow:

Dates: Starts Friday, April 4th, 8 P.M. Ends Sunday, April 6th, midnight. (Local time.)

Operating Time Limit: Your period of operation must not exceed 20 hours.

Object: Each VE will work as many W stations in as many U. S. ARRL sections (see page 6, QST) as possible. Each W will work as many VE stations in as many VE sections as possible.

Scoring: Message preambles will be exchanged. Each preamble sent will count one point and each one received will count one point. It is not necessary for preambles to be exchanged both ways before a contact may count, but one must be sent or received before credit is claimed. All preambles must be handled under approved ARRL procedure. Mark each new Section as it is worked. The “check” portion of the preamble will be the RST report of the station worked. On ‘phone the “T” will be omitted, of course. Sample preamble: “NR 1 VE3CAR CK 589 Toronto Ont 8:03 P Apr 4.” W stations multiply their final score by 5, there being approximately eight times as many U.S. sections. VE stations multiply the number of points by the number of U.S. sections worked.

Frequency Bands: Any or all amateur bands.

Power Multipliers: Under 30 watts, multiply total score by 1; between 30 and 100 watts, multiply total score by 1.5; over 100 watts, multiply total score by 2. (D.c. input to the final.)

Operator Handicap: If more than one operator is used at a competing station, the total score must be divided by the number of operators having a part in the score.

Prizes: A Certificate of Merit will be awarded to the leader in each ARRL section. There will be additional prizes for the highest-scoring Canadian and American stations.

Logs: All logs should be mailed to the Canadian Amateur Radio Operators’ Association, 46 St. George Street, Toronto 4, Ontario, Canada, not later than midnight, April 30, 1947.

Operator’s Certificate: The following certificate is requested on each log submitted: “I hereby state that in this contest I have not operated my transmitter outside any of the frequency bands specified on my station license; and that also the score and points set forth in the above summary are correct and true.”

You’ve been asking for it ever since the end of The Great Silence. Here it is! Let’s see a big turnout for one of the most popular of contests: April 4th-5th-6th; “CQ VE” and “CQ W”; 20-hour time limit; Certificates of Merit; prizes. May the best men win!

25 Years Ago

April 1922 QST didn’t leave any of the recent big ham doings unreported—the little Headquarters staff was busy participating in all the conventions, the Governor-President Relay, and the very important first session of Secretary Hoover’s Radio Commission.

Up front in this issue is the Editor’s report on the Washington Radio Conference, another attempt by the Department of Commerce to make technical and regulatory repairs on the Radio Law of 1912, to cope with the rapid growth of new radio services. The spokesmen for the big corporations were heard first. They did not have an easy time of it, with charges of monopoly, restraint of production, and manufacture of inferior receiving equipment being repeatedly hurled their way. Independent commercial companies and other interests identified with the new medium, radiotelephony, also had their say.

Amateur Radio was represented by ARRL President Maxim, sitting on Mr. Hoover’s advisory committee alongside such prominent amateurs as E. H. Armstrong, C. M. Jansky, jr. and L. A. Hazeltine, and by Vice-President Stewart, Secretary Warner, Paul F. Godley, and officials of League-affiliated clubs. Lead-off man for the amateur argument was our recently-returned hero, “Paragon Paul,” who stated the amateur position in strong terms. He especially denounced the “American-small-boy” publicity we have been receiving in various circles, to which Secretary Hoover replied:

I would like to say at once that anyone starting any such suggestion that this Conference proposes or had any notion of limiting the area of amateur work was simply fabricating. . . . The amateurs were asked to be represented in this Conference and they are represented here today. . . . So I wish to sit on that right at the start—the whole sense of this Conference has been to protect and encourage the amateur in every possible direction.

(Continued on page 189)
DECEMBER CALENDAR

The December issue of the I.A.R.U. Calendar is devoted principally to a discussion of prospects and preparatory work for the coming world telecommunications conference. First briefly reporting the five-power Moscow conference (from data published in the January issue of QST), the Calendar urges officers of all member-societies to keep in close touch with government communications authorities with the following common objectives:

1. The retention of the present Cairo allocation of 1715-2000 kc. shared between amateur, fixed, and mobile. For the information of members, the ARRL reports that it is still taking issue with the U. S. government’s proposal to exclude amateurs from this band of frequencies, and at this writing has reason to feel that there will be a revision of the U. S. proposal so as to include amateurs in at least part of this range.

2. The retention of the present Cairo allocations of the 3.5-, 7-, 14- and 28-Mc. bands. It is here to be noted that there is a great deal of pressure to assign 3000-4000 kc. to the aeronautical mobile service in Europe, and high-frequency portions of the 7- and 14-Mc. bands to the international broadcasting service.

3. Inclusion of a proposal by each government to institute a new amateur band 21-21.5 Mc. It is encouraging to note that three of the five powers at the Moscow meeting proposed some sort of amateur allocation at this point in the spectrum, but it will be necessary for many governments to advance and support the full 21-21.5 Mc. proposal if we are to be successful in finally obtaining the assignment.

4. A liberal set of assignments in the region above 30 Mc., similar to those proposed at Moscow. While most of this portion of the spectrum will be considered by an international conference for the first time, and compromises of actual band limits will undoubtedly be necessary, each member-society should ensure that its government is made aware of the necessity for amateur allocations at approximate octave intervals.

(Continued on page 154)

From the Central Radio Club of Moscow, courtesy URSA-3-1, we have this map of the call districts and prefixes used by amateurs in the Russian sphere.

April 1947
CONDUCTED BY JOSEPH E. GRAHN, WICH

How:

With one-half of the first postwar C.W. International DX Competition a fond memory as this is written, it appears that the contest will go down in history as the maddest scramble of all. Activity seemed to be at an all-time high. Signals were ten deep for every kilocycle on the dial — and then some! In a two-hour listening period we logged 47 countries, while in another of about 40 minutes we heard 21. Did you fellows hear XU6GRL making hay with QLM and QML and refusing to answer calls on his own frequency?

He was one, among several foreigners, who put these signals into operation, to the gain of many of the smart boys on this side. We have the word, gang, that J3AAB, CR9AN and CR9AG have made a compact to never answer anyone calling on their own frequencies. Nuff sed?

What:

Eighty is still giving the gang an easy ride. W2PNB, with 45 watts into an 815, latched onto F3MS, VP6AE, G6RB, G8TK, G5LI, G2HFO, GW8CT, GW5YB, HB9SS, HB9EI, HB9FL, OK1LM, ON4AU, ON4HC, OZ4PT, G3AXT, KP4CO and KA1FL — all between 3500 and 3600 kc. W3HII worked HB9EK, G5JU, YU7KK and G2AVP, between 3525-3550 kc. W1GKA, using 60 watts * 58 Quinapoxet Lane, Worcester, Mass. and a 400-foot wire, QSOed G8CK, G2SO, G5KT and PA6DC, all on the l.f. end of the band. W7BED, with forty watts and 7000 feet elevation, grabbed ZL1NF (3650) with a wire fifteen feet off the ground. He uses a VFO!

Forty offers plenty of thrills for those willing to dig. W4TI sez his biggest came the other day when he worked three Gs... 2PL, 5LI and 5DQ... all in thirty-nine minutes, making his total six, one before the war and five since.

.... W3JL, with one rock and 80 watts, raised G4IF (7150), G5LZ (7150), SM5IZ (7150), CM2BU (7210), and is hearing plenty more with an abandoned telephone lead for a receiving antenna. W3QUJ got VR2MN (7050), ZL2GS (7175), HB9DA (7100), HHI3ES (7115), LX1AS (7115), YR5M (7135), CR9AD (7240), PA9AB (7125), G2ITS (7125), KAI1EA, KHI6MNA and KP4ABK. W4DXI grabbed HB9CS (7140), HB9FP (7160), G6TM (7050), ZL2MM (7110), G8TK (7140) and F9BC (7140).

W2RDK claims 40 is his best band and proves it by clicking with ZL2NT (7165), HK5CR (7009), J2AAM (7100), P4MOM (7170), XE2FG (7090), K16FFG (7130), G13AXI (7097), SM7HT (7100), SM6HN (7070), UA3AF (7110), UA3DQ (7130) and L9AX (7070). Charlie wants to apologize to the gang, especially to the three W9s and the W6 who waited for his 35-minute QSO with CW8AS to end, while he was trying to arrange skeds with an old friend of his in CN.

(Gang, there is an example of real hamming.) W4LAC, using ten watts, had a fine contact with ZL2QM. W4RT had a night of it on Jan. 24th, knocking over W6VSO/J9, XE2HQ, KAI1ZU, W6NQG/KM6, XU6GRL, KP4GC and KP6AB. He is using a new Signal Shifter and sez he is off xtals for life. Proper handling of that VFO will make us all happy, John.

VE3ACS, with two rocks and plenty of patience, worked ZL2GO, KZ5AG, OH2X, and several KF6es and Europeans. After listening to the ungentlemanly way VFOs are being used on the bands, Morgan says he's disgusted (an understatement if we ever heard one).

W3LNE (ex-W5SDWV) jawed with N18F, UB6AB, TRIP, SM3ZW, T4MAR, SM7FN, ZL2MM, HB9CS, KV4AA and UA3KA, on or near the low-frequency end.

Twenty, the band that keeps the DX gang happy, is still up to par... W9RBI, with XYL and other QRMs, is tickled to have worked VP8AD (14,070), VS1BX (14,025), UBSKAE...
The rig at OZ7UU, Charlottenlund, Denmark, consists of 4 stages: a Philips 4654-pentode xtal or VFO, an 802 buffer-doubler, a German 12p35 in another buffer-doubler, and Taylor T40s in the final. Power supplies, which are contained in a screened box on the rear of the transmitter table, deliver 300, 400, 600 and 1200 volts. The modulator is a four-stage job ending up with 6L6s in AB2 plate modulating the T40s. Antennas in use are a voltage-fed Hertz and a W8JK rotary.

April 1947
The Staggering Band Theorem

A Design for Living in Amateur Radio

BY LARSON E. RAPP, WIOU

Once again Rapp, the fearless April scientist, walks boldly in "where angels fear to tread" and locks horns with the greatest problem of all amateur radio, the 'phone vs. c.w. controversy. Attacking it with his usual logic and analytical skill, he comes up with a solution to all of the frequency-subdivision situations. Here is enlightening reading for all students of this basic amateur question.

The "circular-band theorem" described a year ago put many thinking amateurs to work devising ways and means for best utilizing this very logical system for reducing interference in the amateur bands. The work of Shuart and Sexton was particularly outstanding, and it is safe to say that, had conditions remained as they were in 1946, or, better yet, 1936, there would be no need for further attacks on the problem. However, in the year that has elapsed, three factors have contributed to increased interference in the amateur bands to such a magnitude that other solutions must be sought.

The factors responsible for the augmented QRM are the increased number of amateurs, the surplus equipment now available, and 'phone operation. The most reliable figures on the growth of amateur radio indicate that the number of amateurs will be increased by 50 per cent within one or seven years, or possibly sometime in between. Taking the most optimistic attitude, it is still apparent that something must be done.

The surplus market, which is just beginning to get under way, now makes it possible to build a complete 1-kilowatt transmitter complete with pilot lights (three colors) for $47.85, and it is difficult to estimate how many kilowatt rigs there are lurking throughout the world, just waiting for a receiver before they can start working other stations. Some idea can of course be obtained by listening to the number of stations testing each night, obviously with no thought of ever listening, but these figures will vary with the locality, and nothing definite is available. Conservative estimates of the surplus market, which take into consideration the present amateur practice of stockpiling up on spare parts, all agree that it will be roughly 37 years and 4 months before an appreciable dent in the stock becomes apparent. It is interesting to note that the custom of storing the large spare tubes in the final amplifier — it is not at all unusual to find a conservative 1-kilowatt amplifier that uses four 450-T1's in push-pull-parallel — may have some effect on the number of licensed amateurs in the near future, according to the FCC. Radiotelephone operation, in this and other countries, has increased instead of dying out and, although apparently a more attractive form of communication to many than "talking with their hands," it is a great devourer of kilocycles.

As a matter of strict fact, amateur 'phone is undoubtedly the greatest contributor to amateur interference today, both in the amateur and in the broadcast bands. Some of the foreign countries, with whom we enjoy the most friendly relationships otherwise, have developed 'phone techniques that require several times the channel space required by the more primitive domestic 'phones, but information on the exact methods used is difficult to come by. At least nothing on the subject has appeared in the domestic press in the past few years, so the secret must be kept fairly well guarded. However, it is not the purpose of this treatise to engage in a discussion of the relative merits of 'phone vs. c.w., but only to propose a solution to their working together in closer harmony with no mutual jealousies or demands for more frequency assignments.

Reasoning along the lines of more band edges for everyone, a major objective of the Circular Band Theorem, careful study of the "Ten-Meter Plan" was made and many observations of students of that band were carefully analyzed. Regardless of the merits of the proposal, the consensus seemed to be that it was too complicated and that the average amateur, already overburdened by weighty problems about his standing waves and an S-meter that will only hit the pin on strong signals, could not be expected to remember where one allocation within a band leaves off and another begins, even though it is to his best interests to acquaint himself with these details. This weight of opinion discouraged a plan
that the author was about to propose for all of amateur radio, namely, to stagger the 'phone and c.w. assignments every 100 kc. throughout the spectrum. However, it was this very discouragement that gave impetus to a new and even better plan, so it appears that the "Ten-Meter Plan" served a very useful but unexpected purpose.

Research

From intimate discussion with well-informed representatives of both factions, the author has reached the conclusion that if the subdivision of the amateur bands were left up to the 'phone men, all of the amateur frequencies would be made available exclusively to 'phone. Likewise, members of the brass-pounding contingent would be only too happy to see all of the bands made exclusively c.w. That this is basic will be agreed by all and, indeed, it is confirmed by the traditional greeting between 'phone and c.w. men.3

Obviously the best solution to the problem would be the development of some new form of 'phone and c.w. that would allow the two to work independently on exactly the same frequency. It would then be possible for the bands to be thrown open in their entirety to both 'phone and c.w., and both factions could go along blissfully unaware of the other on the air, in much the same fashion that they do now off the air. While this attack is still being carried on in the laboratory, it may be some time before the solution is obtained. Another very promising approach is based on a communications method involving the inverting of the normal speech frequencies into corresponding "contrapolar" frequencies — i.e., frequencies less than zero — modulating the carrier with these frequencies and then reinverting them back to normal after reception. Since negative sidebands are obtained, the signal disappears entirely with modulation, and the higher the modulation frequencies the more it disappears. Thus the more high-fidelity 'phones active on the air with contrapolar modulation, the more room there is, and the only problem, aside from the technical ones, is to guarantee that there be enough 'phones talking all of the time to insure the existence of the frequencies. Present experience indicates that this problem is insignificant. Stations in neighboring countries will undoubtedly supply large portions of the bands to us and will thus be helping to make room for many more stations, a very worth-while step in the right direction.

Staggering the 'phone and c.w. assignments, as mentioned before, brought out some interesting possibilities. Obviously 100-kc. segments are too large and, since all of the international assignments are not necessarily even multiples of 100, there would be some disagreement by the two factions. The next step was to reduce the idea to 50- and then 25-kc. segments, and by the time 8-ks. segments were reached a general equation was developed that permitted one to study the effect regardless of the segment widths. The actual equation is beyond the scope of this paper but, suffice to say, it does show that, for an upper audio limit of 4000 cycles, 'phones always take up more room than c.w. stations. The reciprocal of this equation, incidentally, is the factor by which 'phone men think their assignments should exceed the c.w. assignments. However, in a broader sense, such as 'phone, by using the theory of limits one can visualize reducing the segments until the 'phone and c.w. portions are superimposed. This is the principle of "imposition" which has been hinted at by other workers but never fully explained. Suffice to say, however, it shows the impracticality of staggering assignments in frequency, or "space" on the dial.

The Staggering Band Theorem

The other approach, the new Rapp plan, is one that requires no great technical progress and can therefore be put into effect almost at once. It too is derived along the general basic space-time-frequency canons, and it is so simple and so logical that it seems unfortunate, and somewhat amazing, that no one has suggested it before this time. Known as the "staggering band theorem," it consists simply of staggering frequency assignments in time rather than in space (frequency)! Stated another way: During alternate 24-hour periods, make the bands exclusively 'phone or exclusively c.w. For example, on the day the plan goes into effect, the 3.5-, 14- and 50-Mc. bands would be exclusively c.w. throughout the world, and the 7- and 23-Mc. bands would be exclusively 'phone. At the end of the 24-hour period, 80, 20 and 6 would be exclusively 'phone for a day, while the c.w. men held forth on 7 and 28 Mc. At the end of that 24-hour period, conditions would revert back to those of the opening day for another 24-hour period, and so on. The periods would be concurrent throughout the world, the calendar being based on GCT or some other well-known time. WWV is already prepared for the move, since time signals as well as standard frequencies are a part of the regular schedule.

The advantages of the plan are obvious. No 'phone man could ask for more frequencies, because they would all be available to him. The c.w. man would similarly be content, with no 'phone interference to interrupt his activities. Progressive old-timers, who have camped on one frequency for so long that they have worn a hole there, would have an opportunity every other day either to go on another mode of communication or go to a movie. In either event, they would find out what is going on in the world, an im-

(Continued on page 186)

April 1947 61
COMBINATION B.F.O. AND A.N.L. FOR THE SKY BUDDY

The combination b.f.o. and a.n.l. circuit used in the new S-38 receiver can also be used in the Sky Buddy by substituting a 6SQ7 for the 76 b.f.o. tube originally used. The 76 and its socket are removed, and an octal socket for the 6SQ7 is installed in place. The circuit connections are shown in Fig. 1. The two diode plates are tied together and are connected to the control grid of the audio tube through a switch. The triode section of the tube is then wired as the b.f.o. In operation no trouble has been experienced with the performance of the new b.f.o., and the limiter works very well. With the limiter switched into the circuit it is possible to hear signals plainly that were previously not audible through the noise. — Fred R. Mumma, W3KEK.

CUTTING MATCHING STUBS

Of all the methods tried to determine the correct length of a piece of RG-8U cable used here as a matching transformer for feeding a beam antenna, the process described below seems the simplest, involving less of the old cut-and-try methods used in the past. In addition, it permits the stub to be adjusted before the antenna system is put up in the air, thus saving a lot of scrambling around on slippery roofs.

A piece of cable was cut slightly longer than the calculated length for a quarter wavelength at the desired frequency. A small one-turn coil was then soldered to one end of the cable, and the other end was stretched out and left open-circuited. The rig was then tuned up on low power without an antenna, and the final tank coil brought to exact resonance. Coupling the one-turn coil to the final tank circuit will cause a slight increase in plate current, which is brought back to its original level by retuning the tank condenser. If more capacity is required to bring the tank back to resonance, the length of cable is too long. If the tank stays in resonance, the cable is the correct length, and if less C is required to produce resonance, the cable is too short. The length I arrived at for 14,200 kc. was 9 feet, 10 inches. This figure checked with results obtained by trimming the cable while using a Q-meter to observe similar adjustments. — R. B. Haner, W2FBA

BAND-EDGE MARKERS FOR V.H.F.

A simple crystal calibrator for use in the v.h.f. bands can be made using nothing more complicated than a crystal, a piece of wire, and a switch, as shown in Fig. 2. The “antenna” shown in the diagram is a short piece of wire located close to the tank coil of a superregenerative detector. When the switch is open, the superregenerative hiss is blocked out as if a carrier were being received, when the receiver is tuned to a harmonic of the crystal. Thus, by proper choice of fundamental crystal frequencies, “markers” for band-edges can be set up, eliminating guesswork. — William L. Detwiler, W9NZL.

SELENIUM RECTIFIERS AS A BIAS SOURCE

With several manufacturers including midget selenium rectifiers in their postwar lines, the amateur now has a means of obtaining protective bias for his rig without having to build separate bulky supplies. The compactness of these new...
The Publishers of QST assume no responsibility for statements made herein by correspondents.

WORLD CONFERENCE
3446 Walnut St., Philadelphia, Pa.
Editor, QST:
I have been giving some thought to the forthcoming telecommunication conference, which I understand will be held in Atlantic City commencing May 16th. I doubt whether there are more than a handful of amateurs in this country who understand the situation and who have any inkling whatsoever of the tremendous pressure being brought to bear by all other radio interests for frequencies, and I think it is very necessary for the ARRL to start an educational program through the medium of QST.

... I, of course, know what fine work you people are doing and with what problems you are faced, and, therefore, regardless of the results of the convention, I know that the amateur fraternity will be represented in the most magnificent way and that everything possible will have been done to retain our frequencies; however, I feel that one of a very few who realise this full picture, and I believe the future welfare of the ARRL depends on a large measure on getting this story across to a great majority of its members. ...

—Henry B. Pemberton, W3DPU

[Entron's Note: Mr. Budlong's article in this issue is the first of a planned series before and during the coming conference. Our thanks to W3DPU, wartime head of the Frequency Section of the Army Air Forces, for his endorsement of the policy.]

112 Edward St., Schenectady, N. Y.
Editor, QST:
It has come to my attention that there is a possibility the American amateurs may lose all their present frequencies below 200 Mc. If such a vicious rumor is being circulated and there is a foundation to substantiate it, I feel that every American amateur should be informed of these possibilities.

—Ward Alexander, W2NHY

[Entron's Note: The rumor is indeed a vicious one. There is absolutely no truth to it.]

No one knows precisely what will be the outcome of the world conference. Meanwhile, we are bound to have rumors, which will travel like lightning, particularly in the "phone" bands. Remember that most, if not all, will be untrue—and that the worse they sound, the greater chance they are based on misinformation. If any wild stories come your way, please don't spread them over the air. Check with your director or SCM, or directly with Hq. Or check with W3LW's nightly bulletin service—the absence of any confirming data will be sufficient evidence that the stories you hear are untrue.

826 2nd St., Santa Monica, Calif.
Editor, QST:
... Listening to the short-wave broadcast stations occupies a considerable portion of my free time. The short-wave broadcast bands are crowded. Why? Suppose you had a 100-kc. band to divide into ten channels? There would be room for ten stations broadcasting, say, five different programs; but if twenty stations tried to broadcast the same five programs there would be a good deal of interference. This is actually what is happening especially among the larger government-controlled propaganda stations. These stations are not content with merely being heard well, they want to be so thick on the dial that one can't help hearing them.

—Sherwood Doobghan, W8KNK

April 1947
On Avoiding QRM. Interference is everybody's headache. One method of dodging it is to use an ECO or VFO, and along this line we have made considerable postwar progress. Admittedly use of a single frequency channel by two operators or a score of netters, in traffic handling or casual round tables, tends to reduce the over-all band congestion. It steadily raises our efficiency in the use of amateur frequencies.

But these remarks are dedicated to the possibility of work with minimum QRM. How to avoid QRM? Working through it makes the world's best operators! It's a blessing in disguise. But if while we are operating a channel gets uncomfortably hot, we don't like the interference any better than you do. One way to avoid QRM is to operate in and as part of a systematic network.

Traffic nets, rag-chew nets, and DX round tables— for relaying traffic, taking turns conversationally, or passing a guy around in the friendly fashion of communicators— make their own channel in each case by constant occupancy. These fellows through their very bunching up use only one channel. That leaves more holes in the rest of the band; helps us to avoid QRM. Traffic nets, rag-chew nets, and DX round tables— for relaying traffic, taking turns conversationally, or passing a guy around in the friendly fashion of communicators— make their own channel in each case by constant occupancy. These fellows through their very bunching up use only one channel. That leaves more holes in the rest of the band; helps us to avoid QRM.

The second way, if you don't belong and aren't up to enjoying net operations as such, is to move to clear spots away from the published frequencies of nets, or off those observed to be occupied either by net QSOs or round tables. These remarks are equally applicable to c.w. and voice work.

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emergency communications, and to supplement the above discussion, we publish a condensed survey of the times of operation of the different nets reported to us, 'phone and c.w. It is hoped that traffic movement over all nets and lines may be assisted by the data given:

Starting Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Frequency &amp; Net</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00 A.M. EST</td>
<td>3637 (HIt &amp; Bounu - Transcon)*</td>
</tr>
<tr>
<td>7:00 A.M. EST</td>
<td>3365 (Great Lakes)</td>
</tr>
<tr>
<td>10:00 A.M. EST</td>
<td>3565 (Ari.)*</td>
</tr>
<tr>
<td>1:30 p.m. EST</td>
<td>3700 (Iowa)**</td>
</tr>
<tr>
<td>5:30 p.m. EST</td>
<td>3030 (Mich.)</td>
</tr>
<tr>
<td>8:00 p.m. EST</td>
<td>3956 (Mich.); 3890 (Cal.); 3940 (Alaska)</td>
</tr>
<tr>
<td>9:30 p.m. EST</td>
<td>3740 (Va.)*; 3750 (W. Pa.); 3770 (W. Va.)</td>
</tr>
<tr>
<td>7:00 p.m. EST</td>
<td>3450 (E. I.); 3750 (W. Pa.); 3770 (W. Va.)</td>
</tr>
</tbody>
</table>

FCC CLAMPS DOWN ON ILLEGAL STATIONS

W9ELA's call was bootlegged ... but FCC walked in on the unlicensed man (one J. J. Burnet, garage mechanic) after using a mobile direction finder. Burnet was impersonating the amateur, W9ELA, but his voice was a dead giveaway. He was arrested for violation of the Communications Act ... is said to be a third offender. conviction of operating a radio station illegally carries with it a fine of up to $10,000 or two years imprisonment, or both.

FCC likewise has been running down bootleg stations at many other points. An illegal station operated by a Robert A. Sperry at Cedar Rapids, Iowa, was closed Jan. 11th by FCC investigators using a mobile unit.

Unlicensed stations are potential sources of interference to the amateur service, as well as to all authorized radio services. Watch for illegal operations — on suspicion, ask FCC to investigate.

How would you like to have your call bootlegged? Several calls have been sent in to ARRL to check with any data OOs might send in. Data from "unexpected" QSLs, giving possibly the frequency or time of operation of unlicensed people who have "borrowed" one's call, should be forwarded to FCC for investigation.

WACC

The Oakland Radio Club offers an attractive certificate to any operator who makes two-way contact by amateur radio with every county in the State of California. There are fifty-eight counties in all. Mobile stations are ineligible for the award. However, stations worked do not have to be permanent, but can be portable or mobile units. Contacts may be by 'phone, c.w., or both.

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April 1947
ILLINOIS EMERGENCY

During the last week of January, the worst storm of the winter hit Illinois. Communication was disrupted with 12 towns served by the Illinois Northern Utilities Company, which has its general offices at Dixon, Illinois. SCM Marriner, W9AND, and F. G. Kaskman, W9AIH, both of Dixon, were instrumental in establishing emergency communication channels. First call from the utilities company requested contact with Aledo, Illinois. An emergency call by W9AND on 3.5-Mc. c.w. was answered by W9QKL, Springfield, Illinois, who telephoned the State Police. By police radio a squad car at Alpha, Illinois was raised, and the message pushed through to Aledo by the one remaining landline. Through this circuit, a 75-meter 'phone schedule was arranged between W9AIH at Dixon and W9TFY at Alpha. The amateur radio emergency circuits facilitated repair of lines and restoration of electric service to a large number of users. W9UQT provided valuable assistance at Springfield.

Members of the Illinois State Net (3765 kc.) established a railroad circuit to handle train orders and traffic between Freeport and Clinton, and towns in between, for the Illinois Central Railroad.

THE OLDEST ACTIVE HAM

Edward P. Kingsland, W2NA, Herkimer, New York, is believed to be the oldest ham active on the air today. In his 82nd year, "Ed" is full of the youthful spirit and vigor radiated by his smile. Twenty years a ham, his first license was issued in 1927 as BABQ, later becoming W8NA, and shifting to W2 when the districts were reapportioned. W2NA spends much of his time on 10- and 11-meter 'phone, but also taps out c.w. on all bands, 30 through 10. "Ed" was born in New York City on September 6, 1865. Recalling his early days, he writes, "About the time I finished high school, my father obtained for me a district of 110 gas lamps to light after sundown and put out about four o'clock in the morning." (Suppose there is any connection between W2NA and the song, "The Old Lamplighter"?) Always active in sports, "Ed" still goes in for swimming and skating. He doesn't say that ham radio helped him to stay young, but that's our conclusion!

IOWA ICE STORM

When a severe ice storm in late January brought down power and communication lines throughout much of Iowa, amateur radio stepped into its traditional role of furnishing emergency communications. An emergency network was established on 3970 kc., frequency of the Iowa 75-Meter 'Phone Net. Biggest user of the emergency facilities was the Iowa Southern Utilities Company. W0CPU set up his rig at the utility's offices and was the center of activity in routing many important messages handled relative to the restoration of power. Three mobile stations using Mark II tank transmitters were used to advantage in maintaining communications with the isolated towns. About 100 towns are supplied with electric current by the utility mentioned. Iowa stations known to have participated in the work are W0DMX, W0NMA, W0CFB, W0QLP, W0TNI, W0KZI and W0AUL. Many others played a part but their calls are not available. W0KZI of Ottumwa handled press from Des Moines for the local newspaper. Many other messages of importance were handled by the emergency network, including procurement of weather information for the Ottumwa Navy Base. Many outside stations assisted in monitoring and clearing the 3960-3980-kc. channels.

WPR CERTIFICATE

The Puerto Rico Amateur Radio Club has issued the first postwar "Worked Puerto Rico" certificate to W9VKF. Other holders of this award, in order of qualifying, are K4FKC, K4FAB, K4KD, K4EZR, K4FCV, K4ESH, WSIW, K4EIL, W3EDP, K4PQW, W9FFB, W4FIJ, K4DSE, K4HEB, K4HHR, W8SDR, W9ANS, and W9HTG.

PRARC offers the WPR certificate to any amateur submitting confirmations of contact with 25 Puerto Rican stations. Both prewar and postwar contacts count. K4, KP4, W/K4 and W/KP4 cards are all acceptable so long as there is no duplication of station under different calls. For example, cards from K4HEB and KP4BJ would count only as one inasmuch as they represent the same station. Similarly, cards from W4BZA/K4 (or KP4) and KP4CF would count as one, this also being the same station. Send your 25 verification cards with return postage to K4W. Mayer, KP4KD, P. O. Box 1061, San Juan 5, Puerto Rico.

BRIEF

Life would be so pleasant if we always could have W9NVJ's luck. He took a message from W60CQ addressed to Haverhill, Mass. Deciding to answer CQs from W1s in hopes of landing one near Haverhill, W9NVJ first called W1CCF, who came back, "UR RST . . . HR IN HAVERTOWN MASS." Oh boy!
ENDING SIGNALS

Interpretation of just what is intended by the commonly-used ending signals (AR, K, and SK) has caused some confusion in amateur operating. The ultimate in effective operating is reached when each ending signal used conveys the wishes of the station using it and the status of the contact. Upon completion of a study of usage vs. interpretation, ARRL has prepared a list of recommended uses for all ending signals. For the most part only slight modifications, if any, have been made in suggested uses of AR, K, and SK. A new signal, KN, has been introduced to clarify the actual intent of an operator when concluding certain transmissions. The considerations in arriving at each recommended usage follow:

AR: No change is recommended in the use of this signal. It normally should be used after a call to a specific station, before contact is established, and at the end of transmission of a radiogram. It has been used improperly after CQ calls, thereby causing confusion. When AR is heard one of two things is taking place. The station is completing a call to a station (no contact yet established), or transmission of a radiogram has been completed. It is usually a waste of time to call a station heard signing AR since he is tuned to a specific station.

K: CQ calls should be concluded with the signal K, and with no other signal. K is used also at the end of each transmission during a QSO, when there is no objection to another station breaking into the contact. In other words, K when heard may be interpreted as an invitation to any station to transmit. To avoid calls from other stations when in contact with a specific station, and to avoid being called by another station upon completion of a call to a specific station, a new signal, KN, has been added.

KN: This signal is an invitation to the specific station you are calling or working to go ahead. Negatively, it tells all other stations to "keep out" and that you will ignore their calls to you. This signal will find particular application in DX work, when the DX station wishes it known that he is calling or working a certain station and has no intention of heeding calls from others. It also should find application in "schedule" work, where you are interested only in a specific station and will not answer calls from others. It is the "keep-out" signal and should be used only when your intention is to concentrate on a specific station at exclusion of all others.

SK: This signal is used only at the conclusion of a QSO, and then is used only once by each station. When you conclude your final transmission to a station, use SK. The other operator will then use it upon conclusion of his final transmission to you. Once you have sent SK, do not make another transmission to the station concerned. It should be noted that SK precedes the signing of calls. Example: SK W8LMN de W5BCD. No signal should be transmitted after the call signs, unless you are closing station, in which case CL is appropriate.

CL: This operator's signal should be used after final transmission when you are closing down and

<table>
<thead>
<tr>
<th>Ending Signal</th>
<th>Meaning</th>
<th>ARRL-Recommended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>AR</td>
<td>End of transmission</td>
<td>After call to a specific station before contact has been established, or end of radiogram. Example: W6ABC W6ABC W6ABC de W9LMN W9LMN AR</td>
</tr>
<tr>
<td>K</td>
<td>Go ahead (any station)</td>
<td>After CQ and at the end of each transmission during QSO when there is no objection to others breaking in. Example: CQ CQ CQ CQ de W1ABC W1ABC K or W9XYZ de W1ABC K</td>
</tr>
<tr>
<td>KN</td>
<td>Go ahead (specific station), all others keep out</td>
<td>At the end of each transmission during a QSO, or after a call, when calls from other stations are not desired and will not be answered. Example: W4FGH de XU9GRK KN</td>
</tr>
<tr>
<td>SK</td>
<td>End of QSO</td>
<td>Before signing last transmission at end of a QSO. Example: SK W8LMN de W5BCD</td>
</tr>
<tr>
<td>CL</td>
<td>I am closing station</td>
<td>When a station is going off the air, to indicate that it will not listen for any further calls. Example: SK W7HIJ de W2JEL CL</td>
</tr>
</tbody>
</table>

April 1947 67
will not listen for or answer any additional calls. It notifies the listening operator that any further calls to you will be wasted.

The various existing signals and their recommended uses are tabulated in the accompanying box. Please note well that each signal (AR, K, KN, and SK) is always used by itself and is never combined with another. A common and improper practice of a few operators has been to use AR K at the conclusion of calls. Use only one signal at a time!

HIGH CLAIMED SCORES
ARRL-MEMBER PARTY

The following claimed scores are a preview of results of the Fifth Annual ARRL-Member Party, held on the January 11th-12th weekend. For ARRL members only, the contest served as a "family reunion," first of its kind since 1941. It was good to hear so many "old reliables" with spirits undampened after the long intermission. You should recognize the top scorers, but in case a couple puzzle you, W4KFO is ex-W6KFO, and SKWZ ex-W6KFO. Winners of the distinctive call-pin awards will be announced in the final report. The totals listed are unchecked and include score, stations worked, and sections worked.

CODE-PROFICIENCY CERTIFICATES

The next opportunity to qualify for a certificate or endorsement sticker in the ARRL Code-Proficiency Program is on April 18th. At 10:00 p.m. EST that date WIAW transmits the monthly qualifying run at speeds of 15, 20, 25, 30, and 35 w.p.m. Frequencies: 3555, 7145, 14,150, 28,060, and 52,000 kc., simultaneously.

The text copied, received successfully by ear at the highest speed you can copy, should be sent to ARRL for checking. To avoid errors in recopying, send your original copy. Attach a statement certifying over your signature that the copy submitted is direct copy, made from reception of WIAW by ear, without any kind of assistance, personal or mechanical. If you qualify by making perfect copy for at least one solid minute, you will receive your certificate, or an appropriate endorsement sticker for the certificate you already hold. Those who qualified in the past should submit copy only if the speed is higher than that indicated by present certificate or endorsement sticker.

QST lists in advance the text to be used on several of the 10:00 p.m. EST (Monday through Friday) CP schedules. This makes it possible to check your own copy. It also provides a means of obtaining sending practice since it permits direct comparison of one's first and tape sending. To get sending help hook up a key and buzzer and attempt to send right in step with the tape transmissions. Adjust your spacing in the manner indicated as necessary for self-improvement.

EXPEDITION KON-TIKI

Refer to page 71, March QST, for details on the ethnological expedition, Kon-Tiki. The expedition's call for work with amateurs is L12B. Operation is planned on 14, 28, and 56 Mc. Follow WIAW bulletins for details relative to schedules. Dr. J. H. Dellinger, Chief, Central Radio Propagation Laboratory, National Bureau of Standards, Washington, D. C., advises that CRPL will be pleased to receive reports on contacts with the expedition because of their bearing on propagation conditions. Please send all such reports of two-way work, or reception, via ARRL for forwarding to Dr. Dellinger. The expedition should be leaving Peru by raft about the time this QST reaches you. Estimated time of arrival in the Polynesian island group is 100 to 130 days after departure. (Continued on page 70)

(Continued on page 70)
Dear Sirs,

This is a letter that I have often promised to myself that I would write, if I were fortunate enough to come out of the War in one piece.

The story begins in 1939, those remote days just before the storm clouds broke over Europe. A young 'ham' after saving 'pennies' after what seemed an eternity has managed to realise one of his pipe-dreams, he has become the proud owner of a HRO. This was no hasty decision lightly made, but the result of years of poring over copies of 'QST'.

Unfortunately the joy of using this receiver for 'ham' work (after years of Det and one L.F., and home-made supers) was short-lived. The ban on transmitting was imposed for my country was at war with Germany.

All through that winter and spring of 'phony' war, the HRO was used to get news bulletins from all parts of the world. With the summer it was being used for a grimmer purpose and was bringing in the signals from the Nazi tanks and planes as they over-ran one country after another.

It was at this time that the owner joined the and made the decision to take the HRO with him, perhaps it would provide entertainment for himself and his comrades. It did, and more—it was used also for more serious work, for at that time we were woefully short of precision equipment. For the next year the set was used practically 24 hours a day and 7 days a week on its work official and unofficial. The messages that it handled would provide material for a book that would stand comparison with any work of fiction.

The next move was to an ocean liner once a link between our countries, now running blacked-out and full of troops. It was during this voyage around the Cape to the Middle East that the HRO enjoyed its only rest of the War years, its idleness was enforced as a security measure.

For two years the HRO spent most of its time in the back of a 3-ton lorry (from whose tailboard it fell to the ground more than a few times), along with petrol tins, ammunition boxes, heavy implements, etc. The climate varied from the Western Desert in blazing midsummer, though the rainy seasons of Tunisia, to the snow and ice of the Italian Appenines in midwinter. This was followed by service in Normandy, Belgium, Holland and finally into Germany itself. It was operated in dug-in tents, luxury hotels, and wrecks of bombed villages. The anecdotes of this period are far too numerous to relate, but it might be worthy of mention that in the Ardennes it enjoyed the treat of a new set of 6 volt valves and a vibrator unit (perhaps it would be unfair to add that an American Sgts. taste for tea developed in England prior to 'D' day and unsatisfied by American Army rations was not unconnected with this deal).

Now the HRO and owner have been demobilised are back at the really serious business of 'ham' radio which was interrupted by those long years of War. The HRO has been overhauled and re-aligned, the dents have been beaten out of the cabinet, foreign bodies have been removed from its interior (the locust legs that recall Benghazi, the dust of Sicily, the black mud of the Low Countries). It has had a coat of enamel and it looks and works like new. During all those years it never gave any trouble, not a joint came unstuck despite the terrific hammering it had at times in military transport, from concussion of explosives, etc. The owner had many opportunities, especially during the later phases of the war of trying other communication receivers of all brands, but never found better.

It would be appropriate at this point to suggest some improvement or modification born of hard experience, but it has not been honestly possible to do so. There is however one little gadget which has proved its worth over and over again in which you may be interested. On the back chassis was mounted an ordinary valve socket and connected to the heater and anode supplies. Into this outlet have been plugged a whole host of units at one time or another, especially when operating in the field from a vibrator supply. Some of them came to mind at once, a 100/1,000 kc xtal oscillator, an acorn VHF adaptor, a signal-generator, a V.T. voltmeter, etc., etc. But you can no doubt imagine to yourself the uses that a Communications Section in the wilds can find for 6.3 v and a couple of hundred volts of D.C.

This is the end of the story, but not the end of the HRO which is going to put in many more years of hard work. It has not been written to flatter you, or with any idea of payment but rather to express in some small manner the gratitude of the owner for all the services that the HRO gave to himself and to his country.

I remain,

Yours Sincerely,

P.S. If you should want to publish any of this at any time please do, but don't add my name and address as I am still employed in and they don't welcome publicity.
EMERGENCY AT 50 BELOW

By August G. Hiebert, K7CBF

Alaskan radio amateurs have performed many outstanding individual services of emergency nature during the history of Territorial communications. A major fire on Christmas Eve, 1946, completely destroyed the Fairbanks Telephone Exchange and set the stage for another collective effort on the part of the Arctic Amateur Radio Club, which resulted in sincere editorial and civic commendation of the amateur fraternity.

At least 95 per cent of Fairbanks' downtown business structures, as well as practically all residential buildings, are of frame construction, and because of a 100-per-cent wartime increase in population, are badly overcrowded. Wintertime temperatures, which this season set a new low record for 25 days of minus 50 degrees and lower, meant overheated stoves and a resultant severe fire hazard.

Faced with no means of communication for an indefinite period, Mayor A. H. Nordale proclaimed a state of emergency, and gratefully accepted the offer of Willis Cowles, KL7AN, president of AARC, to help establish an amateur radio network throughout the city.

It was decided to use 3995 kc., since the Army-sponsored aircraft warning service during the early months of the war had used this frequency, and quite a number of crystals were available throughout the Territory. Cowles contacted W7JIJ in Seattle on 28 Mc. and arranged for the procurement of 10 additional crystals, which were shipped by air from Portland, Oregon, early on the morning of December 30th. In the meantime, K7CBF made 75-meter 'phone contact with L7CX at Anchorage, who rounded up additional crystals there. Ladd Field military authorities offered the use of any equipment which could be used, and several receivers, crystals, handy-talkies and transmitters were acquired from that post.

Within a week 14 stations were on the air, standing by for emergency communications, and within 10 days the net consisted of 22 stations, in addition to 7 handy-talkies that were used by ear patrols. Net Control Station was at the Police & Fire Department, where all key communications, including the regular police-car system, a powerful public-address paging system, a handy-talkie, and amateur stations could be controlled by one operator. Other stations were in operation at St. Joseph's Hospital, the Fairbanks Radio Company, Weeks Field airport, Ladd Field Communications, the Nordale and Pioneer Hotels, College Observatory, KFAR transmitter, and various residences in a zone distribution system throughout the city. Experienced service personnel were in constant touch with the net for the purpose of transmitting emergency traffic on the standard broadcast band if the need should arise.

The Alaska Communications System cooperated with the Fairbanks Telephone Company and made connections through their own exchange to important locations as fast as possible. Considerable delay was experienced, however, since all but one 200-pair cable suffered water soaking and could be spliced only after thawing.

A first-class test of the emergency setup came shortly after it was established when another major fire broke out in downtown Fairbanks. At this time the network was used to good advantage for calling doctors, additional help and for traffic in general.

By mid-January the telephone company had flown a small temporary telephone exchange to Fairbanks from Seattle, and began connecting lines into a multiparty system. As fast as telephone service was restored to important areas throughout the city, either through the Alaska Communications System board or through the new telephone exchange, the station in that area was dropped from the net. On February 4th, when service was restored, the network disbanded.

Considerable traffic of emergency nature was handled during the 5-week period of operation, including numerous fire alarms, hospitalization and doctor calls, and disorderly-conduct reports. Priority earthquake warning traffic was handled from KL7FU at College Observatory via K7CBF to the Alaska Communications System for regular telegraphic transmission to the States.

The Fairbanks amateurs who participated in the network, by donating equipment, helping

*ARRL SCM; Chief Engineer, KFAR, Box 910, Fairbanks, Alaska.
SOCKETS AND SHIELDS...

for miniature button base tubes

These new National sockets are of mica-filled natural molded Bakelite with silver-plated beryllium contacts—designed for maximum dependability and adaptability. The contacts—either axially or radially mounted and removable for replacement—provide short leads and low inductance so vital to ultra-high frequency design. The sockets are built to JAN specifications and can be used with or without the shields.

Made in three sizes to accommodate the various sizes of miniature tubes, the shields are of nickel-plated brass, with cadmium-plated phosphor bronze spring to provide correct tension to hold both tube and shield in place regardless of angle or vibration. Shield bases are of nickel-plated brass, with two 4/40" spade bolts mounting both socket and shield base.

You'll find hundreds of other parts, both new and old, to improve your rig in the new 1947 National Catalog.
In the "Meet the SCMs" column, February QST (page 88), we "promoted" SCM Gordon. We said he was transmission "manager" for A.T. & T., but Clayt hastens to point out that actually his title is transmission "man." Sorry, OM, but glad we didn't denote you!

ELECTION NOTICE

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

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

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

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

Petitions must be in West Hartford, Conn., on or before noon on the closing dates specified. In cases where no valid nominating petitions were received in response to previous notices, the closing dates are set ahead to the dates given hereafter. The complete name, address, and station call of the candidate should be included with the petition.

The following nomination form is suggested:

Communications Manager, ARRL (Place and date) 38 LaSalle Road, West Hartford, Conn.

We, the undersigned full members of the ARRL Section of the ......... Section hereby nominate ......... as candidate for Section Communications Manager for this Section for the next two-year term of office.

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

--- E. B. Handy, Communications Manager

ELECTION RESULTS

Valid petitions nominating a single candidate as Section Manager were filed in a number of Sections, as provided in our Constitution and By-Laws, electing the following officials, the term of office starting on the date given.

San Diego Irvin L. Emig, W6GC Dec. 16, 1946

Hawaii John F. Souza, Jr., KH6EL Jan. 2, 1947

Southern Texas Ted Chase, W5HIF Feb. 15, 1947

Maine F. Norman Davis, W1GJ Feb. 17, 1947

Michigan Joseph R. Beljan, Jr., W8SCW Feb. 17, 1947

Minnesota Walter G. Haselamp, W6CUB Feb. 17, 1947

(Continued on page 74)
You buy performance in the HQ-129-X

Pull the weak ones out of the QRM—Tune in a "ZL" and hold on to him—Turn on the noise limiter and really kill ignition noise—That is what thousands of hams are doing every day with the HQ-129-X

See the HQ-129-X at your dealer's

Backed by years of know how

Hammarlund

The Hammarlund Mfg. Co., Inc., 460 W. 34th St., New York 1, N.Y.
Manufacturers of Precision Communications Equipment
BRIEFS

The hangout for amateurs who are police radio operators is 3715 kc. The “QPO Net” meets at no special time, but some of the “ham cops” will be found on 3715 kc. almost any time.

Recent addition to the Rag Chews Club is W9RCC. Another celebrity on the list is Joe Sock, WILCH, probably some distant relative of “The Old Sock” himself!

JANUARY CD QSO PARTY

Members of the ARRL Field Organization held their quarterly QSO-shindig January 25th and 26th. Conditions were erratic, probably the worst ever experienced in a midwinter party. The bands sounded as tired as some of the operators surely must have felt after wading through the SS and ARRL-Member Contests. That’s how we account for the absence from the high-score list of such veterans as W3BES and W1TS!

It was nip and tuck between W4EOP and W4KFC for top honors, with W4EOP edging Vic out by a very slight margin. We don’t remember a closer race in any of these CD parties. Congratulations, Charlie.

The CD QSO Parties are open to all amateurs who hold any official appointment or office in the ARRL organization. They offer a quarterly check of stations and operators, provide the opportunity to contact others with like interests, and on top of all that are more fun than ham radio itself! If you are ineligible to hold any official appointment or office in the ARRL organization. They offer a quarterly opportunity to contact others with like interests, and then make application to your SOM.

The next CD get-together falls on the weekend of April 26th-27th. It will be the last before summer sets in. Let’s make the most of it!

Claimed Scores (C.W.)

<table>
<thead>
<tr>
<th>Station</th>
<th>Score</th>
<th>Contacts</th>
<th>Sections</th>
</tr>
</thead>
<tbody>
<tr>
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<td>4370</td>
<td>253</td>
<td>23</td>
</tr>
<tr>
<td>W1KTE</td>
<td>2300</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>W8PSE</td>
<td>520</td>
<td>8</td>
<td>8</td>
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<tr>
<td>W6IWU</td>
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<td>3</td>
<td>3</td>
</tr>
<tr>
<td>W1LEP</td>
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<td>4</td>
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<td>W9DDW</td>
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<tr>
<td>W7CZT</td>
<td>118</td>
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<td>1</td>
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<tr>
<td>W3CEGE</td>
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<td>4</td>
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<tr>
<td>W3BWP</td>
<td>90</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

**CHANGES & ADDITIONS — DIRECTORY OF ACTIVE NETS**

- **Beaver Net (Ontario)** *3535 kc.*
- **CON-SPN (California)** *3615 7:00 P.M. & 10:00 P.M. EST, daily except Sunday
- **Delta 'Phone Net** *3505 3:00 A.M. & 8:30 P.M. MST, Mon.-Fri.
- **Illinois** *3755 7:00 A.M. & 8:30 P.M. CST, Mon.-Fri.
- **Inter-Mountain Missions Net** *3955 7:15 P.M. CST, Mon.-Fri.
- **Kansas Traffic Net** *3640 7:00 P.M. CST, Mon., Wed., Fri.
- **Md.-Del.-D.C. Section Net** *3700 10:00 A.M. EST, Sundays
- **Midwest & Western Outlet** *3555 8:00 & 10:00 P.M. CST, Wed., Fri.
- **Nebraska State Net** *3535 7:20 A.M. & 8:30 P.M. CST, Mon.-Fri.
- **New Jersey 77-Phone Net** *3900 9:00 A.M. EST, Sundays
- **N.Y.C.-L.I.** *3710 8:30 P.M. EST, Mon.-Fri.
- **New York State (combining E.N.Y. & W.N.Y. nets)** *3720 7:00 P.M. EST, Mon.-Fri.
- **Power Company Net (Mass.)** *3575 & 3635 8:00 A.M. & 8:00 P.M. CST, Mon.-Fri.
- **QPO Net (Police Ops.)** *3745 8:00 A.M. & 8:00 P.M. CST, Mon.-Fri.
- **Southern New Jersey** *3700 9:00 A.M. EST, Mon.-Fri.
- **Susquehanna Emergency Net** *3910 8:00 A.M. & 8:00 P.M. EST, Wed., Fri.
- **Western Pennsylvania** *3750 8:30 & 8:30 P.M. EST, Mon.-Fri.

*New listing: **change in listing. (See page 82, February QST.)

**ARRL ACTIVITIES CALENDAR**

**Apr. 4th-6th:** VE-W Contest
**Apr. 18th:** CP Qualifying Run
**Apr. 26th-27th:** CD QSO Party
**May 16th:** CP Qualifying Run
**May 17th:** V.H.F. Relay and QSO Party
**June 14th-15th:** ARRL Field Day
**June 19th:** CP Qualifying Run

---

Jan. 16th-Dec. 15th: 1947 V.H.F. Marathon
Jan. 1st-Dec. 31st: Most-States V.H.F. Contest

First Saturday night each month:
**A.R.R.L. OFFICIALS NITE** (Get-together for SCMs, RM's, SECs, ECs, PAMs, Hq. Staff, Directors, Alt. and Asst. Dirs.)
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SPEAKERS

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$5 to $1500

CONSTANTLY INCREASING PRODUCTION

Designers and Manufacturers of Fine Acoustic Equipment
ALL OPERATING AMATEURS ARE INVITED TO REPORT THE SCM TO THE SCM, Dave Mathis, W3BE - HQ, who has been hospitalized for some time because of an auto accident, has been on the air from his hospital bed. He used an S50R of HFD's and QSL'd the Field Day portable on 7 Mc. Doc is home now and is having remote control hooked to the big rig. EU has a BC-348Q and is building a portable for his summer QTH using a 12LZOT tube. ORM is registering the 3750-Mc. net. Write him for details or contact him on 3705 kc, where he works into the T.O. Net. The Schuylkill Amateur Radio Club sends code practice daily from 8 to 9 P.M. on 3795 kc. and into the T.O. Net. The Schuylkill Amateur Radio Club invites reports of reception. MLM delivered three messages time because of an auto accident, has been on the air from remote control hooked to the big rig. EU has a BC-348Q secy.-treas.; 2PWP, act. mgr.; 3KT QSL Mgr. KT, GHD, secy.-treas., FJU works DX on 14 Mc. but also shows a fine Madrid Radio Club are BES pres.; 2OXX, vice-pres.; IXN, calibrator. JSU went to town in the CD Party. The Susquehanna Valley Amateur Radio Club are graduates of first class. JARM now is 2TVU, ex-36NM, is looking for contacts in Trenton on 28 Mc. TJY is on 28 Mc, with 150 watts and an HQ-129X. 2PTT is erecting brand-new three-element beam. 3ANH/2 has 'V' beams on 28 Mc. RNK has e.o.o. and beam on 28 Mc and worked W9QDM with 100 watts input. SPF has brand-new 40-foot metal tower with new beam for 28 and 14 Mc. IEQ sports new BC-384Q, OSS is on 3.5-Mc. c.w. CFS met on Feb. 9th. Will all members in the Section please include these forms. The address of all operating amateurs are invited to report to the SCM for inclusion in these columns. The addresses of all SCM's will be found on page 6.

ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, WS6BS - HQ, who has been hospitalized for some time because of an auto accident, has been on the air from his hospital bed. He used an S50R of HFD's and QSL'd the Field Day portable on 7 Mc. Doc is home now and is having remote control hooked to the big rig. EU has a BC-348Q and is building a portable for his summer QTH using a 12LZOT tube. ORM is registering the 3750-Mc. net. Write him for details or contact him on 3705 kc, where he works into the T.O. Net. The Schuylkill Amateur Radio Club sends code practice daily from 8 to 9 P.M. on 3795 kc. and into the T.O. Net. The Schuylkill Amateur Radio Club invites reports of reception. MLM delivered three messages time because of an auto accident, has been on the air from remote control hooked to the big rig. EU has a BC-348Q secy.-treas.; 2PWP, act. mgr.; 3KT QSL Mgr. KT, GHD, secy.-treas., FJU works DX on 14 Mc. but also shows a fine Madrid Radio Club are BES pres.; 2OXX, vice-pres.; IXN, calibrator. JSU went to town in the CD Party. The Susquehanna Valley Amateur Radio Club are graduates of first class. JARM now is 2TVU, ex-36NM, is looking for contacts in Trenton on 28 Mc. TJY is on 28 Mc, with 150 watts and an HQ-129X. 2PTT is erecting brand-new three-element beam. 3ANH/2 has 'V' beams on 28 Mc. RNK has e.o.o. and beam on 28 Mc and worked W9QDM with 100 watts input. SPF has brand-new 40-foot metal tower with new beam for 28 and 14 Mc. IEQ sports new BC-384Q, OSS is on 3.5-Mc. c.w. CFS met on Feb. 9th. Will all members in the Section please include these forms. The address of all operating amateurs are invited to report to the SCM for inclusion in these columns. The addresses of all SCM's will be found on page 6.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — Acting SCM, Empey Darne, WS3WT — The Washington Radio Club's January 25th meeting was a Television Net. There were present: OXX, ex-2TVU, who attended the meeting. IFDK's 7-Mc. beam is having element trouble (wind and snow). Frank worked ZIK1AB for over an hour and gave him the DX Contest rules. GHD has been working on a new beam, a three-element beam-plumber's delight. ENX has had a lot of grief with his rotary machinery. IXN, GYV, and IFDK put up the beam for BES. FLB has repaired his S55 10/20 beam. QU9 is putting up several Sterba curtains. New officers of the Franklin Radio Club are BES pres.; 23XX, vice-pres.; IXN, secy.,-treas.; 2PTP, act. mgr.; 3KT QSL Mgr. KT, GHD, MFM, BES took part in Frequency Measuring Tests. Traffic: W3EU 97, FYU 70, QEW 38, AQN 10, ID 10. CAU 7, MILY 8, JSU 5, OMT 3, QLYW 3, BES 2, Jerry. MARYLAND-DELAWARE-DISTRICT OF COLUMBIA — Acting SCM, Empey Darne, WS3WT — The Washington Radio Club's January 25th meeting was a Television Net. There were present: OXX, ex-2TVU, who attended the meeting. IFDK's 7-Mc. beam is having element trouble (wind and snow). Frank worked ZIK1AB for over an hour and gave him the DX Contest rules. GHD has been working on a new beam, a three-element beam-plumber's delight. ENX has had a lot of grief with his rotary machinery. IXN, GYV, and IFDK put up the beam for BES. FLB has repaired his S55 10/20 beam. QU9 is putting up several Sterba curtains. New officers of the Franklin Radio Club are BES pres.; 23XX, vice-pres.; IXN, secy.,-treas.; 2PTP, act. mgr.; 3KT QSL Mgr. KT, GHD, MFM, BES took part in Frequency Measuring Tests. Traffic: W3EU 97, FYU 70, QEW 38, AQN 10, ID 10. CAU 7, MILY 8, JSU 5, OMT 3, QLYW 3, BES 2, Jerry.
The 4X150A, a new Eimac tetrode, extremely versatile—diminutive in size, will fill the bill in all types of application and at all frequencies up to 500 mc. Performance characteristics include—high transconductance, low plate voltage operation, low grid drive, high plate dissipation, and traditional Eimac-tetrode-stability. Physical features include:

A. Low inductance grid lead.
B. Close element spacing for UHF and high transconductance.
C. Screen grid, mounting, and ring connector design effectively isolates input and output circuits.
D. Heater isolated from cathode.
E. Indirectly heated cathode.
F. Low inductance cathode terminals. (four separate paralleled pins).
G. Controlled primary and secondary grid emission, by specially processed grids.
H. New molded glass header, precision pin alignment.
I. Forced air cooled (vertical finned).
J. Simple installation, adaptable to standard locetal socket.

You will find the 4X150A suited to your requirements, whether for wide-band low-efficiency service such as television video and audio or conventional application. For further information on this new, versatile, Eimac tetrode, type 4X150A, write to:

EITEL-McCULLOUGH, INC.
1456 San Mateo Avenue
San Bruno, California

Follow the Leaders to

Eimac TUBES

The Power for R-F

PRICE, $31.00

EIMAI:: 4X150A Power Tetrode

<table>
<thead>
<tr>
<th>Electrical Characteristics</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Heater voltage</td>
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<tr>
<td>Heater Current</td>
<td>2.7 amps.</td>
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<tr>
<td>Grid-screen amplification factor (approximate)</td>
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<tr>
<td>Direct interelectrode capacitance (typical)</td>
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<tr>
<td>Input</td>
<td>12.0 µf</td>
</tr>
<tr>
<td>Output</td>
<td>4.6 µf</td>
</tr>
</tbody>
</table>

Maximum Ratings

| DC Plate voltage | 1000 volts |
| DC Plate current | 200 ma |
| Plate dissipation | 300 watts |
| DC Screen voltage | 300 volts |

Export Agents: FRAZAR & HANSEN, 301 CLAY ST., SAN FRANCISCO 11, CALIFORNIA, U.S.A.
York State Net. This net is meeting daily at 7 P.M. on 3270 kc., with ITX acting as net control station. ORS and others interested, please get in touch with Ed Preston RIZ, Tully, N. Y., for bulletin. All traffic inquiries should be addressed to Ed. Traffic: (Doc.) W2OVY 4, (Jan.) W2SAB 84, RIZ 41.

6:30 P.M. with TOJ as NOS and KWL as alt. NCS. Both constructed 144-Mc. three-element beam antenna. SHY has

P.M. at the YMCA. Code and theory are being

ARRL Frequency Measuring Tests. LMS has new f.m. exciter for 28 Mc. City amateurs have organized as the

constructed 144-Mc. three-element beam antenna. SHY has completed 100-10 kc. frequency standard, and participated in ARRL Frequency Measuring Tests. LMS has new f.m. exciter for 28 Mc. City amateurs have organized as the Allegheny Radio Amateurs Club, with meetings held every Tuesday evening at the YMCA. Code and theory are being taught by KEQ, LST, KXQ, and MLG. DIL is running 1

 operates on 1550 kc., with ITX acting as net control station. ORS and others interested, please get in touch with KZZ, BVG, and ORV the winners. Congrats to

2TP, 2PZO, 4FTL, and 6PSC. JDW reports QIT is a new ham. Look for him on 144 Mc. OMV has been ill in the hospital with pneumonia. He and CEO are

is on 28-Mc. 'phone. HOD has VFO on 3.85-Mc. 'phone. The engineer for his standard.

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Amphenol Electronic Tube Sockets are specially designed for industrial applications. Ruggedly built for utmost dependability and peak performance, they were the first industrial tube sockets to comply with N.E.M.A. and Underwriters’ specifications for industrial equipment.

Amphenol sockets are molded of melamine resin or bakelite for strength as well as high arc-resistance and reduced carbon tracking. Utilization of the latest developments in spring bronze has insured the highest degree of contact conductivity and long spring life. Maximum spacing between contacts and chassis is maintained. Heavy insulating barriers prevent flashover between contacts under the adverse conditions found in industrial usage. Screw type terminals provide for quick connect and disconnect, ideal for testing and replacement. No soldering is required.

Amphenol sockets are available in types for practically all industrial electronic tubes. Write today for complete information.

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Engineering advancements born of wartime experience make Mallory vitreous enameled resistors better than ever. An improved enamel provides greater protection, keeps out moisture, minimizes warping, stretching and shifting of the wire during manufacture. New processing technique banishes "hidden corrosion," the thief that robs life, whether the resistor be in service or out.

You can depend on Mallory resistors to dissipate heat rapidly, to withstand atmospheric conditions, to remain free from hum-outs or failures, to stay accurate, and to be dependable—always.

Available in fixed and variable types, Mallory resistors cover the power range with sizes from 10 watts to 200 watts and with a wider range of convenient stock resistance values. Mallory vitreous enameled resistors provide this "premium" quality at no extra cost. See your authorized Mallory Distributor, or write to

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(Continued from page 78)

bordering c.w. for Class B exam, ARE schedules ELSB and D4ARP for G.I. traffic. The Central Wisconsin Radio Club was organized Jan. 8th in Wisconsin Rapids with several hundred members in attendance. Monthly meetings are held the 2nd Wed. of each month. Visiting hams are welcome. Traffic: W0LFK 152, DKH 74, S2L 27, ARE 20, HUJ 15, MUN 13, BZ 13, NSW 8, 1QW 2.

DAKOTA DIVISION

NORTH DAKOTA—SCM, Raymond V. Barnett, W9EVP—The Red River Valley Club at Fargo has been reactivated with TSN as president and SHF as secretary. RM PDN gave a talk on ARRL and field organization. PPK substitutes for PDN on net schedules when PDN is working. Interest is picking up and we will have several new appointments. Much traffic is being handled. Send me your reports for credit in this column. GJH is building portable-mobile rig. ABY and EVP have FY103 dynamotor supplies, and are using emergency work. JS-14OT, tra. LNW, hopes to be on soon with 300 watts to 8148. His old call was 9PJW. ZRT is proud owner of new four-element beam. SSW is looking for Nevada and North Carolina, PDN, running 500 watts, will call "CQ North Dakota WOQV". Sunday nights at 7:30 p.m. CST on 3750 kc, and will comb the bands if no call on the spot frequency. Traffic: W9EVP 38, EVP 23, SSW 11, GJH 9, 73, Ray.

SOUTH DAKOTA—SCM, P. H. Schultz, W9QY—TJ, at Milbank, AZE, at Bellingham, Minn., and BJJ, at Watertown, have a 145-Mc. net in operation. They report FB results. BJV works KQO, at Concord, regularly on 50 Mc. UJK, at Rapid City, is handling considerable trunk traffic. Will anyone please offer services as net manager or volunteer to join up with a section net? OLB at Glenham is anxious to make South Dakota contacts for a net. Your SCM visited the Rapid gung gang via YOB on one of their nightly 28-Mc. ragchews. Few could not get to see some of the gang in person.

The club uses Scout Cabin for meetings twice monthly. Hope Field Day results and questions are settled between Bear Butte Club and Rapid Club, WUV reports results of IO NICS. SCM urges others to join in the fun. We could use more reports. How about a 1947 hamfest? 73, Phil.

MINNESOTA—Acting SCM, Norman Beck, W9EPJ—New officers of the Minneapolis Radio Club are: KIS, pres.; PTV, vice-pres.; HRM, secy.; GDL, treas. LNW, and QMW Traffic Net. HCC now is CO, Ex-CWVL now is EQ. TPN has worked 40 states on 7 Mc, with 30 watts. Ex-CSJ now is CST and is running 100 watts to a 6L6. Ex-CYUZ now is EQXZ at Stillmon. KIF is a new ham Ward, and Q9DD took a crack at the Frequency Measuring Test but found prewar equipment needed lots of going over. WUQ reports Missabe Radio Club met with VHF beam experiment by GFC and DUS. RJF was active in CD Party. The St. Paul Radio Club met with VHF beam experiment by GFC and DUS. RJF was "active in CD Party. The Central Wisconsin Radio Club met with frequency men's measuring test but found prewar equipment needed lots of going over. WUQ reports Missabe Radio Club met with VHF beam experiment by GFC and DUS. RJF was active in CD Party. The St. Paul Radio Club met with VHF beam experiment by GFC and DUS. RJF was "active in CD Party. The St. Paul Radio Club met with frequency men's measuring test but found prewar equipment needed lots of going over. WUQ reports Missabe Radio Club met with VHF beam experiment by GFC and DUS. RJF was active in CD Party. The St. Paul Radio Club met with VHF beam experiment by GFC and DUS.
Lighthouse Larry Comments:

When last we were talking about metal tubes, the point was made that the 6AC7/1852 may not actually give you a pepped-up receiver, contrary to the belief of many hams who think they have received more signals by plugging in this tube. Cross-modulation, not increased sensitivity, usually is the result of using a 6AC7/1852 in the r-f stage.

The question was put—how about using a 6AB7/1853? Isn’t that the ticket? ... Let’s see.

The 6AB7/1853 is a metal tube with remote-cut-off characteristics. That’s strongly in its favor, since the sharp-cut-off design of the 6AC7/1852, as explained in our last chat, is the gremlin that causes cross-modulation in your receiver.

Type 6AB7/1853, also, has a higher \( g_m \) than the 6K7 or 6SK7 which we’re thinking about replacing. Higher \( g_m \) means more gain—when you can get it. At fairly low frequencies, or up to about 7 mc, the greater gain is easy to secure. However, above 7 mc the input impedance of a 6AB7/1853 diminishes more rapidly with increased frequency than is true with a 6SK7.

Lower input impedance means a mismatch which results in signal loss. The faster drop in input impedance with the 6AB7/1853 may have only a small effect, and in such cases the tube’s gain will not be lowered appreciably. Generally speaking, use of a higher-gm tube, even at the higher frequencies, means a net gain. A comparison of gains between the 6AB7/1853 and the 6SK7 indicates approximately 6 db in favor of the former, under favorable conditions. However, the gain may be accompanied by a decrease in receiver stability, due to the high grid-plate capacitance of the 6AB7/1853—approximately five times that of the 6SK7.

And 6 db gain is a generous figure! You may not get this by using a 6AB7/1853. Furthermore, certain adjustments in your circuit will be needed. In all probability, if the new tube is to function well, you may have to increase the screen voltage from 100 on the 6SK7, to 200 on the 6AB7/1853. Also, due to differences in plate currents, it may be necessary to change the cathode resistor in order to maintain the same bias.

Whether the game is worthwhile under these circumstances, each ham will have to judge for himself, once he’s aware of the various factors involved. I’ve tried to name these factors, along with their “why” and “how” ... Soon I’ll have another message for you—helpful, I hope—to guide you in applying Ken-Rad top-quality, top-value metal tubes in your rig. CUL!
(Continued from page 80)

AFU is narrow-band f.m. and is still playing with antennas. He had only five at the last count. LIO has quite a collection of antennas. AYH has that gleam in his eye; maybe some 2807Tc. LQN is on 14 and 7 Mc. DXN is back in circulation after four years. AUU, LSH, and LCZ all have new modulation monitors. The Texarkana boys are operating 28-Mc. net, and have worked into Hartford and Hope. Port Smith 28-Mc. net, is on every night and works into Hartford and Paris. The Little Rock Club is building 28-Mc. 'phone rig. The club also has a kw., all-band e.q.o. 73. Morehall.

LOUISIANA -- SCM. W. J. Wilkinson, Jr., W4W7T -- SEC: KTE, RM: KUG, PAM: CEW. The Caddo Amateur Radio Club has elected BFX, pres.; LBT, vice-pres.; and JHY, secy-treas. Meetings are held 2nd and 4th Fridays. JVT is interested in 28-Mc. ANA has new rig on 14-Mc. e.q.o. EGK has worked YR, EI, ZL, and other DX. HOS has completed new 450-watt 'phone rig for 28 Mc. KHII is operating from HGT, LLLF is on 7 and 3.5 Mc. with 6 watts. DXXL has new 25-watt OJW has rig on 7 Mc. GHR, EC, has new 8X-25 receiver and home-grown e.q.o. MO improved audio, QH, CEW, JPF, LJJ, CNG and JNQ are on 3.85-Mc. 'phone. KTE, SEC, is working hard on emergency setup. LAE is building eight-element stacked beam for 28 Mc. LDT is keeping schedules. MHF is now building. OYJ is ex-5GDU. LYY has BC-610. GTB is building for 28 Mc. IXXL is newest portable. daq is on 3.5-Mc. e.q.o. IOP has 47 countries. KTQ, IAX, ABN, ZS, and LQW are active. LAD has 24-Mc. rig. W5KUG has 28-Mc. rig. HOS worked J2 on 28 Mc. HJX and HKE are on 7 Mc. in Natchez. EGK works 14-Mc. e.q.o. consistently. The OVARC has swell meetings. We need ECs for Alexandria, Baton Rouge and other localities. Write KTE for information, ORS, OAS and OBS appointments are still open.

Traffic: (Dec.) W5DAQ 4. (Jan.) W5KUG 163, KTE 143, VT 121, J9J 71, GHH 44, BSR 18, LOH 17, FPX 10, PYX 7, DAQ 7, KWT 3, JBT 3. 73. Dub.

MISSISSIPPI -- SCM, Harold Day, W5NGW -- CUU has a kw. new kw. final for 14 Mc. DNY has new dipole for 3.85 Mc. DEJ has T55a in parallel, modulated with 811a. Welcome to new ham. MFJ, in Meridian. MFJ is blind. QF passed away in January. His many friends throughout the country will mourn his loss. WM made 11,250 points in the ARRL Party in January. A big hand for the Jackson radio amateurs, who certainly planned an excellent program for the big meeting there February 9th. More on the meeting in next month's QST. Thanks to WZ and DEJ for the news this month. Traffic: W5WZ 228, IGW 313, DEJ J 73. Hal.

TENNESSEE -- SCM, James W. Watkins, W4PLS -- AQR and DQH are having a hot battle for local DX championship on 14 Mc. The Mid-South Amateur Association holds regular monthly meetings. AQR is its new president. LFC, in Key Largo, Fla., has a 60-watt rig for keeping schedules with ERL. AA, W4KDL is in one afternoon on 28-Mc. 'phone. CDU had a two-way scheduled contact, with Germany and Shanghai on 28 Mc. JPP, GYE, and GXX are working at WDKA. Oak Ridge Radio Operators Club, an ARRL affiliate, boasts a membership of 76 from all sections of the country and Hawaii and about 30 non-licensed members. 3TW1/4 keeps schedules with the TLP, TL-C, Ohi., W. Pa. and S. C. Nets and needs contacts in West Tennessee, Kingsport, and Chattanooga. Look for him on 3750 kHz at 6:30 p.m., 3798 kHz at 8:00 p.m., and 3650 kHz at 9:30 p.m., Tues., Wed., and Fri. MGT, FRM, BBL, LHB, JUX, and 3TW1/4 are active on 3.9-Mc. 'phone. EOC, EYJ, LBB, JUX, 90Z1/4, and 3TW1/4 keep schedules on 14-Mc. 'phone. TESQ has quite a popular night. Net meets every Sunday at 9:30 A.M. CBT with QT as net control and ERJ alternate net control. Those desiring to participate are requested to call in after roll call. ENL is new CO and new call. EZQ has new OAS. LBA is ex-8J1/4PH's new call. FZ is Tennessee SEC. Those interested in forming a c.o. net should contact PL on 3.5 or 7 Mc. Traffic: W4PL 468. 3TW1/4 86. 73. Jim.

GREAT LAKES DIVISION

MICHIGAN -- SCM, Harold C. Bird, WD0PS -- SWF is running schedules with 39AA1 and handling plenty of GL traffic. TLL1 is back on 7 Mc. with 200 watts. He worked G8JH and HB8FP. SW worked 1P6OD and 5KOU with a 140 and 1440 watts on 3.75 Mc. using half-wave hertz fifteen feet off the ground and then blew his transformer. ZGZ reports he is working 28 Mc. with 200 watts to a pair of 811a. UKV is running the Early Net now and doing a fine job.

(Continued on page 82)
For over a quarter century the name Meissner has stood for the finest in electronic equipment. Founded in 1922 by the late William O. Meissner (famous for his outstandingly successful inventions in communications and electronics) this company has been the source of many new developments in the radio field.

First to build a complete line of jobber coils; first to design and build plastic IFs and to introduce Ferrous IFs, Meissner has long led in the development of fine coil equipment for every application. A pioneer in FM (holding the second license issued in this country) Meissner was also the first to manufacture radio receiver kits. The Meissner Signal Shifter is still the Number 1 requirement for the complete ham shack and the Meissner Analyst has saved thousands of man-hours for servicemen everywhere.

Today Meissner's original policy of aggressive research and development remains unchanged. Strengthened by 25 years of electronic manufacturing experience it is your guarantee of product quality . . . an assurance of perfect performance under all conditions.

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The "556" Broadcast Dynamic microphone is a "living" testimonial to the ruggedness and dependability of all Shure Microphones.

For home use, we recommend the 708A Stratoliner and the 707A Crystal Microphones.

(Continued from page 88)

Dale is working on electronic portion of a tape puller and is trying to stimulate traffic in his neighborhood. UQG reports the Michigan Emergency Net is operating on 3930 kc. 9 A.M. every Sunday. C.L.L. is listening 30- and 144-Mc. rigs and his next project is to build a f.m. exciter for 28 Mc. UGR is having trouble so is operating on 5651 kc. F.W.U. is working 3950, 3613, and 3708 kc. O.N.K is running the Q.M.N 7 O'clock Net on Tuesdays and doing a swell job. S.P.A. hopes to have SH at M.S.C. on Q.M.N as soon as transmitter is completed. F.X. reports his X.Y.L. fell and cracked her shoulder. R.I.G. is keeping up his good work on traffic. Y.C. finished the new rig. 616 to pair 819s running 150 watts input. W.E.T. is directing early Q.M.N. Net now in place of U.G.R. Y.C.T. is handling traffic for all parts and took one for Italy recently. Q.G.K. is back and hopes to be regular reporter on the Q.M.N. TV is doing nice work on the various nets. D.M.N. radios his report and asks for O.R.S. appointment. T.B.F. is traveling a lot so cannot get on often. J.H.B. is doing fine job. On Early Net of Q.M.N. gang, T.R.N. worked a foreign station and got a Q.S.L. card, the first in ten years. He schedules Bain Island and also reports working Moscow and a V.K.A.S. Y.E.F. worked K.H.Y. on ground wave of 28 Mc. for two hours and two minutes. A.B.H. is working Q.M.N. Net and setting as N.O.S. C.W. can be heard any night in the week on Q.M.N. or plugging away on the Trunk Lines.


OHIO - S.C.M., William D. Montgomery, W.S.P.N. - New appointments this month include P.U.N. as O.S.; W.D.Q., Y.E.R., and W.R.P. as O.R.S.; and W.S.P. as C.O.C. for Guam Islands. All appointees are cautioned to send certificates in for renewal a year after they are issued. The Bucikye Net on 5730 kc. is getting better each month under the direction of the Manager, R.E.N., and the N.C.S. and A.A.T. of the Shure Base. The net now has regular outlets into the T.O., Q.M.W., Q.M.N., T.L.A.P., W. P.A., and G.L.E.N. Nets. P.J.M. and L.A.U. alternate in the Q.M.W.; M.P.G., R.N., and P.I.R. alternate into the T.O. net; E.N.W. and G.L.E.N. alternate in the T.L.A.P. and U.7.4. G.L.E.N. Nets. 3730-ke. crystals may be purchased from M.P.G. The Coast Guard Net is to meet nightly at 8 P.M. on about 7050 kc. W.Y.N. reports the following new officers of the Intercity Radio Club: T.T.S., pres.; A.C.L., vice-pres.; W.Y.N., secy-treas.; L.Y.Q., master at arms. L.Y.Q. won the prize offered by the club for the highest score in the S.S. Contest with 42,000 points in 25 hours. L.Y.Q. has passed the 100 mark in countries worked. All hams within traveling distance of Mansfield are welcome at Intercity Club's meetings on the first Friday of each month, at Liberty Park Pavilion. F.F.C. reports the Piqua Radio Club's code classes got off to a good start with W.E.N. as chief instructor. Q.C.H. is working from a three-element beam. J.O.Q. is satisfied with nothing less than a rhombic, which works out quite nicely. The Piqua Club transmitter was exhibited at the local school during a hobby show and messages were handled as part of the demonstration. The Fort Steuben Radio Club's new officers are: M.A.M., pres.; F.W.U., vice-pres.; F.S.I., secy-treas.; E.R.R., trustee; A.Y.R., secy. mgr. The club is located at Steubenville, and all neighboring hams are invited to meetings. A new club, the Brass Pounders Assn., has been started in Cleveland. All hams interested should get in touch with RO.X. The club will cater to traffic handling, contests, and DX. Another new club, the Delaware, the Central Ohio Radio Club, announces its officers as C.N.Y., pres.; E.R.B., vice-pres.; G.R. C.R.Y., secy.; Z.L.R., treas.; C.N.O., O.U.R. and L.E.H., trustees.

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Full automatic protection against damage
to tubes, transformers, and other gear from
overloads and power failures.
Mounts on standard relay rack.
Finger tip control of filament and plate.

"ON" filament button starts transmitter.
"ON" plate button puts station on air.
"OFF" plate button interrupts transmission.
"OFF" filament button shuts down station.

This completely interwired control mounts directly on a standard
relay rack—locating on one panel the control functions necessary
to go on the air. Design is based on survey of practical Ham needs.

The overload relay (furnished in either 250 or 500 milliamperes)
is connected in the plate circuit and is resettable from the front
of the panel by a rotary motion of the reset knob. Position of
the reference point on the reset knob indicates the presence of an
overload. Separate control of both filament and plate circuits is
provided and the operator can, if he desires, connect remote control
buttons directly to this panel. In line with standard Ham procedure,
a time delay relay is utilized to delay the application of plate voltage
until the tube filaments are up to temperature.

Panel size: 3½"x19", with 1½" maximum depth behind panel.
(Back and Front views shown above.) For 115 volts, 60 cycle A.C.

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(Continued from page 84)

transmitter, VVL. The new one does not take a corps of engineers to tune as did the old one. High winds around Cincinnati supplied many famous bears, including that of JIN, the GCARA's DX leader. MGR reports that the GCARA roster of members now is 191. ZPP, formerly W6GR, wonders what he did to rate his new call letters. 144-Mc. activity has started again in Marion, with drives on Thursday nights at 8:15 p.m. It is rumored that all the 50-Mc. boys are converting to 144 Mc. now because of alleged better coverage. Traffic: WSZAU 141, MPG 113, UPB 112, K3ZV 103, PFA 71, PMJ 55, OHE 28, VLA 17, PMQ 16, KUZ 14, TGU 13, VLYW 12, DAE 12, UJJ 10, FFX 6, PUN 6, MPY 5, AQ 4, LCY 3, TUL 3, PBX 2, HUM 1. 73. BHI.

HUDSON DIVISION

EASTERN NEW YORK — SCM, Ernest R. George, W2ZHZ — Through the splendid efforts of ITX, the ENY and WNS traffic nets are now combined into one. "QNC-NYS." Listen for the NYS Net at 7:00 p.m. on 3720 kc. Mon. through Fri. and call in with your traffic. These combined operations should render fine servce to the State. ITX and SAG are net control and alternate net control, respectively, until organization is really under way. EQD asks old Southern NY AAR5 stations to monitor 3545 kc. QJD reports several new antenna going up in his territory, but most of them now rest in the trees awaiting more ham help. Apparently no one owns a jeep. They sure make a good antenna-raising and tightening medium. The Exeg KLM and the Schenectady gang have done it. 50-Mc. schedules are held regularly between QNY in Schenectady and Massachusetts and New Jersey stations. A rotary beam (four-element) superhet receiver and a good transmitter sure make a big difference, not to mention 28-Mc. transverter and frequency. Traffic: W2ITX, W2TV, W2WQ, VQ.

NEW YORK CITY & LONG ISLAND — SCM, Charles Ham, Jr., W2EDC — Queens: BSP reports UVF is the newest station in the 144 EC Net. Suffolk: OQI, active EC, reports interest in the 3.5-Mc. o.w. EC Net. BHH, ADW, and OQI are on regularly for 144-Mc. nets. TIA keeps West Nassau in contact with East Nassau so KNA can report. SAH brought about a family reunion in arranging a schedule with several pairs on each end of the Rome-falp QSO. UX works 3.85-Mc. 'phone but will try 28 Mc. in order to contact his brother, SM7OG. ADW's 60-foot poles are going up. CJJ has a natural QTII for 144 Mc. overlooking L. I. Sound. FSK keeps trans-Atlantic 28-Mc. schedules with GGDH. The XYLs of ELOG and SAH have formed a club for the purpose of getting ham tickets. LCK is on 144 and 3.5 Mc. at NMY. GFX also is at NMY. WH is QRX for rotating mechanism which will take care of his six-element 144-Mc. beam above his four-element 28-Mc. beam. DOG can be heard on 144.05-Mc. crystal with an 815 in the final. PDU is giving code practice to local aspirants. Traffic: WSZA.U 141, MPG 113, UPB 112, K3ZV 103, PFA 71, PMJ 55, OHE 28, VLA 17, PMQ 16, KUZ 14, TGU 13, VLYW 12, DAE 12, UJJ 10, FFX 6, PUN 6, MPY 5, AQ 4, LCY 3, TUL 3, PBX 2, HUM 1. 73. BHI.

(Continued from page 88)
IT WAS NOT EASY... Compact though it is, the new 5516 is a far cry from the cathode-type tubes previously used in mobile vhf equipment. Design and production headaches for instant-heating vhf beam pentodes increase in geometric progression with the operating frequency. A glance at 5516 constructional advantages discloses unusual measures taken to solve such problems. Yes, the 5516 of necessity costs more, but it does a real job at 165 mc.

WHAT THE 5516 DOES FOR YOU... 5516 useful power outputs at 165 mc of 18 watts f-m, 12 watts a-m (more at lower frequencies) are not theoretical but are based on actual tested transmitter designs. Low internal tube drop gives high output at low plate potential, with simplified power supply requirements. Instant-heating filament permits tremendous savings in battery drain — mobile or aircraft. One 2E30 doubler or tripler drives a 5516 in plate-modulated class C to full output at 165 mc. Ratings — designed for mobile use — are CCS and equally suitable for the fixed station. Also the 5516 requires no neutralization in properly designed circuits. Write today for complete data sheet.

**NEW 5516**

**INSTANT-HEATING VHF BEAM PENTODE**

**USEFUL POWER OUTPUT**

**FOR MOBILE F-M**

**WITHOUT NEUTRALIZATION**

**18 WATTS**

**165 MC**

**LIST PRICE**

$5.95

---

**HYTRON TYPE 5516**

**INSTANT-HEATING VHF BEAM PENTODE**

**GENERAL CHARACTERISTICS**

- Filament: oxide-coated, center-tapped
- Potential (a-c or d-c): 6.0 ± 10% volts
- Current: 0.7 amperes
- Grid-plate capacitance: 0.12 μF
- Input capacitance: 6.5 μF
- Output capacitance: 6.5 μF
- Maximum overall length: 3.21/32 inches
- Maximum diameter: 1.7/16 inches
- Base: low-loss, medium-shell, 8-pin octal

**ABSOLUTE MAXIMUM CCS RATINGS**

<table>
<thead>
<tr>
<th>Pin Connection</th>
<th>Pin Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Fil. center tap &amp; control grid</td>
<td>5 Control grid</td>
</tr>
<tr>
<td>2 Filament</td>
<td>7 Filament</td>
</tr>
<tr>
<td>3 Screen grid</td>
<td>8 No connection</td>
</tr>
<tr>
<td>4 Same as pin 1</td>
<td>Cap Plate</td>
</tr>
</tbody>
</table>

**USEFUL POWER OUTPUT (CCS) — TYPICAL OPERATION**

<table>
<thead>
<tr>
<th>Service</th>
<th>Up to: 165</th>
<th>135</th>
<th>80 mc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class C unmod. or f-m</td>
<td>18</td>
<td>24</td>
<td>30 w</td>
</tr>
<tr>
<td>Class C plate-modulated</td>
<td>12</td>
<td>16</td>
<td>20 w</td>
</tr>
</tbody>
</table>

*Carrier condition with max modulation percentage of 100. Useful power output to load equals plate power output less circuit and direct radiation losses.
open the EC net each week. He is on 14-Mc., ‘phone, ORZ has crystal mobile, SMX, FQW, and PCV are using sharp superhet on 144 Mc. QYZ is active on NYOO-L. J. Net. BDN is on 3.5-Mc., c.w. using 10 watts. BO schedules Ronnie Expedition, AYZE, taking traffic on 7 Mc. The Sunris Radio Club officers are LN, pres.; BZ, secy.; NF, assistant secy.; MFK, treas.; and TZZ, secy. TYZ is using TR-4. TWJ copies 35 w.p.m. on Super-Pro. The Sunris Radio Club meets every Friday night at 222-34 14th Street, Raceland. SXT is a member of the HCC. PBO works good DX on 2 Mc. PMA, secretary, reports the Y.I.R.L. of N.Y.C., has round table on 29,200 kc. the first of each month and meets at 8 p.m. the 3rd Friday of each month at 17 E, 67th St. Traffic: W2BO 171, OBU 08, QYZ 01, PBT 23, BHD 16, EPU 21, LGG 21, TUR 10, AYJ 5, OUT 8, MZB 2, PF 2, JBP 1, RQJ 1.

NORTHERN NEW JERSEY — SCM, John J. Vitale, W515N — Asst. SCM, T. J. Ryan, NKD, SEC; GMN, NJN Net 3820 kc., NOS CQG, 700 r.p.m., Mon. through Sat. The MCA celebrated its first anniversary. New Officers are BAT, pres.; HEY, vice-pres.; GHB, secretary, secy.; QGH, corr. secy.; RVI, treas.; ABL, chief engineer; RPF, news editor; SOX, division director. Installed new officers. Club publication is the MCAA News. Meetings are held at the Vail Home in Eatontown on Thursdays. SOV worked his BC-610 on 3.5-, 14- and 28-Mc., ‘phone during recent illness. LGX, on 28-Mc., phone. OCM was a “Monmouth” kilowatt on 3.85-Mc. ‘phone. IQX, FYD, NVD, and NTU kept 24-hour schedules on 7, 14, 28, and 144 Mc. on Christmas and New Year's Eves. EOH worked 65 countries on 3.85-Mc., ‘phone. SEQ is on 7 Mc. NKD is OHS on Tues., Thurs., and Sat., on 063. Clubs are urged to appoint a traffic man to work into the NNJ Net for club traffic. The NNJ 3.85 Mc. Emergency ‘phone Net is holding drills on Sunday mornings. The Hudson County 144-Mc. Emergency Net is in operation. Those interested should see NLE and APL. SOX would like to hear from any amateurs interested in handling traffic on or from SOX on 3830 kc. in conjunction with NNJ Net. NYI holds traffic schedules with IYK, SUP, and GES. OJT is on 14 Mc. BJZ revamped the rig with an 81U in final, 400 watts. FTP rebuilt the rig. The MCA is getting ready for next Field Day. HZY has worked 85 countries. GPW worked 14 and 28 Mc. LFR reports that TIA is handling the traffic for the Byrd Expedition. NCA is rebuilding to p.p. 813S, VFO and f.m. 500 watts on 28 Mc. CJX has been handling D4 (QD) traffic for families here. GVZ has 25 countries. OHS is secretary of North Newark Radio Club. NZE is c.w. on 27 and 28 Mc. The Irving gang is playing with electronic keys. The Fort Monmouth Radio Club conducts code and theory night classes for new members. Maj. F. J. M. Moses is secretary. NZE is now president of Bloomfield Radio Club and on 14 Mc. SXV is on 7 and 3.5 Mc. GFG revamped his BC-312. CO is making changes for break­through operation. FEAs is DXing on 3.5 Mc. QRE is on all bands, ‘phone and c.w. AQG is on the air again. FDL is on 28-Mc. f.m. PWC, on 7 Mc., works England. NEH has a BC-610. The Hudson Division officials meeting was held in Elizabeth Feb. 11th with Director SOX presiding. Those attending were DSZ, alternate director; NJF, as­stant director; 11N, N. N. J. SEC; KOC, N. Y. C.-L. I. SOM; SCM; GMN, N. N. J. SEC; KOC, N. Y. C. - L. L. BCM; and PRT, secretary to SOX. Traffic: W2LFR 249, LTP 156, CGG 150, MLW 124, ANW 109, CGQ 79, NKD 77, NCY 71, NTY 55, OCG 32, PQG 29, CJX 24, APL 22, IIN 21, BZJ 19, GVZ 9, HZY 6, LX 5, BRC 3, ANG 1, TZ. John.

MIDWEST DIVISION

IOWA — SCM, Leslie L. Vennard, W6PRR — 8VF is having fun on 144 Mc. and wants more activity on that band. SIE has a new 8-35 receiver and is working DX on 7 Mc. NMA renewed his EC appointment. The recent storm showed the need for more ECs; so SCP has consented to act. He sure carried on in fine style during the emergency. 8MFX had a fire in his ham shack and is rebuilding. TWFX reports with messages from Iowa 76 Net. The Nash-A-Boyer-Amateur Radio Club meets the third Thursday of each month. Contact sNNXW for information on the meeting place. G3X is a member of the Old Timers Club. D/PB sends Official Bulletins on Tuesday afternoons at 14 Mc. Tues., Wed., and Fri. at 12:30 p.m. PFI is

(Continued on page 89)
SANGAMO PAPER TUBULAR CAPACITORS

ARE NOW MOLDED IN PLASTIC

...just like micas!

Paper Tubular Capacitors, molded in Thermo-Setting Plastic! Designed for use in all circuits calling for Paper Tubulars. Plastic Molding means no leakage. Capacity values remain more stable and moisture is completely sealed out. No wax to run at higher ambient temperatures. Smooth finish prevents catching dirt and dust. All in all, Plastic Molding assures longer life and lower power factor. Specify Sangoamo Plastic Molded Capacitors wherever you use Paper Tubulars.

...try these tests

WITH SANGAMO PLASTIC TUBULARS . . . .

WRITE NOW for the New Sangoamo Capacitor Catalog for full information on the Sangoamo Line.

NO WAX TO MELT....even heat as intense as is encountered in soldering, will not cause leakage in the case or at the lead joint.

LEADS WILL NOT PULL OUT....Plastic Molding so tightly seals the leads in place, that under all conditions of normal use, leads will stay put.

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BRAND NEW EQUIPMENT NEVER USED BEFORE

NATIONAL HRO-W RECEIVER

Brand new, first quality HRO receivers, packed in their original, never opened cases — ready for immediate delivery! Built for the U.S. Signal Corps, these military type sets incorporate all the extra safety factors demanded by global service — give you superb plus features for extraordinary performance. The 110 A.C. power supply allows fixed station operation; the 6 V D.C. supply permits operation in an automobile without the use of extra batteries.

Warning — quantities are limited. While they last, we’ll ship the same day we receive your order. Act today!

HERE’S YOUR OPPORTUNITY to make a real saving on a COMPLETE RADIO STATION for regular or emergency service

* FIXED STATION * PORTABLE * MOBILE * MARINE

It’s the U.S. Navy Model TCS-12 Radio Telephone and Telegraph Transmitting and Receiving Equipment — built by COLLINS and now offered — brand new — in its original, unopened, export packing — at an astoundingly low price.

This is an ideal communications equipment for municipalities, utilities, airports, and commercial users — it’s complete and furnished with enough spare parts for a lifetime of normal maintenance; 203-page manual gives detailed data, photographs, diagrams, and instructions for operation and service.

The Complete Equipment Includes

#52245 7-tube Radio Transmitter —
25 watt telegraph; 10 watt phone; band switching 1.5—3—6—12 Mc; provision for 4 crystal controlled frequencies or continuous coverage with VFO; very stable and easy handling.

#46159 7-tube Radio Receiver
3-band superheterodyne using either crystal or master oscillator control; 6 milliwatts output at 15 microvolts input; ample selectivity and low distortion.

#20211 115-volt 60 cycle Power Unit
with two, full-wave vacuum tube rectifiers for plate supply and a dry-disc rectifier for filament supply in transmitter and receiver.

#23270 Remote Control Unit
for both transmitter and receiver; includes loud speaker, phone jack, and output selector switch.

Accessories
Antenna loading coil; telegraph key; microphones; and all necessary cables and plugs for interconnecting the various units.

Spare Parts
The spare parts chest includes over 200 items of transformers, capacitors, relays, resistors, switches, cables, plugs, insulators, etc.

Every part of this equipment is painstakingly and sturdily built to withstand the severest possible service. It’s a heavy-duty, professional equipment of the highest quality. Price — as described $350.
**BC-348 RECEIVER**

Acclaimed the best military receiver for amateur use, this easy-handling set covers six band-switched ranges from 200 kc. to 18 mc (less BC band), with constant sensitivity on all bands. Has Xtal filter, AVC, MVC, BFO, automatic noise compensator, temperature-compensated oscillator; output at 300 or 4000 ohms; vernier tuning on all bands. Furnished with built-in dynamotor, full set of tubes, and details of conversion to 110v. a-c. Complete a-c conversion kit for BC-348 ......................................................... $6.50

**XMTG CAPACITORS**

Nationally known, high-voltage, oil xmtg capacitors, all in rectangular cases, with stand-off insulators.

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<td>10</td>
<td>1000</td>
<td>4</td>
<td>4000</td>
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**SCR-522 VHF XMTR-RCVR**

for all-purpose work at 100-156 MC

$39.95

Used as standard equipment on all AAF and RAF planes, this set is now yours at but a small fraction of its original cost. Ten-tube crystal-controlled superhet has 3-microvolt sensitivity at 10 mw output. 7-tube temperature-stabilized xmt delivers 15 watts. Remote control box gives push-button tuning on four crystal-controlled send-receive channels. Dynamotor (28-volt d-c) powers entire rig. Furnished with all tubes, plugs, and detailed dope on conversion to 110-volt a-c operation. Condition excellent. Weight about 100 lbs.

**AAF XMTR BC-375-E**

For a real bargain, you can't beat these used, but in A-1 shape, BC-375's. Furnished complete with five tubes, seven tuning units covering 200 kc to 12 mc (less BC band); antenna tuning unit BC-306-A with variometer and tap switch, dynamotor PE-73-C with relay, fuse, and filter. For detailed description of this 200-pound bargain, see our Feb. QST adv.

**FREQUENCY STANDARD BC-221**

This stable, heterodyne frequency meter checks up to 5th harmonic on most receivers and up to the 125th on the better ones. Fundamental ranges are 125-250 and 2000-4000 kc; stability is better than .005%; instrument works on 110 v.a.c., on vibrapack, or on batteries. Use it for a signal generator or make it into a VFO that's a humdinger. Complete with tubes, original crystal and calibration charts. Excellent condition. Order today!

**PE-103 DYNAMOTOR** New Lot, only $9.00

Brand new, in original Signal Corps packing; delivers 160 mils at 500 volts; operates from 6 or 12 volts d-c; complete shock-mounted assembly includes breakers, switches, relays, filters, and cables.

<table>
<thead>
<tr>
<th>TUBES</th>
<th>BUYS in TUBES</th>
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<tbody>
<tr>
<td>572A</td>
<td>$2.25</td>
</tr>
<tr>
<td>607 West'facs</td>
<td>$1.65</td>
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<tr>
<td>811</td>
<td>$1.95</td>
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<tr>
<td>818</td>
<td>$2.45</td>
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<tr>
<td>304-TH Elmac</td>
<td>$2.95</td>
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<tr>
<td>304-TH Elmac</td>
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<tr>
<td>814</td>
<td>$4.50</td>
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<tr>
<td>810</td>
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<td>2AP1</td>
<td>$1.88</td>
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Hammerlund HG-129X and speaker .............. 178.45
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National HRG-STA1 and HRG-STA2 .......... 106.71
National NC-46 and speaker ......................... 107.40
National CRU Scope .................................. 39.90
National 1-10A with tubes, coils and power supply .............................. 90.53
Piel KS-1 (complete with speaker) ............... 376.30
Panoramic panadapter complete ................... 99.73
RME-45 complete ....................................... 198.70
RME-84 complete ....................................... 98.70
Tecum 75GA transmitters ............................ 495.00
Miller 9000 power supply ............................ 37.50
Miller 90281 power supply ........................... 84.50
Gordon Roto Mount ................................... 225.00

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working DX on 14 Mc. His best contact to date is Z22G. KZ1 got in on the emergency work Jan. 29-31 and Feb. 1 and had his rig on most of the time. NMA proved that it pays to have a portable. In fact he had two rigs running in different towns. CPU handled traffic fast. One illness message made it a round trip in ten minutes. The Sioux City Amateur Radio Club has applied for affiliation with ARLRL.

Traffic: W6PF 37, EFI 10, GKS 9, TWX 4, 73, Les.

KANSAS — SCM, Alvin B. Guruh, W6AWP — PAH, our SEC reports there will be a number of new equipment points shortly. RED, EC for Wichita and Sedgwick Counties, held a test mobilization on Feb. 7th in which at least twenty amateurs took part. New AEC members: RED, PRL, MX, LFB, OKN, CVN, IKB, WBR, GCM, HUK, MAR, HCU, LES, UNQ, ZKA, RVM, UUS, JBO, ZV, OKZ, and QCQ are on 3.85-, 14-, and 28-Mc. 'phone.


MISSOURI — SCM, Mrs. Lotha A. Dangorfeld. WOBUD — GCL completed new 14 Mc. 'phone rig — first QSL was from Grand Island about his 3rd harmonic. RAQ and QIN, in Advance, just received tickets and ROB and RPF, from WQXQ, have new Columbia antennas. VM3 is suffering from malaria kept DEA off the air. ARRL’s only DX was T12FU on 14-Mc. 'phone. He has a daily schedule with Iowa 3.85-Me. traffic net, has remodeled the rig, and enjoyed the ARRL Party. EYM could find no QPS on 3.85 Mc. In the CD Party, KIK spent six hours in CD Party with little luck and less power — signal is louder since last rebuilding. QXO, NC8 for MON, tops traffic report, ZVS, alternate NC8, is second and is organizing St. Louis gang into traffic net. WIS has Class A 6L6 rig until BC-610 gets going. At Haskell REB, PGL, LFB, OZN, CVN, IKB, WBR, GCM, HUK, MAR, HCU, LES, UNQ, ZKA, RVM, UUS, JBO, ZV, OKZ, and QCQ are on 3.85-, 14-, and 28-Mc. 'phone.

QXO, NC8 for MON, tops traffic report, ZVS, alternate NC8, is second and is organizing St. Louis gang into traffic net. The North Platte Club holds monthly ARRL Party. ZIS has found no Ops on 3.85 Mc. Short Winded Club. BTC and JAP of Nebraska, are regulars on MON. OUD moved the rig into the house where it was in a soft 812; DDX is experimenting with 144-Mc. beam at 8 P.M. each Tuesday; CXB is building 28- and 14-Mc. beam for ARA; ZJB keeps schedule with Kansas on 50 Mo. ground wave; MRX, INI, and RKM are full members of 3.85-Mc. Short Winded Club. BTC and JAP of Kansas City FCC office are regulars on MON. OUD moved the rig into the house where it is warm and has key clicks in b.c. set. She is on MON nights. Thanks for SWR report.

(CoContinued from page 85)
LIKE many thousands of other veteran hams, Al Adair, Radio Station W8MNJ, prefers and uses an Astatic D-104 Microphone because "the frequency response provides tone brilliance for voice communication." Mr. Adair, with almost fourteen years of short wave communications experience, continues, "The power consuming low frequencies below 500 cycles are attenuated and the response above 4000 cycles is reduced. The attenuation of the lower frequencies makes it possible to maintain a higher percentage of modulation at voice frequencies without affecting intelligibility. "By limiting the response to 4000 cycles, a total band width occupied by the modulated carrier will be 4000 x 2 or 8 Kilocycles (4000 either side of the carrier), providing, of course, that the maximum modulation capability of the transmitter is not being exceeded. "Since the band of frequencies available for phone communication is limited and since the frequencies taken up by the transmitter which is modulated with frequencies above 4000 cycles is quite wide, it is desirable to limit the response of the speech equipment. The result is less interference to adjacent stations."
MEETINGS OF THE CLUBS

NEW ENGLAND DIVISION

CONNECUT -- SCM, Edmund R. Freiser, W1KQY
APA, using T-55 final, expects to follow with a 320TH
or p.p. 810s. KXY and LEP are active on 28 and 114 Mc.
EWF is active in Nutmeg, ENY, "C," and "TO" Nets.
ZL schedules G81UR Saturdays on 3.5 Mc. and also has
worked KCGGR, ZC1AN, ZD4AB, and Z9G. These
schedules 2TB and 2NNK now is WAC with J4AAAC
and UAKJEU QSOs. KKS and MIHF visited JHN and KGY.
Club News: MGX reports new officers of NAR Aare: MRP,
prez.; MGX, vice-pres.; PEA, secy.; and Blore, treas.
PQU is a new ham in Norwalk, NDS is making Field Day prepa-
ations. NARL: DXT reports club meet nets Sundays on
3585 kc. Classes in code and theory are being organized to
supplement code practice transmissions now being
sent out by non-licensed members. NHR: ATH reports code and
theory classes directed by AMM are very popular. The club
has a new HQ-129X receiver, as has Lohse and NWG. WCS
is building p.p. 818 final. KAT headed the DX list at the
club, followed by MVH and EUG. KQX has a pleasant home
QSO with OHTBO on 14 Mc. using break-in at both ends.
MVH completed VFO and exciter. NWG is on 14 Mc. with
p.p. 812s. FMV has club rig on 3.5, 7, 14, and
28 Mc. using p.p. 8128. FMV has club rig on 3.5, 7, 14,
and 28 Mc. using p.p. 8128. FMV has club rig on 3.5, 7, 14,
and 28 Mc. using p.p. 8128. FMV has club rig on 3.5, 7, 14,
and 28 Mc. using p.p. 8128. FMV has club rig on 3.5, 7, 14,
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and 28 Mc. using p.p. 8128. FMV has club rig on 3.5, 7, 14,
and 28 Mc. using p.p. 8128. FMV has club rig on 3.5, 7, 14,
NOW you can get Sylvania quality in TRANSMITTING tubes too!

SYLVANIA INTRODUCES THE TYPE 3D24 BEAM POWER TETRODE WITH ELECTRONIC GRAPHITE ANODE

First of Sylvania's new line of transmitting tubes, the 3D24 is a four-electrode amplifier and oscillator with 45 watt anode dissipation. An outstanding development is the electronic graphite anode, which allows high plate dissipation for small area and maintains constant interelectrode relationship and uniform anode characteristics.

The 3D24 may be used at full input up to 125 Mc—maximum permissible frequency will be announced later upon completion of tests.

OTHER FEATURES INCLUDE:

1. Top cap providing for short path, greater cooling by radiation and convection, resulting in a cooler seal.
2. Thoriated tungsten filament, giving high power output per watt of filament power.
3. Vertical bar grids. #1 grid supplied with two leads for better high frequency performance. #2 grid provided with heat-reflecting shield for greater dissipation, low grid-plate capacity.
4. Low interelectrode capacity. No neutralizing needed with proper circuit arrangement.
5. Hard glass envelope. Permits high power for small size.
6. Lock-In base. Short leads, no welded or soldered joints.

The 3D24, a product of the Electronics Division of Sylvania Electric, has interesting potentialities in amateur, police, mobile and marine radio.

MECHANICAL SPECIFICATIONS

- Type of cooling: Air—radiation and convection
- Mounting position: Vertical, base down or up
- Length overall: 4.3 inches max.
- Seated height: 3.769 inches
- Diameter: 1½ inches
- Net weight: 1.3 ounces

ELECTRICAL CHARACTERISTICS

- Filament Voltage: 6.3 volts
- Filament Current: 3.0 amperes
- Amplification Factor: 50
- Direct Interelectrode Capacitances:
  - Grid-Plate: 0.2 µf max.
  - Input: 6.5 µf
  - Output: 2.4 µf
- Maximum Class "C" Power Input: 180 watts C.C.S.

Direct inquiries to Radio Tube Division, Emporium, Pa.

SYLVANIA Electric

MAKERS OF ELECTRONIC DEVICES; RADIO TUBES; CATHODE RAY TUBES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS
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SCIENCE

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CML MODEL 1210
PORTABLE TYPE

The same engineering skill that produces CML precision equipment for science and industry is now working on a number of new devices designed to fill specific amateur needs.

As you read this we are in production on a series of broad-band converters for 2, 6, and 10 meter operation. The 10 meter converter is especially useful with military receivers and will give improved performance with all standard communication receivers. The 2 and 6 meter converters will enable you to explore the interesting possibilities of these bands at very low cost. Look for complete details in our advertisement next month.

Bullets describing the Model 1210 Stroboscope and other CML equipment will be sent to amateurs in industry who have requested our publication. Contact our office for a copy.

COMMUNICATION MEASUREMENTS LABORATORY INC.

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ALSiMag

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SOLD ONLY TO MANUFACTURERS

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CHATTANOOGA 5, TENNESSEE
46th YEAR OF CERAMIC LEADERSHIP
You've waited a long time for the neat little instrument pictured above. We are deeply appreciative of your understanding consideration in waiting for us to finally get material to manufacture it. That day is here. Your favorite jobber has received substantial allotments. He ought to have one for you right now, but we're not too fast; our 'ATOM-X' transmitters and receivers are positive about that, for orders seem to come in just a little faster than we expected.

We hope next month to be able to announce that our little instrument 'ATOM-X' transmitters and receivers are in production, too.

Send postcard for catalog of new measuring equipment, communication receivers, transmitters, kit, parts. See them at your favorite jobber.

Model 903 Wavemeter $3.30
Plug-in Inductors .65 each

Specify: #100 for 1.6-3.7 mcs; #101 for 3.5-8 mcs; #102 for 8-19 mcs; #103 for 17-40 mcs; #104 for 40-100 mcs; #105 for 100-300 mcs; #106 for 400-500 mcs.

We hope next month to be able to announce that 'ATOM-X' transmitters and receivers are in production, too.
TEMCO TRANSMITTERS are top notch DX performers and here are the important reasons why. Every amateur knows that power input does not govern the DX capabilities of a transmitter... power output is the determining factor. That's why Temco stresses engineering for higher circuit efficiency — to assure maximum power output for every power input rating — and every Temco is conservatively rated.

Frequency flexibility is another reason, for, every Temco features a VFO with crystal-like stability always enabling you to find a spot for a QSO no matter how congested the bands may be. And the distinctive, clear-cut, clickless keying of a Temco assures a fine signal for the CW operators.

Add to this, strength and stability of the carrier... freedom from hum and spurious radiations... complete absence of splashing and you have additional reasons why Temco Transmitters pull in the DX everytime you tune over the band.

Let these reasons be your reasons for selecting a Temco and then settle down to a lifetime of "fine business" and R-9 pluses.
are on 144 Mc. A1K is on 29 and 4 Mc. Nampa; IYQ has new SX-42 and VH6F182. JFYU finally hooked V68AO. Other
29-Mc. DX: W6VIB/C7 China, J9AAI, and W6NZ/MM, off coast of Texas. Caldwell; EVY has ready but a new antenna.
New Western SCMs are planning a round table at 6 p.m. MST on 4 Mc. every 40 Nite. All reports appreciated.
(Continued from page 98}
(Continued on page 101)

PACIFIC DIVISION

HAWAII—SCM, John F. Souza, jr., KII6EL-DD
has finally worked J9AAK, Okinawa, on 50 Mc. for a
record haul. Bill used 500 watts to p.p. Vt-127A, S-36 con-
verter into Super-Pro and 8JK twin-three rotary 45 ft. up.
He also worked W6VDB/K5R for five successive days with
VDB confirming on 28 Mc. W7AGS/KHS also worked
J9AAK on 50 Mc. with AR and DW listening in. DW is
looking for DX on 50 Mc. DB has FH home-built e.o.o.
K6CGK is knocking DX with 5 watts to e.o.o. and is
sated to think of losing G6E for new K68. The Maui
gang is building 50-Mc. crystal-controlled net. DK
is heard on 7 and 3.5 Mc. SXD is on with exciter while
building new 28-Mc. rig. KHO and KNH are new Havre hams. JFQ and GCC are on
28 Mc. GSV is back in Big Sandy. FGZ attended radio
meeting in Spokane. Thanks for all the FB reports, guys.
OREGON—SCM, Raleigh A. Munkres, W7HAZ—
Congratulations to the Portland Amateur Radio Club on its
affiliation with ARL! The PARC is all set to go on future
contests and get-togethers. KJE, Milwaukie, is on the air
and really working out with 12 watts! HBO reports an ac-
bune at LaGrande: CNH is on 7 Mc., IMM and JGI are
on 28 Mc. and change beams are in. W7I is working
JOD is building a beam. ARZ lives in a swimming pool!
SCM gave exam to old-time ham, Tom Hughes, of Starkey.
Tom has RME-69
and a BC-625A. Traffic: W7TJY 26, CX 17. 73.

SCM, Carroll Short, jr., W7TVZ, RM: PST, SEC: JU,
EC: TJY, OPP, KEP, OBS: JUO. OES: TJL. JYS has
VT-127A final with Sonar n.f.m. on 28 Mc. JN2 is on 28 Mc.
with folded dipole in the attic which works plenty DX. TJY
is handling lots of traffic via Mission Trail Net. Those at-
(Continued on page 108)
More and more the boys with "know how" on crowded phone bands are saying: "I've learned to stay put. No more of this gypsy business for me." Take 10 meters for example! On weekends trapesing up and down the band just doesn't do the trick. Usually a move puts you in a worse spot than before. Smart 10 meter operators are using three or four PRs for spot frequencies—low end, middle, medium high and near the top. Try it for a month! See if your luck doesn't improve—on 10, 20 or 75! For accuracy, stability, low drift and high output use PR Precision Crystals. Unconditionally guaranteed. Your EXACT FREQUENCY (integral kilocycle) WITHIN AMATEUR BANDS, AT NO EXTRA COST! See your Jobber. — Petersen Radio Company, Inc., 2800 West Broadway, Council Bluffs, Iowa. (Telephone 2760.)
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HERE'S A New Line OF D-C CAPACITORS

BETTER IN "CuVies" FOR HAVING WON THEIR SERVICE STRIPES

It's an open secret among the trade that G-E Pyranol capacitors, which enjoyed such an enviable reputation before the war, are now better than ever.

The reason for this is obvious. Some pretty tough demands had to be satisfied during the war. The strict quality control methods, new manufacturing techniques, and improved materials, instituted at that time, have produced outstanding results which General Electric has now incorporated in a new line of Pyranol capacitors designed to meet commercial requirements.

This new listing makes available a wider range of sizes, ratings, and mounting arrangements with characteristics for operation over wider temperature ranges (−55° C to +85° C), at altitudes up to 7500 ft. These G-E *Pyranol-treated fixed paper dielectric capacitors range in size and shape from bath-tub and small rectangular case styles to large, welded steel case designs. Capacity ratings from .01 muf to 100 muf, and voltage ratings from 100 to 100,000 volts are listed. The high dielectric strength and stable characteristics of the special Pyranol-impregnated Kraft paper are hermetically sealed into these noninflammable units, thus assuring long life.

*Pyranol is General Electric's nonflammable liquid dielectric for capacitors.

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Apparatus Department, Sec. A407-102
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Gentlemen: Kindly send me further information on "Fixed Paper Dielectric Capacitors for D-c Applications”.

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Organization......................................
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City................................................State..........................

103
Bilmore, other actual field reports of amateurs using the equipment have the pleasure to operate. It's amazing the way QRM has been active on 28-Mc., c.w., except when trying out the QSK modulation on 28-Mc. phone. OXE has been trying out narrow-band f.m. with fine results. He had 100 per cent contact with G4AJ. RBQ has been active on 28, 14.7, and 3.5 Mc. The RM informs us that the CCN and SFN Nets are about ready to go. Anyone interested in net work please contact RBQ. PEEF is on 28-Mc. phone and c.w. with big rig. VQV and WCD have new mobile rigs on 420 Mc. using p.p. C40 modulated oscillator and go. QST says they are all set to try for record again. SRT now has new 28-Mc. phone portable rig and is working out fine. The San Francisco Radio Club monthly meeting in January brought out a good number who were favored with a very fine talk by Robert Helliwell well from the Stanford Electrical Dept. on ``The Ionomphere and Its Effect on High-Frequency DX.''

Read What Another Amateur Says About The WRL Globe Trotter Kit

from J. M. Reagan, Del Rio, Texas - "... and am proud to say it's the best little transmitter I have ever had the pleasure to operate. It's amazing the way it handles QRM. I wouldn't take double the price I paid for it." Many other actual field reports of amateurs using the Globe Trotter testify to its excellent performance. It's the hottest ham equipment on the market today. The WRL Globe Trotter is capable of 40 watts input on C.W., and 25 watts input on phone on all bands from 1500 KC through 28 Megacycles. Incorporates the Triton Oscillator using a 40 meter Xtal; Heising choke modulation; three bands, all pre-tuned; 10, 20, and 40 meters; two power supplies. Immediate Delivery - 40 Watt input. Cat. No. 70-310. $69.95 Complete including all parts, chassis panel streamlined cabinets, less tubes, coils, and meter. No. 70-312 name as above, wired by our engineers. $79.50 1 Set Coils, Meter, Tubing. $15.15 Extra

Our stocks of radio and electronic equipment are growing rapidly. We now have many items that have been scarce for years. Write for our latest Flyer or write us your needs. We are the only "personal service" radio parts mail order house in the country. For faster service order from WRL. - Leo W6GPQ.

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is working out fine with his small rig and new beam antenna on 28-Mc. 'phone, having handed traffic to the East Coast and the Orient. YDG built the "Longfellow" from July QST. He operates on 7 Mc. and is well pleased with results. RBQ has been active on 14-Mc., c.w., except when trying out the QSK modulation on 28-Mc. phone. OXE has been trying out narrow-band f.m. with fine results. He had 100 per cent contact with G4AJ. RBQ has been active on 28, 14.7, and 3.5 Mc. The RM informs us that the CCN and SFN Nets are about ready to go. Anyone interested in net work please contact RBQ. PEEF is on 28-Mc. phone and c.w. with big rig. VQV and WCD have new mobile rigs on 420 Mc. using p.p. C40 modulated oscillator and go. QST says they are all set to try for record again. SRT now has new 28-Mc. phone portable rig and is working out fine. The San Francisco Radio Club monthly meeting in January brought out a good number who were favored with a very fine talk by Robert Helliwell well from the Stanford Electrical Dept. on "The Ionomphere and Its Effect on High-Frequency DX." Mr. Helliwell has charge of the Research Dept. on Ionomphere Data. The SFNS Amateur Radio Club is growing rapidly and has moved into new club rooms at 933 De Haro Street.

NORTH CAROLINA--SCM, W. J. Wortman, W4CYB--Thanks to GMM and DCW for the items sent in. NY is burning up 28 Mc. with a pair of 4-125s. G4V is active in Chapel Hill. BJV is a nightly additit to 3.85 and 14 Mc. GMM won't leave 28-Mc. 'phone. US has fired a new rig up on 28 and 14 Mc. GJX gets fine results with a single 812 on 14-Mc. 'phone and c.w., 125 watts to an Anphonol folded diode. FDV is chiving the 14l on 7-Mc. c.w. and says the Floating Club meeting is set for the third Sunday in May at Raleigh. LBV states that he is a new ham in Raleigh. WMJ and HVZ are running tests on 144 Mc. in addition to regular SSB schedules. RSJ is building a 28-Mc. phone. Anyone interested in 50 Mc.? Contact HVZ or WMJ in Charleston. Rajah's rig is now 28-Mc. but it won't work. The newly-organized Fayetteville/Fla. Bragg Radio Club held a hamfest on Mar. 16th.

SOUTH CAROLINA--SCM, Ted Ferguson, WDQBE/
How often have you wished for a meter you could see clearly—the whole scale of it, wherever you were using it—in the dark, under low lights, or even in the kind of glare that causes reflections on the glass—a really illuminated meter for your transmitter? Well, here it is—the result of a new Simpson patented method of illumination.

On these new Simpson Illuminated Meters (A.C. and D.C. voltmeters; D.C. milliammeters; and Radio Frequency ammeters), every fraction of the dial face is flooded with a full and even radiance—there isn't a spot of shadow.

An ingeniously shaped Lucite cone carries the light from a recessed bulb in the back of the instrument through the front edge that surrounds the entire dial. This makes possible the use of the standard Simpson metal dial. Unlike translucent dials, it cannot fade or discolor so that reading becomes difficult. It cannot warp or buckle, causing the pointer to stick, or distorting readings. The bulb recess is neoprene sealed.

Behind this refinement to the basic reason for preferring Simpson instruments—their in-built accuracy. That high quality which is the indispensable component of every Simpson instrument makes sure that the accuracy will stay there, year after year.

ASK YOUR JOBBER

3" Rectangular Case. Width, 3"; height, 3-1/8". Mounts in round hole. Body diam. 2-3/4".

THE NEW SIMPSON MODEL 240
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1946 version of the first self-contained pocket portable instrument built expressly to check high voltage and component parts of transmitters and receivers.

Ranges: 0-15, 150, 750, 3000 A.C. volts; 0-15, 75, 300, 750, 3000 D.C. volts; 0-15, 75, 300, 750 D.C. milliamperes; 0-3000 ohms (center scale 30); 0-300,000 ohms (center scale 3000); 1000 ohms per volt A.C. and D.C.
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Here's a new name in over-the-counter and mail-order service on communication and electronic equipment—with new stocks and facilities. EMI is owned and operated by men who have grown up in amateur and professional radio—service-minded old timers.

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(Continued from page 104)

ANG — Thanks to C2A for dope on Charleston Club. New officers are BIZ, pres.; CZA, secy.-treas.; and BAT, publicity. AZT is occupied with 3.85-Mc. S.C. phone club. FNT (J9ACT) reports a nice lot of East Coast stations. B58 lays claim to having made the first contact between U.S. A. and Germany, having worked D4ACH Jan. 17. 1946. FNS is running the 2.5-Mc. o.w. S.O. Net and worked England on 3.5 Mc. with ten watts. GTD has a new Meissner 150-B transmitter. GEP, HSM, and GTW are on 28-Mc. phone. FNS reports on the Greenville Club. Officers are RXZ, pres.; ERF, vice-pres.; FME, secy.; and KEC, treas. The SCM appreciated the club's vote of confidence. GBY has a brand-new YL. The following Greenville hams are on 28-Mc. phone: A15, CBF, HEY, KEM, KEC, KED, IMW, ETC, ERO, GBY, HCE, LEQ, and ELY. EGO is on 3.5-Mc. c.w. and is building a modulator for his rig. EMT works 28- and 14-Mc. cw. WA and KGX report new jr. operators. BZX has a new vertical. CXO is kept busy with the P.D. of Rock Hill. DFN has a new final with 813s. Traffic: WACZA 40, FNS 26, AZT 23, TZ, Ted.

VIRGINIA — SCM, Walter R. Bullington, W4JKH — JFV has a new HQ-129X receiver and a pair of 812s on 28 Mc. KAR has a kw. on all bands and a new high-power 144-Mc. rig. JTFE has 150 watts on 7 Mc. IUFW has an 817 on 3.55-Mc. phone and is using a vertical antenna. JHI has an 803 on 7 Mc. and a 616 on 28 Mc. KQB has an 807 on 7 Mc. PTL is using a pair of 803s on 3.55-Mc. phone. JDT is working 8-85-, 14-, and 28-Mc. phone with 900 watts to a pair of 813s. K6DC has a BC-345 receiver and a BC-349 receiver. JGO has an 807 on 7 Mc. and is building a pair of 813s for 28 Mc. KHE is on 7, 28, and 144 Mc. JGW has a.p.p. 6L6 on 7 Mc. KFW is using a 200A on 7 Mc. and can't get used to his new call. ISA is on 7 Mc. and is building a rig with p.p. 813s for 28 Mc. JQF has left the section. JHI is on a new rig with 813s on 7 Mc. and is building a 28-Mc. rig with p.p. 813s. JQX is doing some 9000-Mc. work with JHI. BUR has a new call. He is doing some 9000-Mc. work with JHI. BUR has a new call.

WEST VIRGINIA— SCM, Donald B. Morris, WB3M — The Charleston Amateur Radio Club is sponsoring a Club Contest for the best 50- and 144-Mc. rigs and TDJ is looking for 50-Mc. contacts from Morgantown. YAI has new BC-348 and 807 rig ready for 3.5 Mc. BTL has a new 7-Mc. rig with p.p. 813s for 28 Mc. KHE is on 7, 28, and 144 Mc. rig with p.p. 813s for 28 Mc. JQF has left the section. JHI is on a new rig with 813s on 7 Mc. and is building a 28-Mc. rig with p.p. 813s. JQX is doing some 9000-Mc. work with JHI. BUR has a new call.

(Continued on page 108)
Speer Graphite Anodes
ADD BIG FEATURES
To UNITED Tubes

Almost Unbelievable!
Only 8 Watts Drive for
1/2 K.W. Phone Input with
NEW UNITED GRAPHITE TRIODES
(says United Electronics Company)

Power like this is only one of the reasons why tube users are getting more and more enthusiastic about graphite anode transmitting tubes. This and other equally remarkable advantages are constantly winning new friends and convincing old ones for United Electronics Company. Using Speer Graphite Anodes, United puts these big advantages in every tube:

LONGER LIFE—Graphite anode tubes last longer than metallic anode tubes even under continued severe usage, because they operate at lower temperatures. Cooler operation means less heating of associated tube parts—reduced grid emission.

GREATER STABILITY AT HIGH INPUTS—From 200 to 300% more input power than metal anode tubes of the same plate area is the capacity of tubes with Speer Graphite Anodes. High radiation emissivity and conductivity of graphite make these higher ratings possible.

LOW FREQUENCY-DRIFT—Cool-operating, non-warping graphite anodes maintain their characteristics—assure stability of tube inter-electrode capacitances—inhibit warping in other tube elements. The result: high stability of frequency.

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110 V. A.C. Operation
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4799 Sheridan Road, Chicago, Illinois

(Continued from page 100)
his Colorado Springs emergency net is not all ready to go and drills will start soon. J.V. in Pueblo, is installing a 60° vertical radiator for 14 Mc. WAP, in Loveland, has a reliable schedule with ZBM on 2720 kc. A nine-kw. station is being operated by someone on 28 and 7 Mc. for QSP to Pacific Islands. BZV, in Akron, Colo., is on 14-Mc. phone and has 90 watts to 3/4 and a folded dipole. DX is J2AAAT, COSMP, 2QX, DX7AW, 6V27Z, KLV, E772ZI, and 20 states and Mexico and Canada. U2D is on with a 150B rig in Akron. H1HM in Pasion is on 50 Mc. with 34-kw. and will have a kw. on 7 Mc. very soon. He will operate from the top of the Continental Divide this summer and would like a 60-Mc. schedule with Denver now. On Monday nights you can find 38-Mc. mobile rigs parked on the mountains around Denver for the Electron Club Emergency Net drill. Results are very good. DD, in the Park, is working the boys in Denver on 20 Mc. ground wave at night! All amateurs should send a station activity report to the SCM on the 1st of each month. If you need cards let me know. Traffic: WBWAP 57, BZV 41, KQF 3, 73, Glen.

Utah-Wyoming—SCM, Victor Drabble, W7LLE—DTC needs a few more parts to build his 50-Mc. rig. DLR has a 19-tube receiver 144 and 220 Mc. GBB is busy on the Pioneer and Farm Neta. K1X worked 41 states and 5 VE districts with 5 watts in 3 weeks on the 3.5-Mc. cw. band. BED will change his 40-watt job for a new 500-watt job with a pair of 813 s in p.p. The following was submitted by HDS: 3L1T17 is building a 28-Mc. rotary using pitch control for electrics. B-29 parts on the drive units. OXH is on 7 Mc. CEO will have a pair of 812s for 700 watts into a half-wave doublet on 3.85-Mc., phone. KGD is one of our u.h.f. boys. KIM is active on 14-Mc. cw. with 28 watts to an 807. JET has his 812 all ready to fire up on all bands. JHE uses a pair of 807s on the 14-Mc. cw. band. EVH is now an OPS. IC5A has a BC-348P and an ART/13 perking on 28-Mc. 2PDZ/7 is on 14-Mc. phone with 300 watts to a pair of 813s. EZU has 125 watts on all bands with a 6FU e.c. 6AF4 doubler, 6F6 buffer-doubler, and 529 filter. Additional calls on the Wyoming 3700-ko. net are: TCI, H1HM, and AEC. New appointments: BED as ORS. Traf.

Southwestern Division
Alabama—SCM, Lawrence J. Smyth, WA4GBV—The Birmingham Amateur Radio Club is again active. DEO is pres.; EBZ, vice-pres.; GMH, rec. secy.; HRT, treas.; and FIO, corr. secy. Meetings are held the first and third Thursdays of the month. Regular meetings are held at the National Guard Armory where the club will be allowed to use the National Guard equipment. Code practice will be sent on 28 Mc. each night. ECK worked California with 16-watt portable. CVY is receiving reports for working a G station with 6 watts. GXC worked ZS2CI on 28300 kc. GMH got caught by ZS2CI for a QSO on 7 Mc. SFZP/4 worked VQ7TOM on 28 Mc. DEO has been working Georgia regularly on 28 Mc. GMH bought a code machine and has his XYL interested. BCU is still a regular on 3.85-Mc. phone. IRX is working on new rig with pair 100THs in the final. GVP has a pair 10s on 14 Mc. and is keeping schedule with EZ1AB. GKM is on 7 Mc. with 20 watts and is building 28-Mc. phone rig. GYD is on 14 and 7 Mc. with a new 300-watt rig and getting his share of DX. BA is building a new rig with 100THs final 24G buffs. 806 modulator. GBP is on 3.85 Mc. and 7 Mc. cw. with 8 watts.

Eastern Florida—SCM, Robert B. Murphy, WA4PB—The main topic of the day is the hamfest sponsored by the West Palm Beach Club, to be held June 13th. ACZ will give you a hand in getting lined up for this. ACZ now is SEC of this section. FWZ is his able assistant and is lining up the c.w. net for the section with the able assistance of JU. BNK is doing a good job of organizing the Tampa gang and it looks like we may have a nice c.w. net going at last. ECV is busy with new rig with pair of SIs on 14 Mc. and is keeping schedule with EZ1AB. GKM is on 7 Mc. with 20 watts and is building 28-Mc. phone rig. GYD is on 14 and 7 Mc. with a new 300-watt rig and getting his share of DX. BA is building a new rig with 100THs final 24G buffs. 806 modulator. GBP is on 3.85 Mc. and 7 Mc. cw. with 8 watts.
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<th>Type</th>
<th>Filament Volts</th>
<th>Plate Amps</th>
<th>Max. Plate Disipation</th>
<th>Ccpp</th>
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<td>300 Watts</td>
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WESTERN FLORIDA -- SCM, Lt. Comdr. Edward J. Collins, W4MWS - JPA is on 28 Mc. with a converted ART-13. BJB is ironing out his 813. DXZ, HJA, and BCC received Class A tickets. SJXM now is GPC. KFP has two-element beam. KQ is on 28 Mc. J2Z is rebuilding 7-Mc. rig. EQR is building bigger and better 50-Mc. rigs. HIZ is a crystal-control on 144 Mc. MS is converting an SCR222 to go with his VHF132. DAO also has a VHF132. KIR has his three-element beam up. GQN schedules Gs. KAG is working on a three-element beam for 14 Mc. KXV has a reconed antenna farm but plans additional antennas. DI8 is getting higher power ready. DXQ is returning to 7 Mc. FHQ keeps 7 Mc. going but is looking at 28 Mc. AXF keeps the Rebel Net moving. ACB has a new tower up. JMJ keeps things humming with his mobile rig. BCC is looking at 144 Mc. Traffic: W4AXP 22, 73.

GEORGIA - SCM, Thomas M. Moss, W4HYW

The Cartersville Amateur Radio Society has been formed at Cartersville with GQR, pres.; GEG, treas., and Bob Schindel, secy. Meetings are held on alternating Fridays. The club station, GQK, is being reactivated. The boys at LaGrange have formed their Airways Amateur Radio Club with GMP, pres.; and KVO, secy.-treas. The club will cooperate in emergency work with HYN, EC for Troup. Atlanta Radio Club meetings are held at 8 p.m. the first Thursday at Specialty Distributing Co. GEG is at Georgia Tech. JPF is in the wholesale business in Atlanta. 3GA and 3GE are with CAA in Atlanta. BTI is with Atlanta wholesale house, 88YW now is 4UF. 2PAF is 4KTG, and 3UO is 4UR. The Cracker Waves Net is on 3835-ke. G4F is in service business in Atlanta. He is for G4W2 and holds OBS, OPS and ORS appointments to this section. BTI is for Cobb. VF took the appointment for Floyd and DYE for Stephens. Ultra-high work is being reported from Cartersville, Waycross, Atlanta, Augusta, and Savannah. HD is on sea. Additions to Cracker Emergency Net are: GDR, GKI, HRR. GMP is with WSB. BOF is on in Atlanta. 3PAF is 4KTG, and 3UO is 4UR. The Uracker Waves Net is continuing. Your monthly traffic reports are solicited. Traffic: W4KV 34, HYW 26, GZF 7, MA 5, 73, Tom.

WEST INDIES - SCM, E. W. Mayer, KP4KD - AM had the big rig down for refurbishing and used BE rig at AM QTH. No DX was worked but some DX was handled. BE worked four Gs and two OZs with some R9 reports on 28 Mc. 'phone, BK, our 00, and CF were transferred to North Carolina with GAA. BJ had his tonsils out, further delaying return to activity. W4DQ/KP4 and W4BTE/KP4 are on 14 Mc. e.w. and 28 Mc. 'phone, respectively. W4CA/KP4 now is K4DVM on 14 Mc. 'phone. AZ is active on 'phone and e.w. with new Temco rig. CC, CA, CG, CP, CV, CO, and KD are active on 7 Mc. 'phone, as well as other bands. JX has new 20/10 rotary beam & a Jan. QST working FB. He operates at WAPA where RQ is chief. Lots of cards at the QSL Manager's but very few envelopes. Traffic: W4QCM 39, KP4KD 13, AM 7, 73, 8.

SOUTHWESTERN DIVISION

ARIZONA - SCM, Gladden Elliott, W7MML - 'TOQ has a new call, KNY, for Tucson. KOA has a Mock-T60 on at Thatcher. JMJ works the West Coast regularly on 2 watts. K1F is on 3.5- and 7-Mc. e.w. with new Temco rig. CC, CA, CG, CP, CV, CO, and KD are active on 7 Mc. 'phone, as well as other bands. JX has new 20/10 rotary beam & a Jan. QST working FB. He operates at WAPA where RQ is chief. Lots of cards at the QSL Manager's but very few envelopes. Traffic: WY4CM 46, KP4KD 13, AM 7, 73, 8.

Continued on page 118)
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WEST GULF DIVISION

NORTHERN TEXAS --- SCM, N. G. Settle, WA6AD --- Asst. SCM, J. Bonnett, 6IL, SEC: QA, PAM: ECE. RM: CDU, BSY, at sea, is on 29,200 kc, CHG, Amarillo Club, elected BFA, pres.; Pauline Benselinck, secy-treas.; HVF, reporter. LMQ has a pair of 814 tubes and 6LQ has been elected a new SCM. HT-9. IAN is on 14 Mc. IZW and JAD are on a trip. IWK has a new 129X. BFA has a new Panadapter. HVF, LGW, and JDZ is back on at Terrell.

SOM George Bird, W5HGC. I would like very much to hear from all appointed stations in this section since this former BC-522. The Dallas Amateur Radio elected FDI, pres.; JFD, vice-pres.; KJK, secy-treas.; MA, finances; EI, technical; CUV, vigilance; DAS, program; IQT, entertainment; GOB, sergeant at arms. LFW is back on at Terrell.

Traffic: W5HCH 87, LSN 77, CDJ 39, JVD 27, ASA 18, SIO 18, BYX 11, ECE 11, LOS 3, CZZ 2, DAS 2, Skippy.

OKLAHOMA --- SCM, Bert Beidner, W6WXT --- Asst. SCM George Bird, W6HGO. I would like very much to hear from all appointed stations in this section since this office has no record of any previous appointments. Only three stations have been reporting regularly, AQE, EBC, and IOC. Please get in your reports and help your SCM. OCARC elected officers with JHO, pres.; AXM, secy. Officers: AVM, 144 Mc. KAD, 28 Mc. LQQ, 40 Mc. QZQ, 28 Mc. PHJ divides his activities between 144 Mc. and 28 Mc. "Sidewinders" is a list of hams working for Braniff International Airways: EDW, HMH, KVS, KWL, LBU, HQS, LSP, JNK, K1W, LMQ, JNS, IQT, DXR, BVM, CVB, IU, LCT, GKE, LOQ, EER, BI, 18, ESC, LOQ, BI, J9, NXY, BII, LQQ, CII, SEC, 9NX, 73.

(Continued from page 110)

38 Mc, in Tucson. KWC is ex-KWO and has a new XO. BSD, KAD, and UPR all boast 40-60 towers and four-element beams in Douglas. MDD has two 3.5-5 Mc, "phone rigs. BMC is the proud parent of a YL. The "Sidewinders" on 3865 kc. are NRI, OAS, MDD, MQW, OIF, QWG, JPY, DEF, LYS, SCK, SBN, LNJ, and JY7 and they operate from 8-10 a.m. on Saturday. Working more, UPY has a new daughter. MLL was high man in the second round of the Arizona QSO Party-Contest which takes place third Sunday each month. Radio Club of Arizona is completing plans for the hamfest in October. Make plans to go.

Traffic: W7MLL 30, TCQ 20, QWG 2.

SAN DIEGO --- SCM, Ralph H. Curberson, W6CGY --- NDF is back on the air. GC participated in the ARRL Frequency Monitoring Test in March. He has a new Automatic 13 transmittcr. BDU/6 is on NW. with about 50 watts to an 807. LUI reports he works occasional DX, including XU6CRL (Don Stewart) in Nanking, VSAF, and KAIJU. M1 sends in nice traffic reports. MKW reports LDI worked GSGO on 3.5 Mc, KRL is rebuilding. YBI is working some FB DX on 3.5 Mc, with Signal Shifter. 144-Mc. Club has been organized in Santa Ana. Active stations on Monday evenings from 7:30 to 8 p.m. are DEY, IUW, MKW, IDF, and VKN. CTP was injured in a traffic accident. BDU/6 gave an FB talk before the Orange County Radio Club on his experiences as translator-missionary among Mixtico Indians south of Mexico City. RWF, TMC, and 8RD are on 144 Mc. This week has HY75 on 144 Mc, and has plans for about 200 watts on the band. HWJ has HY75 on 144 Mc, with 807 going on 50.4 and 51.4 Mc. MKW has deserted 3.85 for 144 Mc. Q0Q is on 28 Mc. PJH divides his activities between 144 Mc. and 28 Mc. "Phone UPJ is moving south to Santa Ana from Trabuco Canyon as soon as new house is finished. LGO and FPQ visited HWJ and MKW in January. VAD is on 50 Mc, at Orange. We regret to report that GMU, of La Habra, was killed in a car accident. The Palomar Radio Club is planning for its birthday party. This is my last report and I want to thank all the fellows for the FB cooperation and hope you will continue to send reports to our new SCM, Irving L. Enlow, W6CGO, 4892 Macale, Douglas Dr., San Diego 4. Come on, fellows, let's give him all the support possible. Traffic: W7NDF 59, MI 22, LUJ 13, LDJ 12, CHY 4, LHN 4, bBDU/6 3. 73. Ralph.
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working 3.5- and 14-Mc. cw. FQV is on 28 Mc. with an 813. EST and DQV are on 3.85-Mc. 'phone. EAK is rebuilding but not off the air. ATX is on 3.5-Mc. cw. at night. HGC has a new tower and beam for 14 Mc. ART is on 3.5-Mc. cw. APG is on 3.5- and 3.9-Mc. cw. and 'phone. If you want more, send me reports before the third of each month.

Traffic: W5GO 75, AGS 3.

SOUTHERN TEXAS -- SCM, James B. Rice, W5IC -- The Rio Grande Valley International Radio Club was recently organized at Brownsville with CX, pros.; FAF, vice-pres.; LVY, secy.; and LSO, act. mgr. They have an active membership of forty including several XE2s from Mexico, HIZ, FTA, FPL, GBT, JCC, and T1 have been transferred from Brownsville to New York by Pan-American Airways. LDD is putting in a lot of flying time and is busy as OBS. The Brownsville Chamber of Commerce has provided QSL cards for all club members. The Corpus Christi Radio Club has adopted a PA8 and is going to set him up with a nice transmitter and receiver. HIF is active OBS. EBA has moved from Corpus to Victoria and LVY, LXA, MB2, and S2V are FG and is getting good results. GMT and FZB have new kw. rig near completion. The Houston Amateur Radio Club has changed meeting quarters to the Chamber of Commerce Building with many new daily members. Amateurs in that area are invited to attend. New officers are: L1, pres.; KLG, secy.; FTA, treas.; and IGS, director at large. Among the attractions offered by HARC are interesting programs, door prizes, and air-conditioned facilities. IGS has given up 'phone operation for c.w. The following Houston stations are active on 144 Mc.: LGE, JYJ, JMI, EAL, BHO, ON, IGS, GLS, HMM, FIA, and KFY. LIP has moved from Houston to California with the Gulf station crew. FJA is building new modulator. IMF is away at school and KLQ is using his 808 rig. BEW is renovating his present kw. LI, BDI, 100, HFO, JNJ, ADZ, and MDZ are active on 28 Mc. FTC is now a 14-Mc. 'phone. HGG has a new OBS appointment. IZ is keeping the San Antonio hams well supplied with parts and just completed a new 813 rig for EYL. LXO and LGG are sporting new un

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<td>805</td>
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<table>
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</tr>
<tr>
<td>RG5FU</td>
<td>73 Ohms</td>
<td>$0.10</td>
</tr>
</tbody>
</table>

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(Continued from page 110)

interested in the ARRL appointments available at present. I need traffic men, phone men, experimenters, etc., and have some Official Observer appointments waiting for the right men. Get in touch with SCM, A. W. Morley, VE4AM, for information..."
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Cincinnati 2, Ohio

Predictions

(Continued from page 36)

month to month will be apparent. Only representative data are given, although the predictions have been confirmed by a large number of observations.

Tables showing predicted "open" periods could be worked out for any station location from these charts, but the charts themselves are much more informative and more easily used. Tables can only define areas generally, and would be quite lengthy if made complete.

Predicting amateur "conditions" in the foregoing manner is, of course, subject to certain limitations just as is the predicting of weather conditions. The recommended method is based upon maximum usable frequency since it is felt that the average amateur wants to know what he might usually work and not what he can be certain of working based on optimum usable frequency. Certain errors may occur because of the world-map projection used, and may also result from the method of drawing great-circle paths on this projection. Additionally, ionosphere storms, warnings of which are sent out by WWV at 20 minutes after and 10 minutes before every hour, may disrupt normal communications. In general, attenuation of signals becomes greater as the difference between maximum usable frequency and operating frequency becomes greater. Each of these factors could result in an amateur not making contact in accordance with the predictions. On the other hand, sunspot peaks (at twenty-seven day intervals), sporadic-E and other factors might permit contacts to be made at times other than those predicted by the foregoing method. In any event, it is believed that a much better picture of amateur "conditions" can be predicted by this method than has heretofore been possible, and if charts are constructed and used as described above, the DX hound will have another handy tool in the radio shack.

2-Meter Transmitter

(Continued from page 36)

Performance

A super signal was not the object of this design. What we wanted, and all anyone can expect, is a signal that won't be objectionable on the air. No oscillator can be both efficient and stable, but this one is a reasonable compromise between the two aims. Actual measured output was about 3.5 watts, with 18 watts input. This sounds low, but is quite respectable at this frequency, in comparison to some oscillators. The familiar lamp load is not to be trusted; this rig gave a fairly bright indication with a 15-watt lamp when the wattmeter registered less than four watts!

More important than the output is the sound of the signal on the air. The carrier has a d.c. note; it can be tuned in with a b.f.o., and though

(Continued on page 128)
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(Continued from page 180)

it fizzes when modulation is applied (indicating f.m.) it does not change its center frequency materially. The modulation appears near the center of the carrier, instead of several hundred kilocycles off to one side, and it is readable on all but the most selective of receivers.

Don’t get us wrong — this little rig is no substitute for crystal control — but if you must use a modulated oscillator, this job will at least give you a readable signal on most receivers. It will occupy a considerably narrower portion of the band than many oscillator rigs now in use, and if you decide to go to MOPA later, the oscillator should make a good driver unit for a Class C amplifier using an 829 or 882. It’s no worker of miracles, but it certainly is a step in the right direction toward a cleaner and more enjoyable 2-meter band.

Atlantic City

(Continued from page 41)

itself. When the short waves first opened up, every service in the country — Government, commercial and amateur — could operate anywhere it wanted to in the short-wave territory, and did, with increasingly chaotic results. The 1924 conference represented an attempt to solve an otherwise impossible situation by means of mutual agreements to be voluntarily respected by all services until the law could come along and catch up. Everybody was perfectly aware that the “regulations” resulting from these agreements were not binding, but everyone knew also that some sort of order was essential in order to continue operating at all.

In many respects, this 1924 Hoover Conference was a modern international radio gathering on a small scale. Every domestic service was present, pushing for all the short-wave territory it could get. The “shorts” were so brand-new that nobody had a clear idea of which waves were good for what; for that reason, everyone was out to get all that could be got, from one end of the scale to the other. Without going into detail (details in past QSTs for those interested) we may say that the outcome of the 1924 meeting was amateur bands as follows: 1500-2000 kc., 3500-4000 kc., 7000-8000 kc., 14,000-16,000 kc., 56,000-64,000 kc.

It was recommended that the Supervisor of Radio decide whether one license would permit the use of all these bands or whether multiple licenses would be necessary (it was later agreed that one would do the trick). Incidentally, it will be noticed that we here embarked on the idea of maintaining a harmonic relationship, so far as possible. The omission of any ten-meter assignment in the table, however, is not accidental; there was no assignment. The reason for this is that the Hoover series did not extend as far as the ten-meter territory. The 5-meter assignment

(Continued on page 184)
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1946, page 23.

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(Continued from page 188)

was incorporated by special request solely because of the fact that a small group of experimenters wished to work there; the same reason applies to a subsequent 400-401-Mc. assignment for beam experiments, made shortly after the conference by the Department of Commerce at the special request of ARRL.

Other bands were assigned to the various other services which wanted space in the spectrum and which, remember, were just as much entitled to it as we were.

Since the 1926 conference did nothing to alter this general set-up we will skip over it and say that during 1924, '25 and '26 we here in the U.S. operated in the 1924 bands. By mutual agreement, of course.

In the meantime, Congress was being bombarded with requests and entreaties for a new law but was still doing nothing about it. How long this might have gone on no one knows had it not been that in 1926 the so-called "breakdown of the law" came about when a broadcast station which didn't like its assignment on the mutual-agreement basis made a test case resulting in a court opinion denying the Secretary of Commerce the authority to compel stations to observe any specified wavelength assignments (outside the very broad limits previously mentioned in the basic law). Overnight, all the existing regulations which specified definite wavelength assignments were rendered inoperative. Any other service that wanted to could have started to operate in "our" bands for instance. It was a tense moment! Would all the radio stations in the country jump their assignments? Well, they could have, but most of them didn't; almost unanimously, the radio world in this country sat tight on its Hoover agreements, one of the most remarkable spectacles radio regulation will probably ever see.

However, this up-set of the 1912 law had the effect of spurring Congress to the realization of the absolute necessity for a new law and so in 1927, the same year when the Washington International Conference was held (but before that affair), Congress passed the Radio Act of 1927 which not only defined amateurs for the first time in any law, foreign or domestic, but set up a Federal Radio Commission to administer radio matters and gave it the necessary authority to make regulations that would stick. As soon as the commission was created, we got it to assign to us the same wave-bands that had been agreed upon at the 1924 Hoover Conference, except that we had a 10-meter band included.

We are now almost through with the story. Discerning readers may at this point ask how we could get the Hoover bands assigned to us under the 1927 U.S. radio law when our Government was a party to (and ratified) the 1927 international treaty which gave us somewhat different territory — specifically, narrower bands at 7 and
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(Continued from page 124)

14 Mc. The answer is that the 1927 U. S. law went into effect before the Washington conference was held and, further, that the terms of the Washington conference did not go into effect until January 1, 1929. Until January 2, 1929, therefore, our Government let the wider-band specifications stand as U. S. law. On January 1, 1929, however, it immediately amended our amateur regulations to conform strictly to the international agreements.

From that time to the opening of the second World War, through both national and international regulations, we retained the bands first set up for amateur use in the Washington International Treaty of 1927.

This concludes a very rapid and rather brief résumé of our amateur progress in terms of legislation. It is, needless to say, impossible in such an article as this to go into detail or to describe adequately the tremendous part played in all amateur matters by the ARRL ever since the League's formation.

In the next issue will appear a brief outline of the steps leading up to an international conference, a description of how such a gathering does business, and a résumé of the preparatory work which has been going on in this country looking to our participation in the Atlantic City Conference which opens in May.

7 Although the U. S. government's proposals for amateurs at the 1927 international conference were for the same bands we were using domestically as a result of the Hoover agreements, practically every other nation was bitterly opposed to amateurs having any appreciable bands—or even any privileges at all in the high-frequency spectrum. The bands we got represented the only compromise our Government could see in the face of an almost unanimous effort on the part of the other governments to bar amateurs from the h.f. spectrum entirely, or permit it only under the most restricted conditions, such as use of dummy antennas, etc.

50 Mc. (Continued from page 53)

the use of c.w. should make it possible to copy many signals which are inaudible on voice. They stress the fact that some mighty nice DX work should be possible, if a few of the more advanced workers would use straight c.w. when the band is open. If strong voice signals can be heard at 400 miles, how much farther could we go on c.w.?

There is a considerable swing to horizontal polarization, but the old polarization arguments still rage. WSUKS, Lakewood, Ohio, who has done very well with horizontal arrays, now has a vertical beam up. With it he has been able to work WSNBV, Erie, Pa., and W2KJF, Westfield, N. Y., 100 and 150 miles respectively, when conditions are favorable. Regular contacts are made with WSQK at Erie on horizontal polarization, however. Sam is aiming at Youngstown and Pittsburgh regularly, but has nothing to show for it to date.

There has been a trend to crystal control in Western New York, according to W2RKO, ex-W8NOR, who lists the following crystal-controlled stations: W2S, QZJ, SIC, PZI, UHI,

(Continued on page 188)
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W1ARP 32 140 2 21
W1BQK 8 42 2 15
W1GY* 24 92 2 25
W1HQQ 27 14 102 6 25
W1KLR 39 134 2 27
W1LIL 17 95 5 28
W1PQJ 35 124 5 28
W1PEQ 53 172 1

W2AMJ — — — 24
W2BQK — — — 18
W2BYM 27 123 7 25
W2CM 14 38 138 3 27
W2QWH 37 41 245 7 27
W2RWO 27 228 3 33
W2ZB 134 930 3 33
W2WQV 22 4 111 4 2 8
W2ZGK 4 18 87 1 2 2
W3HWN 28 239 3 3
W3HYN 19 93 4 3 6
W3MBW 14 70 2 7
W3MMA 35 102 2 7
W3MSB 7 21 118 3 1 10
W3KXZ 23 103 6 6
W4FJ 6 1 47 2 1 2
W4H1Y — — — 15
W4JAZ 17 78 2
W4WGT 49 106 1 2
W4H2Z 54 39 101 1 1 5
W4QX 39 318 3 6
W6WNN 7 6 52 1 3
W7KAD — — — 10
W7QAP — — — 11
W8QOS 7 44 2 2
W8UKS 23 144 3 2
W9AB 2 9 2 6
W9WML 5 4 71 1 1 6
W9WRD 5 59 1 1 1
W9WML 6 26 2 3
W9PK 14 108 9 19
W9WCH 0 62 2
W9WBL 0 62 2
W9WQG — — 22
W9WZB — — 27
W9WDG 10 0 10

* Not eligible for award.

BAG, KHO, and IRU. W2SOK and W2RPO have VFO control, and W2QZB is MOPA. Tests are being run with Toronto stations and the first two-way work was done on Jan. 13th, when W2QAG and W2HNN worked VE3ADO.

A group of 144-Mc. enthusiasts in Erie, Pa., recently conducted an expedition to Dunkirk, N. Y., to attend a meeting of the Dunkirk Amateur Radio Club. They took along two complete crystal-controlled transmitters, several beam antennas, and converted 522 and 1068 receivers. These were set up in the Dunkirk Armory, and contact was established promptly with W2RPO and other stations in the vicinity of Buffalo. The Dunkirk gang were properly impressed, and it is hoped that activity there will pick up in order that the gap between Erie, Westfield, and Buffalo can be more reliably bridged. Any club in that

(Continued from page 150)
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area which is interested in a similar demonstration is invited to write W3LTN, W8NBV, W3QKI, or W3WBM for further information.

The spot-frequency net (147.96 Mc.) in the Boston area is growing. W1CTW reports that upward of 20 stations now have crystals for this frequency. The net operates every Monday, except the first Monday of the month, at 9 p.m. W1CTW worked 22 different crystal-controlled stations during January.

A 144 Club operates on 144.13 in the New York area and includes W2s QUF, FIK, BVD, MYL, MIRG, SMX, SYW, CPD, PIX, DFB, ATK, MPN, CDS, and W1LUC/2. Meetings are held on the air each Wednesday evening at 9:30.

Crystal Control on 235 Mc.? With modern tubes, crystal control and superhet receivers are not much more difficult for 235 Mc than was similar technique on 112 Mc. in prewar years. W1CTW has a crystal-controlled rig on 235 Mc., employing a similar approach to that he described in QST last July, except that 832s are used in the tripler and final stages. W6OVK writes that he, W6NSS, W9OA W/6, and W6WQN now all have crystal rigs and superhet receivers on 235 Mc., and that signals are comparable to those heard on 144 Mc. He has rebroadcast these signals on 144 Mc. to the boys in Sacramento, in the hope of getting some 235-Mc. activity started up there.

Activity on 420 Mc.? In an attempt to promote interest in 420-Mc. work, W2MWH is operating on 425 Mc. each Tuesday evening from 8 to 9 p.m. He uses a corner reflector on a rotating pole-oscillator which is modulated with continuous tone. The system rotates 90 degrees every 15 minutes. He stands by for possible Q8Os after the test period. The signal is S9 at 8 miles, but the outer limit of the range has not been established.

Modernizing the Receiver (Continued from page 88) the mixer or the first-i.f. amplifier tubes. The two 0.1-µfd. cathode by-pass condensers shown are actually there. One goes from the cathode to the ground terminal in the middle of the socket and the other goes from the cathode to the ground terminal of the a.v.c. circuit by-pass at the ground end of the r.f. tank coil.

In the practical operation of the receiver, there is absolutely no comparison. The r.f. trimmers on the high-frequency bands really "trim," being very critical in their adjustment. The gain of the receiver is such that full audio gain cannot be used on the weakest signal even with the i.f. amplifier adjusted in sharpest crystal position. The author feels that he has a new receiver which has cost him less than five dollars.
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25 Years Ago This Month
(Continued from page 68)

Messrs. Warner and Stewart followed Mr. Godley, with the argument that commercial broadcasting be shifted from 300 to 1000 meters to avoid interference from and with us on our rightfully owned waves. As a result of the hearings, we hopefully anticipate that the following recommendations of the Commission will be made by Congress: (1) amateur status should be established; (2) limits of amateur bands should be specifically stated, with allocation of 150 to 275 meters for amateur use; and (3) for the purpose of self-policing there should be amateur deputy radio inspectors, elected by licensed amateurs.

The Nation's Capitol also quaked recently to the doings of Third and Fourth District amateurs, in convention at the Hotel Raleigh. Chas. A. Service, jr., colorfully records the event for this QST. Chief Radio Inspector Terrell, amateur radio's booster of long standing, delivered the opening address. The story of the Second District Convention & Show, held at the Hotel Pennsylvania, New York City, is told this month too. All records for attendance were broken by this 5-day affair, with 40,000 persons, including the general public, attending. Speakers included Paul Godley, J. O. Smith, David Sarnoff, Dr. A. N. Goldsmith, and Chief Radio Inspector Batcheller of the Second District.

M. B. West returns to QST's pages once again, this time with a theoretical discussion on "Improving Antenna Efficiency." Let the "power-factor" sharks feed on this effort and digest and argue its new radiation theories! "Improvements in Multi-Stage Audio Amplifiers," by H. E. Bussey, 4AI, and "The Loop Receiver at 3ZY," by L. M. Dunnam, complete our technical fill.

Of operating interest is the tally of messages delivered to President Harding from state governors during our March relay — 40 at last count! We read more reports on the Transatlanticas, and also of 3Z0's scheduled tests with Venezuela in an attempt at a North-South America contact. The "Chicago Plan" and the bang-up First National Convention of last fall have won for the Chicago Executive Radio Council the Smith Cup award.

P. A. Hill, 4GL, and A. L. Groves, author of many fine QST articles on inductances, are introduced in "Who's Who in Amateur Wireless." Station descriptions that meet, our eye are those of Laurence Mott's 6XAD, Avalon, Calif., 7ZU, Polytechnic, Montana, 9BD, Vancouver, B. C., and 1BGE, Boston. A new powerful broadcast station, WGY, Schenectady, N. Y., is described for the benefit of radiophone listeners.

The lighter side of this issue is once more ably enhanced by S.P.W.; this month it's a parable of a much-married ham and a radio widow. Strays report that station 3XM, Princeton, N. J., has produced in "Who's Who in Amateur Wireless." Station descriptions that meet, our eye are those of Laurence Mott's 6XAD, Avalon, Calif., 7ZU, Polytechnic, Montana, 9BD, Vancouver, B. C., and 1BGE, Boston. A new powerful broadcast station, WGY, Schenectady, N. Y., is described for the benefit of radiophone listeners.

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Foreign Notes

(Continued from page 67)
tervals throughout the spectrum, so that bands of frequencies of varying characteristics will be available for amateur experimentation."

There is a proposal by the Headquarters that the delegation of the Union to the 1947 world telecommunications conference be composed of all representatives named and sent by individual member-societies. It proposes further that George W. Bailey, as president of the Union, be named chairman of the delegation, with Kenneth B. Warner, secretary, as his alternate. It is understood that the Radio Society of Great Britain is to send three amateur representatives.

On nonconference matters, the Union welcome into membership the Vereeniging voor Experimenteel Radio Onderzoek in Nederland, the new, combined amateur society in the Netherlands. Membership is proposed for the Union Belge des Amateurs-Emetteurs, the merger of two amateur societies in Belgium.

The Quad-City Amateur Radio Club, Moline, Ill., will hold a hamfest April 27th at the Farmall Club, south of Moline. The program of games, prizes and equipment demonstrations begins at 10 A.M. Tickets are $1.50 and include an evening lunch. They may be obtained from H. E. Hermann, Moline.

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How's DX?
(Continued from page 68)

San Francisco. Other QTHs are: PK6SEE, Box 76, Maecassar, Celebes, N.E.I.; H73MAF, Max Fiallo, P.A.A., Trujillo City, Dominican Republic; CPIAP, Box 346, La Paz, Bolivia; VPSAM, W. H. Hanaford, No. 1 Arch Green, Stanley, Falkland Islands. All QSLs for Y22AM should go via ARRL. Add to QTH list: CT2WX, 53rd Recon. Sqn., APO 406, c/o PM, N.Y.C.; PZTRM, O. W. Morro, Box 118, Paramaribo, Surinam, D.G.; VP9Q, B. S. Atkinson, Kenrose, 3rd Ave., Cavendish Heights, Bermuda; TI2BF, Paco Bermudez Term., E. San Martin Ave., San Jose, Costa Rica; PA10Y, Box 679, Paramaribo, Surinam, D.G.; ZB1AD, Signals Officer, RAF Station, Luqa, Malta; W7IMW/C7, Det. 44, c/o 1st Marine Division Hdqtrs., FPO, San Francisco, California.

Tidbits:
Suggest that everyone read the “Operating News” item in this issue entitled “Ending Signals.” Several DX stations have complained to us that upon using QLM, QHM, etc., the East Coast ignores the procedure and the QSOs are, in most cases, with W6s and W7s, who seem to know the meaning of these signs. Come on, East Coast, let’s show ’em! A certain W2 complains about the key clicks from a certain W4. To the W2: How about getting rid of that resonant filter using and sharpening up your own signal? Know who? About ten of the gang in the N.Y-N.J. area bought a BC-342 receiver for PA0VD. Upon conversion it was shipped to him, after endless red tape. W5IWY has received a QSL from FFSWN which he did not earn, he says. The QSO supposedly took place on Jan. 1, 1947, 0455-0500 GMT. Anyone interested drop him a line. From a reliable source we find that EP3D is a bootlegger, so don’t look for any cards from Persia for this one.

Staggering
(Continued from page 61)

possible condition at the present time. 'Phone men, who like to listen to other 'phones, could have the benefit of the wide-band transmissions of our neighbors, while the c.w. men would be relieved of this annoyance and would have a better opportunity to observe the eccentricities of some of the weaker DX signals.

The success of the plan hinges, of course, on the ease with which we can get all of the countries of the world to agree to it. From observation of past quick mutual agreements between these countries, the U. N. or any other international group should knock it off like anything! Write your director and congressman immediately, telling of your support of the “staggering band theorem” and all it implies. A convenient blank will be found on page 173 of this issue. Sign it and send it air mail—at once.
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AMPLIFIERS for vertical and horizontal deflection as well as intensity
... Linear time sweep from 4-cycles to 50-kc with blanking of return trace...
... Sensitivity up to 100 mv/in...
... Fidelity up to 350-kc through amplifiers...
... Attenuators for AC and for DC...
... Push-pull amplifiers...
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... Trace expansion for detail observations. Completely stable regarding line voltage fluctuations and manipulations of controls, either internal or external... $99 F. O. B., PHILA.

Chassis completely insulated from input circuits assures safety in industrial applications... Direct connections to deflecting plates and intensity grids from rear...
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... Functional layout of controls.

$8 1/2 lbs..11" x 7" x 5"!

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Dependable Control
WITH THE NEW WILCOX BEAM ROTATOR

- Supports 200 lbs. in high wind. Aluminum castings hold weight to 6 lbs.
- Requires no lubrication and is weather resistant.
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- Readily adapted to rope drive by mounting pulley on 1/4-inch steel drive shaft.
- Only four 1/4-inch bolts required to mount to tower and any beam.
- One-to-one ratio between drive and beam.

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Dependable accuracy plus convenient pocket size make these little instruments most useful and popular to radio and other hobbyists. Self contained standard size batteries supply current for resistance readings. Three models are available in this small size:

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The outstanding value in the test equipment field. D'Arsonval movement. Zero adjustment. Rotary range switch. 1000 Ohms per volt. 0-1/10/50/500/1000 Ohms DC. 0-1/50/100/500/1000 Volts DC. 0-1/10/50/100/500/000 Ohms AC. Also 0-1/10/50/100/500/1000 Ohms AC. 0-1000 Ohms AC. Price only $10.90

Model 451A AC-DC Volt-Ohmmeter with Output Ranges

Model 452A High Sensitivity Volt-Ohmmeter

Volts DC 0-1/10/50/100/500/1000 Volts AC and Output 0-1/10/50/100/500/1000 Ohms AC and Output 2/1000/3000/50,000/500,000 Price only $14.90

Ask your Jobber or write direct for circular

CHICAGO INDUSTRIAL INSTRUMENT CO.
219 West Chicago Avenue
CHICAGO 10, ILLINOIS

HINTS AND KINKS

(Continued from page 61)

units makes it entirely practical for one to be used at the base of the tube requiring the bias. The 813 amplifier in use at this station has a grid circuit as shown in Fig. 3. A small selenium rectifier is used in a half-wave circuit, filtered by C1, C2 and L. Values are dependent, Of course, on the particular application, but for the 813 the values shown below the diagram have worked out very nicely. About 80 volts of fixed bias is always present at the grid of the tube, and the additional few volts required for operating bias are obtained by the series grid leak, R1. In my case, bias increases to about 130 volts when excitation is present, varying, of course, with the amount of grid current flowing at the time.

Since only one side of the a.c. line is tapped, a good earth ground to the transmitter chassis is a requirement, and the power plug should be polarized to assure that the bias lead will always be the hot lead. — R. D. Altheus, W8KGD

Strays

The North Shore Radio Club of Long Island is holding a hamfest on Thursday, April 10th, at Lost Battalion Hall, 93-29 Queens Boulevard, Elmhurst, L. I., N. Y. Speakers, demonstrations and prize awards are scheduled. Program starts at 8 P.M. — tickets $1.50.
"Back in 1938 I bought a Turner Ham Mike, crystal. Up until the beginning of the war, I used the little feller nearly every nite. Then the war came and I put the rig and the mike in moth balls and stored it in the attic. The average temperature in the attic in summer was around 125° and in winter 20° below was not uncommon. Sunday, July 14th, I got the old hay burner back on the air... needed a mike. So I dug out this old mike and plugged it in. I called a CQ and got an answer right away. I asked the fellow how the quality was and he said excellent. Every contact I've had since then gives the same report, "you sure have nice quality, old man."

Signed

Johnny Harrison
W9UEL

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Type 702A • 27 mc to 29.7 mc (10 and 11 meter band) ... $44.95
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Type 702C • 144 mc to 148 mc (2 meter band) .......... 24.50

COMPLETE WITH ADJUSTABLE "T" MATCH @ $6.75 extra
S/C LABS THREE-ELEMENT BEAM, DESIGNED FOR 2, 6 and 10 METER BAND. WEIGHT LESS THAN 15 IBS.

Also in stock a complete line of FM and television antennae. See your local dealer or write for circular

S/C LABORATORIES, INC., DEPT. Q, 20 VAN WAGENEN ST., NEWARK 4, N. J.

CRYSTAL processing kit, including 4 diodes, highly active, "BT" certified. Sale in quantity. Send $2 deposit. Contact us for quantity range; 2 holders, abrasive, insulators, treatment, plus postage. Brochure available.


FOR SALE: One 16B Western Electric A.M. radio transmitter used in good condition with tubes, 20-watt output, $50 to 60 ma. H. E. Eberhardt, 35-20 26 St., Woodhaven, L. I., N. Y.

WANTED: Thordarson plate xfmr T-19P70 or T-191'71. Write for further information. This position cannot be bluffedor faked. Write, giving full details. W9GIL, Lincoln Printing Co.

RF-booster, model 60-25W, $245 or self receiver separately. Fob. Atlanta, Ga., W4KEF, 287 Main Drive, Westhaven, N. Y.

SOLD: Collins, AN/ART-13, Autotune transmitter complete with tubes, microphone, dynamos, cables, $245; 30 volt batteries, $245. W3ZV, 600 South 2nd St., Waverly, N. Y.

WANTED: Radio transmitter assembly expert, ham preferred. Must have complete knowledge wiring, assembly, tubes, circuits, and troubleshooting. 6 weeks to 6 months required. This position could not be bluffedor faked. Write, giving full details about experience. MRG Electronics, Inc., Radio Transmitter Div., Wakefield, R. I.

SPECIALIZING in Hallicrafters receivers and transmitters, Also SURPLUS, Bomber Radio, Pioneer Radio, T. Yappan, WZZAD, Waverly, N. Y. SELL: Commercial to ham catalog every week is talking about. Surplus Radio, Inc., 30 West 40th St., New York, N. Y.

FOR Sale: 200-watt phone and C.W. transmitter, complete, Fair 8042 deal, six-foot relay rock job, $100, Write WHDJQ, John Savoldi, 11 High Court, New Britain, Conn.

EREBO beam rotator. High torque output 1-3 Rpm. Selsey indi. VAC operated, Model 160. Send $17.50 to 25. Write for photos, literature. Dealers' inquiries invited. EREBO, 1101 N. Meade St., Boise, Idaho.

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EREBO beam rotator. High torque output 1-3 Rpm. Selsey indi. VAC operated, Model 160. Send $17.50 to 25. Write for photos, literature. Dealers' inquiries invited. EREBO, 1101 N. Meade St., Boise, Idaho.

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The No. 92101—Antenna Matching Preamplifier

The Millen 92101 is an electronic impedance matching device and a broad-band preamplifier combined into a single unit, designed primarily for operation on 6 and 10 meters. Coils for 30 meter band also available. This unit is the result of combined engineering efforts on the part of General Electric Company and the James Millen Manufacturing Company. The original model was described in G. E. Hem News, November-December, 1946. The No. 92101 is extremely compact, the case measuring only 6 1/2 x 5 1/2 x 1 7/8. The hand winding inductor unit plugs into the opening in the front of the panel. Plug is provided for easy power requirements for the 6AK5 tube from the receiver. Coaxial connectors are furnished for the antenna and receiver connections.
BEING a ham, you've often wished for a portable receiver. The RME 84 was engineered with this in mind and is equipped with a special socket connection on the rear of the chassis apron making possible connections to either a B battery and an A battery supply or a similar source of power such as an external vibrapack.

Because of its modern octal tubes, the RME 84 will operate at full power on 135 volts of B and 6 volts of A battery. Drain on the B battery is only 22 milliamperes at 135 volts and the 6 volt A battery provides 1.5 amps, including the two dial lights. Disconnecting the dial lights reduces the A battery drain to but 1.2 amps.

For those many field days, for mobile use or for home use, this modestly priced, 8-tube communications receiver is an outstanding value because of its high quality, precision construction.

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Self Contained Shock Mounted 5” PM Speaker
Four tuning ranges .54 to 44 MC
One Presselector Stage
Smooth Vernier Tuning Control
Bandspread, positively geared to main tuning control for accurate logging—no backlash!
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Beat Frequency Oscillator—continuously variable by panel control
Headphone Jack
Antenna Input Terminals, provision for doublet or single wire
Eight tube superheterodyne circuit

Write for Illustrated Folder
The Collins 310B Exciter puts

Versatility and Precision into your rig

The 310B is the answer to many requests for a multi-band exciter utilizing the Collins 70E-8 P.T.O. (Permeability Tuned Oscillator). Conservatively rated at 15 watts output on all amateur bands up to 30 mc, it will drive a kilowatt pentode final on phone or cw. It provides accuracy and stability of \( \frac{3}{2} \) kc on 80 meters, and precision control on all bands.

The bandswitching buffer stages are ganged, condenser tuned, and permeability trimmed. All trimmers are adjusted from the top of the chassis. In the M. O. Test position the plate voltage is removed from the output tube; thus the exciter can be tuned while you listen to a received signal. The power switch can be interconnected with other equipment so that one switch controls the entire transmitter.

The 2E26 output tube has protective bias for keying purposes. Clean keying is accomplished in the cathode of the first 6AG7. Metering is provided for the 2E26 grid and plate currents. Output coupling is by means of a link on the plate tank coil.

Enjoy the many advantages of this new exciter. Use it also in your 6 meter and 2 meter rigs. The 310B makes multi-band operation a pleasure. Write now for full details and the name of your nearest dealer.
Hams around the world have been National's collaborators in creating the NC-173—ready now after five years of intensive research. Here are some of the advantages this 13-tube superheterodyne receiver offers:

- The NC-173’s newly designed adjustable threshold double diode noise limiter—working on both phone and CW—has an extremely high limiting efficiency because of the short recovery time.
- Voltage regulated circuits give the NC-173 high stability and less drift for changes in powerline voltage. The pitch of code characters barely changes—even over extended listening periods.
- The S-meter circuit allows signal strength recordings to be taken on either phone or code.
- Works equally well on coaxial feed-line, single-wire, directional or balanced antenna.
- AC powered. Will also operate on battery for portable or emergency use—110/120 or 220/240 volts, 50/60 cycle. Frequency range .54 to 31 and 48 to 56 MC. (Includes calibrated band spread on 5, 10, 11, 20, 40 and 80 meters).
- Ask your dealer to let you see and hear the new moderate-priced NC-173.
RCA-807's are still tops in watts-per-dollar value. They will operate without neutralization and they provide high efficiency at low plate voltage.

1. Two RCA-807's push-pull in ICAS Class C telegraph service can deliver 100 watts RF output with 750 volts on their plates.

2. Two RCA-807's push-pull in ICAS Class C telephony service can deliver 85 watts RF output with 600 volts on their plates.

3. Two RCA-807's push-pull in ICAS Class B modulator service can deliver 120 watts audio output with 750 volts on their plates.

4. Two RCA-807's push-pull in RF service can be driven by an inexpensive receiving type tube, such as the 6V6, used as a doubler.

5. Two RCA-807's push-pull will take full input and operate at high plate-circuit efficiency at frequencies up to 60 Mc.

For the complete story, see the next issue of Ham Tips. It's available at your local RCA Tube Distributor or from RCA, Commercial Engineering Department, Sec. M-54D, Harrison, New Jersey.

THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA