It is very likely that your city or community is giving consideration to the matter of installing new police radio facilities. High frequency radio is an old story to you but frequently it is a new one to the "city dads." Possibly, because of your experience, you will be asked to discuss the subject with them. If so, you may want to mention the name "Collins" as a synonym for performance and high-quality equipment. We make this suggestion, not with the intention of asking a favor, but in the hope and belief that you will want to recommend Collins Police Radio in the interest of your community.

Collins equipment is now being used extensively in state, county and city police radio systems all over the country. New transmitters of advanced design with powers of 50 to 1000 watts output for medium and ultra-high frequencies are in production. The new Collins uhf patrol car transmitter is of particular interest as are also the new Autotune multi-frequency transmitters for inter-zone police telegraph networks. Every Collins police installation in service has contributed to an unequalled reputation for coverage and dependability.

*A bulletin describing the 50S, 50 watt Medium High Frequency Police Transmitter (illustrated above) will be sent on request.*
The S-17 SUPER SKYRIDER
Proved by Popularity

Operating Range — 625kc to 345kc
2 Stages of Pre-Selection
Built-In Automatic Noise Limiter

Amateur Radio Operators have conclusively demonstrated their preference for the S-17 Super Skyrider in the past months. Almost without announcement this model appeared in the Hallearafters Line, to be greeted with enthusiastic acceptance by amateurs everywhere. Quickly it assumed its place as the most popular receiver of the famous Hallearafters Line.

And no wonder — the S-17 offers complete coverage from 5 to 550 meters. Two stages of pre-selection, a Dickert Built-In Noise Limiter, 1000° Electrical Band Spread — every electrical and mechanical feature the amateur could want — all available at an extremely modest price for so much real receiver value. See the S-17 Super Skyrider at your dealer's today! Operate it. Compare the value!

3: 350 Meters Continuous Coverage
2 Stages Pre-Selection
Built-In Automatic Noise Limiter
15 Tubes
Wide Range Variable Selectivity

1000° Electrical Band Spread
6 Bands
25° Meter
Better than 1 microvolt average Sensitivity on all bands

All Hallearafters Receivers available on Liberal Time Payments

the hallearafters inc.
2611 Indiana Ave., Chicago, U. S. A.
Cable Address: HALLICRAFT, Chicago

Now at
$125.50
LESS SPEAKER AND CRYSTAL
The New HT-4

a hallicrafters transmitter

325 Watts Phone - 450 Watts CW

In the development of this new transmitter unit in the Hallicrafters Transmitter Line, this organization followed the same policies formulated when the first Hallicrafters Transmitter was designed.

There was no blind pursuit of tradition, the problem was approached from a fresh viewpoint with the principles of functional design ever in mind.

The result is the Model HT-4, a distinct departure from customary design, yet meeting every requirement for a transmitter of its capacity, with a new and amazing simplicity of operation and compactness in design. It is conservatively rated at 325 Watts Phone Output—450 Watts CW Output—the equivalent of the ordinary 300 Watt Phone Input Transmitter in performance.

Every detail of its construction has been closely scrutinized for dependability, all components are generously oversized, the entire transmitter is built in the "commercial" style for the utmost reliability in operation. Ask your Hallicrafters Dealer about the Model HT-4 or write for complete specifications and description.

SPECIFICATIONS

CARRIER POWER OUTPUT—325 WATTS PHONE,
450 WATTS CW
FREQUENCY RANGE—ANY 3 CRYSTAL CONTROLLED FREQUENCIES IN THE 10 to 100 METER AMATEUR BANDS
TUBES—1—6F6 Oscillator, 1—6L6 Doubler, 2—RB22 Drivers, 1—RA65—Class C Amplifier, 2—RB22—Class B Modulators; 1—RA85—Audio Drivers, 2—366 Receivers, 2—325 Rectifiers.
R. F. SECTION—Quickly set up for any three operating frequencies.
Antenna connection to tapped pick-up coil on final tank coil.
METERS—Filament Voltage, Excitation Plate Current, Grid Current, Amplifier Plate Current, Modulator Plate Current.
CONTROLS—Filament Power, Tune-Operate Switches, Plate Power, Filament Rheostat, Bias Adjustments, Band Switch, Amplifier Tuning.
Cabinet—"CONSOLE" Type. Heavy steel construction, finished in black and chrome.
The Contents

Editorials ........................................ 9
A Visit to W1AW ............................... F. E. Handy, W1BDI 10
A Low-Cost Single-Signal Receiver .......... George Grammer, W1DF 14
Next Month — National Convention Story ..... 18
Amateurs Aid Hughes on World Flight ......... 19
W21XY and VR6AY Receive Public Service Certificates 20
Massachusetts State Convention .............. 20
Building Television Receivers With Standard Cathode-Ray Tubes .......... J. B. Sherman 21
What the League Is Doing ..................... 26
A Six-Band Kilowatt Transmitter ............. J. E. Jennings, W6EI 28
Characteristics of Sky-Wave Transmission .... Harner Selvidge, W9BOE 32

Refinements in Combination Exciters ......... T. M. Ferrill, Jr., W1LJI 36
Radio Control of Powered Models .............. Clinton B. DeSoto, W1CBD 42
Some Thoughts on Rotary Beam Antennas .... Arthur H. Lyneb, W2DKJ 45
What, No Meters? ........................... Fred Sutter, W8QBW—QDK 49
Midwest Division Convention ................. 50
Silent Keys ..................................... 50
Army-Amateur Radio System Activities ...... 51
How Would You Do It? Crystal Oscillator Keying Systems 52
A Compact 100-Watt Transmitter ............ Thomas Sue Chow, W6MVK 54
Low Z for Linearity ............................ M. A. Brown, W6ABF and J. N. A. Hawkins, W6AAR 57
56-Mc. DX Tests .............................. 59
Hints and Kinks ................................ 60
I.A.R.U. News .................................. 63
Navy Day Receiving Competition ............. 64
Correspondence Department ................. 73
A.R.R.L. QSL Bureau ......................... 102
Standard Frequency Transmissions .......... 106
New Data on Direction of Wave Propagation . 109
Hamads ......................................... 123
QST’s Index to Advertisers .................... 126
TO PURCHASERS OF NECESSARY TAYLOR TUBES

FOR THIS 275 WATT DUAL RF UNIT DE LUXE ALL-BAND TRANSMITTER

To quickly establish the popularity of this most modern transmitter, we are making available, through your distributor, free of all charges, the four 13" x 17" x 3" sturdy metal chassis, used in this rig, with all socket and other large holes already punched. (Holes ¼" and smaller are not drilled.)

- THIS TRANSMITTER is NEW — DIFFERENT — BETTER. 275 WATTS INPUT ON ALL BANDS — 5 to 160 METERS. TZ-40's in Push-pull in the final amplifiers modulated by TZ-40's in Class B.

- PEAK COMPRESSIONS CONTROL BUILT-IN. (Thordarson New Amateur Speech Amplifier No. T-17K20M or equivalent is recommended.)

- TWO SEPARATE RF UNITS one for 5-10-20 Meters — the other for 40-80-160 Meters — each complete from Crystal Oscillator to P. P. Final.

- ALL POWER SUPPLIES, Meters, Modulator and Antenna equipment common to both RF units — thus making possible a new low price standard. The flip of one toggle switch gives instant use of either of two selected bands such as 75 and 20, 160 and 10, 20 and 5, etc. Acclaimed the "Hit of the Chicago Convention." Get full information in the

NEW 1938-1939 TAYLOR TUBES MANUAL AND CATALOG NOW READY

All new circuits—New Technical Data—including complete building information on the De Luxe Dual Unit Rig shown here and on other brand new transmitter circuits. You liked the last Taylor Manual — THIS IS BETTER THAN EVER — AND IT’S YOURS FOR THE ASKING — at your distributors or write direct to us.

Say You Saw It in QST — It Identifies You and Helps QST
During the past two years, hundreds of amateurs have asked for a Taylor Beam tube for their Oscillator and other low-powered stages—many expressed this desire so they could be "100% Taylor Tube equipped." Taylor now presents a Beam Tube that lives up fully to the Taylor Tubes' slogan "More Watts per Dollar." Tests prove a better than average output in all R F services. The usual broad Taylor guarantee protects you — insist on Taylor T-21 for best performance. Write for complete technical bulletin.

BEAM-TETRODE, POWER AMPLIFIER
6 PRONG ISOLANTITE BASE

Max. Plate Dissipation .......................... 21 watts
Max. Screen Dissipation .......................... 3.5 watts
Heater Voltage ........................................ 6.3 volts
Heater Current ........................................... 0.9 amp.
Grid to Plate Capacity .......................... 1.4 mmf.
Output Capacity .................................... 11.5 mmf.
Input Capacity ...................................... 11.5 mmf.
Max. Plate Voltage ................................. 400 volts
Mutual Conductance ............................. 6000 ohms
Amp. Factor ............................................. 135
Max. Plate Current ................................ 95 m.a.
Max. Screen Current ................................ 8 m.a.

NEW! 872A $12.00
Taylor Tubes announces a New type 872A — different and better. Tried and proven in actual Broadcast station use. Plate anode and shield of Speer Processed Carbon. A performance test will thoroughly prove the superiority of Taylor 872A's. Write for technical bulletin.
Section Communications Managers of the A.R.R.L. Communications Department

All appointments in the League's field organization are made by the proper S.C.M., elected by members in each Section. Mail your S.C.M. (on the 16th of each month) a postal covering your radio activities for the previous 30 days. Tell him your DX, plans for experimenting, results in phone and traffic, He is interested, whether you are an A.R.R.L. member or other appointments he can tell you about them, too.

<table>
<thead>
<tr>
<th>Eastern Pennsylvania</th>
<th>ATLANTIC DIVISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>W3QOP</td>
<td>John Buck Morgan</td>
</tr>
<tr>
<td>Illinois</td>
<td>EDGAR L. HUDSON</td>
</tr>
<tr>
<td>W9QG</td>
<td>247 K. Atlantic Ave.</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>W9VCE</td>
</tr>
<tr>
<td>W8OFQ</td>
<td>Kendall Speer, Jr.</td>
</tr>
<tr>
<td>Wyoming</td>
<td>BLUE BELL</td>
</tr>
<tr>
<td>W8MN</td>
<td>Edgerton, Delaware</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Audubon</td>
</tr>
<tr>
<td>W8YD</td>
<td>Teane</td>
</tr>
<tr>
<td>Ohio</td>
<td>LOWER</td>
</tr>
<tr>
<td>South Dakota</td>
<td>CENTRAL DIVISION</td>
</tr>
<tr>
<td>W9ZWA</td>
<td>Eddleyn Farm</td>
</tr>
<tr>
<td>Arkansas</td>
<td>W9JQ</td>
</tr>
<tr>
<td>South Dakota</td>
<td>R. P. D. 3</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Miller L. Bender</td>
</tr>
<tr>
<td>W3AIH</td>
<td>608 N. Huron Ave.</td>
</tr>
<tr>
<td>Missouri</td>
<td>DAKOTA DIVISION</td>
</tr>
<tr>
<td>W9GJZ</td>
<td>Box 202</td>
</tr>
<tr>
<td>Texas</td>
<td>H. E. Voie</td>
</tr>
<tr>
<td>W9UP</td>
<td>4415 West 12th St.</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Eugene H. Treadaway</td>
</tr>
<tr>
<td>W9YIQ</td>
<td>2749 Myrtle St.</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>Rob Hoff &amp; Smith</td>
</tr>
<tr>
<td>W4DEP</td>
<td>673 Hillcrest St.</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Robert B. Height</td>
</tr>
<tr>
<td>N. Y. C. &amp; Long Island</td>
<td>511 South State St.</td>
</tr>
<tr>
<td>W6LY</td>
<td>Fred C. Read</td>
</tr>
<tr>
<td>New Jersey</td>
<td>1014 North Ave.</td>
</tr>
<tr>
<td>W9MN</td>
<td>MIDWEST DIVISION</td>
</tr>
<tr>
<td>Iowa</td>
<td>815 Dunham St.</td>
</tr>
<tr>
<td>W9ARE</td>
<td>Burlington</td>
</tr>
<tr>
<td>Kansas</td>
<td>404 Miami St.</td>
</tr>
<tr>
<td>W9PR</td>
<td>Halawa</td>
</tr>
<tr>
<td>Missouri</td>
<td>1012 W. 3rd St.</td>
</tr>
<tr>
<td>W9CQ</td>
<td>Joplin</td>
</tr>
<tr>
<td>Nebraska</td>
<td>4 Green St.</td>
</tr>
<tr>
<td>W9FAF</td>
<td>Clark</td>
</tr>
<tr>
<td>Connecticut</td>
<td>NEW ENGLAND DIVISION</td>
</tr>
<tr>
<td>W1CITI</td>
<td>Frederick Ellis, Jr.</td>
</tr>
<tr>
<td>Maine</td>
<td>Wildfield A. Ramesdale</td>
</tr>
<tr>
<td>W1FRJ</td>
<td>1185 Washington Ave.</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>Jean Grove</td>
</tr>
<tr>
<td>W1WIC</td>
<td>520 Massachusetts Ave.</td>
</tr>
<tr>
<td>Western Massachusetts</td>
<td>W1A9H</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>1160 W. Brookfield</td>
</tr>
<tr>
<td>New Hampshire</td>
<td>Carl B. Evans</td>
</tr>
<tr>
<td>W1BFT</td>
<td>80 E. State St.</td>
</tr>
<tr>
<td>Idaho</td>
<td>Crawford C. Gordon</td>
</tr>
<tr>
<td>W1HSE</td>
<td>192 Washington St.</td>
</tr>
<tr>
<td>Nevada</td>
<td>Alvin H. Batson</td>
</tr>
<tr>
<td>Washington</td>
<td>101 Central St.</td>
</tr>
<tr>
<td>W7ENA</td>
<td>Alice E. Hustler</td>
</tr>
<tr>
<td>Idaho</td>
<td>Customhouse</td>
</tr>
<tr>
<td>W7ETM</td>
<td>LeRoy B. Casterman</td>
</tr>
<tr>
<td>Montana</td>
<td>Carl Engelberger</td>
</tr>
<tr>
<td>W7FL</td>
<td>Route 2</td>
</tr>
<tr>
<td>Oregon</td>
<td>O. A. Watson</td>
</tr>
<tr>
<td>W7FNO</td>
<td>Holter Dam</td>
</tr>
<tr>
<td>Washington</td>
<td>1545 M. E. 48th Ave.</td>
</tr>
<tr>
<td>W7FUG</td>
<td>W. Beale</td>
</tr>
<tr>
<td>Colorado</td>
<td>R. 8, School Ave.</td>
</tr>
<tr>
<td>W9FA</td>
<td>PACIFIC DIVISION</td>
</tr>
<tr>
<td>Utah-Wyoming</td>
<td>Harold C. Smith</td>
</tr>
<tr>
<td>W7CGL</td>
<td>P. 0. Box 150</td>
</tr>
<tr>
<td>Alabama</td>
<td>Edward W. Heim</td>
</tr>
<tr>
<td>W4DGS</td>
<td>509 Claremont St.</td>
</tr>
<tr>
<td>Eastern Florida</td>
<td>Robert A. Maganis</td>
</tr>
<tr>
<td>W4DYO</td>
<td>455 Washington St.</td>
</tr>
<tr>
<td>Western Florida</td>
<td>Harold J. Burchfeld</td>
</tr>
<tr>
<td>W4AXP</td>
<td>9240 106th Ave.</td>
</tr>
<tr>
<td>W4PM</td>
<td>J. L. C. Buckingham</td>
</tr>
<tr>
<td>Portico-Antilles</td>
<td>George L. Rickard</td>
</tr>
<tr>
<td>W9A4</td>
<td>Box 849</td>
</tr>
<tr>
<td>W9E6</td>
<td>2720 22nd St.</td>
</tr>
<tr>
<td>Colorado</td>
<td>Angelo V. Astone</td>
</tr>
<tr>
<td>W7QF</td>
<td>729 Safford</td>
</tr>
<tr>
<td>Utah-Wyoming</td>
<td>ROCKY MOUNTAIN DIVISION</td>
</tr>
<tr>
<td>W7CGL</td>
<td>Glen Glasscock</td>
</tr>
<tr>
<td>Alabama</td>
<td>2164 So. Corona St.</td>
</tr>
<tr>
<td>W4DGS</td>
<td>Salt Creek Electric Plant</td>
</tr>
<tr>
<td>South Carolina</td>
<td>SOUTHERN DIVISION</td>
</tr>
<tr>
<td>W4DYO</td>
<td>SOUTHWESTERN DIVISION</td>
</tr>
<tr>
<td>Virginia</td>
<td>SOUTHEASTERN DIVISION</td>
</tr>
<tr>
<td>W4AXP</td>
<td>SOUTHWESTERN DIVISION</td>
</tr>
<tr>
<td>North Carolina</td>
<td>Los Angeles</td>
</tr>
<tr>
<td>W4B1</td>
<td>Phoenix</td>
</tr>
<tr>
<td>South Carolina</td>
<td>Western Electric Company</td>
</tr>
<tr>
<td>W4BA</td>
<td>Howard K. Brandt</td>
</tr>
<tr>
<td>Virginia</td>
<td>W2B1A</td>
</tr>
<tr>
<td>W4J2</td>
<td>Tutorial Program</td>
</tr>
<tr>
<td>West Virginia</td>
<td>W2H9D</td>
</tr>
<tr>
<td>Colorado</td>
<td>1002 Narrow Lane Rd.</td>
</tr>
<tr>
<td>W9FA</td>
<td>Audubon</td>
</tr>
<tr>
<td>Utah-Wyoming</td>
<td>San Diego</td>
</tr>
<tr>
<td>W7CGL</td>
<td>790 Farmington St.</td>
</tr>
<tr>
<td>Arizona</td>
<td>747 E. Polk St.</td>
</tr>
<tr>
<td>W6MC</td>
<td>Los Angeles</td>
</tr>
<tr>
<td>California</td>
<td>Champion</td>
</tr>
<tr>
<td>W6KFC</td>
<td>2023 E. 3rd Ave.</td>
</tr>
<tr>
<td>San Diego</td>
<td>204 E. 2nd Ave.</td>
</tr>
<tr>
<td>W6REM</td>
<td>281 W. Riverside Drive</td>
</tr>
<tr>
<td>California</td>
<td>OAKtober Lagoon</td>
</tr>
<tr>
<td>W5DLY</td>
<td>San Jacinto</td>
</tr>
<tr>
<td>Colorado</td>
<td>206 W. Riverside Drive</td>
</tr>
<tr>
<td>W6XJ</td>
<td>Jacksonville</td>
</tr>
<tr>
<td>Nashville</td>
<td>2101 N. 4th St.</td>
</tr>
<tr>
<td>W9SK</td>
<td>203 N. 2nd St.</td>
</tr>
<tr>
<td>New Mexico</td>
<td>202 E. 1st Ave.</td>
</tr>
<tr>
<td>W3GJ</td>
<td>Davenport</td>
</tr>
<tr>
<td>Nevada</td>
<td>LEVI D. COWLESS</td>
</tr>
<tr>
<td>W6QE</td>
<td>212 S. E. 1st Ave.</td>
</tr>
<tr>
<td>Eastern Texas</td>
<td>SCOTT B. ROBY</td>
</tr>
<tr>
<td>W6W2</td>
<td>Edgerton, Delaware</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>1111 S. 2nd St.</td>
</tr>
<tr>
<td>W6WY</td>
<td>Audubon</td>
</tr>
<tr>
<td>Kansas</td>
<td>LEVI C. COWLESS</td>
</tr>
<tr>
<td>W6XH</td>
<td>1011 S. 6th St.</td>
</tr>
<tr>
<td>Missouri</td>
<td>335 W. Riverside Drive</td>
</tr>
<tr>
<td>W7IDQ</td>
<td>1071 N. 4th Ave.</td>
</tr>
<tr>
<td>Ohio</td>
<td>PRAIRIE DIVISION</td>
</tr>
<tr>
<td>W6ID</td>
<td>W6YB</td>
</tr>
<tr>
<td>Nebraska</td>
<td>W6YB</td>
</tr>
<tr>
<td>W6ID</td>
<td>SOUTHWESTERN DIVISION</td>
</tr>
<tr>
<td>South Dakota</td>
<td>SOUTHWESTERN DIVISION</td>
</tr>
<tr>
<td>W6ID</td>
<td>1011 N. 4th Ave.</td>
</tr>
<tr>
<td>Missouri</td>
<td>PRAIRIE DIVISION</td>
</tr>
<tr>
<td>W6ID</td>
<td>W6YB</td>
</tr>
<tr>
<td>Kansas</td>
<td>W6YB</td>
</tr>
<tr>
<td>W6ID</td>
<td>W6YB</td>
</tr>
<tr>
<td>Missouri</td>
<td>W6YB</td>
</tr>
<tr>
<td>W6ID</td>
<td>W6YB</td>
</tr>
</tbody>
</table>

* Officials appointed to act until the membership of the section choose permanent S.C.M.'s by nomination and election.
REACTORS play a very important part in the satisfactory operation of any power supply. If the inductance of the first, or input reactor, is not high enough, poor regulation may result. Even more serious than this, unstable rectifier operation may be caused. This will give an output having a high percentage of ripple and it may overload the plate transformer.

A simple way to determine the minimum inductance required for an input reactor is to divide the D.C. output voltage by the output in milliamperes. If the load is variable, then a swinging reactor should be used. It should be rated so the inductance at the minimum current is equal to the voltage divided by this current in milliamperes. In order to meet this specification, the inductance at the maximum current is usually twice as large as would be indicated by the formula

\[ \text{Inductance} = \frac{\text{Voltage}}{\text{Current}} \]

This is desirable from two points of view. It reduces the ripple in the output voltage and it also maintains the load drawn from the plate transformer at a favorable value.

If the load is constant, the input reactor should not be of the swinging type, for this gives a lower inductance at high current, for the same size, than the smoothing type. The inductance of the smoothing type reactor should be selected so that at least 50% more than needed is available. Then if the current demand is lower than calculated, unstable operation will not result.

The ripple percentage which is desired in the output is determined by the inductance of the reactor, the capacity of the condenser, and the number of filter sections used. For a single section choke input filter the percentage ripple is equal to \( \frac{85}{L} \times C \) when \( L \) is in henries and \( C \) is in microfarads. If a second stage of filtering is added the output ripple may be determined by multiplying the ripple at the output of the first stage by \( \frac{127}{L} \times C \) where \( L \) is the inductance (in henries) of the second reactor and \( C \) is the capacity (in microfarads) of the second condenser.

From the above it will be seen that the inductance needed to obtain stable rectifier operation is the most important requirement in the selection of reactors. The ripple content of the output may be determined by the size of condenser used and by the number of filter sections.
The American Radio Relay League

DIRECTORS

President
EUGENE C. WOODRUFF, W8CMP

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

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

Atlantic Division
WALTER BRADLEY MARTIN, W3DV
Box 612, Roslyn, Pa.

Central Division
R. H. G. MATHEWS, W9ZN
100 East Ohio St., Chicago

Dakota Division
FRED W. YOUNG, W9MZN
Apartment 16, 500 Harvard St., Minneapolis, Minn.

Delta Division
E. RAY ARLEDGE, WSSI
P.O. Box 286, Pine Bluff, Ark.

Hudson Division
KENNETH T. HILL, W2AHC
115 Willow St., Douglaston, L. I., N. Y.

Midwest Division
FLOYD E. NORWINE, Jr., W9EFC
120 South Fourth St., St. Louis, Mo.

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

Northwestern Division
RALPH J. GIBBONS, W7KV
C/o United Air Lines, Portland, Ore.

Pacific Division
J. L. McCARGAR, W6EY
65 Hamilton Pl., Oakland, Calif.

Reno Division
H. L. CAVENESS, W4DW
State College Station, Raleigh, N. C.

Rocky Mountain Division
EDWARD C. STOCKMAN, W9ESA
618 So., Williams St., Denver

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

Southwestern Division
CHARLES E. BOLACK, W6GG
443 Main St., El Centro, Calif.

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

The American Radio Relay League, Inc., is a non-commercial association of radio amateurs, bound for the promotion of interest in amateur radio communication and experimentation, for the relaying of messages by radio, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

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

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

Inquiries regarding membership are solicited. A bona fide interest in amateur radio is the only essential qualification; ownership of a transmitting station and knowledge of the code are not prerequisites. Correspondence should be addressed to the Secretary.

HIRAM PERCY MAXIM, FIRST PRESIDENT

OFFICERS

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

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

Secretary .............. KENNETH B. WARNER, W1EH
West Hartford, Connecticut

Treasurer .............. ARTHUR A. HEBERT, W1ES
West Hartford, Connecticut

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

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

Address all general correspondence to the administrative headquarters at West Hartford, Connecticut.
THERE'S an old proverb that was written long before the days of radio amateurs but which we could well embroider in old filament wire and hang on our shack walls: "Be not too zealous; moderation is best in all things."

Yes, even in amateur radio.

That probably sounds like a strange pronouncement coming from us whose traditional duty it is to keep amateur radio activity whipped up to a fine lather by the promotion of all sorts of operating activities and by the monthly exhortations of this illustrious journal. Yet, even so, we mean it, and in our own best interests, of course.

What we particularly have in mind is that unbalanced amateur activity is quite capable of injuring one's health—physical and mental—sometimes permanently, and that such immoderation is therefore unwise and something to be discouraged. Not that ham radio is a hazardous avocation; precisely the same thing is true of innumerable other pleasant human activities when carried to excess: too much sunshine, too much exercise, too much eating, too much mental work, too much loafing, too much intensive work on any complex hobby, all exact their penalties from the old shell. And so appealing are the myriad fascinations of amateur radio that, unless one is a bit circumspect about it, it is all too easy to be led into immoderation. The average ham doesn't get enough sleep or exercise; he smokes too much, he works too hard at it and keeps himself under a strain too long at a time. Most of us live, eat and sleep amateur radio; it fills our waking moments and our dreams. Our point is that too much of this isn't good for us or for the game. It used to be even worse in the old spark days. Many an old-time spark man is permanently deaf in one ear from parking it hours on end alongside a crashing rotary gap, and the mark of the amateur in those days used to be the red-rimmed eyelids inflamed by the volatilized zinc of whirring electrodes. Traffic men still sit down to a hard night's work with cob pipes pre-loaded in a row, and in the average ham shack after a good DX night the cigarette butts are to be bailed out by the quart. The amount of sleep lost in our contests is prodigious. Night after night we sit humped hollow-chested over our junkpiles to all hours, straining every nerve to read through interference, and the next day we're devoting every stolen minute to planning some new piece of gear, until we don't know whether we have families, jobs or bodies. After years of this sort of treatment the old human frame commences to complain. We've really been moved to mention this subject editorially because we've encountered several amateurs recently who are paying the price for having loved radio not wisely but too well.

In The Radio Amateur's Handbook there is still published The Amateur's Code, a platform created for us many years ago by an illustrious amateur. Most of you know it. It has six points. The amateur is gentlemanly, he is loyal, he is progressive, he is friendly, he is patriotic. The other point we quote in full:

The Amateur is Balanced. Radio is his hobby. He never allows it to interfere with any of the duties he owes to his home, his job, his school, or his community.

It's a good standard, isn't it? As we enter upon our period of intense winter activity it would be well for us to think a little about this. Moderation in all things, including amateur radio, will make a ham healthy, wealthy and wise. Radio is our servant; let us not become enslaved to it. We'll have more fun out of it, enjoy it more heartily, if we retain sensible perspective and don't overdo it. We'll think more clearly, get things done better, make better contributions to our art, have more zest for our game and actually last longer in amateur radio, if we use a little common sense about the hours we keep and the factor of balance in the lives we lead. Go to it like anything when you have to, of course, when there's an emergency or a contest on; but radio will be infinitely more pleasurable if approached with the clear head and healthy body that come from living a reasonably balanced life. Therefore we say be not too zealous; remember that moderation is best in all things.

R. B. W.
A Visit to W1AW
The New Maxim Memorial Station Now in Operation
By F. E. Handy,* WIBDI

The evolution of your A.R.R.L.'s Headquarters station from a modest corner-of-a-room 20-watt outfit into a station with several complete kilowatt transmitters ready to go on 'phone or telegraph at the throw of a switch is something which parallels the growth of amateur radio and the League itself. It is hard to put in a few words all that it represents. The sturdy brick-and-stone building is of colonial design, large enough to house all the modern facilities installed. The signal, W1AW, constantly on the air to work as many amateurs as possible, constitutes the most fitting, and in a true sense a "living" memorial. The station was erected by your Board in tribute and recognition to our first leader who envisioned a continuing organization to represent the amateur, whose tireless efforts and planning brought the representative nationalized Amateur Radio, Beloved First President of the American Radio Relay League." President Woodruff unveiled the Memorial Tablet shortly after 2 P.M. that date, in the presence of a large number of League members, with all A.R.R.L. officers, and the Headquarters staff in attendance. Dignitaries from the town of Newington wished us well. Gen. Ladd represented Connecticut's Governor. The ceremonial was broadcast over the CBS network, and locally by WDRC and WTIC. After the dedication the station devoted its first big evening to intensive operations in the Maxim Memorial Relay, results of which, appear elsewhere in this issue. WTIC carried an evening bulletin mentioning progress of the Relay. Thus was the new station opened.

The first famous IAM was operated by H. P. M. himself. When A.R.R.L. grew to sizable proportions a small station was established in the Headquarters offices at Main St., Hartford, for work direct with members and amateurs responsive to their request. This, the first IAM, was installed in '24. More equipment was added when A.R.R.L. moved to larger offices on Park Street. In 1927 the Board of Directors ordered the creation of a real man-size station, with the full power permitted amateurs. By February of 1928 this was completed. W1MK now had a two transmitter status. Its operating program and equipment was explained fully in December 1930 QST. The station set the example, followed expeditions around the globe with useful contact, and the call became a by-word for operating excellence.

On the anniversary of his birthday, September 2nd, the new Memorial Station, W1AW, was dedicated "to Hiram Percy Maxim, Father of Organ-

* A.R.R.L. Communications Mgr.

This Headquarters station was brought to an untimely end in the floods of March 1936. Temporary work continued through W1INF, a small station at the West Hartford offices. In May 1936, at the Board meeting following President Maxim's death in February and the flood loss in March, your Directors determined to build a new and better station to replace W1MK, and to make this station a Memorial to Hiram Percy Maxim, to carry forward his ideals and inspiration. Appropriations totalling $18,000 were made by the Board for this Memorial, now completed and ready to carry on the work of the amateur association we know to-day as A.R.R.L. into being. When we speak of that man who defended our hobby, obtained recognition and maintained frequencies for the youthful organization, and whose leadership and vision united the scattered and diverse personalities of transmitting amateurs to form a strong and practical organization we, of course, speak of Hiram Percy Maxim.

On the anniversary of his birthday, September 2nd, the new Memorial Station, W1AW, was dedicated "to Hiram Percy Maxim, Father of Organ-

QST for
service in the traditional manner.

All amateurs, and Members of the A.R.R.L. particularly, are invited to visit W1AW as well as work the station from their own shacks. W1AW is dedicated to fraternity and service, and available time is divided between different bands and modes for QSO's with Rag Chewer, DXer, Traffic Man, etc. The station will take part in all A.R.R.L. Operating activities, but with its new facilities will not compete with individual members, though results will be given for the information of Members. Many pages of the new visitor's book at W1AW have already been filled, in the period between the inspection of the Board in May and the official opening September 2nd. Visitors are most welcome at all times when the station is open.

Members who have not yet visited W1AW have been interested in some of the features. Suppose then we travel to W1AW briefly via the pages of QST. The station is located in Newington, Conn., about 4½ miles almost directly south of the A.R.R.L. offices in West Hartford. If we call at Hq. we get information on operating visiting hours and a map that shows us the best way to get there. The station is located about 65 feet back from the highway, center front in the eastern end of a field approximately 370 feet N-S by nearly 900 feet E-W, more than a seven acre area. The first thing we notice will be the call signal W1AW in gold letters in the stone above the entrance of the 26’ 42’ building—and the masts and antennas in the field back of the building. There is a parking space 25 feet wide all around the building, so we drive in. We ring the doorbell and as soon as the operator is free from his schedule he makes us welcome.

We pause to read the inscription on the Memorial Tablet which occupies the prominent position in the entrance hall or lobby. The room is not ornate or large, but one is properly impressed by the simplicity and dignity of the design. The operator explains that the building is wholly utilitarian except for this room, and we pass into a “visitors” room at the right. Equipped with a chair, divan, table and ash trays we can make ourselves right at home with the latest QST, or pause to chat with other guests without disturbing operating that may be in progress in the adjoining room. A "radio operating" action picture of Mr. Maxim catches our attention. The room also contains an album with a complete pictorial record of the construction of this station and interesting historical photographs of its predecessors. There will be a similar album of QSL's, and exhibits of station awards, log books and other information of interest soon on tap. Since our time is limited we pass on into the operating room after a quick peek at the work shop.

Tools and parts are in evidence here, as the operators are completing some new units for five-and ten-meter work, and marker frequency work. Daily schedules and tests on all bands to check on the characteristics of the new antennas are in progress. Everything has been carefully and systematically put together, and the new units authorized at last May’s meeting of the Board will be added over the next season in just the same fashion. The station went into full operation in early September with the exception of these newly authorized things.

The station bulletin board is in the work shop. We note a copy of the latest Official Broadcast for the news that is current and of national significance. We also see just how the station operation is being expanded during September and October, so that by the middle of that month it will be on the air close to 12 hours per day.

But we pass along to the operating room—a sort of amateur’s dream. One of the photographs with this article gives a rough idea! Transmitter after transmitter is in the front of the room—three

October, 1938
two-outlet 110-volt line, independently fused, that runs to each transmitter to facilitate repair work, use of soldering iron, etc. when the power circuit is dead or automatically disconnected by interlocks. All leads come up through floor conduits within the dust covers and in the back of each transmitter.

Each of the five transmitter units has its individual power supply. Each can be run individually, or simultaneously, for telegraph transmissions. Each transmitter has an individual 72-inch-high metal rack and dust cover. Pilot lights indicate “live” transmitters, and any transmitter can be controlled directly from the desk.

Pairs of transmitters with room to pass between or work on each! The operating desk carries the receiver, mike, keys, speech-limiter, message-file and controls. Beside the desk there are two other rack-and-panel units, likewise in neat dust covers. The walls have convenient maps of the U.S.A. and the world. O.R.S., O.P.S. and O.B.S. certificates indicate the service, work and high standards of the operating program. Left to right in the front of the room, the racks contain: The completed portion of the 28-Mc. transmitter, the 14-Mc. transmitter, the 7-Mc. transmitter, the 500-watt modulator (switchable to any set), the 3.5-Mc. transmitter, the 1.8-Mc. transmitter. All the transmitters are kilowatt jobs. Room is provided in the modulator rack for installation of a medium power 56-Mc. transmitter. A table back of the operator carries the perforator for punching out tapes for the constant-speed transmissions of the “automatic.” The tube line-ups are as follows:

1.7 Mc.: 47-RK28-204A’s, P.P.
3.5 Mc.: 89-6L6-RK48-EK 354’s P.P.
7 Mc.: 6L6-RK20-HF200’s P.P.
14 Mc.: 89-807-35T’s P.P.-Eimac 250THs, P.P.
28-30 Mc.: 89-807-814’s P.P.-806 P.P.
Speech Amplifier, Signal-Limiting Volume-Compressor and Modulator: 6J7, 6C5-6J7, 6L7-6H6—6C5’s P.P., 6L6’s P.P., Taylor 822’s P.P.

Power provisions permit balancing load on each side of the 220-v. line by allocation of filament or plate circuits of each unit to different sides of the line. There is a special

Conduits under the floor bring all control leads to the desk, and relays switch on power, or switch antennas, or switch the rhombic antenna from send-to-receive, if desired.

**Phone provisions**

Pilot lights also indicate by inspection which transmitter is connected to the modulator. This is quickly switchable manually to the desired band. An oscilloscope in the station provides for checking modulation adjustments. The volume-compressor speech-limiter circuit is simple and inexpensive and something that every telephone amateur ought to consider essential to the good performance of his station. The “mike” is directive, and so is efficient for communication with the

**Antenna system on 7 1/2 acre site**

---

**QST for**

---

12
minimum of background conversation and room echo.

Every transmitter is designed for break-in operation! The buffer stages are all provided with links which will later receive excitation from oven and temperature-controlled Biley BC-10 units that will operate close to particular band edges at particular times in a marker-frequency program to be inaugurated some time in the future. The 4-Mc. set can be used in emergencies as e.c.o. controlled, though it is normally crystal controlled. Power for the station is independent of the Hartford utility company that suffered interruptions of service in 1936 floods. The station is some miles from the river insuring safety from this hazard, and power from C. L. & P. Co. to the vicinity was supplied uninterruptedly to this community at that crucial time.

OPERATORS

While different members of the A.R.R.L. staff may work you from W1AW on occasion, the most regular operation is by the men who take care of the building and show us its facilities. Mr. Harold Bubb (Hal—W1JTD) is the first operator and responsible for the fine construction of the units. He can tell you of experiences at old W1MK, too. Mr. George Hart (Geo—W3AMR) is a new addition to the Hq. staff and likewise a first-class operator in every respect. He comes to us from W3NF and W8YA and will be no stranger to those who have worked those stations on 'phone and c.w. in the past.

OBS SCHEDULE

The station now observes the following regular Official Broadcast schedules:

<table>
<thead>
<tr>
<th>Frequencies</th>
<th>Starting times (P.M.)</th>
<th>Speeds (W.P.M.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.W.: 1800.5-3825-7150-14254 kcs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EST CST MST PST</td>
<td>M T W Th Fri</td>
<td></td>
</tr>
<tr>
<td>8:30 7:30 6:30 5:30</td>
<td>20 15 25 15 20</td>
<td></td>
</tr>
<tr>
<td>Midnight 11:00 10:00 9:00</td>
<td>15 25 15 20 15</td>
<td></td>
</tr>
</tbody>
</table>

Phone:

Each code transmission will be followed in turn by voice transmission:

- 1808
- 3950
- 14,240 kcs.

General Operation: Following completion of the early evening (8:30 EST) transmissions on each frequency as above indicated, W1AW will operate on different bands in turn each night of regular operation until the time for transmission of the midnight QST (Official Broadcast). A more complete and expanded "general" time schedule of the station will be given in QST next month.

We have looked over the straightforward construction of each transmitter and now are curious about getting the r.f. to the antennas, there being several feet between antenna networks and transmitters for working on equipment. A unique arrangement takes care of this nicely. A formica tube on the top of each transmitter runs back to a shelf across the back of the room. This tube is the mechanical control for tuning the antenna condenser, and it also carries the "link" wires that carry the r.f. power inside the tube in addition. Thus long leads below the floor and attendant losses are avoided.

Back of the six transmitter units are six windows and six plate glass transoms above them and the shelf. All lead-ins come through brass rods spaced in the plate glass—a more efficient system, also less expensive than special bushings. The operator tells us that each of the transmitters has its own antenna, as well it may, with seven acres of field back of the station. The shelf contains L-C circuits tuning to each transmitter band. The coils are of bare conductor with taps provided to make it possible to match almost any desired feed line impedance. A heavy plug-jack system is used to make possible interchange of antennas between transmitters when necessary, and most particularly to make the excellent west-directivity of the "diamond" available for work as low as 3.5 Mc. as well as up to and including the 28-Mc. band. This system makes grounding the antennas just a simple proposition of plug-and-jack. In theory this L-C arrangement for matching to the impedance of any feed line is ideal. However the operator tells us that in practice the impedance is changing rapidly as the feed line goes through a current loop so that a suitable amount of loading has been added to some of the resonant feed lines on the lower frequencies, to make it possible to load the sets to their maximum permitted outputs.

(Continued on page 76)
A Low-Cost Single-Signal Receiver
Double Regeneration for I.F. Selectivity and Image Reduction

By George Grammer,* W1DF

There is no doubt that with amateur activity at its present height something considerably better than the t.r.f. receiver is not only desirable but essential. But recognition of that self-evident fact does not give material aid to the fellow with a t.r.f. pocketbook. Something more concrete than sympathy is needed—to wit, suggestions for what to do about it. We propose to offer some herein, in the form of a description of a superhet which will do a real single-signal job, but which costs little if any more than the average t.r.f. set—maybe less.

Figures prove the case, and we rest ours on the fact that the receiver pictured here can be built for $21, plus approximately $4.50 for the six tubes used in it. It is a ham-band outfit, using plug-in coils adjusted so that each band is spread over practically the whole dial range. What you get out of it depends to some extent on how

The circuit, shown in Fig. 1, will not be hard to follow by anyone having an understanding of the operation of a superhet receiver. The mixer, a 6L7, is coupled to the antenna. To reduce image response and provide additional gain, this stage is made regenerative. The oscillator is 6J5 triode, one of the most satisfactory types for this purpose. There is a single i.f. stage, using a 6K7 and iron-core transformers. The second detector is a 6C5 operated as a plate rectifier to handle large signals and to provide good headphone output; this type of operation, incidentally, does not load the i.f. transformer and hence better overall selectivity results than when a diode detector is used. The audio output tube is a 6F6. A 6C5 beat oscillator completes the tube complement. Metal tubes were used throughout because they are self-shielding and thus eliminate the need for extra tube shields. Although not indicated on the circuit diagram, the i.f. amplifier is made regenerative by a very simple method to give the single-signal effect.

Taking the circuit features individually, the mixer stage uses the familiar tickler circuit to obtain regeneration. This method was used in preference to the popular cathode-tap arrangement for three reasons: first, it is much easier to change the number of turns on a separate coil in making preliminary adjustments than it is to move a tap; second, the possibility of hum, always likely to be present in regenerative circuits using 6-volt tubes, is lessened by having the cathode at ground potential; third, with the cathode grounded it is less likely that any oscillator voltage will appear in the mixer grid circuit. The appearance of oscillator voltage on the No. 1 grid of the mixer is not only undesirable from the standpoint of tube performance, but also, since in this case the mixer works directly from the antenna, is likely to bring in unwanted signals. This is particularly so on the lower-frequency bands, where high-frequency commercial signals can be picked up on oscillator harmonics.

To avoid constructional complications, the mixer tuning is not ganged with the oscillator.

* Asst. Technical Editor, QST.
Although this might seem a disadvantage, in that the two circuits must be tuned separately, in practice it has not turned out to be so. In fact, the mixer tuning condenser, $C_1$, makes a quite effective volume control, and for c.w. reception in particular its use in this fashion is quite advantageous. The regeneration control is a variable resistor, $R_0$, in series with the 6L7 cathode resistor.

In the high-frequency oscillator the tickler circuit again is used, the reason being to keep the cathode at ground potential to reduce hum. Our previous experience with 6-volt oscillators using the cathode-tap circuit has been none too good—all of them were only too prone to turn "r.a.c." on 14 Mc. and practically refused under any circumstances to be "d.c." on 28 Mc. Results so far with this receiver have justified grounding the cathode. Band-spread is by the usual tap method, $C_2$ being the tuning condenser and $C_3$ the band-setting trimmer. The oscillator grid is coupled to the No. 3 grid of the 6L7 through a small trimmer condenser, $C_5$.

The i.f. stage as shown in the diagram is quite conventional. Its gain is controlled by $R_4$, which varies the control-grid bias. The stage is made regenerative by simply running a short length of insulated wire from the control grid of the 6K7 through a hole in the shield can of i.f. transformer $T_2$ so that a small amount of energy is coupled back to the grid from the plate. When

---

THE TUBES AND MOST R.F. COMPONENTS ARE PLAINLY SHOW IN THIS PLAN VIEW

The location of various parts is discussed in the text. The i.f. transformers are permeability-tuned, with high-stability fixed mica condensers. Any type of air-tuned iron-core transformer may be used instead.

---

**FIG. 1—CIRCUIT DIAGRAM OF THE REGENERATIVE S.S. RECEIVER**

- $C_1, C_2$: 50-µµfd. variable (Hammarlund MC-50-S).
- $C_4$: 70-µµfd. mica trimmer (Hammarlund BBT-70).
- $C_5$: 30-µµfd. Isolastic-insulated mica trimmer (National M-30).
- $C_6$: 0.1-µµfd. paper, 400-volt.
- $C_7$: 0.2-µµfd. paper, 400-volt (or larger).
- $C_8$: 0.005-µµfd. mica.
- $C_9$: 0.005-µµfd. mica.
- $C_{10}$: 0.01-µµfd. paper, 400-volt.
- $C_{11}$: 10-µµfd. 25-volt electrolytic.
- $C_{12}$: 5-µµfd. 25-volt electrolytic.
- $C_{13}$: See text.
- $C_{14}$: 25-µµfd. variable (Hammarlund SM-25).
- $R_1$: 300 ohms, ½-watt (see text).
- $R_2$: 500-ohm variable, wire-wound.
- $R_3$: 300 ohms, ½-watt.
- $R_4$: 25,000-ohm volume control.
- $R_5$: 30,000 ohms, 2-watt.
- $R_6$: 50,000 ohms, ½-watt (L.R.C. Type F).
- $R_7$: 150,000 ohms, ½-watt (L.R.C. Type F).
- $R_8$: 12,000 ohms, 1-watt.
- $R_9$: 6,000 ohms.
- $R_{10}$: 50,000 ohms, ½-watt.
- $R_{11}$: 500 ohms, 1-watt.
- $R_{12}$: 0.5 megohm, ½-watt.
- $R_{13}$: 450 ohms, 1-watt.
- $T_1$: 455-kc. interstage-type i.f. transformers (Sickles 6504).
- $T_2$: 455-kc. beat oscillator transformer, with grid condenser and lead (Sickles 6577).
- $L_1, L_2$: See coil table.
- $J_1$: Double-circuit type.
- $Sw$: S.p.s.t. toggle.
In \( T_2 \), the grid lead should be pulled through the side of the can and brought out the bottom with the other leads, since the grid of the 6C5 second detector comes through the base.

The transformer at the rear right is for the beat oscillator. The 6C5 second detector is directly in front of it and the beat oscillator tube is about midway along the right chassis edge. The 6F6 output tube is in the rear right-hand corner.

Power cord, headphone jack (insulated from the chassis) and a tip jack for the speaker are on the rear edge of the chassis. The antenna input terminals are on the left edge, near the mixer coil socket.

The controls along the bottom edge of the panel are, from left to right, the mixer regeneration control, \( R_2 \), the on-off switch, \( S_w \), the i.f. gain or regeneration control, \( R_4 \), and the beat-oscillator vernier condenser, \( C_{20} \). The latter has the corner of one rotary plate bent over so that when the condenser plates are fully interleaved the condenser is short-circuited, thus stopping oscillation.

The second detector, beat oscillator and power amplifier need no special comment. The headphones plug into the plate circuit of the second detector; the signal level is quite high here and no additional audio amplification is needed. For simplicity, no audio gain control is incorporated in the set, since the various r.f. controls afford quite a range in volume.

LAYOUT

The various photographs show the layout, both top and bottom, quite plainly. The chassis is a standard item measuring 11 by 7 by 2 inches. The band-spread tuning condenser, \( C_s \), is at the front center, operated by the vernier dial. At the left is \( C_1 \), the mixer tuning condenser, and at the right, \( C_2 \), the oscillator band-setting condenser. The oscillator tube is directly behind \( C_3 \), with the mixer tube to the left on the other side of a baffle shield which separates the two r.f. sections. This shield, measuring 3\( \frac{3}{4} \) by 4\( \frac{3}{4} \) inches, is quite effective in preventing unwanted coupling between oscillator and mixer. The mixer coil socket is at the left edge of the chassis behind \( C_1 \); the oscillator coil socket is between \( C_2 \) and \( C_3 \).

The i.f. and audio sections are along the rear edge of the chassis. The transformer in the rear left corner is \( T_1 \); next to it is the i.f. tube, then \( T_2 \). The transformers are mounted so that the adjusting screws project to the rear where they are easily accessible. With the particular type of transformer used this requires drilling a new hole in the shield of \( T_1 \) so that the grid lead to the 6K7 can be brought out the proper side.

WIRING POINTERS

Study of the bottom view will show how the various resistors and by-passes are wired in. The tube sockets are bakelite except that for the high-frequency oscillator, which is Isolantite. The coil sockets also are Isolantite, a six-prong socket being used for the mixer coil and a five-prong unit for the oscillator. In most cases the various components can be mounted by their wire leads, but one or two insulated lugs will be needed for "B" connections.

As shown in Fig. 1, one side of the heater circuit is grounded, so that only one filament wire need be run from tube to tube. The more conventional method of running heater current through a twisted pair can be used if preferred. The method indicated has proved to be quite satisfactory, however, in that it does not seem to introduce any particular hum. On each tube socket the shield prong and adjacent heater prong are tied together and grounded.

In making ground connections the practice of bringing all by-pass condenser returns for each individual stage to a single point has been followed when possible, the cathode ground (through the by-pass condenser, when used) being the focal point. In some cases, where long return leads would have been necessary, separate grounds are used on the same stage. If desired, such grounds can be tied together with heavy wire, but since no instability resulted without them they were not used in this case. In any event,
it seems desirable to make the r.f. path from
cathode to chassis as short as possible, as a
fundamental requirement.

The oscillator-mixer coupling condenser, $C_b$, is
mounted from one of its connection tabs on a
small ceramic pillar (furnished with one of the
tube sockets) between the oscillator and mixer
tube sockets. The antenna series condenser,
$C_a$, also visible in the bottom view, is
mounted between one terminal on the anten­
tenna strip and one of the mixer coil-socket
prongs. These condensers do not require
readjustment in normal operation, hence are
screw-driver adjusted from the bottom.

The i.f. plate by-pass condenser, $C_{11}$, actually
actually consists of two 0.1-µfd. units in
parallel. A minimum of 0.2 µfd. was found
necessary to prevent i.f. instability, but any
convenient larger value can be used, or a
single unit of the proper capacity may be
substituted.

In doing the actual wiring, it will be
found convenient to start with the filaments
and follow with all the by-passes and resistors,
leaving the r.f. until last. This
method makes it possible to find room for
the larger parts first and thus avoids any re-
wiring if things don’t fit right toward the end
of the job. It also keeps the condensers close to the
chassis and leaves the
wiring out in the open.

The grid and plate leads from $T_2$ are covered
with shield braid to help prevent coupling back
to $T_1$. This precaution probably is not necessary,
but may mean avoiding unwanted i.f. oscillation.

The b.o. coupling condenser, $C_{19}$, is not an
actual condenser unit but is simply the capacity
existing between the grid prong on the 6C5 socket
and the adjacent prong on the side away from
the plate. This prong, ordinarily unused, is con­
nected to the b.o. as shown; more conveniently,
it may be connected directly to the grid of the
b.o. tube with identical results. This coupling
puts a rather strong beat voltage at the grid of
the second detector; sufficient coupling was used
so that strong signals give loud audio response.
If a weaker beat signal is wanted, the coupling
should be from the cathode of the b.o. tube.

$R_1$, the fixed cathode resistor in the 6L7 circuit,
is an adjustable unit furnished with $R_2$. It was set
to 500 ohms before installation.

The method of winding coils is shown in Fig. 2, and complete specifications are given in the table.
All windings are in the same direction. With connec­
tions brought out as shown, reversing $L_3$ with
respect to $L_1$, or $L_3$ with respect to $L_4$, will
prevent oscillation.

In Fig. 1, the ticklers, $L_3$ and $L_5$, have been
shown coupled to the grid ends of $L_1$ and $L_4$,
respectively. This was done purely to make the
diagram less awkward; the actual method of
construction is given in Fig. 2, with the ticklers
coupled to the grounded ends of the grid coils.

The specifications given should be followed
rather closely in the case of $L_3$ if complete band-
spread is to be obtained in each band. The tickler,
$L_5$, is not so critical; use enough so that the tube
oscillates readily with fairly low plate current,
but not so much as to cause blocking. There is a
good deal of leeway in the case of $L_5$, since the
tuning condenser has sufficient range to compen­
sate for moderate changes in the inductance of
this coil. The tickler coil $L_3$, however, is another
story, and it may be necessary to "tailor" it to
fit the antenna. It must be large enough to make
the mixer circuit oscillate readily, but yet not

<table>
<thead>
<tr>
<th>COIL DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>1.75 Mc...</td>
</tr>
<tr>
<td>Li</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>3.5 Mc...</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>7 Mc......</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>14 Mc.....</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>L_a</td>
</tr>
<tr>
<td>28 Mc.....</td>
</tr>
<tr>
<td>L_a</td>
</tr>
</tbody>
</table>

All coils 5/16 inches in diameter, on Hammarlund S.W.F
forms. Spacing between coils on same form approximately
3/4 inch. Band-spread taps are measured from bottom
(ground) end of $L_4$. All coils are wound with enamelled wire.
so large that oscillation continues over the whole range of $R_2$. The desirable condition is that of having the circuit go into oscillation when the optimum bias, approximately six volts, is applied to the 6L7. The number of turns on $L_9$, or the coupling between $L_4$ and $L_1$, should be adjusted so that the mixer goes into oscillation with $R_2$ set at about half scale. The antenna coupling condenser, $C_4$, affords some compensation for the antenna loading effect, and is particularly useful on the higher frequencies where the number of turns is small and the adjustment therefore more critical.

Where spaced windings are called for, the turns may be spaced by hand or by winding small wire or thread between them. After the windings are finished they may be held permanently in place by Duco cement spread along the coil-form ridges. After soldering the coil ends in the pins, be sure to clean off any rosin which may have formed a thin film over the contact surfaces.

Any convenient pin-connection arrangement may be used. Make the connections so that the shortest leads between coil socket and circuit points result.

### I.F. ALIGNMENT

The i.f. alignment procedure is an oft-told story and probably does not need too detailed treatment here. Undoubtedly the most difficult feature is that of securing proper equipment for the job, but a service-man friend or the local parts store may be able to help out. A test oscillator and 0-1 milliammeter make a suitable combination. The i.f. should be aligned without the regenerative connection and with the h.f. oscillator coil out of its socket. A mixer coil may be in place in order to complete the 6L7 plate connection; without the coil it is necessary to connect a jumper across the $L_4$ prongs on the coil socket. Incidentally, if no speaker is used either the speaker terminals must be short-circuited to prevent damage to the 6F6, or else the tube must be out of its socket.

Connect the test oscillator output between the 6L7 grid and chassis, with the normal grid connection to $C_1$ removed. Hook the milliammeter to a 'phone plug and insert plug in the head-phone jack. Set the oscillator to 455 kc. and adjust the trimmers on $T_1$ and $T_2$ to give maximum meter reading, with $R_4$ set for maximum gain or slightly below. The beat oscillator should be off. Without signal the second detector plate current should be between 0.1 and 0.2 ma.; adjust the test oscillator output so that the reading with signal is about 0.4 or 0.5 ma. As the circuits come into line, reduce the signal input to keep the reading about the same. Line up the circuit as accurately as possible, since correct alignment helps both gain and selectivity. If the i.f. is unstable, the meter will not show a smooth rise and fall through maximum as a circuit is adjusted but will be jumpy, probably to full scale or more if oscillations start. There should be no trouble on this account if adequate by-passing and reasonable circuit isolation are employed.

If no 0-1 milliammeter is at hand a fair alignment job can be done by ear. Using a modulated test oscillator, peak all the trimmers for maximum audio output, using a fairly weak input signal for the final adjustment. With a little practice an equally good result can be obtained even without modulation on the oscillator, careful attention being paid to the change in character of the hiss as the circuit is tuned through resonance.

If no regular test oscillator is available, the beat oscillator can be used as a substitute, preferably set up temporarily in a separate unit. The output can be taken, in many cases, without formal coupling, the oscillator simply being on the same table as the receiver. A resistor of several thousand ohms should be connected between the 6L7 grid and ground to complete the d.c. grid circuit and give some impedance for the i.f. The beat oscillator can be set to the correct frequency by coupling it to a broadcast receiver and adjusting the tuning so that its 2nd and 3rd har-

(Continued on page 80)

---

**Next Month—National Convention Story**

**CLICK-CLACKING** train wheels punctuate the echo of tooted c.w. from "2-lung-power" whistles as we head homeward from the Chicago National A.R.R.L. Convention—the greatest amateur convention ever held, bar none. We had hoped to bat out a hurried story of the convention activities that would "make" this issue of QST, despite the stern fact that final press date was but two days after the convention ended. But now we know that can't be done—the affair was too big, too spectacular to be jammed into any hurriedly-written piece. The wealth of color and incident that characterized this convention is only hinted when we repeat that it was half again as large as any held heretofore—and set a faster pace, with more going on, than anything we have known. So pardon our enthusiasm until next month, when we will hope to weave all the threads into a detailed account worthy of amateur radio's greatest gathering of all time.
Amateurs Aid Hughes on World Flight

EVERYONE is familiar with the recent record-breaking round-the-world flight of Howard Hughes and his associates in their special Lockheed plane, but not so well known is the story of the radio activity behind the achievement. Amateur radio played an important part—not in the sense that amateurs throughout the world participated in the communication, but because three outstanding amateurs contributed a great deal to the success of the radio contacts.

It was of course necessary that absolutely reliable contact be available with the plane at any time, so that the all-important weather data could be transmitted from the flight headquarters at the New York World's Fair grounds, and also so that engineering data could be exchanged. The marked success of the radio communication tells its own story of the effectiveness of the preparations.

Charles Perrine, W6CUH, Hughes’ ground radio chief and assistant to Richard R. Stoddart, was responsible for much of the ship’s installation and also was in charge of the ground network. This network consisted of W2GOQ, remotely-controlled from flight headquarters at the New York World’s Fair grounds, and also so that engineering data could be exchanged. The marked success of the radio communication tells its own story of the effectiveness of the preparations.

Charles Perrine, W6CUH, Hughes’ ground radio chief and assistant to Richard R. Stoddart, was responsible for much of the ship’s installation and also was in charge of the ground network. This network consisted of W2GOQ, remotely-controlled from flight headquarters at the New York World’s Fair grounds, and also so that engineering data could be exchanged. The marked success of the radio communication tells its own story of the effectiveness of the preparations.

William C. Rockefeller, one of the country’s foremost meteorologists, undertook the gigantic task of charting and predicting weather over the full course of the flight. In order to do this (which has never been done before) it was necessary to receive weather reports from London, Berlin, Paris, Rome, Moscow, Manila, Honolulu, San Francisco and Arlington, for complete coverage. An idea of the extent of this data can be gained from the transmissions that were copied each day from Moscow in order to provide a single forecast for one leg of the trip in Russian territory. The transmission from Moscow, lasting one hour and twenty minutes, was comprised of over 250 stations in Russia and Siberia alone, with a total of over 10,000 numbers recorded, all representing certain items of weather information and coded in the standard international weather code. The collection of the weather data required about six hours each day of nearly steady copying (at about 30 w.p.m.) by the operators at W2GOQ, with W2UK standing by at all times in case of local QRN. It then took another two or three hours to finish compiling the data and make the forecasts.

The regular amateur transmitters were employed at the ground stations, with two HRO receivers in use at each station. Four HRO’s were required to do the job at W2GOQ, Flight Headquarters. Aboard the plane, the complete installation was designed for ruggedness and, in the event of failure duplicate equipment was immediately available. The main transmitter was a 100-watt affair built by the Hughes Aircraft Company, designed for A1, A2 and A3 transmission. Eighteen different crystal-controlled frequencies were almost instantly available, ranging from 333 to 23,100 kc. The second transmitter (a Bendix) was also of 100-watt power with 8 frequencies, duplicating certain of the frequencies used in the other rig. It was intended for use in case of failure in the main transmitter.

A complete emergency station was also incorporated. This consisted of a 15-watt c.w. transmitter incorporating four crystal frequencies from 500 to 16,000 kc. and a receiver with a similar range. Power could be obtained from a hand-driven generator or batteries. The complete emergency station, including key, headphones and antennas, was contained in a waterproof container 15” × 8” × 10”. A kite and a
balloon were available to raise the antenna in case no other support was available.

The receivers were two Bendix superheterodynes covering both low and high frequencies for general communication and for use with the Bendix loop unit, the emergency receiver already mentioned, and a Fairchild loop receiver used with the Kruesi radio compass.

An electric reel for letting out the trailing antenna was located in the tail of the ship and controlled from the operating position. It was fed through a 100-ohm concentric line provided with a novel means of indicating to the operator when the antenna length was correct and a perfect match obtained. The antenna could of course be made practically any odd number of quarter waves long on the higher frequencies, and the directivity characteristics of long-wire antennas were employed to boost the signal at various times. The antenna was completely clear of the ship, the concentric line extending right out through the tail cone.

\[B. G.\]

**W2IXY and VR6AY Receive Public Service Certificates**

By order of the Executive Committee of the A.R.R.L., Public Service Certificates were issued on August 12th to Mrs. Dorothy Hall, W2IXY, and Andrew Young, VR6AY for "meritorious radio contact work in connection with the threatened isolation of Pitcairn Islanders, due to rumored epidemic. The above work . . . took place on schedule during several consecutive days of the latter part of July, 1938."

Mrs. Hall has been credited widely in the press and over the broadcast chains for having averted what might have been a serious condition on the island. The full story can best be taken from her log.

W2IXY has been scheduling VR6AY every other day since early May, handling a number of messages to and from the island. In the latter part of May, Andrew Young, operator of VR6AY, made mention that ships had neither stopped or called him by radio, and in June he said that he had learned that it was probably due to a false rumor of typhoid on the island. At Young’s request, Mrs. Hall sent a message to the shipping agents at Balboa, C. Z., assuring them that all were well on Pitcairn and that boats could stop. This message was acknowledged.

On July 19th Young said that no boat had stopped since May 25th and the islanders were then short of provisions, medical supplies and gasoline and were dependent on the wind-driven generator for their radio power. Mrs. Hall then wrote to the British Consulate General in New York to inform him of the condition.

On July 22nd Douglas Williams, an American correspondent for the *London Daily Telegraph*, came to W2IXY and spoke for over an hour with Young and Richard Christian, chief magistrate of the island, via radio, checking on the island conditions and Mrs. Hall’s reports. Williams promised to do all he could to help.

On July 25th Miss Emily McCoy, sister of Richard Christian’s wife, spoke with the islanders via W2IXY and found that the typhoid rumor had been started by a New Zealander who had lived on Pitcairn for ten years. This man had told a ship’s doctor that there was typhoid and the doctor had not bothered to confirm the story before reporting the typhoid.

Meanwhile the British Consulate reported that they had cabled to the High Commissioner at Fiji but with no result. Williams reported that the Colonial Office was investigating, but when no results were forthcoming, Mrs. Hall cabled to Prime Minister Chamberlain and telegraphed to President Roosevelt with pleas for action.

On July 27th, N.B.C. and the B.B.C. rebroadcast a QSO between W2IXY and VR6AY, after permission had been obtained from the F.C.C. The QSO took place from 11:30 p.m. to midnight, E.S.T. Another contact was made at 4 a.m., at which time Young told Mrs. Hall that the New Zealand steamer *Akaroa* had called and was stopping within two hours. On their next schedule, Young reported that the ship had left 12 sacks of flour but no medical supplies.

The *Akaroa* finally arrived in Panama, whereupon the captain killed the rumor that there was typhoid on Pitcairn. This information was cabled to New Zealand and the promise was made that full supplies would leave for Pitcairn on August 20th.

\[B. G.\]

**Massachusetts State Convention**

(N. E. Division)

Boston, Mass., October 15th


A good array of speakers, lots of prizes, contests, meetings and a real Turkey Supper with all the fixings.

Demonstrations and Display Booths.

Registration $1.00 and this will entitle you to one chance for a prize.

Banquet and registration $2.50; entitles you to three chances for a prize.

For tickets or information write to Frank L. Baker, Jr., W1ALF, 233 Atlantic St., Quincy, Mass.
Building Television Receivers With Standard Cathode-Ray Tubes

Part I—Scanning, Synchronizing and Power Supply Circuits for One-Inch, Two-Inch and Three-Inch Tubes

By J. B. Sherman*

The articles by Marshall P. Wilder in QST, November, 1937, to May, 1938 constitute the first comprehensive treatment of modern television published in this country. Since their publication we have been able to gain an estimate of the widespread interest in the subject of television by amateurs everywhere and now are pleased to present this article as the first of a second series. An appropriate title for this treatment (and Part II to follow) would have been "Television for Thin Pocketbooks." It is aimed to fill the demand expressed by amateurs for simple equipment with which they can begin experimental work with an absolute minimum of expense.—EDITOR

BEFORE discussing the construction of apparatus for television reception, it may be well to review briefly the essential elements of a television receiver. Fig. 1 shows a block diagram of these elements. The total frequency band, including both sound and picture carriers, is handled in the r.f. first detector, and oscillator circuits. The intermediate-frequency output of the first detector is then fed both to an i.f. amplifier which selects the sound i.f. and rejects the picture i.f., and to an i.f. amplifier.

The second detector and video amplifier circuits which follow the picture i.f. and supply the video signal to the cathode-ray grid must likewise satisfy this requirement. The synchronizing impulses are removed from the video signal by an amplitude-separator circuit, and the horizontal and vertical synchronizing impulses are then separated from each other and supplied respectively to the horizontal and vertical scanning circuits, which in turn furnish the cathode-ray deflections.

Thus there is produced on the screen of the cathode-ray tube a moving spot, the brightness of which varies from point to point in accordance with the brightness of the original scanned subject, and so reproduces on the screen an image of the original subject.

The foregoing brief outline of a television re-

---

* Research and Engineering Dept., RCA Manufacturing Company, Harrison, N. J.
receiving system will serve to refresh the general scheme in the mind of the reader.

Several standard electrostatic-deflection cathode-ray tubes available for oscillograph use afford the amateur the opportunity of constructing television receivers. This article will describe synchronizing, scanning, and power-supply circuits for one-inch, two-inch and three-inch tubes. Later articles will discuss the r.f., i.f., and video amplifiers.

The three oscillograph tubes mentioned are respectively the 913, 902, and 906. It will be appreciated that the picture quality of these tubes cannot equal that of regular kinescopes operating at much higher anode voltages; however, very presentable pictures can be obtained. Some definite figures on resolution obtainable are given below. "Resolution" as used here means the number of parallel lines which, if transmitted, can be distinguished as separate lines in the received picture.

The synchronizing and scanning circuits are the same for the 913, 902, and 906 and are shown in Fig. 2. The power supplies for the outfits are shown in Figs. 3 and 4.

Referring now to Fig. 2, we find a pentode-triode (6F7) which supplies synchronizing impulses from the received signal to gas triodes (884's). These 884's are used as relaxation oscillators to generate the horizontal and vertical sweep voltages. The oscillators feed 6F6 output tubes which furnish the cathode-ray deflecting voltages. It will be noted that the cathode-ray tube has a common connection for the second anode and one deflecting plate of each pair, permitting the use of single output tubes. Ordinarily, when a cathode-ray tube is connected

<table>
<thead>
<tr>
<th>Tube Type</th>
<th>Screen Size</th>
<th>3rd Anode Voltage</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>913</td>
<td>1''</td>
<td>500</td>
<td>Below 100 lines</td>
</tr>
<tr>
<td>902</td>
<td>2''</td>
<td>800</td>
<td>About 150 lines</td>
</tr>
<tr>
<td>906</td>
<td>3''</td>
<td>1500</td>
<td>About 250 lines</td>
</tr>
</tbody>
</table>

Let us now consider Fig. 2 in detail. The synchronizing signal, separated from the video signal, consists of high-frequency and low-frequency impulses, both supplied with negative polarity. These impulses are separated from each other and amplified in the 6F7 tube, the pentode section of which is connected for passage of the high-frequency impulse only and the triode section for passage of the low-frequency impulse only. The impulses leave the 6N7 with positive polarity and are applied to the respective 884 grids. The high- and low-frequency sweep outputs of the 884's are respectively 13,230 and 60 cycles. Coarse as well as fine frequency adjustments are provided to allow for variations among tubes. In use, the fine adjustment should be set to the center of its range, and the frequency set by means of the coarse control, after which the fine adjustment alone will be used. In use, each frequency control is manipulated together with the corresponding synchronizing voltage control, until best stability of the image is obtained.

The 884 oscillator outputs are not perfectly linear sawtooth waves. Adjustment of 6F6 bias gives an excellent means of
A sawtooth wave is made up of a large number of harmonics, of which it is desirable to preserve about 10 if the sawtooth form is to be retained. This means that the 13-kc. sawtooth requires uniform transmission of frequencies up to about 130 kc. For this reason, care should be used in wiring and layout so that the circuit capacities, commencing with the high-frequency 884 plate circuit and going up to the cathode-ray deflecting plates, are as small as possible. Crowding of the picture due to loss of high frequencies in the horizontal sawtooth occurs at the left side of the picture. Should this occur, the insertion of \( R_{17} \) and \( R_{18} \) will be found helpful in increasing the high-frequency transmission. In practice, it will be found that the blanking signal which, during picture reception, cuts off the cathode-ray tube for the return of the horizontal sweep, removes a portion of the left side of the scanning field. Hence, some non-linearity at the extreme left can be tolerated and will not appear in the received picture.

At this point the reader will want to know how to check the linearity of the scanning. This can be done quite simply in the following manner. If a signal is applied to the control grid of the cathode-ray tube and one or both scanning oscillators synchronized with this signal, various stationary patterns can be produced on the screen. If in particular a signal of, say, 600-cycle frequency is applied to the cathode-ray grid and the vertical oscillator (60 cycles) is synchronized with this signal, the grid will be driven alternately positive and negative (with respect to its initial bias) ten times during one vertical sweep, and a series of ten bright, stationary, horizontal bars with intervening dark spaces will appear on the screen. If the vertical sweep is linear, the bars will be equally spaced and an actual picture received under this scanning condition would be uniformly spread from top to bottom. Similarly, vertical bars to determine the horizontal distribution can be produced by applying a high frequency between, say, 75 and 150 kc. to the cathode-ray grid and synchronizing the horizontal oscillator.
with this signal. If both high and low frequencies are applied together and the scanning oscillators synchronized, a checkered pattern will appear which will show both vertical and horizontal distribution at once. (It is not necessary to do this; each may be taken separately.) Fig. 5 shows a distribution pattern produced on a 906 tube in this manner.

The test signals are applied to the video input terminal shown on Fig. 2 through a blocking condenser of 0.1 μf., and also connected to the synchronizing input terminal. Fig. 6 shows the circuit of a simple double-oscillator which is convenient for obtaining the test signals. A beat-frequency audio oscillator and r.f. signal generator of the service-equipment type may be available; if so, they will furnish convenient signal sources. However, it is desirable to have signals of the order of 15-20 volts, which the r.f. service outfit may not supply without amplification.

The same scanning circuits are used for either the 906, 902, or the 913 cathode-ray tube. Some simplification of the power supply can be made in the case of the 902 and 913. Fig. 3 shows the power supply and cathode-ray tube connections for the 906.

Everything except the unit marked ‘power pack’ is built into the same unit as the equipment in Fig. 2.

C1—0.001-μfd. mica.
C2, C3—1 μfd., 200-volt.
C4—0.5 μfd., 2000-volt.
C5—0.5 μfd., 1000-volt.
C6—16 μfd., 800-volt.
C7, C8—4 μfd., 900-volt.
C9—0.05 μfd., 200-volt.
R1—1.0 megohm, 1-watt.
R9, R11—50,000 ohms, 1/2-watt.
R3—0.5 megohm, 1-watt.
R5, R6—0.2-megohm potentiometer.
R7, R8—0.1 megohm, 1/2-watt.
R9—0.5 megohm, 1-watt.
R10—0.5-megohm potentiometer.
R11—0.25 megohm, 1/2-watt.
R13—50,000-ohm potentiometer.
L1, L2—5 henrys.

FIG. 3—POWER SUPPLY AND CATHODE-RAY TUBE CONNECTIONS FOR THE 906

FIG. 4—POWER SUPPLY AND CATHODE-RAY TUBE CONNECTIONS FOR THE 913 AND 902

Everything except the power pack is built into the same unit as the equipment in Fig. 2.

C1—0.001-μfd. mica.
C2, C3—1 μfd., 200-volt.
C4—0.5 μfd., 2000-volt.
C6—16 μfd., 800-volt.
C9—0.5 μfd., 1000-volt.
C10—0.05 μfd., 200-volt.
R1—1.0 megohm, 1-watt.
R9, R11—50,000 ohms, 1/2-watt.
R3—0.5 megohm, 1-watt.
R5—0.2-megohm potentiometer.
R6—0.1 megohm, 1/2-watt.
R7—0.5 megohm, 1-watt.
R8—0.25 megohm, 1/2-watt.
R10—0.5-megohm potentiometer.
L1, L2—5 henrys.
tube connections for the 906, and Fig. 4 shows these for the 902 and 913. A special doubler arrangement is used for the 906 which supplies both high and low voltages from a single transformer winding. An ordinary receiver power transformer will take care of all the requirements with the possible exception of the 81 filament, which may call for a separate transformer. The filter condenser requirements can be met economically by using combinations of standard 450-volt electrolytics; for example, four 16-µfd. condensers in series-parallel to give 16-µfd. and two 8-µfd. condensers in series to give 4 µfd.

It will be noted that, contrary to usual oscillograph practice, the cathode-ray tube is operated with cathode near ground potential and second anode at high positive potential with respect to ground. This arrangement permits a d.c. connection to the grid of the cathode-ray tube. The direct connection allows the use of the receiver, with the transmission scheme of d.c. carrier modulation for control of the background intensity of the picture, without the use of a d.c. restoring tube. This of course requires d.c. amplification between the second detector and cathode-ray grid, or a d.c. connection from second detector to cathode-ray grid if sufficient output is available without amplification.

Potentiometers \( R_5 \) and \( R_6 \) are adjustments which permit the picture to be centered on the screen.

In the absence of scanning, the intensity control should be turned far down to avoid a bright, stationary spot which may permanently damage the screen. The usual precautions in the handling of high-voltage apparatus should, of course, be observed.

The power supply should preferably be built as a separate unit and connected by cable to the cathode-ray and scanning unit. If the second-anode lead is run separately and isolated, the high-voltage bypass condenser \( C_4 \) may not be necessary, in which case, however, \( R_7 \) should be by-passed by a 1-µfd., 200-volt condenser.

It is recommended that panel controls be made of the two amplifiers, the two fine-frequency, and the brilliance and focus controls. The remainder of the controls can be screw-driver adjustments; that is, the potentiometer shafts are cut short and slotted with a hacksaw to receive a screw-driver blade.

On page 22 are shown photographs of images transmitted from a Monoscope and received on the 913, 902, and 906, respectively. Despite the inferior resolution of the smaller tubes, the smaller size of the picture tends to mask the loss of detail. The photographs were 30-second exposures, which gives some idea of the stability of the outfit. These pictures were received by direct wire connection of the video signal, no r.f. system being interposed. While the performance of regular Kinescopes must not be expected, it is nevertheless felt that some very acceptable results are obtained.

General Electric Bulletins GES-1996 and GEA-1999 are azimuthal world projection maps centered on Schenectady, New York, and Oakland, California, respectively. These bulletins, printed on letter-size paper, should be convenient for use on the operating tables of DX men.

![FIG. 6—CIRCUIT OF A SIMPLE BAR PATTERN GENERATOR FOR CHECKING THE LINEARITY OF SWEEP VOLTAGES](image)
Election

To all members of the American Radio Relay League residing in the Central, Hudson, New England, Northwestern, Roanoke, Rocky Mountain, Southwestern and West Gulf Divisions.

You are hereby notified that, in accordance with the constitution, an election is about to be held in each of the above-mentioned divisions to elect both a member of the A.R.R.L. Board of Directors and an alternate thereto, for the 1939-1940 term. Your attention is invited to Sec. 1 of Article IV of the constitution, providing for the election of the government of the A.R.R.L. by a Board of Directors; Sec. 2 of Article IV, and By-Law 12, defining their eligibility; By-Laws 13 to 23, providing for the nomination and election of division directors, and By-Law 14 providing for the simultaneous election of alternate division directors. Copy of the Constitution & By-Laws will be mailed any member upon request.

Voting will take place between November 1 and December 20, 1938, on ballots that will be mailed from the headquarters office in the first week of November. The ballots for each election will list, in one column, the names of all eligible candidates nominated for the office of director by A.R.R.L. members residing in that region; and, in another column, all those similarly named for the office of alternate. Each member will indicate his choice for each office.

Nomination is by petition. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members residing in any one of the above-named divisions may join in nominating any eligible member of the League residing in that division as a candidate for director therefrom, or as a candidate for alternate director therefrom. No person may simultaneously be a candidate for the offices of both director and alternate. A separate petition must be filed for the nomination of each candidate, whether for director or for alternate director. The following form for nomination is suggested:

(Place and date)

Executive Committee
The American Radio Relay League
West Hartford, Conn.

We, the undersigned members of the A.R.R.L. residing in the Division, hereby nominate (as a candidate for director (or for alternate director, as the case may be) from this division for the 1939-1940 term.

(Signatures and addresses)

The signers must be League members in good standing. The nominee must have been both a member of the League and a licensed radio amateur operator for a continuous term of at least four years immediately preceding the receipt by the Secretary of his petition of nomination. He must be without commercial radio connections; he may not be commercially engaged in the manufacture, selling or renting of radio apparatus normally capable of being used in radio communication or experimentation, nor commercially engaged in the publication of radio literature intended, in whole or in part, for consumption by licensed radio amateurs. Further details concerning eligibility are given in By-Law 12. His complete name and address should be stated. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon EST of the 20th day of October, 1938. There is no limit to the number of petitions that may be filed, but no member shall append his signature to more than one petition for the office of director and one petition for the office of alternate director. To be valid, a petition must have the signatures of at least ten members in good standing; that is to say, ten or more members must join in executing a single document; a candidate is not nominated by one petition bearing six signatures and another bearing four signatures. Petitioners are urged to have an ample number of signatures, since nominators are frequently found not to be members in good standing.

state, Wm. B. Hollis, W5FDR, Houston, Texas.

These elections constitute an important part of the machinery of self-government in A.R.R.L. They provide the constitutional opportunity for members to put the direction of their association in the hands of representatives of their own choice. Members are urged to take the initiative and file nominating petitions immediately.

For the Board of Directors:

K. B. WARNER,
Secretary
August 1, 1938.

Delays The F.C.C.'s ultra-high-frequency allocation from 60 to 300 Mc., which was to have become effective October 13th, has been postponed to April 13th next, to provide time for the Commission to redetermine its u.h.f. policy following the recent hearing of commercial complaints that too many frequencies have been assigned to government and television uses. The chief point made by the protestants is that not enough is known of the u.h.f. art to warrant assignment, but the higher bands would not be earmarked for any particular service until the Commission intends to wait until next April before releasing any of the definite assignments above 60 Mc. On the other hand, there have been no complaints about the projected amateur u.h.f. bands and it seems to us that the Commission might well allocate these bands to us while revising our regulations.

Official Washington has been very much in the doldrums during the dog-days of late summer. At the time of writing, no action has been taken on the contemplated general revision of our regs, although it is still hoped to make them effective in the early autumn.

Financial Statement Operations for the second quarter of this year resulted in a loss to the League of nearly $8,500. While it is customary for operations to yield a loss during the second and third quarters of the year, this quarter’s deficit is the largest on record. Largely this was a result of the very bad business conditions that existed generally during this period but partly it was because League activities are now at a larger scale than ever before and expenses of course continue during lean quarters as well as good. With business conditions improving, the League expects to finish the year in the black. (The first quarter yielded a gain of over $16,000.) At the instructions of the Board of Directors, the operating statement for the second quarter is presented for your information.

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

<table>
<thead>
<tr>
<th>REVENUES</th>
<th>EXPENSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership dues</td>
<td>$9,528.10</td>
</tr>
<tr>
<td>Advertising sales, QST</td>
<td>21,611.49</td>
</tr>
<tr>
<td>Newdealer sales, QST</td>
<td>10,938.58</td>
</tr>
<tr>
<td>Handbook sales</td>
<td>5,196.84</td>
</tr>
<tr>
<td>Spanish edition Handbook revenues</td>
<td>118.90</td>
</tr>
<tr>
<td>Booklet sales</td>
<td>2,040.83</td>
</tr>
<tr>
<td>Calculator sales</td>
<td>265.52</td>
</tr>
<tr>
<td>Membership supplies sales</td>
<td>1,890.38</td>
</tr>
<tr>
<td>Interest earned</td>
<td>395.68</td>
</tr>
<tr>
<td>Cash discounts received</td>
<td>232.75</td>
</tr>
<tr>
<td>Bad debts recovered</td>
<td>8.07</td>
</tr>
<tr>
<td></td>
<td>$51,926.74</td>
</tr>
</tbody>
</table>

Deduct: Returns and allowances          $3,507.32
Exchange & collection charges          10.25
Cash discounts allowed                 399.20

Less decrease in reserve for news¬|                      |
dealer returns of QST                   196.06
                                      3,702.21

Net revenues                           $48,224.53

<table>
<thead>
<tr>
<th>EXPENSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication expenses, QST            $16,437.42</td>
</tr>
<tr>
<td>Publication expenses, Handbook       3,362.48</td>
</tr>
<tr>
<td>Publication expenses, booklets       708.09</td>
</tr>
<tr>
<td>Publication expenses, calculators    95.68</td>
</tr>
<tr>
<td>Spanish edition Handbook expenses   550.18</td>
</tr>
<tr>
<td>Salaries                             24,091.76</td>
</tr>
<tr>
<td>Membership supplies expenses         1,049.21</td>
</tr>
<tr>
<td>Postage                              1,743.71</td>
</tr>
<tr>
<td>Office supplies and printing         1,367.47</td>
</tr>
<tr>
<td>Travel expenses, business            1,482.90</td>
</tr>
<tr>
<td>Travel expenses, contact             639.11</td>
</tr>
<tr>
<td>QST forwarding expenses              1,014.53</td>
</tr>
<tr>
<td>Telephone and telegraph              592.19</td>
</tr>
<tr>
<td>General expenses                     1,476.91</td>
</tr>
<tr>
<td>Insurance                            36.53</td>
</tr>
<tr>
<td>Rent, light and heat                 1,142.10</td>
</tr>
<tr>
<td>General Counsel expenses             294.89</td>
</tr>
<tr>
<td>Provision for depreciation of furni¬</td>
</tr>
</tbody>
</table>
ture and equipment                    328.72      |
| Communications Department field ex¬|                      |
penses                                127.15      |
| Headquarters station expenses        138.28      |
| Alterations and repairs expense      6.10        |
| Bad debts written off                131.15      |

| Total expenses                       56,723.56 |

Net loss before expenditures against appropriations $8,499.03

Judging by questions asked at a number of conventions where the four-band 814 transmitter was demonstrated by Reinartz, the close coupling intentionally used between plate coil of an oscillator and plate coil of the following stage has led to much confusion. Actually, this coupling prevents oscillation, for the circuit when operated with output at crystal frequency is simply an inductively neutralized amplifier.
A Six-Band One-Kilowatt Transmitter
Compact Four-Stage Outfit for C.W. or 'Phone
By J. E. Jennings, W6El

Besides describing a particular transmitter, the author also discusses some aspects of circuit operation not so generally appreciated. Even if you're not interested in having a kilowatt there are some good pointers to be picked up from reading this article.—EDITOR

During the past few years a great variety of combinations of tubes and circuits have been employed in high-power transmitters, but unfortunately the flexibility of the transmitter often goes down in some ratio to the increase in power and efficiency. Being an average ham, my interest is not confined to any one band, and the ability to change frequency rapidly not only inside a given band but also from band to band was a prime consideration. An ideal transmitter for amateur work should operate on all bands from 56 to 1.75 Mc., should be capable of the maximum input allowed by law, and should be usable on both 'phone and c.w. To put on the air a clean signal free from excessive harmonic radiation and "splatter," when fully modulated, tank circuits designed for optimum values of Q should be provided. The band-changing should be a simple operation not necessitating a major overhaul, so that when things are "hot" on any band rapid change-over can be accomplished.

With the above requirements in mind the writer attempted to build such a transmitter by utilizing some of the newer ideas in radio transmission as well as some of the newer equipment. We feel that the transmitter to be described has met practically all of the requirements. Since the speech equipment is no concern of the present article its description will be omitted.

A pair of 100TH tubes was chosen for the final amplifier since two of these tubes will handle a full kilowatt readily. With 3000 volts and a plate current of 330 milliamperes, plate efficiencies over 80 per cent can be obtained. This means that a carrier power of the order of 750 watts should be expected.

If the tank circuits are properly designed very little harmonic radiation should take place, with the result that practically all of the output is confined to the fundamental frequency. The tank circuit presents a problem which could not be solved until the advent of the vacuum tank condenser, inasmuch as no conventional tank condenser having adequate spacing for 3000 volts on the plate with 100 per cent plate modulation was available in the necessary capacity for optimum tank circuit Q on the lower frequencies. The final tank circuit uses a 6-µfd. vacuum condenser for 28-Mc. operation, a 12-µfd. condenser for 14-Mc., a 12-µfd. condenser for 7-Mc. (c.w. only), a pair of 50-µfd. condensers for 1.75-Mc., and a 50-µfd. condenser for 3.5-Mc. A more economical arrangement, though not quite as convenient, is to use a 6-µfd. condenser for 28 Mc., parallel another 6 µfd. for 14- and 7-megacycle operation, a single 50-µfd. unit for 3.5 Mc. with a second 50-µfd. section connected in parallel for 1.75 Mc. Thus it is possible to cover all the bands with only four units.

Tuning of the tank circuit can be accomplished in a number of ways, but since the value of capacity is fixed for opti-
maximum Q, the inductance preferably should be the variable factor. The tank circuits are made up as units with the proper coil and capacity already combined. A refinement of the plug-in arrangement would be to build a unit holding all of the tank circuits and to select the tank circuit for the desired frequency by means of a switch in the plate lead to each tube. Voltage insulation of this switch would need to be high but since the capacity and inductance are in a unit very little circulating current would flow through the switch, hence the contacts could be small. This elaboration was not used since there was no objection to changing only the final tank; the rest of the transmitter requires no coil changing.

**EXCITER STAGES**

Operation of the 100TH's with a kilowatt input as a Class-C modulated amplifier requires from 50 to 75 watts of grid excitation power. The conventional exciter uses receiving type tubes for the oscillator and frequency multiplier stages, thus necessitating one or two buffer stages to obtain the desired power output. Such an arrangement usually requires the changing of many coils and always has the disadvantage of having more than one stage operating at the same frequency at the same time. The 35T makes a good crystal oscillator tube and outputs of 50 to 75 watts are obtained on the 3.5- and 1.75-Mc. bands. This output is quite sufficient fully to excite the final amplifier on 3.5 or 1.75 Mc. No reaction on the crystal oscillator stage is detectable, so that the use of a buffer stage is unnecessary. The plate tank condenser of the oscillator is 200 µfd., this value being chosen so that the tank circuit could be tuned from the low-frequency end of the 1.75-Mc. band to the high-frequency end of 3.5 Mc., without changing coils. Suitable crystals are switched into the grid circuit when operation on either of the bands is desired; of course the tank circuit must be adjusted for resonance with the proper crystal. The coil is "pruned" so that the 1.75-Mc. limit is reached with the condenser at maximum capacity and 4 Mc. with the condenser at minimum capacity.

The plate voltage used on the crystal oscillator may be anything from 1000 to 1500 volts. Such high voltages are rather unusual for a crystal oscillator stage but present no hazard to the crystal providing a few precautions are taken. The low interelectrode capacity of the 35T prevents excessive feed-back, and if some method is used to limit the grid swing, current well within the crystal manufacturer's rating can be realized. (Of course the crystal should be well isolated from the plate circuit.) The easiest method of limiting the grid swing is to eliminate the conventional grid leak entirely, bias being obtained from a 500-ohm cathode resistor. This value has been found to give the best all around results. It is very important that this resistor be non-inductive, since dangerously high crystal currents may result if an inductive resistor is used. As a precaution it is wise to keep a 60-ma. pilot bulb in series with the crystal. Ordinary flash-light bulbs are worthless as a protective device because many of them require more than 300 ma. to blow. The 60-ma. variety burn out at about 120 ma. To prevent modulation of the output of the crystal it is necessary to return the bias lead either to a center tap on the filament transformer or to a center-tapped resistor.

**FREQUENCY MULTIPLIERS**

The first frequency multiplying stage is also a 35T and is designed to operate either as a doubler or a quadrupler. Again the tank capacity is great enough to allow a frequency range of slightly
more than two to one. With a properly pruned coil, this stage covers from the low-frequency end of 7 Mc. (doubling) to the high-frequency end of 14 Mc. (quadrupling). No difficulty should be experienced in obtaining 50 to 75 watts output from this stage on either band with excitation from the 3.5-Mc. oscillator. Thus we have adequate excitation for the final without changing anything but the setting of the frequency-multiplier tank condenser. The third harmonic is very strong, by the way, and should not be confused with the fourth.

A few points about the successful operation of such a stage might be in order. The power gain of the stage goes down as the order of the harmonic goes up. For example, a power gain of 4 to 6 might be expected on the second harmonic while on the fourth harmonic practically no power gain can be realized. This means that for 50 to 75 watts output on the fourth harmonic practically that much grid drive must be supplied by the oscillator. The bias for this stage is obtained from a 50,000-ohm grid leak. With the normal grid current of about 20 ma, a bias voltage in the order of 1000 volts is obtained—almost equal to the plate voltage! It will be noted from the diagram that this stage is "neutralized"; actually, a slightly greater capacity is necessary for neutralization is used. This additional capacity greatly accentuates the fourth harmonic without causing instability.

The second frequency multiplying stage is used for 56- and 28-Mc. operation, quadrupling or doubling respectively. It was hoped that a coil-condenser combination could be found that would cover both 56 and 28 with the same coil, but because of high stray capacities this arrangement proved impracticable. The only coil change necessary in the exciter unit is for five-meter operation.

**INTERSTAGE COUPLING**

The exciter unit employs capacitive coupling throughout in order to reduce the number of

---

**FIG. 1—CIRCUIT DIAGRAM OF THE SIX-BAND HIGH-POWER TRANSMITTER**

- **C1**—200-µfd. variable, 0.027" spacing (Cardwell MT-100-GD with sections connected in parallel).
- **C2**—150-µfd. variable, 0.027" spacing (Cardwell MT-150-GS).
- **C3**—35-µfd. variable, 0.084" spacing (Cardwell NP-35-ND).
- **C4**—Fixed vacuum condensers: 28 Mc (6 µfd); 14 Mc, and 7 Mc, 12 µfd; 3.5 Mc, 20 µfd; 1.75 Mc, 100 µfd. (Eimac type VC).
- **C5, C6, C10, C15**—2-10 µfd. disc-type neutralizing condenser (National NC-800).
- **C7**—6-µfd. mica, 5000-volt.

---

- **RFC**—Sectional-wound r.f. chokes of current rating suitable for stage (see text).
- **L1**—30 turns No. 20, length 1½ inches, inside diameter 2½ inches, center-tapped; excitation taps 7 turns each side center.
- **L2**—11 turns No. 14, length 3¼ inches, inside diameter 2 inches, center-tapped; excitation taps 2½ turns each side center.
- **L3**—8 turns No. 14, length 3 inches, inside diameter 1¼ inches, center-tapped; excitation taps 2½ turns each side center (for 28 Mc). 56-Mc. coil four turns, adjusted to resonate over band with C9.
- **L4**—Barker & Williamson HDVL coils, adjusted and tuned as described in the text.
- **S4**—Three-pole, three-position, three-section isolating-insulated switch (Centralab).
- **M1**—0-250 d.c. milliammeter.
- **M2**—0-500 d.c. milliammeter.

---

**METER CIRCUIT**

---

**FILAMENT TRANSFORMER SWITCHING**

---

**QST for**
controls to a minimum and also to take full advantage of the high mu of the tubes used. As the frequency multiplying stages operate with very high bias a large voltage swing from the driver stage is required. To obtain this large swing the grid of the following stage is connected directly to the "hot" end of the driver plate coil through a suitable blocking condenser. If the frequency-multiplying stage is not required that circuit is made ineffective merely by turning out the filament of the unwanted tube.

The grids of the 100TH's are switched to the proper driver stage by means of two sections of a small Isolantite-insulated switch of the type used in receivers. A third section of this combination switch automatically provides the proper sequence to the lighting of the tube filaments. Individual filament transformers facilitate metering of the various circuits and also provide a method of controlling the filament power by opening the primary circuits.

Even though the grid leak is 50,000 ohms, very heavy loading of the driver stage will result if this grid leak is connected directly in the circuit without the use of series radio-frequency chokes. The best chokes are none too good, and for best results several of the conventional type may have to be connected in series. If still greater efficiencies are desired it will be necessary for you to "roll your own."

TUNING THE FINAL AMPLIFIER COIL

Several methods of tuning the final amplifier were tried. It seems that any scheme will work well providing the proper mechanical details are worked out. Probably the simplest method is to hunt a comparatively small variable condenser across a few turns of the inductance, allowing the vacuum condenser to shunt the whole coil. The tuning range of the condenser goes down as the voltage across it is made smaller. To make a very small condenser withstand the high voltages existing across the coil during 100 per cent modulation the tuning range becomes very limited. Probably a compromise between tuning range and physical size will give the proper conditions of operation, although it must be pointed out that an advantage of the vacuum condenser is its small physical size, and a bulky tuning condenser will add stray capacity to the circuit with the result that full tank-circuit efficiency may not be realized.

Methods of varying the inductance were tried with excellent results. A single closed turn of quarter-inch copper tubing tunes the circuit quite well, although probably the best method found to date is to use several turns of wire in series with the main inductance. The final coils were built from Barker & Williamson HDVL coils with a few turns of the same size wire as the main coil connected in series. Mechanical adjustment of the variable coil is made by means of a flexible shaft that connects to the center post of the coil assembly by means of a spline. The number of turns necessary to cover any one band varies from $\frac{5}{2}$ turns at 3.5 Mc. to $\frac{1}{2}$ turn on 28 Mc.

**BESIDES THE USUAL BY-PASS CONDENSERS AND RESISTORS, THE BOTTOM OF THE CHASSIS ALSO CONTAINS THE CRYSTAL AND METER SWITCHES, AND SEPARATE FILAMENT TRANSFORMERS FOR EACH STAGE**

The variable coil should be made to rotate through 360 degrees so that the extra inductance either adds to or subtracts from the main inductance of the coil.

The picture of the transmitter shows still another method of varying the inductance which works quite well. The tank coil is split in the center and one-half of the coil is moved up and down by means of a threaded shaft. The inductance is varied as the mutual coupling between the coil sections is varied. Any of the above methods gives excellent results and there is little choice between them from the standpoint of electrical efficiency. The minimum plate current of the final amplifier should be between 20 and 35 mils at unloaded resonance with a plate voltage of 3000.

ADJUSTMENT

A transmitter of this type is, in its completed form, a very simple and practical unit. However the final results were obtained only after considerable "bug" hunting. We trust that a few suggestions will save needless duplication of some of the more obvious difficulties.

The coil sizes and condenser capacities were chosen after a lot of experimental work. If variable condensers of other makes than those shown are used, be sure the minimum capacities are at least as low as the ones used here, since probably the biggest difficulty in obtaining a two-to-one

October, 1938
AY, Joe, the band sure has been acting funny here to-day. I don't know what the trouble is,” wails our friend Archie into his chromium-plated kilowatt. Sure enough, the band is acting up, and in the middle of his next sentence Archie goes into a walloping fade which twists his voice into a mush that the worst non-linear Class-B stage couldn't equal, and we mercifully shut off the receiver and wonder why Archie didn't know what the trouble was with the band. If he had only known how to do it, he could have discovered what was wrong in a few minutes by listening on his receiver — and he wouldn't have to do any slide-rule work, or wait until Wednesday and copy WWV's ionosphere reports, either. But Archie didn't know what to listen for, and who can blame him? What ham wants to wade through pages of high-powered theory on ordinary and extraordinary rays, magneto-ionic splitting, elliptical polarization, refractive indices, and all the other polysyllabic emissions from the realm of atmospheric physics, in the hope of finding out what the trouble is when the band starts acting up. Suppose he does know what “conditions” are, he can't change the Kennelly-Heaviside layer, can he? No, he can't, but he might save himself a lot of mental distress, as well as wear and tear on his tonsils, if he did know what was going on. It is the object of this article to remove the theoretical and mathematical whiskers from some of these things that Archie would like to know about, and set forth a few items which have a direct practical application to amateur transmission. There is only one worry: Archie, we are afraid, won't read the article. It won't be because it is too tough for him, but it will be because of the fact that, really to know what happens to signals after they leave an antenna, one must thoroughly understand things like skip-distance. "Shucks," says Archie, "I know all about skip-distance." Maybe so, Archie, but your remark to Joe doesn't show that you do. If you will just stay with us through a little elementary stuff, you may find out the answers to some of those things you have often wondered about.

Engineers and physicists have been very much interested in what happens to radio signals in the upper atmosphere since 1901, when Marconi first demonstrated that signals could be transmitted across the Atlantic Ocean. It is of interest to note that prior to this time scientists had claimed such a thing was impossible. The correct explanation of why this transmission was possible was given the following year by Kennelly, and also Heaviside, in articles suggesting the probability of a reflecting layer in the upper atmosphere which kept the signals from leaving the earth and being lost in space. However, it was not until amateurs explored the regions below 200 meters and skip-distance was discovered, that much interest was taken in the Kennelly-Heaviside Layer. This was the result of experiments by John Reinartz and other amateurs in 1924, and nearly all our present knowledge of transmission effects, particularly in the short-wave region, dates from that time. We know now that there are several of these reflecting layers in the upper atmosphere, and if one knows a few simple facts about what happens when a radio wave strikes one of them he will find that he also has a good understanding of the various peculiarities of the amateur bands.

The Reflecting Layer

We need only a very brief explanation of the composition of these reflecting layers, which happens to signals after they leave an antenna, one must thoroughly understand things like skip-distance. "Shucks," says Archie, "I know all about skip-distance." Maybe so, Archie, but your remark to Joe doesn't show that you do. If you will just stay with us through a little elementary stuff, you may find out the answers to some of those things you have often wondered about.

Engineers and physicists have been very much interested in what happens to radio signals in the upper atmosphere since 1901, when Marconi first demonstrated that signals could be transmitted across the Atlantic Ocean. It is of interest to note that prior to this time scientists had claimed such a thing was impossible. The correct explanation of why this transmission was possible was given the following year by Kennelly, and also Heaviside, in articles suggesting the probability of a reflecting layer in the upper atmosphere which kept the signals from leaving the earth and being lost in space. However, it was not until amateurs explored the regions below 200 meters and skip-distance was discovered, that much interest was taken in the Kennelly-Heaviside Layer. This was the result of experiments by John Reinartz and other amateurs in 1924, and nearly all our present knowledge of transmission effects, particularly in the short-wave region, dates from that time. We know now that there are several of these reflecting layers in the upper atmosphere, and if one knows a few simple facts about what happens when a radio signal strikes one of them he will find that he also has a good understanding of the various peculiarities of the amateur bands.

The Reflecting Layer

We need only a very brief explanation of the composition of these reflecting layers, 1 Reinartz, "The Reflection of Short Waves," QST, April, 1925.
and how they reflect radio waves. They are formed when energy radiated from the sun, in the form of ultra-violet light, strikes the gases in the upper atmosphere. This radiant energy knocks some of the gas molecules apart, into negative and positive charges of electricity. This process is called ionization, and the ionized region is generally called the ionosphere. Radio waves will travel faster when they strike such a region, and this change in speed causes them to bend in their path, and may even cause them to become completely reflected by the layer and thus be returned to the earth. It is also possible to get so much ionization that the waves may be absorbed at low levels and not be reflected, but this effect is less important at high frequencies than at lower frequencies.

Therefore we have three possibilities, as shown in Fig. 1. (For the purpose of simplification only one reflecting layer is shown.) There may be so little ionization that the signals will be bent only slightly, and will pass on through the layer and not be returned to the earth as in Fig. 1A. The next case is Fig. 1B, which shows enough ionization to bend and reflect the waves back to earth, while in Fig. 1C we find so much ionization that the waves are absorbed.

When we consider the effect that the wavelength of the transmitter signal has on the amount of reflection from the ionized layers, it is helpful to remember that light and radio signals are the same kind of waves, the only difference being one of wavelength. We know we see the sun, moon, and stars through these layers, so we come to the conclusion that very short waves will go through and not be reflected. This is the actual case, as shown in Fig. 2. Here the same amount of ionization is present in the layer during the transmission of 14- and 30-megacycle signals. The 14-Mc. signal (solid lines) is reflected and returns to the earth, while the 30-Mc. signal (dotted lines) is bent only slightly by the layer and is lost in space. At the same time we should find that signals in the low-frequency bands below 14 Mc. also would be reflected, and those above 30 Mc. would pass on through and be lost. We have now two important facts to remember. First, the lower the transmitted frequency, the greater the likelihood of reflection. Second, the stronger the ionization in the reflecting layer (neglecting absorption) the higher the frequencies which it will reflect.

**SKIP DISTANCE**

We must also take into account the effect of the angle at which the signals strike the layers. For example, suppose you stand on the bank of the river and shoot a rifle directly down at the water. The bullet will penetrate the surface and go on down. But if you shot at something out in midstream, where the bullet would strike the water at a low angle, you would probably find that it would bounce right off the surface and continue on. The same thing may occur when a radio signal strikes an ionized layer in the upper atmosphere, and this is what gives rise to the effect known as skip distance. It takes place when the ionization is not sufficient to reflect signals of a particular frequency when they strike the layer at a steep angle, but will reflect them when they strike the layer at a smaller angle. This is illustrated in Fig. 3, which shows all waves radiated from the antenna at greater than a certain critical angle will penetrate the layer and be lost, while all low-angle radiation will be returned to earth. In the skip-distance region no signals will be heard, providing you are beyond the range of the ground wave near the transmitter. It will also be observed that the ray shown striking the earth at the limit of the skip-distance zone at A is shown being reflected from the surface of the earth, striking the layer again, and once more being reflected and returning to the earth at B. Two-, three- or four-hop transmission paths of this kind are very common in high-frequency transmission, particularly over long distances. In Fig. 3 we see that we may also have a signal arriving at B after only one reflection. If these two signals arriving at B are about the same strength we may find bad fading as they interfere with each other. Recalling the statement at the close of the preceding paragraph, that the lower the frequency the better it is reflected by the layer, we can see that the amount of ionization shown in Fig. 3, which would reflect only low-angle radiation on 14 Mc. probably would reflect 7-Mc. signals striking it from all angles, thus making zero skip-distance on that and all lower frequency bands.

**SKIP DISTANCE AND TRANSMISSION CONDITIONS**

We can make use of this skip-distance effect to tell us what is going on in other bands merely by listening on one. Suppose we hear stations as close as 100 miles on 14 Mc. We conclude at once that there is a good deal of ionization overhead, and that 30-Mc. signals are also being returned to earth. On the higher frequency the skip-distance will be perhaps 1000 miles, but that is short enough to make the 30-Mc. band very active. Since we have observed a very short skip on 14 Mc. we can tell that 7 Mc. will have zero skip, as will the 3.5- and 1.75-Mc. bands.

October, 1938
Now when we have a long skip-distance we will hear and work only distant stations, but when the ionization increases and skip shortens, we will begin to hear nearby stations. We will then start losing the DX signals for two reasons. First, they are buried under the QRM from nearer stations, and second, the high ionization has started to absorb these distant signals which travel a long way in the ionized regions, so they are usually much weaker. This accounts for the fact that the longer the skip-distance and the higher the frequency band you can work, the better your chance for DX.

Since radiation from the sun causes the ionization in the upper atmosphere, we would expect to find different conditions during the night and the day. For example, let’s see what takes place during a normal winter day. In the early morning hours before sunrise there is little ionization present, since no energy is being received from the sun. Under these conditions we find 30 Me. gone completely, and only a few very distant signals (or none at all) on 14 Me. There is enough remaining ionization from the day before to reflect the lower frequency signals somewhat, and we find DX conditions on 7 Me., and a short skip on 3.5 Me., with probably zero skip on 1.75 Me. As the sun rises, the ionization will increase rapidly and reach a maximum at about noon. Thus as noon approaches, the skip will get shorter on all bands, in mid-morning becoming short enough to return 30-Me. signals to earth. We find the 14-Me. cycle band full of comparatively local signals with nearly zero skip-distance from about 9 A.M. to 3 P.M., during which time the 30-Me. band is open for DX. As the sun sets, the ionization decreases, since the free positive and negative charges in the layers will start to recombine as soon as the ionizing agent (light from the sun) is removed. The time which must elapse after sunset before this process is complete will depend on the season and the amount of ionization which was present at the maximum during the day. At any rate, we will find that as evening comes on the skip-distance will increase in each band until the skip distance increased so much, on account of the low ionization, that they were no longer reflected. We find, then, that we have night conditions during the day, and conditions of this kind will last throughout the duration of the storm, which may be anywhere from one to three days. During this time we will find that the high-frequency bands usually will fade out much earlier in the evening than on normal days. During the storm we will usually find good DX on 14 Me. at noon, when on normal days we would only be able to work about 1000 miles at that hour. Thirty megacycles probably would be completely useless at that time. If one is reasonably familiar with what he normally hears on a band at a particular time of day, he should be able to tell by a couple of minutes’ listening if a magnetic storm is in progress. The turbulence in the ionosphere at such times gives rise to considerable fading, accompanied by severe distortion, and this is another important clue. At such times DX hounds will find things just to their liking with plenty of distant signals coming in (if they look on the right bands), but all other hams either will have to QRT or move down to a lower-frequency band until things settle down again.

MULTIPLE LAYERS AND ABNORMAL IONIZATION

Before we talk about seasonal changes, and why 30 Me. is—or isn’t—any good in the summer, there are two other abnormalities that should be mentioned. The first and most important of these is the so-called “abnormal” or “sporadic”
E layer. Most amateurs are familiar with the fact that the ionization in the upper atmosphere occurs in the form of distinct layers above the earth. Why there should be layers rather than a continuous distribution is a point which scientists have been unable to explain. Roughly speaking, the layers usually remain at about the same heights from day to day, and for amateur and high-frequency work, the most important ones are those known as the E layer and the F layers.\(^3\) The E layer lies in a region about 100 kilometers (62 miles) above the earth, while the F layer region is up approximately 240 kilometers (150 miles). These heights should be carefully noted. They are far above and entirely untouched by any weather conditions on the surface of the earth. We often hear hams commenting on how the weather is affecting "conditions." With the exception of the bending of ultra-high frequencies mentioned in the last part of this article, such effects will almost always be found to be traceable to moisture on feeders and insulators, rather than any change in transmission conditions.

In the F region we often find two layers which are known as F\(_1\) and F\(_2\), the former usually being somewhat below the latter. The higher F\(_2\) layer is more heavily ionized than either the E or F\(_1\) layers, and as a result it is the most important layer in high-frequency transmission, since signals of high-enough frequency to penetrate the moderately-ionized E and F\(_1\) layers may still be returned to earth by the higher and more-heavily ionized F\(_2\) layer. This is shown in Fig. 4. Of course, for lower frequencies the E layer is more important, and most of the transmission in the 1.75-Mc. band is by reflection from the E layer. It is in this E-layer region that we occasionally find a patch or cloud of very intense ionization that is known as the abnormal E layer. It may happen at any time, day or night, and the reason for its existence is not known. When it occurs, it may cause signals to be reflected on frequencies as high as 60 megacycles. In fact, its effect is noticed mostly on the high-frequency work, since it often occurs when the ionization is caused by the sun we might expect pronounced seasonal changes. The exact reasons why some of these changes take place are not known, but enough data have been collected so that we have at least a fair idea of what to expect. It has been found that the ionization in the F\(_2\) layer (which is the one in which we are most interested) is greatest in the winter time, when it reaches its daily maximum at about noon. This means that in a given year the shortest skip-distances will be found at about noon in a winter day. That will be the time that the highest frequencies can be used reliably; for example that will be when the 30-Mc. band will be at its best. In the summer time the maximum amount of ionization is considerably less than in the winter, and the daily peak for the F\(_2\) layer shifts to about sunset. This means that, on the average, 30 Mc. will have a much longer skip in summer than in winter, and in fact may be out completely a good few hours or a few minutes or a few hours, and usually results in an almost complete wiping-out of high-frequency communication on the lighted portion of the globe. The reason for the disappearance of the signals is just the opposite from that a magnetic storm, the fade-out arising from a very great increase in ionization at low levels where it results in absorption of the signals. The magnetic storm always affects higher frequencies first, while the fade-out may affect lower frequencies only, the higher ones being able to penetrate the absorbing layer and be reflected as usual from the F region. However, many of these fade-outs are so intense that all high frequencies are absorbed, and there is also a considerable decrease in static and atmospheric noise. So if you turn on your receiver some day and it seems nearly dead, don't tear it apart until you are sure that a fade-out isn't to blame.

\textbf{SEASONAL CHANGES}

What happens to the 30-Mc. band in the summer? That brings up the matter of seasonal changes in the ionosphere. We know that the sun is in a different place in the summer time, and since the ionization is caused by the sun we might expect pronounced seasonal changes. The exact reasons why some of these changes take place are not known, but enough data have been collected so that we have at least a fair idea of what to expect. It has been found that the ionization in the F\(_2\) layer (which is the one in which we are most interested) is greatest in the winter time, when it reaches its daily maximum at about noon. This means that in a given year the shortest skip-distances will be found at about noon in a winter day. That will be the time that the highest frequencies can be used reliably; for example that will be when the 30-Mc. band will be at its best. In the summer time the maximum amount of ionization is considerably less than in the winter, and the daily peak for the F\(_2\) layer shifts to about sunset. This means that, on the average, 30 Mc. will have a much longer skip in summer than in winter; and in fact may be out completely a good few hours or a few hours, and usually results in an almost complete wiping-out of high-frequency communication on the lighted portion of the globe. The

\footnote{Letters are used merely as a convenient way of identifying the layers. The first two layers found were labeled \textit{E} and \textit{F}, leaving alphabetical space for any possible layers above or below them. This was a wise precaution as we now have evidence of \textit{C}, \textit{D}, and \textit{U} layers also. The letters are arranged in alphabetical sequence ascending from the surface of the earth.}

\footnote{QST, Jan., 1936; June, 1936; Feb., 1937.}
Refinements in Combination Exciters

Effective Designs for Low-Power R.F. and Audio Stages

By T. M. Ferrill, Jr.,* W1LJI

FEW are the amateurs who have not wished for a transmitter which could be operated as easily as the modern receiver. The desire to operate on more than one of the amateur bands, shifting from one to another with great ease and rapidity, has brought development of receivers to the point where it is only necessary either to plug in one unit or turn one knob to select another amateur band, and then simply to turn one dial to select the frequency of reception in that band.

The transmitter or exciter pictured in these pages is as compact as a modern superheterodyne receiver, is designed for operation in a small cabinet or rack on the operating table, is equipped for electron-coupled oscillator as well as crystal frequency control, and is capable of being used on five bands with the utmost convenience. To select any of these bands (160, 80, 40, 20, and 10 meters) it is only necessary to turn one switch knob to the proper position. To select any desired frequency in that band, it is only necessary (with the crystal selector-e.c.o. switch set for e.c.o. operation) to turn the calibrated vernier band-spread dial in the center of the panel to the proper setting. If crystal control is preferred, the same procedure is followed with the crystal selector-e.c.o. switch set for the desired crystal.

If a power output of 20 to 35 watts is sufficient, the unit may be used as a complete transmitter for code and 'phone operation. This is an ideal exciter for a high-power amplifier.

This article is not confined to the constructional details of this one unit, but rather is planned to give a few pointers which will be useful to the amateur building such a device to suit his individual needs. Since the majority of present-day amateurs participate in code operation alone, many would not be interested in the speech-amplifier equipment included in the arrangement pictured here. Indeed, of those interested in providing speech amplifier as well as r.f. exciter-transmitter, few consider the care and patience required to build both into a single panel and chassis justified by the operating convenience thus provided. Construction and adjustment of the unit shown in the illustrations required many hours of tedious work—in addition to parts, tubes, and crystals totaling $150. Since the expense of this type of construction may prohibit its use in many cases, more economical methods of achieving the desired end also will be discussed.

R. F. STAGES

A single crystal oscillator stage may be used to deliver an output of approximately 25 watts on the crystal frequency. Why, then, should such an elaborate, expensive, and difficult-to-construct method of obtaining this output be used? The answer to this question lies in the ease with which band change, frequency change, and change from crystal to e.c.o. oscillator with full output may be effected for operation in any of the five bands covered; in the fact that the output tube operates as a properly isolated Class-C amplifier and is thus suited to plate modulation if desired; and in the fact that each of the crystals provided may be used for operation on three to five crystal-controlled output frequencies. This last-named feature is an

TOP VIEW OF THE COMBINATION UNIT

In this view, the 807 tube is shown with top of shield removed. This shield is used to supplement the bottom-of-tube shield mounted on the chassis. The two 5Z3 tubes are located at back of chassis behind the power transformers. The 6L7 tube is seen at the left of the condenser gang directly behind the panel, and is followed by the 6V6, 6N7, and the other 6N7 r.f. tube which is hidden by the 807 shield. The four crystal sockets are mounted on an aluminum plate which is in turn mounted on top of the first four condenser sections. The 6Z7 speech input tubes are located directly behind the panel beneath the meter, and the tubes between the 6L7's and the audio output transformer are the 6N7 push-pull speech amplifiers. It will be noted that the chassis is laid out primarily for correct wiring of the r.f. stages, with thought given also to placement of the speech amplifier transformers as far as conveniently possible from the power transformers. The plug-in tanks in the row at left are, from panel toward rear of chassis: 80-meter doubler plate tank, 20-meter doubler tank, and 10-meter doubler tank. In the row of six, beginning at panel, there are: 160-meter c.c. oscillator grid, crystal oscillator-buffer plate, 40-meter doubler plate, 60-meter amplifier tank, 40-meter amplifier, and 10-meter amplifier tank. The 20-meter amplifier tank is located at rear of chassis behind the 807 tube, and the 160-meter amp. tank is located beside the push-pull audio transformer. The three 7-prong sockets at rear of chassis are those for power and output cables, as shown in the diagrams, and the 4-prong socket is included for making the 300-volt power supply available for a receiver.

bands as well. A desirable characteristic of such an r.f. oscillator-amplifier arrangement as that shown is the fact that the crystals are operated in a lightly-loaded tetrode oscillator with plate voltage never exceeding 300 volts, so that there is no danger of injury to the crystals.

To go back once more to the question of a single-tube exciter, suppose that some such tube as an RK39 or 807 were used as a band-switched, crystal-e.c. oscillator. Tuned plate tanks and grid tanks could be provided for e.c. operation, and one crystal could be used on each band. With this system, representative power output of the oscillator, crystal-controlled, would be in the neighborhood of 5 watts on 10 meters, 10 watts on 20 meters, and higher output power on the lower-frequency bands. For good frequency stability, the power of the e.c. oscillator probably would not exceed 5 watts on any band. Furthermore, the oscillator would have to be adjusted on five bands for stable e.c. operation, rather than on one. These considerations point to one type of arrangement—oscillator on one low-frequency band, and successive doublers for operating important one, for the maximum value in a crystal may only be realized when this crystal may be used to control output not only on the crystal frequency, but on harmonic frequencies in the amateur

BOTTOM VIEW OF THE AUDIO-R.F. CHASSIS

Filter chokes and condensers are mounted along each side beneath the chassis. The two r.f. chokes at the input of the speech amplifier are shown in their shield can which is mounted around the back of the microphone jack. The bottom plate for the chassis completes the shielding of this unit.
FIG. 1—CIRCUIT OF R.F. EXCITER AND POWER SUPPLIES

C1—200-µfd. fixed condenser (two Sickles 11-883 100-µfd. condensers parallel connected and inserted in tank unit).

C2—50-µfd. variable condenser (both sections of plug-in unit).

C16, C17, C18—25-µfd. variable condenser (single section of tank).

C19—50-µfd. variable condenser (both sections of tank).

L1b—L4—5-25-henry, 200-.ma. swinging choking chokes.

L1a, L5—20-henry, 200-.ma. smoothing choking chokes.

M—0-200 d.c. milliammeter.

R1—50,000-ohm, 1-watt carbon.

S1—Large 7-prong socket, r.f. and audio output.

S2—Large 7-prong socket, power connections.

Sw1—Single-pole, single-throw toggle power switch.
on the higher frequencies. Two doubler stages may be built at the cost of one dual-triode tube such as the 53 or 6N7, one tube socket, two coils, two tuning condensers, two r.f. chokes, two by-pass condensers, two carbon grid leak resistors, and two coupling condensers. Thus, the cost of two successive doubler stages, without special tuning and switching equipment, is in the neighborhood of $3.00 to $5.00. Hence the power output of which such doubler stages are capable is quite low, it is logical to begin with a low-power oscillator, both for crystal and for e.c. operation, and to provide some type of amplifier requiring only a small amount of driving power.

The circuit of Fig. 1 makes use of five tubes in seven r.f. stages. The four doublers and the 807 stage are straightforward. A 6V6 tube is used as the oscillator on the 160-meter band for crystal operation, and when e.c. operation is preferred, this stage is converted to a buffer amplifier. With this design, it is possible to adjust the electron-coupled oscillator for very stable operation on the 160-meter band. This makes practical the use of the harmonics of the e.c. oscillator for stable operation in the high-frequency bands. In addition, since the tube is used solely on 160 meters, and since it is reasonably well isolated from effects of load changes in succeeding stages, it is possible to build the oscillator in such a way that it is comparable to an e.c. frequency monitor. This suggests the use of a calibrated oscillator, so that the unit serves the dual purpose of exciter and frequency monitor.

The band-switch system considered most suitable for use with such a set of doublers and amplifier is one which accomplishes three functions: Switching the grid of the amplifier to the tank circuit of desired frequency, grounding the grids of the unused doublers to insure that they be inoperative, and switching the plate of the amplifier to the output tank of the desired frequency. Here the question of power loss due to switching arises. Since doublers of the type chosen (as well as the 6V6 stage as either crystal oscillator or buffer) provide a good margin of driving power for the amplifier, there is little need for worry about the efficiency of this portion of the switching system. On the other hand, the efficiency of the amplifier output circuit is of paramount importance, since any power lost here would, if saved, be additional output. However, if a switch of low contact resistance and low-loss insulation is provided, and is so placed that it does not seriously affect the Q of the circuit, and if the switch is used to select the plate connection of a complete pre-tuned condenser-and-coil tank circuit as is done here, the loss in the switch may be neglected.

This type of switching requires one pole or section for each doubler grid, one pole for the amplifier grid, and one pole for the amplifier plate. The switch shown in Fig. 1 has additional poles for band-spread condenser, output link, and control of external relays. Since the capacity to ground of the 807 grid and associated wiring exceeds that of the 6N7 doubler grid circuits by a few micro-microfarads, small semi-fixed condensers designed to neutralize low-capacity tubes are connected in parallel with the grid-to-ground circuits of the 6N7 doublers so that separate adjustment of each stage may be made.

The next question of importance must be considered from the standpoint of operating convenience vs. additional cost. If the transmitter-exciters is to be capable of efficient operation on any frequency between 3500 and 4000 kc., some provision must be made for retuning the oscillator, doubler, and amplifier. If it is to be capable of operation on any frequency between 7000 and 7300 kc., provision also must be made for retuning a second doubler to obtain maximum
output. In the unit of Fig. 1 this is accomplished by a gang of 8 condenser sections. One of these is a high-capacity section in the grid circuit of the e.c. oscillator, and another is in the plate circuit of the 6V6 crystal-oscillator buffer-amplifier stage. Four sections of the condenser are used to tune four doublers simultaneously, while the remaining sections tune the amplifier tank circuits. The alternative would be use of a band-spread condenser on the e.c. oscillator, a variable condenser tuning the plate circuit of the 6V6 stage (mounted on the panel so that readjustments could be made for crystals of different frequencies, and for maximum output when using the e.c. oscillator) and, if maximum output and efficiency at all frequencies were desired, readily available tuning controls for each of the doubler and amplifier tanks. To adjust to a desired frequency in the 10-meter band, it would then be necessary to switch the band-change knob to the proper position and to adjust six or seven condensers, depending on whether crystal- or self-controlled operation were desired. While this is not a too-great inconvenience at some times, it often proves too lengthy for most efficient operating. In any event, the latter and more cumbersome method may be installed at a saving of $10 to $30, the actual amount depending on the type of condensers used for the gang unit, on the type of tank coils and condensers used, and on the number of bands covered.

The gang-tuning system as used in the exciter-transmitter of the illustrations consists of two dual Trim-air condensers followed by four single Trim-air midgets. The first section of the dual condenser at the panel is replaced by a set of plates and spacers taken from a 75-µµfd, single condenser. The seven remaining ganged sections are 25 µµfd. each. Thus, the inductance used for 160-meter e.c. oscillator grid circuit is equal to one-third the inductance values in the other 160-meter tanks, and the total capacity is three times as great, resulting in stages which remain resonant with tuning readjustments. It will be noted that in all but three of the circuits the bandspread gang condenser sections are connected in parallel with the padder condensers. This may be done with equal gang capacities if the total circuit capacities are all equal. This means that if frequency doubling is to be accomplished, the inductance of a doubler plate tank circuit must be one-fourth that of the preceding tank circuit.

The condenser sections should be rigidly coupled. The tanks may be either manufactured units or home-built assemblies such as shown in Fig. 4.
The disadvantage of this system, if carried through a large number of successive doubler stages, is the fact that the high-frequency stages, where efficiency is of the greatest importance, must have relatively high-capacity tanks. In this set, the difficulty was partially overcome by making use of extremely low-capacity circuits at the lower frequencies, so that those at the 20- and 10-meter bands were conventional values for those frequencies. In addition, it will be noted that the gang sections for the 10- and 20-meter doublers, and for the 20-meter amplifier tank, are connected across tapped portions of the respective coils. Although this method does not result in stages tuning exactly together, it is sufficiently accurate for the width of the narrow 20-meter band, and for the last doubler stage where excitation of succeeding doublers need not be sacrificed by reduced output from an off-resonant circuit.

With so many condenser sections ganged for single control some mechanical loss, particularly due to use of flexible couplings, is inevitable. Consequently, it is important that the condenser which tunes the e.c. oscillator not be separated from the calibrated dial by anything but the most rigid type of condenser shaft or coupling. This

![Diagram](image)

**FIG. 4—AN EASILY-CONSTRUCTED AND ACCESSIBLE TANK ASSEMBLY**

By removing the box shield from above the coil and condenser, the coil may be pulled from the socket (or unscrewed, if a fixed coil mounting to the bracket is used) to be readjusted.

![Diagram](image)

**FIG. 5—AN EFFECTIVE METHOD OF SWITCHING IN E.C. OSCILLATOR OR ANY OF FIVE CRYSTALS**

section, in the interests of good electrical layout, could be third or even fourth from the dial if a continuous shaft is used, or if the shafts are carefully aligned and connected by means of metal bushing-type couplers.

The grid tank capacity of the e.c. oscillator is made up of two silvered-mica fixed condensers of 100 μfd. each, the two 25-μfd. condensers normally supplied with the type of condenser-coil tanks used, and the parallel capacity of the bandspread condenser. With this combination of capacities, together with the distributed capacity of the coil and the capacity of the tube and circuits, the tuning range of the oscillator is just limited to 1750 to 2000 kc., with very small margins at the extremes of the dial. The two 25-μfd. condensers are used to center the tuning range on the calibrated dial.

For the other tanks, one or both of the 25-μfd.

(Continued on page 110)
Radio Control of Powered Models

By Clinton B. DeSoto, Assistant Secretary, W1CBD

Applying successful radio control to a powered plane requires that the control simulate, as far as possible, the equivalent actions of a pilot in a regular ship. The use of at least two control elements—rudder and elevator, in this case—actuated by continuously reversible electric motors approximates this condition.

The use of RK-62's in the receiver minimizes ignition difficulties since, being carrier-operated, these tubes as detectors are not responsive to audio frequency disturbances.

D.C. MOTORS POWER CONTROLS

A survey of the miniature d.c. motor field led to the choice of a type made by the Utah Radio Products Corp. of Chicago for use in automobile radio push-button tuning systems. The design is ingenious, rugged, dependable. The motors weigh 6 ounces each. Two flashlight cells will operate them for a short time, although three cells in series or a heavier 3-volt battery are preferable for positive starting over a period of time.

Several possible methods of reducing the nominal 4000 r.p.m. speed of these motors to a comparatively slow movement required on the controls were considered, but in the end conventional clock-work gear trains were used. The construction of such a gear train is shown in Figure 1.

The motor and gears are assembled as a unit on sheet aluminum mounting plates. These plates must be accurately drilled and the assembly must be precise to avoid trouble with gear slippage or binding.

The gears are standard clock wheels throughout, and were obtained from the E. Ingraham clock works in Bristol, Conn. Similar wheels can be ordered either direct or through a local clock repairer by specifying the number of teeth and approximate diameter.

Since clock wheels do not correspond with engineering gear standards, it is difficult to secure an exact match for the built-in pinion on the Utah motor. The nearest approach to the pinion, which is 96 diametral pitch, is a 3/4-inch wheel of 98 diametral pitch (30 teeth per peripheral inch). Alternatively, an ordinary electric power meter contains a wheel of just the right size. All the other wheels specified run 20 teeth per inch with the exception of the last gear in the elevator assembly. Since this has a substantial load, it and the driving pinion are of the 15-teeth per inch size.

Small brass collars are located on the shafts so as to serve as bearings running against the mounting plates, keeping the wheels centered. In the case of all wheels except the last one in each train (which is soldered) a pressure fitting on the shaft is sufficient.

The gear trains are assembled with spacers, cut from 1/8-inch aluminum tubing, and bolts of threaded 3/8-inch aluminum rod. In this way the weight is kept down to 1 3/4 oz. total per unit; the gross weight for motor and gear box is 7 1/2 oz.

With light oil on all bearings the train should move so freely as to permit driving the motor from the first gear inside the box by finger pressure.

RUDDER CONTROL

The motors as supplied by Utah are fitted with a built-in clutch assembly designed to eliminate over-run in tuning systems. The use of this clutch is neither necessary nor desirable in the control system. In the case of the rudder control motor it is held “in” permanently by inserting a spacer on the drive shaft inside the housing.

The gear-box assembly bolts are made long enough to serve in mounting the motor unit on a plywood bulkhead located in the fuselage at the rear of the cabin. The 3/8-inch shaft of the final gear extends through a 2-inch hole in the bulkhead. Driven onto this shaft by a forced fit is a brass collar, which is further secured by a light pin going through the.
shaft. A small steel arm is forced over the turned-down outer end of this collar, which is then swedged for additional strength. At the end of this arm a ¾-inch steel pin is threaded into a hole until it is tight, whereupon the end is peened down to lock it in place.

The driving arm operates a small rudder bar, which moves the control cable along over pulleys and back to the rudder horns. This “cable” is actually fine steel or brass wire up to the pulleys, where it is tied into a short length of good quality casting line.

ELEVATOR CONTROL

In the case of the elevator motor, owing to the horizontal installation gravity automatically keeps the clutch engaged. The assembly is supported in the fuselage by a narrow plywood cross-piece. The motor is braced against the rudder assembly to reduce horizontal distortion caused by twisting of this support.

The ¾-inch shaft of the driving gear is fitted with a brass collar and steel arm and pin as in the rudder assembly. The end of the pin is drilled to receive a small cotter pin. The end of a length of ⅛-inch aluminum tubing, flattened and drilled, is secured on this pin with washers and the cotter pin.

The far end of the aluminum control shaft is also flattened and drilled, in the vertical plane. It is connected to a fork of aluminum sheet, the fork being in turn riveted to the center of the elevator assembly. All tolerances must be kept small so as to reduce looseness and wobble.

RECEIVERS

Four radio channels are required to manipulate the two controls with instantaneous reversal in each case. The four 1-tube receivers are grouped on a plywood chassis 8 inches square.

Apart from tuning, there are two controls in these receivers—antenna coupling and filament voltage—and each must be adjusted carefully.

To start with, however, the plate voltage must be right. Many RK-62’s work satisfactorily with a straight 45 volts on the plate, but some perform best with lower voltages—30 to 40 volts. In that case the “B” battery container should be opened up (an easy matter with the small portable types) and the proper tap wired in on the basis of experiment.

With the correct plate voltage, the filament voltage can usually be set at 2.2 volts and forgotten. However, some adjustment within the permissible range (2 to 2.6 volts) may be necessary for optimum results.

That leaves antenna coupling the really important adjustment. The antenna should be the proper length, to start with. This means not less than 3 or 4 feet, with 5 or 6 preferable. (In the present ship one antenna is run along the bottom of the fuselage, one along the top, and the others in each wing. Antennas of neighboring receivers should be kept as widely separated as possible.)

The maximum plate current should not be permitted to exceed perhaps 2.5 ma. Under average conditions the optimum operating figure is about 1.7 or 1.8 ma. If all adjustments are correct even a weak signal will cause a change to 0.5 ma. or less. If a sufficiently high grid leak resistance is used the cut-off can be made substantially complete, but then the time constant becomes objectionable.

Although the receivers can be tuned by watching the relays alone, it is best to make provision for inserting a tuning meter in each plate circuit—even if this consists merely of jumper connections, as shown in the wiring diagram. A point to be remembered is always to tune up after batteries are charged, never before.

Speaking of batteries, the types found most useful in connection with this installation are the
THE RADIO-CONTROLLED GAS MODEL.

14-ft. span, 8½ ft. long overall, weight 28 lbs., powered by a special Forster Bros. 2-cylinder opposed type motor rated at ¾ hp.

Burgess T2FL for filament supply (3 volts, 8 oz.), the Burgess X30FL 45-volt 13-oz. "B," and the Burgess T3BP (3 volts, 12 oz.) for the motor drive. Three standard flashlight cells (4.5 volts, 10½ oz.) are also suitable for the motor. The battery combination with the minimum feasible weight would be two pairs of flashlight cells for filament and motors and the Burgess W30FL 8.5-oz. 45-volt "B," a net weight of 1 lb. 6.5 oz.

Any transmitter that will give a reasonably stable signal at four points in the 56-Mc. band will do. High power is not required, although at least 5 to 10 watts input is recommended.

The transmitter originally used employed four RK-34's as self-excited tuned-grid tuned-plate oscillators, the plate tanks consisting of 24-inch long pairs of ½-inch copper tubing spaced about ¾-inch, tuned with 35-µµfd. midget variable condensers. Sliding taps connected to ¾-wave spaced feeders and center-fed half-wave antennas.

This transmitter worked satisfactorily, but the interlocking of grid and plate controls and antenna coupling made it difficult to spot frequencies precisely when setting up in the field. So a new transmitter was built, using the RK-34's as push-pull doublers with conventional low-C coil-condenser tuned circuits. Driving them are four 6L6G's as electron-coupled oscillators on 14 Mc., doubling in their plate circuits to 28 Mc. Inductive coupling is used interstage. With "bandspread" oscillator grid tuning circuits it is possible to calibrate the transmitters quite accurately.

The transmitting antennas are of the cheapest "whip" type as supplied for automobile radios. They telescope to 24 inches and open to 52. Two 8-foot "masts" of 1×2-inch wood have simple fittings at the tops permitting connection of four of these antennas pointing in as many directions. Feeders are connected to opposite pairs, of course, and run to the transmitter. The stakes are set in the ground as far apart as the feeder length permits, the wires being kept taut.

The control box is mounted on a light camera tripod. Telephone-type key switches, which have an "on" position each side of neutral, are used. One connects in either of two transmitters for rudder control "left" and "right," while the other controls the remaining two transmitters for elevator control "up" and "down." The "stick" nature of the handles on these switches makes visualization of the response easier than with any rotary wheel or key device yet tried. A 50-foot cable connects the control box to the transmitters.

In tuning up it is necessary to remember merely that the relays are switches which turn the motors off and on, and that these switches are "open" only when the receivers are idling—that the motors turn either when a signal comes along or the receiver plate current is off.

The best procedure is to set one of the previously-calibrated transmitters on 56 Mc. and then tune one of the receivers to it. Repeat this process at 57.3, 58.7 and 60 Mc. Then go through the positions with the control box, checking several times under a variety of conditions for reliability.

In handling the controls the same basic precaution as in regular airplane piloting applies: Do not over control. A very small movement will change the angle of flight considerably. Even though the total travel of both elevator and rudder has been kept small it is more than can normally be used. The timing of the controls has been worked out so as to enable accurate setting of small angles of arc; yet the total transmit time per quadrant of 1 to 1½ seconds enables quite rapid shift in direction when necessary.

**FIG. 2—WIRING DIAGRAM OF ONE OF THE FOUR RECEIVING UNITS**

Some Thoughts on Rotary Beam Antennas
A Lightweight and Inexpensive Supporting Frame Adaptable to
Several Types of Arrays

By Arthur H. Lynch,* W2DKJ

So much has been written and discussed over the air, among amateurs, regarding the
design, construction and operation of rotary beams, that it would seem that any
further conversation on the subject would be practically useless. The
same might be said of matching stubs, transmission lines and the
various forms of mechanical structures which have become so popular.

At the outset, let us say that the fellow who expects to find anything
very revolutionary in this text will be wasting his time. It is not our
purpose to provide any thrills, but we do believe that a few practical ideas
may be had from our own experience and that of others who have been
using beams to good advantage.

Little doubt remains that the simple beam which has been so thor­
oughly described by John Kraus,1
WSJK, is a much more satisfactory antenna than any of the simpler
affairs which were used before he showed how easy it was to build and
tune a good beam. The same may be said of Mims's Signal Squirter,2
and some of the close-spaced arrays so
well covered by Brown,3 Romander,4 Roberts5

* 136 Liberty St., New York City.
1 Kraus, "Directional Antennas with Closely Spaced
Elements," QST, Jan., 1938.
2 Mims, "The All-Around 14-Mc. Signal Squirter,"
QST, Dec., 1935.
1937.
4 Romander, "The Extended Double-Zepp Antenna,"
QST, June, 1938.
5 Roberts, "The Compact Uni-Directiona Array,"
Radio, Jan., 1938.

about their efficacy, but there have been many
who have been more than a little disappointed
with the results they have been able to get.

Taking it for granted that the average ham,
particularly the fellow who inhabits the 20-meter
phone band, has a pretty fair idea of what it is all
about and that he can actually follow the in­
structions which have been so ably set forth, we
believe that the principal reason for dissatisfac­
tion is found in the fact that the new beam user
expects too much. To make our point a bit
clearer, let's make one statement and then
analyze it a bit. Then, perhaps, the other
points will stand out a little more plainly.

One of the beams shown in the diagrams
is a bidirectional affair, which may be either
fixed or rotary. It has a gain of about 4.5 db
over the ordinary half-wave dipole, and it
will be recognized at once as being a typical
"8JK" affair. The particular one, from
which many of our facts have been drawn,
has been in operation at W2AZ since the
fourth of July. One of the receivers used at

October, 1938
that station is an HRO, which has been very accurately calibrated in microvolts. Here is the statement: In an actual test with LUBAB, the measured signal put the meter needle against the pin, when the beam was smack on him, but his signal strength was so weak when the beam was turned 90 degrees in either direction, that it could not be observed on the meter.

That statement is as true as gospel, but it is only half the truth. It is the kind of enthusiastic

FIG. 1—BIDIRECTIONAL ANTENNA AT W2AZ
This is an actual drawing of the electrical arrangement used at W2AZ, on twenty-meter 'phone. The beam will have a bit better gain when used on ten meters, and it only is necessary to open the shorting bar on the matching stub and run the transmission line up to the points indicated by the dots. The shorting bar is used for twenty-meter operation.

FIG. 2—UNIDIRECTIONAL BEAM ANTENNA
This is a compromise type incorporating some of the principles outlined by Brown, simplified by Roberts, and applying a few additional kinks suggested by the present author.

QST for
statement which has caused much of the misunderstanding of what we can and what we can't expect from these new marvels. At the time that particular test was made, conditions between New York and Buenos Aires were not what would be called "open" and the beam really had a chance to do its stuff. Let's suppose that we were to let the statement go at that and began casting that kind of oil on the troubled waters, giving all the dope on the construction of the beam itself, the matching stub and the transmission line. If the same sort of results were not experienced by the fellows who duplicated it they would have fair reason to assume that they were saps or that we were a liar.

Actually, neither of these things would, necessarily, be true. Most of us forget that the various bands play some funny tricks on us, particularly when we are really out for the "far corners." While the result we have mentioned was an actual occurrence, it is not average—not by a very long shot. If, for instance, conditions between B.A. and N.Y. began to improve, we should have found that the beam would be less and less efficacious and it is quite likely that a wide-open condition between the two cities, when low-powered rigs, hooked to ordinary aerials, on each end were bringing reports of S9, that we could swing the old beam around as much as we liked and the signal level would be about the same or not much different. It is doubtful that any condition would arise which would come into this category, but the point is that we would not be getting anything like the results we thought a good beam should be capable of giving compared to our ordinary aerial, and would be somewhat less than satisfied.

Let's figure, then, that there is still room for a good transmitter with real power behind it and that no matter how well our beam is constructed and tuned, it is not going to give us the earth on a silver platter if we insist on using a couple of watts. On the other hand, it is surprising to watch the color change from white through rose to crimson in the cheeks of some of the California Kilowatters when the hundred-watter around the corner makes his rotary beam put them to shame on the income and the outgo.

The second reason why many beams perform fewer miracles than is expected from them is the slip-shod manner in which the mechanical details are executed. "Executed" is just about the word for it, by the way.

So much has been written about the various types of beams and the results which have been obtained with them that there is little use in reviewing that subject here. Rather, we shall tell how some of the mechanical details have been worked out and indicate how they may be duplicated with but little expense and moderate ability in the handling of some of the simpler carpenter's tools.

The rotary beam shown in the photograph has been in use at W2AZ since the fourth of July. That station is operated with about eight hundred
watts input most of the time, but it can be run up to a kilowatt. Before the little rotary was put up, an attempt was made to cover the world by using three full-wave “8JK” beams, suitably oriented, and in the clear. These three antennas were eighty-five feet high. Never could the full power be pushed into one of them without having plenty of radiation from the other two. The little beam was put on top of a sixty-foot pole and since it was in operation every contact that could be had with any of the others also could be made with the little one. Tests have been made, of course, with the other units both up and down. Full mechanical details of this beam, its matching stub and transmission line are given in Fig. 1. It is bi-directional, and for certain territories we believe it would be better to use a close-spaced half-wave uni-directional affair such as is shown in Fig. 2. But we are not considering the merits of any particular type of array; you can do as you please about that. Some serious consideration and more than a little experimental work has resulted in the construction of a good supporting structure, which may be used with almost any sort of array you may desire to use for either ten- or twenty-meter operation.

The job which W2AZ did in building his framework was so good and substantial that we decided that all our worries were over and we duplicated it, hook, line and sinker. We not only got a shock when the lumber and bolts set us back a few cents over five dollars, but our misery was practically complete when we found that the wooden structure, without the insulators or the antenna elements, weighed sixty-four pounds. We don’t have all the room in the world, nor do we have a telephone pole. A three-by-three, poked in a corner by a chimney, is just about all we can get away with. So we had to do the job over again, making the changes shown in Fig. 3. The unit which resulted suits our situation very nicely. It cost very much less, weighs only twenty-eight pounds all assembled, and is rugged enough to be perfectly safe. In fact, with the center anchored, we have actually sat on all four of the outside corners, one at a time, without being able to bend the structure more than a fraction of an inch.

The finished unit is shown in another photograph. We stuck to the same form of center construction, as well as to the use of 2” by 2” oak main supporting members. Though we have not actually tried it, we are convinced that these could be reduced to 1” by 2”, mounted edgewise, further cutting the weight without weakening the structure.

The light-weight final assembly is believed to be a better all-around job, so we will outline a few pointers in connection with its construction, in the hope that some of the time it took us to do the work will be saved those who may wish to copy it. It should be remembered that we are not advocating any particular type of beam, but are suggesting a particular type of framework, which will be found useful in connection with the making of almost any type of beam which the supporting structure can be made to hold. We illustrate but a few, just to give an idea of the versatility of the wooden framework and some new corrugated, copper-plated telescopic steel elements, which have just been developed for this sort of work.

Getting right down to brass tacks, the following list of material is necessary for our own version of the framework which W2AZ built:

- 2 pieces of 3/4” plywood, 12” x 12”. These should be perfectly square and are used together to form “A.”
- 2 pieces of 2” x 2” x 36” oak, main supporting members (“C”), free from knots.
- 2 lengths of redwood, cedar or white pine, suitably finished and free from knots, 16’ x 3” by 1½.”
- 4 square head, 5/16” x 4” bolts, used to attach “A” to “B.”
- 43/8” x 5” square-head bolts, used to join “C,” “D” and “F” together, in the center.
- 43/8” x 3” square-head bolts, used for joining the outside extremities of “E,” to provide the bowing.
- 21/4” x 5/8” machine bolts, with suitable washers and nuts, used to join the centers of the units marked “P.”
- 123/8” x 4” square-head bolts, used for joining all the other sections together.

All bolts should have a washer on each side. None of them should be taken up all the way before all the rest of the bolts have been put in place, and they should be taken up a little at a time and in regular rotation.

If the entire platform is measured properly, the hole centers on the units marked “IP” of the W2DKJ assembly will measure 5 feet, 1¾ inches apart.

(Continued on page 118)

6 Made by Premax Products, Niagara Falls, N. Y., and to be placed on the amateur market in the near future.
What, No Meters?
Pilot Bulbs as D.C. and R.F. Current Indicators

By Fred Sutter,* W8QBW-QDK

WHEN a fellow figures out a little rig, say 25 to 50 watts output, and discovers that the bulk of the cost is due to plate and antenna meters he is naturally somewhat perturbed. He thinks if only those meter dollars could be spent on the rig itself or on the antenna—or better still, remain on deposit in the good old Lisle Thread National Bank! Can this be done, he asks, and the reply is "Indubitably!" Instead of spending eight or ten dollars on meters use pilot bulbs.

FIG. 1—THE PILOT-BULB INDICATORS WITH THE QSL-FORTY
The number of sockets in the antenna lead will depend on the number of bulbs needed to carry the current in the feeder. Only one socket is needed for a plate-current indicator.

From your supply house order the following:
1 box of G.E. Mazda Pilot Bulbs (10) as follows:
2 Type No. 40 6.3-volt, 150 ma. Tan Bead
3 Type No. 46 6.3-volt, 250 ma. Blue Bead
5 Type No. 41 2.5-volt, 500 ma. White Bead
6 Sockets for same, either ARH, Y-38 (2 lug) or Yaxley No. 317 H.

The cost of all this will be 90 cents. If you buy the bulbs in less than 10 lots they cost about 10 cents each so you may as well get the box of 10 for 54 cents. You may not need the No. 40, but in any event you should put one of these in series with your crystal (between the crystal and the ground) to be sure how you stand on r.f. crystal current. You won't need all the others, but it is nice to have some spares.

CONSTRUCTION
Mount a socket on the chassis (insulated from
*1000 Kensington Road, Grosse Pointe, Mich.

An economy stunt for the low-power man. The variety of low-current bulbs now available makes a better job possible than was the case with the old flashlight bulbs. Here are some pointers on using them.—EDITOR.

TUNING
Tune plate and antenna so that the antenna bulbs burn brightest while the plate bulb burns dimmest. This gives you maximum antenna current with minimum plate current. There is only one thing that may require watching. When the current is only about half the rated bulb full-load current, the filament will rather sluggishly come up to visibility instead of snapping into brilliance. You are then apt to tune past resonance before the filament has time to light up, especially if the tuning is a little critical. You should therefore "sneak up" to the resonance setting and once the filament heating is visible it is simplicity itself to tune on the nose. Or, a lower-current bulb which will flash up as resonance is passed through may be inserted in the socket and then later replaced by a higher-current bulb. More accurate tuning is possible with a bulb which glows bright yellow instead of white, on account of the great change in brilliancy with even slight tuning adjustments. The eye is very sensitive to these light changes. Anyhow, once you have found out where you are all is smooth sailing. If your antenna system is such that there is no current at the point of measurement then the bulbs won't show anything, but neither will a meter.

Of course you know that the indicated antenna current value may be greater or less depending on the location of current nodes on your antenna system. And you also know that the object of tuning is to push all the juice into the antenna that the transmitter is capable of supplying regardless of the fact that the indicator shows a quarter of an ampere or an ampere

October, 1938 49
thing for nothing, the main difference being that with bulbs you can see the watts while with meters you cannot. The No. 46 bulb at average operating point takes about one watt or slightly less and the No. 41 about the same. Plate d.c. milliammeters consume very little power—a hundredth of a watt or so. Antenna meters consume more, depending on the range. About a half watt to one watt would be a fair average.

Midwest Division Convention
Omaha, Neb., October 29th–30th

THE Hotel Paxton awaits you HAMS. Just mark your calendar and plan to come to this unique convention. The special convention committee under the general chairmanship of W. H. (Bill) Graham is putting its efforts in preparing a program that will long be remembered by those who attend. This is a final appeal to all amateurs in the Midwest Division to attend the affair. Just sit down and drop a note to “Bill” Graham, Suite 212, Hotel Paxton, Omaha, Neb., and tell him you will be there.

Silent Keys

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

Harry E. Anderson, W9CQB, Sioux City, Iowa
Howard C. Barton, W8IH, Buffalo, N. Y.
Ralph L. Brown, Jr., W5CYC, Hollandale, Miss.
W. Collins, VK2AEI, Wagga Wagga, N.S.W., Aust.
Wilbur H. Crumbaker, Sr., W9TAD, Elmwood, Ill.
Walter A. Deane, W1SB, Quincy, Mass.
James A. Fink, W9UMO, Minneapolis, Minn.
Owen F. Foin, W6NTS, Fresno, Calif.
Frank D. Foster, W5GQ, Meridian, Miss.
Lt. Cmdr. Frank M. Hawks, W1JJI, Redding, Conn.
Luis A. Mailhe, CX1FO, Real de San Carlos, Colonia, Uruguay
Walter Schultze, ex-W9LAI, Chicago, Ill.
J. Howard Shaw, Jr., W1GGS, Portland, Me.
Leonard D. Sumner, W4ACI, Hendersonville, N. C.
George P. Wiggins, W6JJA, Alhambra, Calif.

POWER LOSS

It may be pointed out that bulbs consume power. Well, so do meters, for you can't get some-

and a half. Whatever it is, you want tops and when the antenna bulbs burn brightest you have it.

When you change bands, which will alter the location of the current nodes, start in with the four 41’s and proceed as before. Once you have determined your data no further tentative trials are necessary; just stick in the proper bulbs and tune up. Any unnecessary sockets can be cut out when you find what you require.

The antenna here at W8QBW is an 80-meter half-wave Zepp, 130 feet long, with feeders about 55 feet long; the following is the data:

Transmitter,
“QSL-Forty” Plate bulb No. 46
On 80 meters Antenna bulbs—3 No. 41's
On 40 meters Antenna bulbs—1 No. 41
On 20 meters Antenna bulbs—1 No. 41

The photograph shows a “QSL-Forty” (with a 20-meter coil), the plate meter opening being closed by a bit of bakelite on which is mounted the socket for the plate bulb, a No. 46. The antenna condenser panel is also shown with the r.f. antenna meter opening similarly closed, and an array of four sockets in parallel mounted thereon. I have mounted these in front so as to show the construction more clearly, but to make a sightly job the sockets should be mounted in the rear and only the shells extend through the panel. I cannot prophesy just what you will need with your rig and antenna, but what has been said above should make it easy for you to determine this. A cautionary word: Be sure that your bulb array is in the antenna feeder and not in the antenna tank circuit, which in some cases may show a current of 4 or 5 amperes even with low power. It is conducive to peace of mind to know that while a burned out or damaged meter means money, a burned out pilot bulb means only a nickel.

QST for
IN maintaining a large operating organization such as the Army Amateur Radio System, many problems are encountered. As in other Corps Areas, the Sixth Corps Area has its own particular place in the system and its own special problems, besides those that are common to the whole system.

Not the least among these problems is the great need for a trained group of operators and their stations in those sections of the Corps Area most subject to emergencies, such as floods and storms. The need for more and better operators in the nets already in operation is also felt. More members of good caliber are especially desirable in order to increase interest in the work and maintain the reliable relay and delivery of traffic within the Corps Area. Prospective members invariably ask, "What interesting activities does membership in the A.A.R.S. provide for the average amateur?" Our third problem then, is to provide interesting and constructive activity for our members.

The Sixth Corps Area consists of the three states, Illinois, Michigan and Wisconsin. Colonel J. C. Moore is the Signal Officer in charge and Major A. V. Eliot acts as Liaison Officer. Headquarters is located in the New Post Office Building, Chicago and Headquarters station W9ANR/WLT is maintained at the Army Supply Depot in Chicago.

The big Ohio River Valley flood of 1937 proved that we lacked an adequate number of stations in that area. An investigation by Major Eliot disclosed that the reason for this was that nearly all of the amateurs in that area were 'phone men. One of our members, Sgt. George Freer, W9MWU, with the help of two or three others, then organized an 1887-ke. 'phone net for the Corps Area. A system of procedure, similar to that used by c.w. members but adapted to 'phone net use, was made up. By concentrating on southern Illinois, Freer was able to build up the Illinois section of the 1887-ke. 'phone net to 38 members in a half year, the greater number of which are located in vital emergency areas of the state. Later a 3915-ke. 'phone net was organized to further aid our coverage.

To increase interest and flexibility of operation for the c.w. stations, an unusual system of operation and cooperation was devised. As in other Corps Areas, we have all the stations in each state operating on a single state net frequency, with one exception—a local net in Chicago using 1765 kc. We have improved upon that idea a great deal, however. Through cooperation of the SCM for Illinois and the Radio Aide, an agreement was made between the A.R.R.L. Traffic Net stations and the A.A.R.S. stations for the joint use of the A.A.R.S. State Net frequency. Due to the mutual interests of both groups, it was a distinct benefit to both. The scattered traffic men came together and, with a large group from the A.A.R.S. State Net, formed a state-wide A.R.R.L. Traffic Net. Many of them then became interested in the A.A.R.S. work they heard on that frequency and became members of the A.A.R.S. By setting certain periods for each group to operate, many more stations were able to use the net frequency each day, and interference was kept at a minimum. Many amateurs not connected with either the traffic or A.A.R.S. organizations were impressed with the efficient system we had, and the connections it offered, and joined the nets. Michigan and Wisconsin took up the idea and we now have three state net frequencies in this Corps Area used by cooperating A.R.R.L.-A.A.R.S. nets, 3663 and 3775 kc. for Michigan and Wisconsin, and 3765 kc. in Illinois. The bulk of the traffic is moved during the A.R.R.L. Traffic Net periods, which leaves the A.A.R.S. period free for various forms of drill and instruction work. As an emergency feature this system offers a much faster means of getting organized in time of need. The joint use and the large number of stations means that the frequency is being covered almost continuously by some state net station from 5:00 P.M. to midnight or even later. Stations come in and drop out of the net all through the evening so that in a short while a sizable net could be formed covering most of the state. All these features tend to attract the better class of operators to the A.A.R.S. Keeping them interested after they become a part of the system is the problem that we need to place most emphasis on now.

The interest of the average amateur seems to run in cycles. First he gets very interested in one thing, then he changes to another. When he becomes interested in handling traffic and in emergency work, he has found something useful to do. But if he has to sit around and twiddle his thumbs all the time while the net clears all the traffic he soon will tire of it and lose his interest in the net. To prevent this, all nets should be made as interesting as possible. The traffic net arranges its callup and operations so that the operator will know whether he has any traffic to a minimum and concentrates on drill work and various problems, such as finding unknown stations, moving the entire net to other frequencies and reestablishing the net.

(Continued on page 128)
RESPONSE to Problem No. 20 shows evidence of plenty of interest in the subject of clean keying of crystal oscillators free from chirps. It must be said, however, that the number of opinions on the best keying system almost equals the number of contestants! Nevertheless, there seems to be general agreement on some points. The axis of crystal cut seems to have little bearing on its performance in keyed oscillator circuits. "Active" specimens, however, appear to operate with less tendency towards chirp than those which deliver less output.

No marked preference for tubes was expressed except that W8OMM claims that the RCA Type 1610, a little-known tube in amateur circles, similar to the Type 47, is superior to other types. W2ESO's experience shows that the better screened tubes, such as the 802, RK25, 807 and 2A5, do not key as well as the beam types or triodes with less screening, or no screening at all, unless they are provided with the right amount of feedback coupling. The majority of diagrams submitted show the 6L6 as the oscillator, quite probably a result of the natural popularity of the tube rather than any particular merit this particular type may possess in respect to keying.

It has been the experience of most of the contestants that the use of a voltage divider instead of a simple series resistor for the screen helps materially in eliminating chirps. The most popular place for the key in the simpler arrangements is between the cathode circuit and ground as shown in Fig. 1. This is reported by many to be a very satisfactory arrangement from consideration of both chirps and key clicks. At A is shown the alterations recommended with the Tri-tet circuit. Fig. 1B shows the recommended connection for the key in the grid-plate type oscillator. Most of the contestants recommend the use of a separate plate-voltage supply for the oscillator.

Of the less conventional circuits those shown in Fig. 2 are interesting. The one shown at A is by W6EPM. "From the circuit diagram it will be noticed that plate voltage is applied continuously to the tube and that the key is in series with the screen. The advantage of this is that the voltage across the key is not very high and that the current to be handled by the key is of the order of only a few milliamperes. Under the conditions of the circuit, the plate circuit may draw one-half to two milliamperes with the key open. This tends to keep the crystal oscillating at low amplitude. When the key is closed, the tube draws normal plate current. Even with only fair crystals, the oscillator will key perfectly and not chirp. In the case of a poor crystal, excitation may be increased by short pieces of push-back wire from the plate and from the control grid running parallel for about one and one-half inches, spaced about one-eighth inch.

FIG. 1—CATHODE KEYING FOR TRI-TET OSCILLATOR

Typical values for 6L6: R1—50,000 ohms; R2—20,000 ohms. B—Cathode keying for grid-plate oscillator. Typical values for 6L6: R1—50,000 ohms; R4—20,000 ohms.

FIG. 2—TWO SYSTEMS FOR SCREEN KEYING OF TETRODES OR PENTODES

A—For 89 or 802: R1—7500 ohms; R2—5000 ohms; R3—30,000 ohms. 20 watts. B—R1—40,000 ohms; 20 watts. R4—10,000 ohms; R5—75,000 ohms. R6—100,000 ohms; R7—Usual plate supply bleeder.
Problem No. 22

Our Hero has three different antenna systems now and is planning the addition of one or two more. Some of these employ a 70-ohm transmission line, others a 600-ohm line while one or more may have a tuned line for multi-band operation. He has one antenna relay for switching from transmitter to receiver. He is now faced with the problem of devising an antenna changing system by which, with a minimum of switches and tuning gear, he may change rapidly from one antenna system to another maintaining constant load on the transmitter for a given frequency and also proper coupling to his receiver. He wants to be able to control all switching operations from the operating position.

This is not often necessary, but it regulates the current with key open and consequently the strength of oscillation. If too much capacity is used, it will be possible to hear an S7 to S8 signal in the receiver at the crystal frequency. Either 802’s or 89’s are recommended. The Type 802 is much the better tube; the local signal is difficult to eliminate with the 89. The 6L6 is not recommended.” — W6EPM.

This arrangement seems possible of providing excellent keying characteristics, although the presence of the local signal would be objectionable to those desiring break-in operation on the crystal frequency.

Another screen-circuit keying scheme is shown in Fig. 2B. This particular combination is described by W9QOA. G2IS suggested a very similar arrangement employing a relay at the key position.

“The keying circuit shown in Fig. 2B was built into a new transmitter at W9QOA and has given very satisfactory results. Keying is reported to be very smooth and no chirp has been noticed when the signal has been monitored locally. The circuit was designed to allow keying of the oscillator without the use of a separate filament supply, but it has been found very satisfactory in other ways also.

“The basic principle of the circuit has been in use for years, but the writer has never seen it applied in the form shown here. When the key is open, the keying tube acts as a low-resistance shunt across the screen of the oscillator tube because of the positive bias impressed on the keying tube grids through the resistance Rs. Since the combined resistance of the oscillator screen circuit and the keying tube plate circuit is low compared to Rs, the voltage between the screen and filament of the oscillator tube is reduced to such a low value that oscillation cannot be maintained.

“When the key is closed, the positive bias on the grids of the keying tube is removed, thus increasing the plate resistance of the keying tube and causing the oscillator screen voltage to increase to the proper value required for the generation of oscillations. Operation of the keying tube can be improved by applying a negative bias to its grids and to the grid of the oscillator by tapping the filament return up on Rs as shown in the diagram. This has the dual effect of increasing the plate resistance of the keying tube when the key is closed and of increasing the plate resistance of the oscillator tube when the key is open, both of which increase the range of control.

“The most suitable tubes for use as keying (Continued on page 69)
A Compact 100-Watt Transmitter
Six-Band Coverage with Quick Band-Changing
By Thomas Sue Chow,* W6MVK

The author mentions, rather casually, that the transmitter described here was built in preparation for the last Sweepstakes. The rest of the story was left out, either because results speak for themselves, or possibly, because complete contest results had not been published when the article was written. This is the rig with which W6MVK established new Sweepstakes records—first c.w. station to work all sections, and the highest score ever made under the present rules—EDITOR.

In planning for the last Sweepstakes Contest, it was decided that a complete new transmitter would have to be built to get better results. The requirements for the new outfit were, low cost, multiple band coverage, QSY with minimum retuning, ample excitation with no “trick” circuits, low-cost ‘phone operation, and foolproof non-critical adjustments. Much time was spent searching through radio publications for ideas with these goals in mind. The resulting design is the combination of what appeared to be the most suitable circuits.

Transmitter
The transmitter is a small one using three tubes and four stages—6A6 oscillator-doubler, 6L6G buffer-doubler, and RK-20 output. It is mounted completely on a 10” X 17” X 8” steel chassis except for a bias battery and the high-voltage supply for the final.

The three most used bands, 40, 20 and 10 meters, can be switched on within five to ten seconds with full (100 watts) output, without disturbing the final coil or antenna coupling. The adjacent bands can be switched on within three to five seconds. The circuits are broad enough to QSY from 50 to 150 kc. without retuning the final stage. This in itself is a distinct advantage. Other advantages of this exciter-transmitter are that it is compact (it is only eight inches high), it can be built at low cost, and it will cover as many bands as the majority of band-switching receivers with practically the same speed. With a 160- and a 40-meter crystal, six bands can be covered. The output on five meters is reduced because the final is a doubler.

Final
The RK-20 was selected for the output tube because it is easy to drive, needs no neutralizing, doubles well, and can be easily suppressor-grid modulated. The tube is placed horizontally to reduce the overall height, with the plate edges down to minimize the effects of filament sag.

A single sheet of aluminum, bent as shown in the photograph, serves a two-fold purpose by acting as a coil shield, shielding the final plate output circuit from the input, and as a base for mounting the RK-20. An old i.f. can trimmed

---

* 701 8th Street, Modesto, California.
down to the height of the lower edge of the pentode's internal shield, serves as a base shield, and clears the glass about a quarter of an inch.

The band switch is controlled from the front panel by a flexible insulated shaft, which had not been installed at the time the photo was taken. The shaft is mounted on a square of bakelite, since the switch itself is insulated for only 600 volts. The lugs for mounting coils on the switch were made more firm by scraping the lug up to the ceramic and covering it with a heavy layer of solder.

In the plate circuit of the RK-20, the tuning condenser is left permanently connected to the plate for all bands and only the individual inductances for various bands are changed. This saves the cost of separate tuning condensers for each coil, although the condenser used will require retuning when changing bands. When the RK-20 is shielded sufficiently, no neutralizing is necessary. A single-section condenser is used, with the lower of "cold" ends of all the coils tied together and to the condenser rotor, and the plate ends are switched to change the inductances.

Losses on 10 and 20 meters were reduced by using air-wound coils and soldering them directly to the lugs of the band switch. This arrangement not only eliminates several standoff insulators, but also provides short leads and low-resistance connections. The third contact on the switch is wired to an isolantite socket in order that the low-frequency final coils can be handled there with plug-in coil forms. These ribbed bakelite forms are handy, inexpensive, durable, easy to wind, and have little loss at low frequencies.

W6MVK'S QUICK BAND-CHANGE TRANSMITTER-EXCITER

Except for the RK-20 plate supply and a bias battery, the unit is a complete transmitter. Coil switching covers three bands in the final stage, with a plug-in position for additional bands.

**DRIVER**

The small beam power tube used as a driver gives excess excitation both as a buffer and as a doubler. The use of a 200-µfd condenser makes just one coil necessary to tune the plate circuit to resonance on two adjacent bands. The 6L6G was selected over the transmitting type because of its low cost, in spite of the fact that it had to be neutralized. Neutralizing is not expensive because of the low r.f. voltage encountered, and can be accomplished very easily by soldering a heavy piece of No. 10 wire about an inch long to the plate condenser, wrapping about six turns of heavily insulated wire around this bus, and by varying the number of turns of the bus wire trombone style. The same battery which supplies fixed bias to the final serves a double purpose by also supplying sufficient negative voltage to cut off the 6L6G, thus allowing complete break-in and preventing damage to the tubes in case of excitation failure. The plate of the driver need not be retuned in QSY-ing across the entire band because of the use of a large coupling condenser to the final grid.

**OSCILLATOR-Doubler**

The 6A6 crystal oscillator-doubler can be changed from oscillator to oscillator-doubler without use of switches. Low-priced bakelite sockets for the two crystal positions were reamed out slightly with a countersink in order to accommodate both types of prongs on most crystal holders. These

---

enlarged holes enable one to change crystals more quickly by acting as guides to the proper insertion points. From 200 to 250 volts on the 6A6 and about 350 volts on the 6L6G are all that are necessary to give sufficient excitation. This was an important consideration, since the.

volt winding gives about 7.7 volts to the RK-20 filament. This voltage can be found at a point 1 1/4 volts from one end of the 6.3-volt winding, as shown in Fig. 2. The full 2V½-volt winding is used to help relieve the drain of the RK-20 filament on the regular 6.3-volt windings. The voltage drop to the RK-20 socket was reduced by the use of No. 12 wire insulated with spaghetti.

The need of immediate replacement of filter condensers is done away with by grounding them through a short piece of fuse wire. As a general rule, only one section of the filter blows out at one time; under this arrangement, the blown section automatically removes itself from the circuit.

The operation, while obviously depending on the frequency of the crystal used, is straightforward and needs no detailed comment. The quickest adjacent-band switching can be done by hitting the lowest frequency desired on the coil which resonates on the high-capacity side of the driver condenser, C9, using the driver tube as a straight amplifier. To shift to the next band, it is only necessary to double in the driver by shifting C9 to the low-capacity end and switch the coil of the final to the same frequency. If separate antenna tuners are linked to each final coil, no adjustment is necessary once the coupling is correct. No retuning would be required to QSY across the entire band except in the plate tank of the final. The necessity for even this tuning can be minimized by reducing the plate voltage to 1000 volts and using tight antenna coupling so that the RK-20 is heavily loaded (to about 100 ma.). Retuning will be necessary every 200 kc. on 20 meters and 125 kc. on 40 meters.

For 56-Mc. work, the final acts as a doubler and a small outboard tank circuit can be slipped on in place of the regular plate clip. Reduced plate voltage, approximately 600 to 800 volts, is used. On ten meters, the plate showed no color with the key down, although the input was 100 ma. at 1350 volts. The driver plate condenser was detuned to reduce the final grid current to from 5 to 7 ma. The RK-20 screen draws 7 ma. at 325 volts, with 90 volts positive on the suppressor grid. No attention need be paid to the remaining stages so long as sufficient excitation is available. A 100-watt lamp measures full brilliance at 10 meters, with slightly greater output on lower frequencies.

If no suppressor-grid modulated 'phone is desired, a RK-47 or 814 will give higher output. About 150 watts can be obtained with proper changes. Connection for suppressor-grid modulation is made by plugging into J6, shown in Fig. 1. This automatically puts a negative bias of 45 volts on the suppressor, and disconnects the positive 90 volts used for c.w. operation.

---

**TABLE I—COIL DATA**

<table>
<thead>
<tr>
<th>Coil Type</th>
<th>Frequency</th>
<th>Turns</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6A6 Oscillator-Doubler Coils</td>
<td>1.75 Mc.</td>
<td>59</td>
<td>22 d.c.c. close-wound.</td>
</tr>
<tr>
<td></td>
<td>3.5 Mc.</td>
<td>31</td>
<td>22 d.c.c. close-wound.</td>
</tr>
<tr>
<td></td>
<td>7 Mc.</td>
<td>16</td>
<td>22 d.c.c. close-wound.</td>
</tr>
<tr>
<td></td>
<td>14 Mc.</td>
<td>8</td>
<td>18 d.c.c. space-wound to 1 1/4 in.</td>
</tr>
<tr>
<td></td>
<td>6L6G Plate Coils</td>
<td>1.75—4 Mc.</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>3.5—7.5 Mc.</td>
<td>20</td>
<td>22 d.c.c. close-wound.</td>
</tr>
<tr>
<td></td>
<td>7—14.4 Mc.</td>
<td>10</td>
<td>18 pushback, space-wound to 1 1/4 in.</td>
</tr>
<tr>
<td></td>
<td>14—30 Mc.</td>
<td>4</td>
<td>10 air wound 1&quot; dia.</td>
</tr>
<tr>
<td>RK-20 Plate Coils</td>
<td>1.75 Mc.</td>
<td>44</td>
<td>16 enamelled, closed-wound.</td>
</tr>
<tr>
<td></td>
<td>3.5 Mc.</td>
<td>24</td>
<td>14 enamelled, space-wound to 3 in.</td>
</tr>
<tr>
<td></td>
<td>7 Mc.</td>
<td>12</td>
<td>14 enamelled, space-wound wire diameter.</td>
</tr>
<tr>
<td></td>
<td>14 Mc.</td>
<td>7</td>
<td>14 enamelled, 1 1/4 in. dia.</td>
</tr>
<tr>
<td></td>
<td>28 Mc.</td>
<td>4</td>
<td>10 enamelled, 1 in. dia.</td>
</tr>
<tr>
<td></td>
<td>All wound on 2 1/4&quot;-in. ribbed forms except the 14 and 28 Mc. coils, which are air-wound. The 14-Mc. coil is on celluloid strips; the 28-Mc. coil self-supporting.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Low Z for Linearity

A 35-Watt Low Distortion Speech Amplifier with Push-Pull-Parallel Triode Output

By M. A. Brown,* W6ABF and J. N. A. Hawkins,** W6AAR

While it has been widely known that good driver regulation is desirable for a low-distortion Class-B modulator, the authors found recently, with the aid of a borrowed RCA distortion-measuring set, that 6L6's with normal amounts of feed-back are far from ideal as Class-B drivers. After spending considerable time and effort in trying to get the bugs out of the 25 db of feedback which was found to be necessary with 6L6 drivers, it was decided to try out some of the newer low-mu Class-A tubes which have appeared recently. It was felt that a higher net gain with fewer tubes might be realized with the lower mu triodes, since less feedback is necessary with those tubes.

Low-mu triodes are inherently non-uniform. Past experience with practically all of the older types showed that the RCA 45 and the Western Electric 205D were the only ones available whose characteristics matched closely enough for the theoretical benefits of push-pull operation actually to be obtained in practice. The types WE-300A and the 2A3 were particularly bad offenders, so far as unbalance is concerned. However, tests with many of the newer types of pentodes, tetrodes and triodes, all operated as triodes, showed that the new 6A5G had interesting possibilities. Because of its indirectly heated cathode, trouble from tired and leaning filaments is avoided, and a more rigid element support is used than in most other available tubes.

A haywire breadboard setup showed that the 6A5G was just about what was wanted, so a complete speech channel was built up, ending up in four of them in push-pull parallel. After chasing out the bugs that breed in any new speech channel, the final result represented a marked improvement over the 6L6 channel used previously.

In laying out the voltage amplifier to feed the push-pull-parallel output stage it was decided to provide a high-gain input for low-level high-impedance microphones and a medium-gain high-impedance input for phonograph or telephone lines. Grief with pentode audio amplifiers made the use of triodes desirable, and the phase distortion caused by conventional resistance-coupled phase inverters caused us to go to a transformer-coupled phase inverter.

The circuit was originally laid out with about 6 to 10 db of inverse feed-back in mind but it was decided to do as good a job as possible with the amplifier before the feedback was applied. It should be pointed out that no amount of feedback will entirely eliminate distortion and noise—all it can do is reduce it—so obviously the less noise and distortion you start with, the less work the feedback has to do.

The diagram shows 10 db of feed-back, but the single-pole double-throw switch in the cathode of the 6F6G cuts it out when desired and raises the net gain by the amount of the feed-back, or 10 db. With feed-back the distortion is slightly under 2 per cent at 35 watts output and is under 0.5 per cent at 25 watts output. Without feed-back the distortion at 35 watts output is slightly less than 5 per cent, and is under

October, 1938
1.5 per cent at 25 watts output. It is felt that, in general, the feed-back branch can be left out without any noticeable impairment of speech quality. The frequency response is flat to 2 db from 40 to 8000 cycles without feed-back and there is no need to worry about anything outside of this range with present mikes and speakers. As a matter of fact, it is generally desirable, in a ham rig, to kill most of the highs with the tone control, to avoid adjacent channel QRM.

Without feed-back the plate-to-plate load for maximum undistorted output is 1500 ohms. As a Class-B driver the optimum plate-to-plate load is 2750 ohms. The use of feed-back cuts these loads way down, but extremely low load impedances make the Class-B input transformer design difficult.

For driving zero-bias Class-B modulators about a 1.25 to 1 step-down in the Class-B input transformer is desirable when working from four 6A5G's. For the medium-mu tubes such as 354's, 150T's and 250TL's, etc., about a 1-to-1.25 step-up works out best. Thus the same transformer would work with any tube combination. The output transformer shown, and used at present in the amplifier, is a universal type with both low-impedance and high-impedance taps on it, allowing the amplifier to serve for p.a. use when opportunity affords. However, one big advantage of triode drivers is that they work well with nearly any anything outside of this range with present mikes and speakers.

The authors make out a good case for 6ASG output tubes, and describe a high-gain amplifier with plenty of output for driving a 500-watt Class-B modulator. Good, too, for public-address work.—EDITOR

gives good results with triodes over a wide range in secondary loads while input transformer design is quite critical when using beam tetrodes as drivers.

The 6A5G's have very high transconductance, and the two 100-ohm grid resistors are desirable to prevent oscillation which sometimes occurs with these tubes. They are not always necessary, but they do no harm and they help hold things down.

Bigger blocking and by-pass condensers could have been used to bring up the low-frequency response, but this is generally unnecessary on speech. It was considered desirable to make the

---

**FIG. 1—CIRCUIT DIAGRAM OF THE 35-WATT SPEECH AMPLIFIER**

C1, C2, C3—0.1 uf, paper, 600-volt.
C4—0.01 uf, paper, 600-volt.
C5—0.05 uf, paper, 600-volt.
C6, C9—16-uf, 450-volt electrolytic.
C11—25-uf, 600-volt.
C12—50-uf, 450-volt electrolytic.
C14—5 megohms, 1-watt.
R5—150,000 ohms, 1-watt.
R6, R7, R8—500,000-ohm volume control.
R9—500 ohms, 1-watt.
R8—5000 ohms, 10-watt.
R10—5000 ohms, 1-watt.
R11—100 ohms, 1-watt.
R12—25,000 ohms, 1-watt.
R13—5000 ohms, 10-watt.
R14—5000 ohms, 25-watt.
RFC—2.5-mh. r.f. choke.
T1—Audio transformer, single plate to push-pull grids, primary to carry 6F6G plate current (Hadley 3991A).
T2—Output transformer, 1500 ohms to line or speaker, 50-watt (Hadley 3997A).
T3—Power transformer, 350 ma. at 300 volts, with bias tap (Hadley 4070A).
L1—50-ma. filter choke (Hadley 872).
L2—350-ma. filter choke (Hadley 3772A).
input resistance in the high-gain channel 5 megohms for maximum gain and then hold the boominess down with lower values of blocking and by-pass condensers. The maximum gain is 120 db in the high-gain channel and 80 db in the low-gain channel.

The new 6F8G is ideal for electronic-mixer use because it has high plate resistance, which means that the unused half does not unduly load the side being used. Its high-mu also allows it to contribute considerable gain, which is unusual in an electronic-mixer stage.

A 6J5G could have been used in place of the 6F6G to drive the push-pull-parallel stage, but overload tests showed that the 6J5G stage over loaded first (at about 38 watts) so it was replaced with the triode-operated 6F6G, which costs no more. As long as it doesn’t cost anything, it is desirable to have every stage “crack up” at about the same point, which gives most usable peak output.

Ordinarily the push-pull-parallel stage draws no grid current, but since the 6F6G can supply some power when and if called on to do so, the quality does not suffer materially on speech thereby. It should be noted that while this should be called a 35-watt amplifier for use on music, it will do a fairly good job of lighting up a 75-watt lamp with better than average speech quality. It was used to overmodulate over 150 watts of Class-C r.f. amplifier input with better quality than most push-pull-parallel 6L6 amplifiers.

Normally the output stage operates Class-A and the plate current varies very little so regulation of the plate supply is not a problem. No difficulties have been encountered in building several copies of this amplifier by various local hams so it is believed to be pretty well debugged.

The 6Z3 is working fairly hard but seems to like it so its virtue of cheapness was gladly utilized.

The shielding around the input of the 6F5 and over the whole amplifier is particularly important if the amplifier is to be used around a transmitter. A gain of 120 db is a lot in any league, and is rarer than one might think after reading the catalog! How Would You Do It?

(Continued from page 57)

56-Mc. DX Tests

W ith 56-Mc. DX via the F2 layer a good possibility this winter, test schedules have been proposed by E. H. Conklin, W9FM. He suggests (and so notified British amateurs) that W stations listen from 10:00 to 10:10 A.M. E.S.T. and for alternate ten minute periods until 11 A.M. each Saturday and Sunday during November. DX Stations should, of course, listen during alternate ten minute periods beginning at 10:10.
Hints and Kinks for the Experimenter

Three-Band Crystal-Controlled Exciter Using One Tube

A small oscillator-doubler combination which gives maximum stable output and frequency flexibility for the tube and parts investment is shown in Fig. 1. Although the system does not contain radically new ideas, it is well recommended by the simple and straightforward circuit employed.

One section of a 6A6 dual-triode tube is used as oscillator for fundamental and second-harmonic output, and the other section is used as a triode non-regenerative doubler. For fundamental or second-harmonic excitation to a succeeding stage, the output of the oscillator alone is used. Only when quadrupling the crystal frequency are both oscillator and doubler operated.

When the plate tank circuit of the oscillator is operated on the 160- or 80-meter band, an oscillator plate tuning condenser of at least 100-µfd. maximum capacity should be used; otherwise each of the two plate tuning condensers should have 50-µfd. capacity.

For operation of the oscillator at crystal output frequency, condenser $C_3$ should be shorted. Provision for this may be arranged by slightly bending the corner of an outside rotor plate so that it makes contact with a stator plate at full mesh of the condenser. For doubling frequency in the oscillator, $C_3$ is used to provide regeneration—a decrease of the capacity of $C_3$ results in increased regeneration and increased output. If the adjustment of this condenser is carried too near minimum capacity, self-excited oscillation of the stage will be the result. Accordingly, a careful check of the oscillator output should be made to determine whether changes of adjustment result in proper operation.

The r.f. power obtainable from this small unit is approximately five watts on 160, 80, and 40 meters, and corresponding lower outputs on the higher-frequency bands. Using a 10-meter crystal, sufficient power is obtainable on 2½ meters to make a 2½-volt, 60-ma. bulb glow with normal brilliance, and it is thus enough to excite an 807 to several watts output on this band.

—Marvin C. M. Lane, W$\$LCR

Receiver as Neutralizing Indicator

Did you ever try to neutralize an amplifier without a neon bulb or any other of the usual indicating instruments except the receiver? Here is a method:

Turn on the oscillator only. Tune the receiver to the frequency of the oscillator and listen to the note while the amplifier neutralizing condenser is being adjusted. Each time a small change is made in the neutralizing condenser setting, swing the amplifier plate tuning condenser slowly through its entire range. If the note produced in the receiver by the oscillator changes, reset the neutralizing condenser. Do this until a setting of the neutralizing condenser is found at which no change in the note may be detected while tuning the tank condenser. Remember that in tuning any amplifier the plate supply must be disconnected, but don’t disconnect the plate supply by taking the clip off the top of the tube (if the amplifier uses a top-cap plate connection) because

---

FIG. 1—CIRCUIT DIAGRAM OF THE THREE-BAND CRYSTAL EXCITER

C1—100-µfd. midget for 160 and 80 meters; 50-µfd. midget for the higher-frequency bands.
C2, C3—0.002-µfd. mica.
C4—100-µfd. midget variable.
C5, C6—100-µfd. midget.
C7—50-µfd. midget variable.
R1—5000-ohm, 20-watt with slider.
R2—50,000-ohm, 1-watt carbon.
R3—50,000-ohm, 2-watt carbon.
J1 and J2—closed-circuit meter jacks for osc. and doubler plate current.
J3—Closed-circuit jack for key
L1 and L2—Al! coils are 1½-inch diameter. The 160-meter coil is made of number 22 enameled wire, while the remainder are made of No. 18 enameled.

<table>
<thead>
<tr>
<th>Band</th>
<th>No. Turns</th>
<th>Winding Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>160-meter</td>
<td>65</td>
<td>2 inches</td>
</tr>
<tr>
<td>80-meter</td>
<td>32</td>
<td>1⅜ inches</td>
</tr>
<tr>
<td>40-meter</td>
<td>16</td>
<td>2 inches</td>
</tr>
<tr>
<td>20-meter</td>
<td>8</td>
<td>1⅜ inches</td>
</tr>
<tr>
<td>10-meter</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>5-meter</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.5-meter</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

---

QST for
this breaks the r.f. circuit. This last may sound foolish to the expert ham but many old-timers and many beginners alike have made this mistake and then wondered what was wrong!

—Ross F. Cutting, W8KQZ

Need More Neutralizing Capacity?

THE capacity and the breakdown voltage of a neutralizing condenser may be increased by insertion of high-dielectric material between the plates. Two somewhat similar methods for doing this have been suggested, and are given below.

“The range of those neutralizing condensers which lack sufficient capacity to neutralize 203-A and 212-D tubes may be increased by insertion of 1/8-inch bakelite sheet between the plates,” writes Will A. Bell, W6JXS. “The bakelite should be cemented securely to one of the plate surfaces to insure that all effective areas be parallel. The condenser air gap (distance between surface of the bakelite and the metal surface opposite) ordinarily should be approximately 1/16-inch. Other dielectric materials may be used, but consideration of dielectric constant should be used in their selection.”

Erwin Aymar, Tegucigalpa, Honduras, C. A., gives the following note: “To raise both the maximum capacity and the breakdown voltage of a transmitter neutralizing condenser such as one of the National NC series, it is only necessary to place a piece of window glass on one of the assembly. Fittings of 3/4-inch pipe and a ball joint are used to bear the weight of the wood column and serve as a pivot. At W8EEP, this base is located on the ground just outside the basement window. A steering axle and steering wheel is located above the operating table opposite the column of the antenna structure. The axle is equipped with a bicycle sprocket fastened


Simplifying the Rotary Antenna Mechanism

A Beam antenna rotating system which is little short of ideal for amateurs having basement and first-floor operating positions is shown in Fig. 2. Outstanding among its features are the following: Simple mechanical arrangement for turning the beam; economical, easy-to-build, rigid construction of supporting parts; and freedom from the unsightly and costly masts, poles and guy wires usually associated with rotary beam installations.

A piece of 4-inch by 4-inch wood 33 feet long forms the main stem of the assembly. Fittings of 3/4-inch pipe and a ball joint are used to bear the weight of the wood column and serve as a pivot. At W8EEP, this base is located on the ground just outside the basement window. A steering axle and steering wheel is located above the operating table opposite the column of the antenna structure. The axle is equipped with a bicycle sprocket fastened
at the height of the top of the window frame, and two bicycle chains fastened together are used to connect this sprocket with a similar one at the same height on the column outside. Two small holes bored through the window frame allow passage of the connecting chain.

A bracket for holding the column in vertical alignment is fastened to the house near the roof directly above the basement window. This bracket, conveniently located at the top of a second-floor window, is made of 3/4-inch angle iron stock, and is provided with a band of strap iron made of two semi-circular sections bolted together. A round wood collar is made from four pieces of heavy board, so that it makes a snug fit when assembled and screwed on the column. The outside edge of this collar serves as a bearing against the iron aligning ring.

The top of the wood column is cut off square, and a simple light framework for holding the 10-meter radiator and reflector is mounted on it. A 3/4-inch steel conduit is used for the antenna elements, which are held in place by 4 1/4-inch standoff insulators. The two halves of the radiator are each 8' 1" long, and are fed by a V-match from an untuned transmission line. The reflector elements are 7' 11" long, and the center ends are bent at right angles to form an adjusting stub of 2-inch spacing and 6-inch length. A shortening bar is moved along this stub to obtain an optimum setting. The pieces of 3/4-inch conduit, thus arranged, form a half-wave radiator and a somewhat shorter director spaced 1/10- to 1/2-wave length apart.

Connection of the center ends of the radiator may be made through a similar adjusting stub if desired. Number 12 wire is used for the transmission line, and a spacing of 6 inches is employed. The ends of the line are "fanned" apart at the connections to the radiator, being adjusted to give minimum indication of standing waves on the feeders.

The 6-inch spacing of the transmission line is maintained along the column by use of 1-inch standoff insulators mounted centrally on opposite sides along the 33-foot length of the column. Diametrically opposite holes are bored in the wood bearing collar, and feed-through insulators here serve to maintain rigid and correct spacing of the conductors.

In order to make connections to the feeders which allow continuous and unlimited rotation of the system, two rings of 3/4-inch copper tubing are mounted on standoff insulators around the column immediately above the outside sprocket. One pulley, assembled on the top of a standoff insulator, is mounted on the end of a bracket for each of the two connecting rings, and a small spring is used to keep a contact pressure of the pulley on the ring. The conductor ending in the lower ring is carried inside the upper ring, so that no interference with the upper pulley is possible.

If desired, two pulleys could be mounted on separate arms for each of the contact rings, and the pulleys could be kept tight on the ring by means of a tension spring between them. —R. J. Blaho, W3EEP

How Would You Do It?

(Continued from page 60)

the keying tube and was used in conjunction with a conventional 6L6 tetrode oscillator circuit.

Although the circuit of Fig. 2B involves the use of a keying tube, it would appear to have certain advantages over the circuit of A; it permits stopping oscillation entirely and the use of the keying tube should be effective in eliminating key clicks.

Two novel systems in which keying is introduced in the crystal circuit are shown in Fig. 3. In the circuit at A, a back-contact relay short-circuits the crystal when the key is open. WESSA has had very good results with this arrangement, even when crystals of poor activity were used. The contacts of the relay should be well insulated.

In the version suggested by W11AP, shown in Fig. 3B, the keying-relay contacts are connected in series between crystal and ground.

"Without doubt, every ham has to find an answer to the problem of key clicks or be ostracized by his neighbors. A similar situation developed at WSNMH, station of the Clarkson College Radio Club, located on the school campus amidst a multitude of b.c. receivers. So we started to find an answer to this problem of a clickless and chirpless keying circuit. The one finally developed works exceedingly well. I do not know that the idea is new, but I have never heard of it before. Here at the shack we have a b.c. receiver and the transmitter may be keyed without causing interference of any kind. Chirps were eliminated by adjusting the cathode resistance so that the tube drew essentially the same current with key open or closed. This places a constant load upon the oscillator plate-voltage supply permitting no variation in voltage output. A Type 6L6G was used in the oscillator.

"In tuning the oscillator, it was noticed that the screen current varied from two to six milliamperes while tuning the plate circuit through resonance while the plate current changed hardly at all. The screen current is therefore used as an indication of resonance rather than the plate current. Link coupling to the following stage was used and the oscillator is lightly loaded.

"One might expect trouble with this method since the tube is called upon to dissipate considerable power when the key is open. No difficulties have been experienced so far; if the 6L6G does not last as long as it might under other conditions, it is worth this loss to maintain a clickless and chirpless signal.

"The variable resistor across the relay contacts

(Continued on page 118)
Devoted to the interests and activities of the

INTERNATIONAL AMATEUR RADIO UNION

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

<table>
<thead>
<tr>
<th>MEMBER SOCIETIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>日本アマチュア無線連盟 Japan</td>
</tr>
<tr>
<td>Liga Colombiana de Radio Alectronados</td>
</tr>
<tr>
<td>Liga Mexicana de Radio Experimentadores</td>
</tr>
<tr>
<td>Magyar Radioamateuró Amatőrek Osztályos Égésülete</td>
</tr>
<tr>
<td>Nederlandse Vereeniging voor Internationaal Radioamateurisme</td>
</tr>
<tr>
<td>Nederlandse-lidstede Vereeniging Voor Internationaal Radioamateurisme</td>
</tr>
<tr>
<td>Newfoundland Amateur Radio Association</td>
</tr>
<tr>
<td>New Zealand Association of Radio Transmitters</td>
</tr>
<tr>
<td>Norrköping Radio Hela Liga</td>
</tr>
</tbody>
</table>

Conducted by Byron Goodman

General:

The July, 1938, issue of the T. & R. Bulletin (R.S.G.B.) carries an interesting story on “The Dawn of International DX” by G2UV, of interest to any DX-minded ham because it gives a European slant on the early DX work across the pond. Read along with the American views carried in QST and “Two Hundred Meters and Down,” it will round out your picture. . . . Apparently the summer-camp station of the E.D.R. (Denmark), OZ7EDR, was a big success again this year. It was set up for a week at Smidstrup Strand, and averaged about 60 visitors a day. More than 100 amateurs visited the camp, 80 of them staying overnight, and the guest included German, Swedish, and Dutch amateurs. The 85-watt station was never lacking in operators and, from the account in OZ, the gang left the camp happy, sun-burned, and well-fed. . . . New regulations giving Roumanian amateurs a more substantial position have recently been formulated and adopted, according to information received from the U. S. Department of State. . . . J. Mahiut, ON4AU, well known to all DX men, was recently elected Traffic Manager of the Réseau Belge. . . .

QSL Bureaus:

Following is the latest revised list of the foreign QSL Bureaus to which QSL cards may be sent for distribution. Many of these bureaus now refuse to handle SWL cards and reports, and therefore listener reports should be sent directly to the station.

Alaska: Dean Williams, Box 2373, Juneau.
Antigua: A. Tibbits, Box 43, St. John’s.

Argentina: Radio Club de la Argentina, Rividavida 2170, Buenos Aires.
Australia: Ray Jones, 23 Landale Street, Boxhill, Victoria.
Barbados: see Antigua.
Belgium: Baron Bonaert de la Roche, ON4HM, Chateau de Marchennes, Harpenrij nr. Mons.
Bermuda: Alfred E. Redman, “Elsing,” Middle Road, Devonshire.
Bolivia: Henry E. J. Smith, c/o Standard Oil Co. of Bolivia, La Paz.
Borneo: see Malaya.
British Guiana: see Antigua.
British Honduras: D. Hunter, Box 178, Belize.
Canal Zone: Norman Miller, 15th Air Base Squadron, Albrook Field.
Ceylon: Radio Club of Ceylon and South India, P. O. Box 282, Colombo.
Chile: Luis M. Desmaris, Casilla 781, Santiago.
Costa Rica: Federico Gonzalez, Box 384, San Jose.
Cuba: Adolfo Dominguez, Milagros 66, Vibora, Habana.
Denmark: Arne Hammer, OZ7D, Norre Aaby.
Dominican Republic: H. H. Godling, Calle Cesar Nicolas Penson, Ciudad, Trujillo.
Ecuador: Carlos Cordoves, Box 30, Riobamba.
Federated Malay States: see Malaya.
Finland: S.R.A.L., Pohjola, Box 42, Helsinki.
France (and any country with prefix beginning with “F”): Réseau des Émetteurs Francoises, 6 Square de la Dordogne, Paris, 17e.
Germany: D.A.S.D., Cecilienalle 4, Berlin-Dahlem.
Greece: C. Tavaniotis, 17-a Bucharest St., Athens.
Hawaii: James F. Pa, K6LBH, 1416D Lunalilo St., Honolulu.
Hong Kong: H.A.R.T.S., Box 651.
A MESSAGE to radio amateurs from the Secretary of the Navy will be transmitted on Navy Day, October 27th. In connection with this message A.R.R.L. will conduct the Fourteenth Annual Navy Day Receiving Competition. All amateurs are invited to take part in this activity, which constitutes amateur radio’s participation in the celebration of Navy Day.

Two messages will be transmitted, one from Radio Washington (NAA), the other from Radio San Francisco (NPG). These messages will be substantially the same in thought but will vary slightly in wording. A letter of appreciation from the Navy Department will be sent to every amateur who makes perfect copy of the text of one message. Both messages may be copied, but only the best copy should be submitted in the competition. It is not necessary to copy both stations, and no extra credit is given for so doing. However, if both stations should be copied, please mention the fact when submitting your best copy so that the number of operators copying each station may be ascertained. Only the text (including any punctuation therein) of each message will count (not the preamble, break signs, and the like). Copy what you hear. Do not guess! Credit will of course be deducted for logging anything that was not actually transmitted!!

Mail copies for grading to the A.R.R.L. Communications Department, West Hartford, Conn. Send your original copies—recopying invites errors. An Honor Roll of letter winners and all other participants will appear in QST. The relative standings of the various Naval Districts will be determined by comparing the number of letters awarded with the number of copies submitted from each District. In submitting copy please mention it if you are a member of the Naval Communication Reserve.

Transmissions will be at approximately 25 words per minute and will be preceded by a five-minute CQ call on the following schedule: From Washington: NAA, 9:00 p.m., E.S.T., simultaneously on 4045 and 8090 kcs. From San Francisco: NPG, 7:30 p.m., P.S.T., simultaneously on 4045 and 5060 kcs.
The A.R.R.L. Sweepstakes is scheduled this year for November 12th-13th and November 19th-20th. Full details of this major activity in the operating field will appear in November QST. Get your station in prime condition for two weeks-ends of fun and QSO-opportunity. All set for the 9th annual SS!

Utilization of Operating Frequencies, Domestic and Foreign. A comparison of our use of amateur frequency bands in this country, with that reported by foreign members makes an interesting study. Tabulation of thousands of returns from a League membership questionnaire now makes some of the facts known. In the following table a percentage use comparison is followed by a ratio-of-use in which other figures are reduced to small round numbers to make comparison easy. The figures show mainly the distribution of amateur interest between the different bands, and do not give indication of the total numbers of amateurs active. The foreign membership return analyzed runs about 6 per cent that of the U.S.A. return.

PER CENT USE OF BANDS AND RATIO OF USE

<table>
<thead>
<tr>
<th>Band</th>
<th>Domestic</th>
<th>Foreign</th>
<th>U.S.A.: Foreign</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 m 1.8 Mc</td>
<td>.0167</td>
<td>.0538</td>
<td>1 : 1</td>
</tr>
<tr>
<td>80 m 3.5 Mc</td>
<td>.0915</td>
<td>.0861</td>
<td>5 : 1</td>
</tr>
<tr>
<td>40 m 7 Mc</td>
<td>.0861</td>
<td>.0861</td>
<td>5 : 1</td>
</tr>
<tr>
<td>20 m 14 Mc</td>
<td>.2530</td>
<td>.5206</td>
<td>1 : 2</td>
</tr>
<tr>
<td>10 m 28 Mc</td>
<td>.5438</td>
<td>.7707</td>
<td>1 : 3</td>
</tr>
<tr>
<td>5 m 56 Mc</td>
<td>.4973</td>
<td>1.3777</td>
<td>1 : 4</td>
</tr>
<tr>
<td>20 m 112 Mc</td>
<td>.0747</td>
<td>.0722</td>
<td>1 : 1</td>
</tr>
<tr>
<td>14 m 224 Mc</td>
<td>.0427</td>
<td>.0427</td>
<td>1 : 1</td>
</tr>
</tbody>
</table>

Total Domestic: 100.00% Total Foreign: 100.00%

Referring to the table, 1.8-Mc. telegraph use is "comparable." Due to foreign restrictions and sharing with other services, 3.5-Mc. telegraph use is only 22.6 per cent as much. Amateurs of some countries do not have use of the band at all. Others may use only certain band sectors. Possibly the most valuable territory of all is our 3.5-Mc. or domestic band in which useful emergency communication work and traffic organization go forward. Since the "other services," not hams, use so much of the low-frequency territory that is available to assign to amateurs (if governments want to), it is a correct observation that about all the average foreign amateur can do in operating is to work a little DX! The 7-Mc. telegraph work of foreign amateurs is 51 per cent that reported from U.S.A. members. On the 14-Mc. band the table shows 200 per cent foreign, or double our percentage use of telegraph for DX. Similarly, the 28-Mc. telegraph band has 300 per cent, or three times foreign-to-U.S.A. utilization, and foreign 50-Mc. telegraph is four times the U.S.A. percentage. This is due, we believe, not to any difference in popularity of bands, but to irksome restrictions, no allocations at all, power limited to ten watts or less, so that practical work is less effective, even where permitted in foreign nations, on the lower frequency amateur bands.

Coming to our radiotelephone comparisons: 1.8-Mc. 'phone work is but 11 per cent as common in foreign lands as in our own U.S.A. 4-Mc. 'phone has exactly comparable utilization. 7-Mc. 'phone, of which we have none, due to the narrowness of the band and our great numbers, is one fifth or 20 per cent of all foreign amateur radiotelephone operation! 14-Mc. 'phone rates 165 per cent as compared to U.S.A.'s 100 per cent. 10- and 5-meter telephone utilization is "down" in foreign lands. Perhaps there are fewer amateurs in the big cities to use "five" and a thinner distribution of amateurs in the population of other countries, or else u.h.f. equipment is harder to build or obtain. The 28-Mc. use is only about half what we experience. This is doubtless because 7- and 14-Mc. 'phone are satisfactory to foreign amateurs, who are less numerous, and have no elaborate special band classifications to limit QRM. An examination of foreign regulations (see index of such presentations in the I.A.R.U. section of back issues of QST), with comparison of our own, strongly emphasizes how lucky we hams are who operate amateur stations under the most liberal frequency assignments, in the good old U.S.A. Our VE-brothers also have regulations and assignments that correspond closely with our own. But elsewhere in the world, even where substantial fees are paid the governments by amateurs for their...
licenses (for which qualifications in citizenship and code and theory is the only test in U.S.A.), the work permitted under licenses is extremely limited and part or all of certain frequency bands, even where available by international treaty, are prohibited by foreign government administrations.

Sportsmanship with E.C.O.'s. "Several DX stations have been heard complaining about e.e.o.'s parking right on the frequency of the station they were working and calling before they finished their Q5O. Recently VK9DM told a W8 what he thought of him for doing it. A TF was trying to get his report from a W9, but gave up and left the air after asking the stations on the W9's frequency to stand by several times. HS1BJ hooked a W1, and in five minutes there were so many stations on the W1 tuning up and calling it was impossible for him to copy any of them."

The above is from a U.S. amateur who also reports that on every desirable DX station mentions that he and other foreign station operators are going to skip the whole selfish bunch . . . and instead work just the stations that use common sense and proper sportsmanship.

From a DX ham, "They would have a better chance at working us if they would stay spread out over the band, at least not all right on each other's frequency and on the unfortunate station that hooked us first. Some of the DX W's are 'scavengers' who find the frequency of the person I am working, swing their e.c.o.'s to his frequency, and bust up the QSO before it is well underway. Tell them to lay off, and stay on their own frequency, and I'll manage to hear and work a lot more of them."

Operators, patronize the A.R.R.L. QSL Bureau. An operator who has visited these United States but who is now on the air regularly from a foreign land writes, "Have sent a card to everyone with whom I have had a QSO, and to some others heard, but always to the QSL Bureau for their respective W-district. If they want their cards tell them to get them from their QSL Manager. Just consult the directory of the men in the nine U.S.A. and five Canadian Districts who run the QSL Bureau. Their addresses are elsewhere in this issue. Send the district manager a stamped, self-addressed envelope. Keep one always on file, and when there are communications for you they will be forwarded. Use your A.R.R.L. QSL service. It is organized to help you."

—F. E. H.

The Maxim Memorial W1A—Dedication Relay

T

E

HE new W1A received a grand send-off on the occasion of the Maxim Memorial Dedication Relay, held following the dedication ceremonies on Friday, September 2d. 372 messages of greeting and good wishes from League officials and members in 60 Sections were received by Connecticut stations during the approximate 12 hours of the Relay tells its own story of the outstanding success of the affair! The true spirit of T.O.M. was exemplified by the participation, which included many hundreds of relaying stations in addition to those from which messages were received. It was a most fitting activity to honor the memory of Hiram Percy Maxim and to launch the W1A-Memorial on a course of "service to amateur radio," to which it is dedicated.

Included in the hundreds of greetings received were messages from 177 A.R.R.L. officials (10 Directors, 5 Alt. Directors, 9 Asst. Directors, 30 S.C.M.'s (including 4 Asst. S.C.M.'s), 77 R.M.'s, 20 P.A.M.'s and 17 E.C.'s). Twenty-seven amateur radio clubs and network organizations as well as a number of civic bodies added their felicitations. Space prevents publication of all the messages received but a few representative texts, typical of the spirit of the event, will be of interest:

"The Maxim Memorial WlA W received a grand send-off on the occasion of the Maxim Memorial Dedication Relay, held following the dedication ceremonies on Friday, September 2d. 372 messages of greeting and good wishes from League officials and members in 60 Sections were received by Connecticut stations during the approximate 12 hours of the Relay tells its own story of the outstanding success of the affair! The true spirit of T.O.M. was exemplified by the participation, which included many hundreds of relaying stations in addition to those from which messages were received. It was a most fitting activity to honor the memory of Hiram Percy Maxim and to launch the W1A-Memorial on a course of "service to amateur radio," to which it is dedicated.

Included in the hundreds of greetings received were messages from 177 A.R.R.L. officials (10 Directors, 5 Alt. Directors, 9 Asst. Directors, 30 S.C.M.'s (including 4 Asst. S.C.M.'s), 77 R.M.'s, 20 P.A.M.'s and 17 E.C.'s). Twenty-seven amateur radio clubs and network organizations as well as a number of civic bodies added their felicitations. Space prevents publication of all the messages received but a few representative texts, typical of the spirit of the event, will be of interest:

"On this momentous occasion the Pacific Division extends greetings and welcome to our new Maxim Memorial Station."

—J. L. McGregor, W5FF, Director, Pacific Division

"Congratulations and best success to W1A and A.R.R.L. on dedication of Maxim Memorial, 73."—O. N. Brown, VE1TV, Route Manager, Maritime Section, Canada.

"Greetings to the Maxim Memorial Station."—W8 what he thought of him for doing it. A TF was trying to get his report from a W9, but gave up and left the air after asking the stations on the W9's frequency to stand by several times. HS1BJ hooked a W1, and in five minutes there were so many stations on the W1 tuning up and calling it was impossible for him to copy any of them."

The above is from a U.S. amateur who also reports that on every desirable DX station mentions that he and other foreign station operators are going to skip the whole selfish bunch . . . and instead work just the stations that use common sense and proper sportsmanship.

From a DX ham, "They would have a better chance at working us if they would stay spread out over the band, at least not all right on each other's frequency and on the unfortunate station that hooked us first. Some of the DX W's are 'scavengers' who find the frequency of the person I am working, swing their e.c.o.'s to his frequency, and bust up the QSO before it is well underway. Tell them to lay off, and stay on their own frequency, and I'll manage to hear and work a lot more of them."

Operators, patronize the A.R.R.L. QSL Bureau. An operator who has visited these United States but who is now on the air regularly from a foreign land writes, "Have sent a card to everyone with whom I have had a QSO, and to some others heard, but always to the QSL Bureau for their respective W-district. If they want their cards tell them to get them from their QSL Manager. Just consult the directory of the men in the nine U.S.A. and five Canadian Districts who run the QSL Bureau. Their addresses are elsewhere in this issue. Send the district manager a stamped, self-addressed envelope. Keep one always on file, and when there are communications for you they will be forwarded. Use your A.R.R.L. QSL service. It is organized to help you."

—F. E. H.

The Maxim Memorial W1A—Dedication Relay

"On this momentous occasion the Pacific Division extends greetings and welcome to our new Maxim Memorial Station."

—J. L. McGregor, W5FF, Director, Pacific Division

"Congratulations and best success to W1A and A.R.R.L. on dedication of Maxim Memorial, 73."—O. N. Brown, VE1TV, Route Manager, Maritime Section, Canada.

"Greetings to the Maxim Memorial Station."—W8 what he thought of him for doing it. A TF was trying to get his report from a W9, but gave up and left the air after asking the stations on the W9's frequency to stand by several times. HS1BJ hooked a W1, and in five minutes there were so many stations on the W1 tuning up and calling it was impossible for him to copy any of them."

The above is from a U.S. amateur who also reports that on every desirable DX station mentions that he and other foreign station operators are going to skip the whole selfish bunch . . . and instead work just the stations that use common sense and proper sportsmanship.

From a DX ham, "They would have a better chance at working us if they would stay spread out over the band, at least not all right on each other's frequency and on the unfortunate station that hooked us first. Some of the DX W's are 'scavengers' who find the frequency of the person I am working, swing their e.c.o.'s to his frequency, and bust up the QSO before it is well underway. Tell them to lay off, and stay on their own frequency, and I'll manage to hear and work a lot more of them."

Operators, patronize the A.R.R.L. QSL Bureau. An operator who has visited these United States but who is now on the air regularly from a foreign land writes, "Have sent a card to everyone with whom I have had a QSO, and to some others heard, but always to the QSL Bureau for their respective W-district. If they want their cards tell them to get them from their QSL Manager. Just consult the directory of the men in the nine U.S.A. and five Canadian Districts who run the QSL Bureau. Their addresses are elsewhere in this issue. Send the district manager a stamped, self-addressed envelope. Keep one always on file, and when there are communications for you they will be forwarded. Use your A.R.R.L. QSL service. It is organized to help you."

—F. E. H.
The Radio Society of Northern Ireland announces the Leonard Trophy Contest to be held on the first Sunday in October, ends at 2400 GMT Sunday, October 1st 1936. The contest is open to all licensed amateurs. Only one operator per station is permitted; however, if more than one operator is used, each operator may submit an individual score. All stations must exchange RST reports before points may be claimed. Stations may be worked once only during the contest. All amateur frequencies may be used.

Contacts will be between EI and G1 stations and stations in all other parts of the world. Points may be claimed as follows: For contacts between EI/G1 and Europe, 1 point; Africa, above Equator, 2 pts.; Africa, below Equator, 3 pts.; North America, 3 pts.; South America, 4 pts.; Oceania, 4 pts. In the case of Irish participants, scores will be multiplied by the number of countries worked. United States and Canadian districts each count as a separate country.

The "Leonard Trophy" will be awarded to the leader of the Irish station for one year, as well as a replica for permanent possession. The leading station outside of Ireland will receive a gold "trophie". The second leading station outside of Ireland will receive a silver "trophie". The leading station outside of Ireland will receive a gold "trophie".

The contest is open to all licensed amateurs. Only one operator per station is permitted; however, if more than one operator is used, each operator may submit an individual score. All stations must exchange RST reports before points may be claimed. Stations may be worked once only during the contest. All amateur frequencies may be used.

Contacts will be between EI and G1 stations and stations in all other parts of the world. Points may be claimed as follows: For contacts between EI/G1 and Europe, 1 point; Africa, above Equator, 2 pts.; Africa, below Equator, 3 pts.; North America, 3 pts.; South America, 4 pts.; Oceania, 4 pts. In the case of Irish participants, scores will be multiplied by the number of countries worked. United States and Canadian districts each count as a separate country.

The "Leonard Trophy" will be awarded to the leader of the Irish station for one year, as well as a replica for permanent possession. The leading station outside of Ireland will receive a gold "trophie". The second leading station outside of Ireland will receive a silver "trophie". The leading station outside of Ireland will receive a gold "trophie".
PRIZES FOR BEST ARTICLE

The article by Mr. Arthur John Pinard, W9PTF wins the C.D. article contest this month. Each month we print the most interesting and valuable the article received marked "for the C.D. contest." Contributions may be on any phase of amateur operating or communication activity (DX, "phone, traffic, rag-chewing, clubs, fraternalism, etc.) which adds constructively to amateur organization work. Prize winners may select a 1938 bound Handbook, QST Binder and League Emblem, six logs, eight pads radiogram blanks, DX Map and three pads or any other combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

WHAT DO YOU TALK ABOUT?

By Arthur John Pinard, W9PTF

ONE question which the amateur DX operator can seldom answer satisfactorily is, "When working foreign stations, what do you talk about?" It is a common question which ought to be simple to answer. Yet the usual attempts at an answer leave both parties in a state of confusion. The truth is that usually we don't talk about anything! Listen in on the 14-Mc. band some day to stations working DX and see how little originality is expressed in DX QSO's. The great majority of our QSO's sound as though they have all come out of an endless tape with only the call and report to distinguish one from another. No matter whether we are working England, Australia, Japan, South Africa or Pineapple Island, the DX operator speaks only of his QTH, the tract of real manners: "r'ok ge om es tx vy fer call." This may have started as a routine operating practice, but it seems now to have become a ritual which, apparently, many feel cannot be omitted without committing a breach of amateur etiquette. It occupies many precious seconds of a DX contact.

Next we vary the routine slightly by sending "ur sigs st 570x her in racine wi. condx fb hrw ar." Our second transmission is not likely to be much more interesting: "rw tx vy fer qso es hpe cuagn 73 luck dx ar." If the station referred to is answering a CQ the second transmission is probably omitted. Now the above QSO form would not be particularly objectionable if it were used once and no more. But when we use the same form for hundreds and hundreds, when every other station uses the same form or a slight variation of it for nearly every QSO, when the only difference between one QSO and the next is the call and the report (the QTH is often omitted), then it seems time that we question the value of DX communication. So great is the tendency toward routine communication that many operators do not even bother to copy the text and listen only for the report. It should not be inferred that a few poor operators are responsible for this condition. It is characteristic of practically all DX operators. A clue to the tendency toward routine and lack of interesting matter may be drawn from the fact that we have long placed the emphasis upon quantity of QSO's rather than upon the individual quality of each. The mark of esteem is placed upon the operator who works more countries, or more districts than anyone else. When W8XYZ works 17 VK's in one morning he receives wide acclaim when it is generally conceded that he has contributed anything toward ham friendship in rattlefing off 17 QSO's in a few hours. After a fellow has worked five or six VK's he can be fairly well certi-

Hamfest Schedule

October 1st, at Schenectady, N. Y.: The Schenectady Amateur Radio Association's Autumn Hamfest will be held Saturday, October 1st. Complete details are available from Roy D. Jordan, W2KUD, R.F.D. No. 7, Schenectady, N.Y.

October 2d, near East St. Louis, Ill.: The third annual auction of the Egyptian Radio Club is scheduled for Sunday, October 2d, at the club shack, 1720 South Chouteau Slough Road, north of East St. Louis, Illinois. Previous E.R.C. auctions have met with great success. The members
bring all their obsolete and extra apparatus for auction, the club taking a percentage of the proceeds. Free cats for all who attend. All buns are invited. There is plenty of room for picnicking and games. No charge of any kind. Visitors are not required to participate in the auction if they do not so desire. The auction will be in charge of Harold Jansen, W9DJG, and any further information may be obtained from him at 1110 Pine Street, Alton, Illinois.

October 8th, at Rutland, Vt: The Green Mountain Radio Club of Rutland will sponsor the 1938 Vermont Hamfest. The date: October 8th. The place: Hotel Bardwell, Rutland, Vt. Registration fee of $1.50 will cover everything, not doing so badly at that!!

October 9th, at Poplar Bluff, Missouri: The next quarterly meeting of the Moarky Amateur Radio Assn., Rutland, Vt. on the second Sunday in October, the 9th. Visitors are welcome! Worth-while attendance prizes will round out the program . . . and, of course, there will be plenty of fun for all. This meeting is under the auspices of the Poplar Bluffs Licensed Radio Amateur Operators Assn. Additional details may be secured from H. C. Young, W9DJG, and any further information may be obtained from him at 1110 Pine Street, Alton, Illinois.

October 9th, at Poplar Bluff, Missouri: Radio Club of Rutland will sponsor the Hamfest. The date: October 8th. The place: Hotel Bardwell, Rutland, Vt. The Poplar Bluffs Licensed Radio Amateur Operators Assn. is working hard to make this the best hamfest in the history of ham radio in the Green Mountain State. For further details write Robert C. Teachout, W1FSV, 42 Pine St., Rutland, Vt.

A.R.R.L. Headquarters Operators

The following calls and personal sines belong to members of the A.R.R.L. Headquarters gang:

Note the addition of a special listing for radiophone. The fight for leadership is mighty keen of late, and the following calls and personal sines belong to members of the A.R.R.L. Headquarters gang:

W1AW, J. J. Lamb, “Jim”
W1AIA, A. H. Hebert, “ah”
W1AW, R. B. Beaudin, “rb”
W1BDI, F. E. Handy, “fh”
W1CBD, C. B. de Soto, “dP”
W1JEQ, Vernon Chambers, “vc”
W1JFN, A. L. Budloring, “bud”
W1JPE, Byron Goodman, “by”
W1JTD, Hal Bubb, “hal”
W1JVI, Thomas M. Ferrill, Jr. working hard to make this the best hamfest in the history of ham radio in the Green Mountain State. For further details write Robert C. Teachout, W1FSV, 42 Pine St., Rutland, Vt.

DX Century Club

The following have submitted proof of contacts with 75-or-more countries, including (please) sufficient postage to finance the return of your QSL’s. In order to receive the return of your QSL’s it is suggested that you send enough postage to make possible their return by First Class Mail, Registered!

GAWY (No. 5) ... 137 W9HDI (No. 21) ... 107
W1S7Z (No. 7) ... 129 W8LEC (No. 25) ... 107
W1TW (No. 3) ... 125 W6GDH (No. 41) ... 107
W2CRCA (No. 1) ... 126 ON4UI (No. 31) ... 107
W6CXX (No. 4) ... 124 W6FST (No. 35) ... 105
W6DFH (No. 14) ... 124 G6RCH (No. 36) ... 105
W6GRL (No. 15) ... 124 W5CAL (No. 50) ... 105
ON4AU (No. 40) ... 124 W2BH (No. 39) ... 104
G2ZZQ (No. 6) ... 123 E1SF (No. 19) ... 103
WITS (No. 7) ... 123 G6KL (No. 45) ... 103
W2GTZ (No. 12) ... 121 W4CBY (No. 20) ... 102
W1BUX (No. 2) ... 118 W8FZL (No. 48) ... 102
W1LZ (No. 10) ... 116 W5ZWR (No. 49) ... 102
W2GW (No. 11) ... 115 F6DF (No. 8) ... 101
W6KIP (No. 28) ... 115 JCC (No. 46) ... 101
W8BTH (No. 30) ... 114 W5CRS (No. 47) ... 101
HBBJ (No. 13) ... 112 W3EDP (No. 53) ... 101
W9ALR (No. 18) ... 112 W2HHF (No. 54) ... 101
W2CQ (No. 2) ... 111 W4CRA (No. 55) ... 101
W6GK (No. 16) ... 111 W4CEN (No. 56) ... 101
W6OSL (No. 23) ... 111 G6CL (No. 57) ... 100
W7AMX (No. 32) ... 111 W8FAT (No. 58) ... 100
W1DFP (No. 29) ... 111 W9KA (No. 42) ... 100
W8JMP (No. 22) ... 110 PA0XF (No. 43) ... 100
W8DMC (No. 27) ... 110 W5ECF (No. 44) ... 100
W8QOF (No. 39) ... 110 W2CJM (No. 47) ... 100
W9JHI (No. 19) ... 109 W3EDP (No. 53) ... 99
W8APD (No. 34) ... 109 W7CSF (No. 55) ... 99
W9DWW (No. 17) ... 108 W3EMM (No. 58) ... 99
W5BB (No. 37) ... 108 ZLHY (No. 59) ... 99
W9DWDN (No. 61) ... 100

MEMBERS, DX CENTURY CLUB

The following calls and personal sines belong to members of the A.R.R.L. Headquarters gang:

W1AW, J. J. Lamb, “Jim”
W1AIA, A. H. Hebert, “ah”
W1AW, R. B. Beaudin, “rb”
W1BDI, F. E. Handy, “fh”
W1CBD, C. B. de Soto, “dP”
W1JEQ, Vernon Chambers, “vc”
W1JFN, A. L. Budloring, “bud”
W1JPE, Byron Goodman, “by”
W1JTD, Hal Bubb, “hal”
W1JVI, Thomas M. Ferrill, Jr. working hard to make this the best hamfest in the history of ham radio in the Green Mountain State. For further details write Robert C. Teachout, W1FSV, 42 Pine St., Rutland, Vt.

Note the addition of a special listing for radiophone. The fight for leadership is mighty keen of late, and this round we find W1S7Z second-high and W1TW third. The buyers are sure that W1S7Z is holding out on ‘em, but he’s not doing so badly at that!!

Note the addition of a special listing for radiophone. The fight for leadership is mighty keen of late, and this round we find W1S7Z second-high and W1TW third. The buyers are sure that W1S7Z is holding out on ‘em, but he’s not doing so badly at that!!
How's DX?

How:

Realizing that last the neophyte ballad-writer has a really appreciative friend, many budding (and sometimes over-ripe) poets have submitted samples. We herewith present a poignant little thing that can be appreciated by any DX man. The author submitted proof of its authenticity, so it is no mere figment of the imagination.

DX AT LAST

I've got some cards from China, and from VE, and when I mailed a Siamese, I thought my luck OK.

I have had my fill of fun, when making such a call; but this morning gave a thrill, the biggest of them all.

The mail brought a request for card from one who'd heard my sig—it was a friendly SWL.

Two blocks from my rig. —QMAO

Where:

Things look fairly bright this month. By that we mean that through a slow process of elimination we're gradually getting the low-down on some of the questionable stations. For example, many of the lads have a hunch that Z71BW (T7, anywhere in high-freq. portion of 20) is not where his prefix says he is. To the contrary, he's very much authentic, although undercover of course, and it is no mere figment of the imagination, over-ripe poets have submitted samples. We herewith present a poignant little thing that can be appreciated by any DX man. The author submitted proof of its authenticity, so it is no mere figment of the imagination.

Realizing that last the neophyte ballad-writer has a really appreciative friend, many budding (and sometimes over-ripe) poets have submitted samples. We herewith present a poignant little thing that can be appreciated by any DX man. The author submitted proof of its authenticity, so it is no mere figment of the imagination.

DX AT LAST

I've got some cards from China, and from VE, and when I mailed a Siamese, I thought my luck OK.

I have had my fill of fun, when making such a call; but this morning gave a thrill, the biggest of them all.

The mail brought a request for card from one who'd heard my sig—it was a friendly SWL.

Two blocks from my rig. —QMAO

A BUNCH OF THE BERMUDA BOYS

In the front row, from left to right, VP9X, 9R, and 9H, and in the back, 9L, W2KRE, and 9C. DX has been quite active on c.w. lately—he uses a 6L6-T20 rig with 35 watts input. 9R, Senior Health Officer of the island, is very well known on 20 phone. 9H has been a ham since 1925 but has been inactive lately. 9L is a newcomer but rapidly making up for lost time, with 50 watts on 20 'phone. 9G runs about 75 watts to his 'phone rig on 10 and 20.

Realizing that last the neophyte ballad-writer has a really appreciative friend, many budding (and sometimes over-ripe) poets have submitted samples. We herewith present a poignant little thing that can be appreciated by any DX man. The author submitted proof of its authenticity, so it is no mere figment of the imagination.

DX AT LAST

I've got some cards from China, and from VE, and when I mailed a Siamese, I thought my luck OK.

I have had my fill of fun, when making such a call; but this morning gave a thrill, the biggest of them all.

The mail brought a request for card from one who'd heard my sig—it was a friendly SWL.

Two blocks from my rig. —QMAO

A BUNCH OF THE BERMUDA BOYS

In the front row, from left to right, VP9X, 9R, and 9H, and in the back, 9L, W2KRE, and 9C. DX has been quite active on c.w. lately—he uses a 6L6-T20 rig with 35 watts input. 9R, Senior Health Officer of the island, is very well known on 20 phone. 9H has been a ham since 1925 but has been inactive lately. 9L is a newcomer but rapidly making up for lost time, with 50 watts on 20 'phone. 9G runs about 75 watts to his 'phone rig on 10 and 20.

Realizing that last the neophyte ballad-writer has a really appreciative friend, many budding (and sometimes over-ripe) poets have submitted samples. We herewith present a poignant little thing that can be appreciated by any DX man. The author submitted proof of its authenticity, so it is no mere figment of the imagination.

DX AT LAST

I've got some cards from China, and from VE, and when I mailed a Siamese, I thought my luck OK.

I have had my fill of fun, when making such a call; but this morning gave a thrill, the biggest of them all.

The mail brought a request for card from one who'd heard my sig—it was a friendly SWL.

Two blocks from my rig. —QMAO

A BUNCH OF THE BERMUDA BOYS

In the front row, from left to right, VP9X, 9R, and 9H, and in the back, 9L, W2KRE, and 9C. DX has been quite active on c.w. lately—he uses a 6L6-T20 rig with 35 watts input. 9R, Senior Health Officer of the island, is very well known on 20 phone. 9H has been a ham since 1925 but has been inactive lately. 9L is a newcomer but rapidly making up for lost time, with 50 watts on 20 'phone. 9G runs about 75 watts to his 'phone rig on 10 and 20.

Realizing that last the neophyte ballad-writer has a really appreciative friend, many budding (and sometimes over-ripe) poets have submitted samples. We herewith present a poignant little thing that can be appreciated by any DX man. The author submitted proof of its authenticity, so it is no mere figment of the imagination.

DX AT LAST

I've got some cards from China, and from VE, and when I mailed a Siamese, I thought my luck OK.

I have had my fill of fun, when making such a call; but this morning gave a thrill, the biggest of them all.

The mail brought a request for card from one who'd heard my sig—it was a friendly SWL.

Two blocks from my rig. —QMAO

A BUNCH OF THE BERMUDA BOYS

In the front row, from left to right, VP9X, 9R, and 9H, and in the back, 9L, W2KRE, and 9C. DX has been quite active on c.w. lately—he uses a 6L6-T20 rig with 35 watts input. 9R, Senior Health Officer of the island, is very well known on 20 phone. 9H has been a ham since 1925 but has been inactive lately. 9L is a newcomer but rapidly making up for lost time, with 50 watts on 20 'phone. 9G runs about 75 watts to his 'phone rig on 10 and 20.
midnight, which might be a good one . . . . Frankly, we're skeptical about UR1B (7100) worked at midnight by K6OVN (14,320 T9), W6LTM (14,350 T7), and W60GW at midnight P.S.T. and claiming to be on Christmas Island . . . . According to W6BB, we had it wrong about K6BAZ going to Samoa. At least he wasn't there but back at Hawaii when Tom worked him the other way . . . . The correct address is K6LHI, L. H. Hinkle, c/o Tuba Project, Marshman & Co., Teganayan, Tayabas, P. I. He'll be on soon with a k.w . . . . W4BPD says ZK1A (14,400 T6) doesn't check on the beam and is a fake, coming in from the north or south instead of the way he should . . . . W6QPG worked FO6SA (14,405 T9) the other evening . . . . VQ8AI (14,320) says his Call Book QTH is wrong, and to QSL via VQ8AF . . . . You'll thank G2TR for letting us know that OX7OU (14,040 T9) is the even-money chance of being legit . . . . W5ACA heard doesn't check on the beam and is a fake, coming in from the north or south instead of the way he should . . . . . . . . W5ACA heard

When:

You can't afford to pass up 28 Mc., because about the time your weary eyes get down to here that band should be wide open again. It isn't doing so badly at the time these lines were written, as W5MIL reports he heard a beam on 28 up in Maryland and W6 during the last of August and the Saturday and Sunday crowds have been having some fine meetings.

VOSA5 has a 'phone running down there. That old deboil 20 seems good at almost any time. At noon W5EUN (14,320), X6DSV (14,370 T7) and J21T (14,405 T7) . . . . They're a little earlier down South, but W4CBN grabbed off XU8CM (14,300 T9x) and PK3EM (14,355 T9), and heard XU5G (14,425 T9x), XU15F (14,320 T9x), XU19R (14,940) V82AE (14,395 T9x) CR7AU (14,350 T9) and CR7AF (14,290 T9) . . . . W6EJF reports V6SAO (14,265) J2NF (14,430), J2KQ (14,410), KAI1C (14,300) KAI1P (14,320) CR7AK (14,410) JSCG (14,405) and KAI1R (14,315). W4BDF has a nice sock including as it does Eliza (14,300 T9), ZDTA (14,415 T9), PK3AA (14,330 T9x), Z6QAQ (14,355 T7), VQ9AA (14,370 T9x) and US6IH (14,360 T9x) . . . . The XU's are good in W5 around 8 a.m. . . . . W5EUN has CN85J (14,360), Y24HE (14,380) and CT2BD (14,350), while W5EC adds EA7AV (14,410 T7) XU5WS (14,420 T9) and TF2X (14,430 T9), QSL via T9RQ . . . . W8KRG has nice ones in QY4C (14,370 T9) Z6A (14,320 T9) and TAA1A (high end of 20 T9) . . . . W2DBH doesn't waste much time, and has-LX1IA (14,430 T9), GI4A (1100 'phone on the Isle of Man, J2CD (14,400 T9) VSJ7W (14,350 T9), ZMIAA (14,300 T9), VS6G (14,405 T9) and VS6TJ (14,400 T9) . . . . PK3AT (14,420 T9) . . . . W6ERK reports K6OYV (14,300 T9) in Guam, L1YIK (14,320 T9), J2CD (14,275 T7) and VS2FG (14,340 T9) . . . . W5HI adds J2UKL (14,420), LY1B (14,105) and KAI1Q (14,350) . . . . W6YEG has been really knocking 'em off, and his list includes ST2CM (14,330 T9), VQ31UP (14,425 T6), UX1CQ (14,430 T9) and K6BAZ (14,395 T9) . . . . W5QGE tips us off to the fact that Z6IP (Southwest Africa) is now on 10 'phone. Paul has been working Z6IP (14,320 T9), VQ5AI (14,320 T9) and VQSS (14,420 T9) . . . . W5HHM worked L21H (14,275 T9), ZA1D and CR7AQ (14,125 T9) . . . . W9WY contributes CH4A (14,300 T9) and V55ADX (14,040) at Great Bear Lake, Port Radium, N.W.T . . . . W6EJF contributes XU19R (14,305 T9), PK3I (14,350 T9) and PK1MI (14,345 T9) . . . . W6BB says he doesn't think PK1MPF can speak English because he gives everyone the same spiel . . . . Latest at J2JL include Z2IP (14,390 T9), Z6II (14,360 T9), ST6KR (14,320, 14,400 T9), VQ5HC (14,320 T9), OQ5AQ (14,360 T9), YA6XX (14,355 T9), ZA2ED (14,270 T9) and PX2A were heard.

Who:

If you've wondered why a lot of the gals are wearing black these days, here's the answer. Dave Evans, W4DHZ, is taking the fatal step on October 15th, with a lovely lady from the land of oranges and kilowatts. Dave may show up in your shack, but he may be gone. Time and Winchell alone will tell . . . .

Quite a few members of the Century Club were at the Chicago Convention—thirteen to be exact. They had a real bang-up DX meeting, presided over by W9KA, and from the looks of things the interest in DX isn't exactly flagging. ZL1JQ and PK3AT were also present at the meeting . . . . W5B5 has it all figured out. If they are new they (1) are so snooty because of their popularity that you have to send your pedigree and cross their palm to get a card, or (2) they are "phony," or (3) they will gladly work you, say "sure QSL" and take your card and Reply Coupons, and never answer! Tom must be only kidding, though, because he gives a song and dance about New England being a good DX location, when he knows it's the worst. (Jeeves, quick pushing that Century Club list in my face) . . . . W6FDR reports FG6SAH (7120 T9) is still on . . . . VP7NT just missed getting it when he left his shack only a few minutes before lightning demolished his gear . . . . FN1C writes to say that he is back on 14,200 and 14,085 k.c., with an R2K0 final. His only W5 so far has been W6LTM . . . . W6IITH passes along some 'phone dope. KAI1K (14,300) has a nice call via a Vee beam, PM1 has a new 34-wave vertical that raps him through and, worse luck, Z6PA has not been active lately. Rog worked VQ2HC (14,315) on 'phone the other a.m. . . . . PY2AJM, whom you should remember from 'way back, has just been made district attorney for Santa Cruz County, C. A. . . . . QV6A9 and SUIAQ are the same fellows but in the right countries though, in case you were getting worried. 6AQ decodes the W's that park on the frequency of the station he's working and won't even let him finish a QSO. Nice friendly thing, this DX! . . . . W2ICY, visiting in Europe, says OK1IIF needs only Nevada and Utah for his W5A . . . . W5ENX passes along the fact that ZL2C (14,330, 14,012) is hunting Delaware with a vengeance . . . . W650 has real trouble. He heard someone signing his call and calling J2NF. That will come in handy during the next DX Contest, if the BL sends in a log too. Oscar works HR2ON (14,410), HK2CC (14,120) Z6JI (14,530) and Z6LIQ (14,345) . . . . YV4AQ now signs YV4AE, and has YV4A9 for a portable call . . . . VP4TM has dismantled his rig and will soon show up in XZ2. He is ex-PK5DL . . . . On 189 'phone W9TFN has worked K6, X4 a V0 and several VE5A, which sounds like DX on that band . . . . W8EUY is up to 102 with QSO's with 0Y4C, VOSHP, UK5KJ, VSWP and FY6AA . . . . Latest at W7ENW are FBAC, XYS1M, 111ML, HB9CE, FASBG, PK1EM and Z6QIJ . . . . In the low-power contingent, W6EYF reports several contacts of ST in the DJDC, using only 35 watts to his 807 exciter, while W5FMT made his WAG with 25 watts to 6lA Tritet and a Q antenna . . . . Q4A8S is now W2JNC, on 10 and 20 'phone a Senior WAG. He's locked to the colons with 500 watts into a vertical surrounded by telephone wires . . . . W1APA and y.t. were "paddling" around at the Maritime Convention together and we figured it all out. When we get on with a fake call it will be a good one: F1Y. Don't you get it? Talk, talk, talk.

A.R.R.L. Official Broadcasting Stations

The following listed stations address information regularly "to all amateurs" rendering a distinctive service to fellow amateurs. First information on changes in F.C.C. regulations, new data on expeditions, special tests and activities, DX conditions and records of prime interest to the amateur world reaches amateurs first through these sources. The list includes weekly broadcasts and the latest-revised list of stations that follows. Stations in all districts assure good coverage on the information which in many cases is so well sent it is used for code practice. Written for the amateurs from these stations. Report results to the stations you copy too, so the operators

October, 1938
ELECTION NOTICES

To all A.R.R.L. Members residing in the Sections listed below:

(Thats stating the closing date and number of nominating petitions for Section Manager, the name of the present incumbent, and the date of expiration of his term of office.) This notice supersedes previous notices.

In cases where no valid nominating petitions have been received from A.R.R.L. members residing in the different Sections in response to our previous notices, the closing dates for receipt of nominating petitions are extended to the dates given herewith, in the absence of nominating petitions from Members of a Section, the incumbent continues to hold his official position and carry on the work of the Section subject, of course, to the filing of a proper nominating petition, or a ballot, or as may be necessary. Petitions must be in West Hartford or before noon of the close of the election period.

Due to a resignation in the Oregon Section, nominating petitions are hereby solicited for the office of Section Communications Manager in this Section. Petitions must be in West Hartford or before noon of the close of the election period.

Participation in these elections is invitational. Further details are given under Election Regulations on page 104, or on the front page of your Station Manager.

In Canadian Sections nominating petitions for Section Managers must be addressed to Canadian General Manager, 185 Reid, 105 Logan Ave. S.W., Toronto, Quebec. To assure receipt of such petitions must be filed with him on or before the closing date named.

1. You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office which is about to be held in each of the Sections in accordance with the provisions of the By-Laws.

2. The elections will take place in the different Sections immediately after the closing date for receipt of nominating petitions as given opposite the different Sections. The Ballots mailed from Headquarters will in alphabetical sequence the names of all eligible candidates nominated for the position by A.R.R.L. members residing in the Sections concerned. Ballots will be mailed to members as of the closing dates specified above, for receipt of nominating petitions.

3. Nominating petitions from the Sections named are hereby solicited. Five or more A.R.R.L. members residing in any Section have the privilege of nominating anyone the League as candidate for Section Manager. The following form for nomination is suggested:

[Place and date]

Communications Manager, A.R.R.L.

38 Lafayette Road, West Hartford, Conn.

You are hereby notified that an election for an A.R.R.L. Section Communications Manager for the next two year term of office is about to be held in each of the Sections listed below in accordance with the provisions of the By-Laws.

The candidates and five or more signatures of A.R.R.L. members required. The candidates and five or more signatures must be mailed to the candidate and the candidates the privilege of nominating any member of the League as candidate for Section Manager. The following form for nomination is suggested:

[Place and date]

Communications Manager, A.R.R.L.

38 Lafayette Road, West Hartford, Conn.

You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office. (Five or more signatures of A.R.R.L. members are required.) The candidates and five or more signatures must be mailed to the candidate and the candidates the privilege of nominating any member of the League as candidate for Section Manager. The following form for nomination is suggested:

[Place and date]

Communications Manager, A.R.R.L.

38 Lafayette Road, West Hartford, Conn.

You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office. (Five or more signatures of A.R.R.L. members are required.)

In Canadian Sections nominating petitions for Section Managers must be addressed to Canadian General Manager, 185 Reid, 105 Logan Ave. S.W., Toronto, Quebec. To assure receipt of such petitions must be filed with him on or before the closing date named.

1. You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office which is about to be held in each of the Sections in accordance with the provisions of the By-Laws.

2. The elections will take place in the different Sections immediately after the closing date for receipt of nominating petitions as given opposite the different Sections. The Ballots mailed from Headquarters will in alphabetical sequence the names of all eligible candidates nominated for the position by A.R.R.L. members residing in the Sections concerned. Ballots will be mailed to members as of the closing dates specified above, for receipt of nominating petitions.

3. Nominating petitions from the Sections named are hereby solicited. Five or more A.R.R.L. members residing in any Section have the privilege of nominating anyone the League as candidate for Section Manager. The following form for nomination is suggested:

[Place and date]

Communications Manager, A.R.R.L.

38 Lafayette Road, West Hartford, Conn.

You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office. (Five or more signatures of A.R.R.L. members are required.) The candidates and five or more signatures must be mailed to the candidate and the candidates the privilege of nominating any member of the League as candidate for Section Manager. The following form for nomination is suggested:

[Place and date]

Communications Manager, A.R.R.L.

38 Lafayette Road, West Hartford, Conn.

You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office. (Five or more signatures of A.R.R.L. members are required.)

In Canadian Sections nominating petitions for Section Managers must be addressed to Canadian General Manager, 185 Reid, 105 Logan Ave. S.W., Toronto, Quebec. To assure receipt of such petitions must be filed with him on or before the closing date named.

1. You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office which is about to be held in each of the Sections in accordance with the provisions of the By-Laws.

2. The elections will take place in the different Sections immediately after the closing date for receipt of nominating petitions as given opposite the different Sections. The Ballots mailed from Headquarters will in alphabetical sequence the names of all eligible candidates nominated for the position by A.R.R.L. members residing in the Sections concerned. Ballots will be mailed to members as of the closing dates specified above, for receipt of nominating petitions.

3. Nominating petitions from the Sections named are hereby solicited. Five or more A.R.R.L. members residing in any Section have the privilege of nominating anyone the League as candidate for Section Manager. The following form for nomination is suggested:

[Place and date]

Communications Manager, A.R.R.L.

38 Lafayette Road, West Hartford, Conn.

You are hereby invited to run for an A.R.R.L. Section Communications Manager for the next two year term of office. (Five or more signatures of A.R.R.L. members are required.) The candidates and five or more signatures must be mailed to the candidate and the candidates the privilege of nominating any member of the League as candidate for Section Manager. The following form for nomination is suggested:

[Place and date]
Hawks As an Amateur
Muskogee, Okla.

Editor, QST:

It was with much regret that hundreds of amateurs like myself heard over the radio last night, or read in cold, black type this morning, these words—"FRANK HAWKS KILLED." The majority of the people of these United States remember Frank Hawks for his work in aviation, but to many of us he was a fellow amateur—W11JJI-W2GKL. His loss is our loss.

This morning I turned back through the files and in QST of the issue of January, 1934, on page 86, there was a letter written by Frank Hawks soon after he passed his amateur examination and obtained his license. Several things in that letter are deserving of our attention.

Although W11JJI had experienced more thrills in a year than most of us experience in a lifetime, he still got a thrill out of something that is common to all of us, namely passing the amateur exam. He said, "I was thrilled beyond words in passing the examination and receiving certificate and station license."

W11JJI did not make the mistake common to many new amateurs, that of going on the air with the maximum of input when finances will permit. Instead he chose to go on the air with flea-power until he gained the requisite experience.

Did he bust, open the air with endless CQ's, or get impatient when he was slow in getting answers to his calls? No! (Quoting his own words, "spent the first three nights following A.R.R.L.'s recommendations, sent very few CQ's, twiddled the dials religiously to pick up others. I was not in the least optimistic in my own outfit, so I called stations in my own immediate district." That statement needs no further comment.

W11JJI was proud of his affiliation with A.R.R.L. His closing statement of the letter was "... and to the best interests of A.R.R.L., with which I am proud to be affiliated." ... W11JJI has signed SK for the last time, but his memory lives on in the hearts of his thousands of friends and admirers, both in aviation and in his chosen hobby, amateur radio.

—Lester Harlow, W3CVO

Mfd. vs. Handmade
Berkshire, England

Editor, QST:

I am glad to see that Mr. Charles Olsefsky, W8RCL, drives an automobile which he made himself. That places him in a class with Malcolm Campbell, John Cobb and the men who race at Indianapolis.

No custom-built car is good enough for a racing driver. He sees every nut and bolt into place and knows the strength and function of the most obscure parts of his mount.

The man-in-the-street who ambles along in the family sedan has a perfect, safe and comfortable means of transportation—but it's not a racing car.

—Jack Paddon, G3IS

‘Jareadit?

844 Bridge Road, Charleston, W. Va.

Editor, QST:

QST! How many of you mugwumps didn’t read ‘It Seems to Us—’ in the August issue of QST, featuring foreign broadcasts on 7200-7300 kc.? Uh-huh. Well, that’s just how many more should have read it than did. Fellow Lids, it not only proves that K.B. W. can write a gud piece of readin’ but it’s one of the most blazingly hot journalizations that ever lighted up these orbs!

Such headline phrases as ‘Let them squawk their bleeding heads off’ (Hoot, mon!), ‘Whose band is it anyhow?’ (You wouldn’t think that K.B.’s innocent pen had this much heat behind it!), ‘It’s their funeral,’ ‘There are plenty of other broadcast frequencies for them (American SWBL’s) to listen to, if they yearn to be propagandized.’ And then he slaps ‘em in the face: ‘We’ll blast ‘em off the air! We’ll mow ‘em down! And serve them right; bad luck to them, anyway!’

A FB article, inspiring you and me to stand up for our just rights, and warning us against ‘bad peoples’ knifeing us in the belly when our backs are turned. Bouquets to you, Ken OB, and also to any fullblooded ham that can read that page of condensed heat without jumping es shouting with glee (like I did) and sweating like a horse from its sizzling emission! Are you nearsighted? Then beware! Don’t stick ur billboard too close to page 7 of August QST or we’ll have singed eyebrows for dinner. Hi, es CUL.

—Geo. H. Knapp, WSSFT
Editor, QST:

Your splendid account of the "Battle of Cairo" in QST for July should be printed and circulated to every ham in the world. This would, perhaps, awaken the brotherhood to the determined attack now in progress to root out the ham, lock, stock and barrel, from the international picture and make them realize that drastic changes are necessary if we are not to meet our Waterloo at Rome in 1942.

On all bands to-day one is painfully made aware of the giddy irresponsibility of, I am sorry to say, the majority of the determined attack now in progress to root out the ham, make them realize that drastic changes are necessary. Ballyhoo! The genuine frequencies I can fully understand the administrations concerning being quite unscrupulous in their demands.

The last sentence in your article on Cairo is a potent one: "We have it in our own hands and it is chiefly a matter of conducting ourselves properly as individual amateurs." But I am afraid it is too late—the writing is on the wall.

-P. T. Daly, E15G

QSLs, DX—A Racket?

Blue Bell, Pa.

Editor, QST:

This QSL business seems to have developed into a most pernicious racket, and I for one should like to see something done about it.

What is amateur radio? My definition of it is a personal means of communicating with others of the same interest at various points around the world. Nine out of every ten DX QSOs you hear run something like this: "r r r ok ok ok ur ur ur rst rst rst 569x 569x 569x hr hr hr in in in extown extown extown extown ur ur ur mi mi mi vy vy vy x x x so so so so so pse pse pse om om om qal qal qal." After all continents have been worked, any operator has a fair idea of the directional properties of his antenna, the hours at which signals will often be heard from the various points of interest, and what band should be used to accomplish the contact.

What then proven by the ability to show the neighbors a flock of DX QSLs? Can you take them into the station and work any one of these operators at any time? No. Can you be certain you will even hear any of them again, or that they will hear you, without a prearranged schedule? No. Does this QSL file make you any better at operating, or does it mean that all these men, who have spent good money to send you cards, must be your close friends? No.

The man is rare who has more than four or five really close friends, and the operator is rare who can handle schedules with four or five DX stations anywhere from daily to weekly, and the reason is that all the time one can give to pursuing a friendship is none too much to really learn to know that fellow well.

How much do the foreigners like it? When they are trying to have a chat with some friends over the air, to have a bunch of W stations land right on the station they happen to be working in order to try to break up the chat and horn-in themselves? Sport, maybe, for the W's, but extremely aggravating to the foreigner, and hardly conducive to kindly relations internationally. Taking the other extreme, suppose the QSL card did not exist at all. Immediately the air would be free of the cajoling, pleading, begging, almost demanding of DX stations that they must send cards. This is not amateur radio; it is a racket, and it stands a good chance of spoiling the game for those of us who find something more useful in it than papering our walls. If any operator is sufficiently inspired by the QSO with some foreigner, let him place the proper postage on his card and address it to the man himself, and not dump it into the racket-barrel with a million others, to be delivered or not, as the QSL-Bureau Manager may decide. A QSL card, if one is sent, should be a souvenir of something one wishes to remember with great pleasure; a friendship formed with someone with whom there is some thought or language or hobby or interest in common, one which will be a pleasure to resume and continue whenever conditions and time permit. There is no place on this earth which cannot be worked if you pick the right time of day, the right band, the right conditions, and if there happens to be a station there and working under simultaneous conditions. So, if you know all this to start with, what is all the noise about? Even a souvenir hunter "can't take it with him."—John B. Morgan, W10QP

Is It Fair?

Shanghai, China

Editor, QST:

In almost every QSO one can hear frantic requests for a QSL card, and also equally earnest assurances that that particular station will surely send his own confirmation. But just how many of them do so?

We who live in a far country attach an almost sentimental value to a confirming card. It is a breath from the outside world. An acknowledgment that the station worked was as good as his word. A contact with an operator who knows that to have certain privileges presupposes the same amount of obligations. It does seem thoughtful, as if the promise of a card were a matter of routine. And it is a promise it does not matter if it pertains to a card or a more important matter.

Let us therefore be more outspoken. If an operator does not care to send his card, well and good. Only let him openly say so. It is at least an honest way of doing things. There may be operators who do not care for a card. That is quite in order. But then why beg the other fellow to send one? There is an operator here, and a very good one at that, who wishes to help those taking part in a recent DX contest. He not only made contact with them—and XU contacts are not so very plentiful at the best—but sent them in the neighborhood of some 400 cards only to receive 16 in return. Is there anything fair about that?

—Robert Lang, XUBRL

Slant on Insulation

Port Isabel, Texas

Editor, QST:

I have had quite a bit of transmitter trouble due to inadequate insulation on tank and antenna condensers, being forced as I am by economic necessity to use BCL stuff. These condensers could be made electrically and mechanically efficient by just switching the insulation to insulnite or some other good insulation.

To date I have only seen one advertisement as to where this insulation could be obtained in sheet or strip form, and accidentally misplaced that. It would be a boon to hundreds of amateurs like me, who have to closely watch the pennies, if they could obtain high class insulation cheaply. Of course, it might hurt the manufacturers a little, but for the hams whom the ARRL is supposed to help, it would be a big help. . . .

-Ray LeRoy, W6GOU

Rho Epsilon Fraternity

Editor, QST:

Our letter in QST last April brought many inquiries for information regarding Rho Epsilon, and indicates a great interest in an inter-collegiate radio organization. Two new chapters were established last spring, and more will be established during the coming school year. We would like to renew our invitation to those amateurs attending colleges and universities to write the national secretary for information relative to establishment of a chapter of Rho Epsilon on their campus.

(Continued on page 76)
So much of our space in QST this month seems to be devoted to transmission equipment, that we might as well go the rest of the way and use this page too. There are a number of small points that we have been wanting to clear up for some time, so here goes.

The National Buffer Coils of the AR series (self-supporting air spaced bare copper turns) were somewhat underrated in our original announcements. The ability of a coil to handle power in a tuned circuit depends on its ability to dissipate its own losses in heat. The AR coils are so surprisingly efficient that they have very little loss to dissipate, so they can handle quite a little power in spite of their small size. Of course so much depends on the other parts of the circuit that it is hard to give precise figures, but after extensive tests in average circuits we find that they can readily handle 50 watts plate input. An input of 65 watts is about the safe limit. As the original rating was only 25 watts, this discovery seemed well worth telling you about.

In perfect fairness, we also should call your attention to the fact that another rating has been reduced. Through an oversight, the NTE was originally rated at 15 watts audio output. We corrected this figure to 10 watts in all of our later advertisements and booklets, but to avoid any possible misunderstanding, we want to call your attention to it now. The NSA Speech Amplifier does have 15 watts output (no mistake there)!

While on the subject of NTE ratings, the R.F. output of the exciter is not less than five watts. This is actual useful power, effective at the grid of the buffer. The output depends on the band, to a certain extent. The 6L6 frequency multipliers have enough gain to give some amplification in each stage, so that there is more power available at 10 meters, for instance, than there is at crystal frequency (80 meters). This is not true of 5 meters, where the output is a little less than at 10 meters, due to low tube efficiency. However, the output is never less than 5 watts, as mentioned above. One further point — when coupling the exciter, the link should be grounded both at the exciter and at the buffer, otherwise neutralization adjustments will be difficult and may not be the same for different frequencies. One side of the link circuit is grounded in the exciter at the factory, so care must be taken to get the same side grounded at the buffer.

The 600-watt transmitter is designed for use on 10, 20, 40 and 80 meters, and we are sorry we cannot give much help to those who have written to us asking how to use it on 160 meters and 5 meters. The NTE-B Exciter has a 5-meter range, of course, but the effective tank capacity in the final becomes too large for efficient operation above 30 MC and for this reason we made no attempt to design the associated circuits for frequencies higher than this. On 160 meters, on the other hand, the tank condenser capacities are rather too low, and furthermore there is no provision for it in the exciter. Of course, by making some compromises it is possible to build a transmitter to cover all bands from 5 to 160, but considering everything — efficiency, simplicity, cost and general usefulness — it seemed wisest to design for a smaller number of bands, with peak efficiency on each.

James Millen
Make Control Replacements EASILY...QUICKLY...EXACTLY
With a Mere Handful of
MALLORY
YAXLEY
MIDGET VOLUME CONTROLS
and 17 PLUG-IN SHAFTS

Mallory-Yaxley Midget Volume Controls have flexibility... adaptability... universality... and attachable switches where necessary. But overshadowing all these advantages is the Mallory-Yaxley Plug-In Shaft!

For example... 10 new Mallory-Yaxley Midget Controls plus 17 Plug-In Shafts give you the servicing range of 170 ordinary Exact Replacement Controls with fixed shafts. To cover the 56 known basic type controls with fixed shafts (so-called "specials") means a total of 952 individual controls... but Mallory-Yaxley Midget Volume Controls with Plug-In Shafts provide the same service range with only 56 controls and 17 Plug-In Shafts.

MR Midget Controls are satisfactory for many applications where special shafts and couplings are unnecessary. For complete details, see your distributor... or consult the Second Edition MYE for complete recommendations on 17,000 receivers.

P. R. MALLORY & CO., Inc.
INDIANAPOLIS, INDIANA

Use MALLORY APPROVED RADIO PRECISION PRODUCTS

Use YAXLEY APPROVED RADIO PRECISION PRODUCTS

Correspondence Department
(Continued from page 74)

We also invite college radio clubs and amateurs having stations at school to join the National Inter-Collegiate Press Association, a net of stations sponsored by Rho Epilson for the exchange of news for college papers.

—Nilo E. Koeks, W7EL, National Secretary

A Little Matter of Telepathy

906 N. Vine St., W. Lafayette, Ind.

Editor, QST:

I had a very unusual experience on the air the other day, and I wonder if anything like it has ever happened to other hams.

A few months ago, a friend and I conducted some home experiments on mental telepathy, in which I am somewhat interested. We discovered nothing of exceptional merit, but after what occurred a few days ago, I am convinced that there is actually a firm foundation to the science.

Forty meters was still pretty well open at 11:21 a.m., C.S.T., when I answered a CQ from W8RDZ. We were well started on a good old-fashioned rag-chew when I heard the beginning of that familiar phrase, "handle hr is...". I recognized what was to come when the first word was half sent. Simultaneously, there popped into my head the word Jerry.

At the time, I realized what was in my mind, although I gave no conscious thought to it. The sentence continued, and I heard: "handle hr is Jerry." I had not been consciously searching for names, nor had I ever QSO'ed W8RDZ before. Neither had I ever heard of him, and I have no acquaintances named "Jerry." Because of these facts, I firmly believe that my subconscious mind divined the thought in the mind of the person to whom I was listening. The word was actually sent about ten seconds after it entered my mind, as we were conversing at about twelve w.p.m.

This may sound like bunk to some, but it actually happened just as I have told it.

—Ray C. Miles, W9KBL

A Visit to WIAW

(Continued from page 15)

uniformly, at each end of the band, without having to change feed line taps on the antenna circuits.

After a last look at the interior of the transmitters in which we observe tubes and parts of all kinds, the operator beckons us through the garage to take a look at the antenna systems. The masts themselves are impressive. They are self-supporting wooden poles, Oregon red cedars, five in number. They are 65-footers, each seven feet in the ground. Instead of unsightly ropes that involve counterweights and replacements, the antennas are suspended directly from the pole tops. Each pole is steped all the way to the top to facilitate any necessary climbing. Even with a stout lineman's belt available few staff members have climbed to the top, although a splendid view is available. It is a long way down! To avoid stretching, the flat tops all are made up of copper-weld, for tensile strength and conductivity, while the down leads are of ordinary hard-drawn copper wire.

A diagram showing the disposition of antennas about the lot tells the whole story on which antenna goes with which transmitter. A dozen or more fourteen-foot feed line poles in the rear of the station carry the multiplicity of wires neces-
**THE ANSWER FOR A ONE-TUBE RADIO REMOTE CONTROL SYSTEM**

RK-62 is a gas-filled triode designed for use as a high sensitivity detector with a large enough plate current shift with signal to operate a relay. Operates on only 45 volts of B battery. Ideal for remote control. Filament 1.4 volts at 50 milliamperes. $3.50 list.

**THE ANSWER FOR A ONE-TUBE FULL-WAVE POWER SUPPLY FOR THE SMALLER RIGS**

The RK-60 is a full-wave rectifier capable of handling all of the smaller rigs (i.e., a pair of RK-39). Delivers 600 volts at 250 milliamperes. Filament 5 volts at 3 amperes. $2.75 list.

**THE ANSWER FOR A LOW-COST TUBE FOR THAT BIGGER RIG**

RK-57 is a real low-cost, high-powered, extremely low bias triode. Thoriated tungsten filament, carbon plate brought out at the top. 125 watts plate dissipation. At 1500 volts on the plate, 105 volts bias, a single tube (used in class C) delivers 215 watts. A pair of tubes (class B) at 1500 plate volts, 16 volts bias, produces 370 watts. At 1250 volts, the tube can be operated at zero bias. Filament 10 volts at 3.25 amperes. $13.50 list.

*Treatise on Amateur Tube Uses and Theory*

Don't forget your copy of Raytheon's new book. It presents complete information on tubes, their theory and proper application. Included in it is a valuable Temperature Color Chart, detailed chapters on modulation, L.C. radio, driving power, ultra high frequency operation etc. Available at your jobber or write the nearest Raytheon office. Price 50c.

-Raytheon tubes make the difference-

"WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS"
Clever constructors are using these, and other Cardwell units in modern transmitter designs. New developments will undoubtedly include these units with push button tuned tank circuits, with mechanical control of final tank capacitors. Oak Manufacturing Co., in Chicago has a 6 button mechanical tuner permitting, for example, two frequencies anywhere within the ranges of a 180° variable capacitor and its inductor, ON EACH OF THREE BANDS.

X-160-70-XQ or FEX will supply the correct capacity ranges for modern coils, such as Barker-Williams's.

Once tuned up, you switch in proper tank circuit, push the button for the desired frequency and your condenser is automatically moved to proper setting. Broadcast receiver practice simply applied to a transmitter tank circuit, that's all.

Like to have a dope sheet outlining the idea? Yours for the asking.

**A Prophecy...**

Four split-stator capacity ranges: 5 to 18.5 mmds., 7 to 35 mmds., 10 to 50 mmds. and 19 to 120 mmds. For 250 watt input final tank. Not to amateurs...

**$15.00**

**TYPE FEX MULTI-BAND CONDENSER**

Three split-stator capacity ranges: 9 to 34 mmds., 13.5 to 83 mmds., and 19 to 114 mmds. For 250 watt input final amplifiers. Not to amateurs...

**$13.20**

**TYPE XE-160-70-XQ MULTI-BAND**

Four split-stator capacity ranges: 5 to 18.5 mmds., 7 to 35 mmds., 10 to 50 mmds. and 19 to 120 mmds. For 250 watt input final tank. Not to amateurs...

**$15.00**

**DUAL TRIM-AIR MIDGET TRANSMITTING CONDENSER**

A sturdy and compact design for U.H.F. transmitters of medium power. 110° airgap — Insulated insulation. Not to amateurs...

**$2.16**

**TYPE ET-30-AD**

A reprint of a small article on a "QRM DODGER" (stable E.C. osc. or "rubber crystal"), sent free on request. Got yours?

**SAFETY**

As we turn back to the station and fall into a discussion of amateur radio matters generally we get to talking about the safety belt for outside work, and safety generally. The average amateur we fear has somewhat too little respect for his personal safety and that of his friends. In haste to get "results" safety is sacrificed, with lasting recriminations and regrets in some cases we know about.

W1AW is not only a model station in its two-way communication abilities and straightforward technique in construction and design. We expected it to have some special features not found in the usual amateur station to help in the very special programs it will conduct, and we were not disappointed. But W1AW is also a model for **safety** engineering! We're not talking about the overload relays in the power supplies that add to the high voltages and radio frequency power circuits.
A space-saving lever action switch that can be furnished singly or assembled to an attractive mounting plate with any required number of switches in a group. Each switch will take up to 12 contacts that can be used in countless shorting or non-shorting sequences.

Contacts are of the long lived double wipe type. Centralab Lever Action Switches are furnished with either two or three positions. Index action can be positive in all positions, or spring return to center from either side.

Send for specification sheet number 628 for further electrical and mechanical details.
PRECISION

A.C.—D.C.—VOLT—OHM—DECIBEL

MILLIAMMETER—AMMETER

with 2500 Volt A.C.—D.C. RANGE

and 1000 M.A. and 10 AMP. RANGES

The "Name Tells the Story . . ."

The NEW Series 842-L

The NEW Series 842-L

PRECISION

APPARATUS CORPORATION

821 EAST NEW YORK AVE., BROOKLYN, N. Y.

EXPORT DIVISION—458 BROADWAY, NEW YORK

Cable Address: "Morhanex"

The "safety" story is worth telling too and we hope that you will use any one, or all the measures in your own shack, to improve on some of the situations we have seen. We have personally added an inexpensive electric warning sign to our own "heap." "Familiarity breeds contempt." We find it advisable, then, to keep the idea of safety constantly before us.

The safety features of W1AW, in brief: (1) Interlock switches. In series with 110-220 volt power, "kill" the transmitters instantly, if a dust cover door is opened in the rear of any unit. (2) The latches—prevents "burning curiosity" from bursting fingers. (3) Grounding antennas, accomplished by plug jacks, protects from lightning—fire hazard—and grounding metal frames of the sets—putting meters in B minus (no metal cased meters) completes the job. (4) The danger sign, within each unit automatically warns the operator to be ever watchful—as well as showing if fuses have been removed on either side of the power circuit. These signs are turned on by an interlock at the same time the power is turned off.

A Low-Cost Single-Signal Receiver

(Continued from page 18)

monics fall on broadcast carriers of the proper frequency, i.e., 910 and 1360 kc., in round numbers. The i.f. does not have to be exact; anything between 450 and 460 will be satisfactory. With the beat oscillator serving as a test oscillator, the alignment procedure will be the same as before, but adjustment of signal level will not be so convenient.

ADJUSTING R.F. CIRCUITS

After the i.f. is aligned, the next step is to get the r.f. end working. No special equipment is needed for this purpose. Plug in a set of coils for some band on which there is a good deal of activity—7 Mc. in the evening, for instance. Set the oscillator padding condenser, C3, at approximately the right capacity; with the coil specifications given, the proportion of total C3 capacity on each band will be about as follows: 1.75 Mc., 80 per cent; 3.5 Mc., 75 per cent; 7 Mc., 95 per cent; 14 Mc., 90 per cent; 28 Mc., 45 per cent. Now set the mixer regeneration control, R2, for minimum regeneration—all the resistors in circuit. Connect an antenna and set C1 at maximum capacity. Switch the beat oscillator on by turning C20 out of the maximum position, and adjust the screw on T3 until the characteristic beat-oscillator hiss is heard.

Now tune C1 slowly over its scale, starting from maximum capacity. Using the 7-Mc. coils as an example, when C1 is at about half scale there should be a definite increase in noise, and in the strength of the signals which no doubt by this time have already been heard. Continue on past this point until a second peak is reached on C1; at this peak the input circuit is tuned to the frequency which represents an image in normal reception. The oscillator in the receiver is designed...
New UH35

An ultra high frequency tube with the lowest inter-electrode capacity of any transmitter tube available today.

Filament voltage......5 volts
Filament current......4 amps.
Amplification factor......30
Grid-plate capacity 1.6 mfd
Max. plate voltage 1500 volts
Max. plate current 150 milliamperes
Plate dissipation......35 watts
List price NET........$10

New TWIN TRIODE

A small tube with two plates, two grids and a common filament possessing unusual power capabilities at all frequencies. Capable of a power output of 15 watts at 300 megacycles. A 6 volt filament, that can be operated from a storage battery, makes this tube particularly adaptable for portable equipment where a high order of power output is desired. A quick heating filament, which permits simultaneous application of plate and filament power, conserves power. Can be operated in class "B" audio and is very desirable for aircraft transmitters.

Filament voltage......6 volts
Filament current......4 amps.
Amplification factor......37
Max. plate voltage 1500 volts
Characteristics per section
Grid-plate capacity 2.2 mfd
Grid-filament cap. 1.9 mfd
Max. plate current 85 milliamperes
Plate dissipation......35 watts
List price NET....$13.50

New UH50

Directly interchangeable with certain conventional tubes now on the market. Eimac specially processed tantalum plates and grids assure you of vastly superior performance.

Filament voltage......7.5 volts
Filament current...3.25 amps.
Amplification factor......10.6
Grid-plate capacity 2.6 mfd
Grid-filament cap. 2.2 mfd
Max. plate voltage 1250 volts
Max. plate current 125 milliamperes
Plate dissipation......50 watts
List price NET....$12.50

New UH51

A great improvement over conventional tube types. The use of a rugged Eimac filament permits higher power operation and greatly reduces inter-electrode capacities.

Filament voltage......5 volts
Filament current......6.5 amps.
Amplification factor......10.6
Grid-plate capacity 2.3 mfd
Grid-filament cap. 2.2 mfd
Max. plate voltage 2000 volts
Max. plate current 175 milliamperes
Plate dissipation......50 watts
List price NET....$12.50

1000UHF

The highest power high frequency triode available on the market today. A pair of 1000UHF tubes are capable of a power output of approximately 2 kilowatts at 100 megacycles. Due to its small physical size (12½ in. overall height) it is necessary to cool the bulb and seals with forced air while it is in operation.

Filament voltage......7.5 volts
Filament current......16 amps.
Amplification factor......30
Grid-plate capacity 4.5 mfd
Grid-filament cap. 6 mfd
Max. plate voltage 6000 volts
Maximum plate current
8500 milliamperes
Plate dissipation....1000 watts
List price NET......$175

Say You Saw It in QST — It Identifies You and Helps QST
You've always wanted a dummy antenna resistor that would be practically non-inductive, suitable for use over a wide range of radio frequencies, and have nearly constant resistance at various loads. Now you have it in the new Ohmite Model D-100 "Vacuum-Type" Dummy Antenna Resistor.

3. 7 ohm value — to simulate concentric and twisted pair lines.
4. 100 watt rating. Easily combined in series, parallel and series-parallel groups for increased power capacity or other required resistances.

You need an efficient, dependable Dummy Antenna to check your power and insure peak efficiency from your rig — to avoid interference when tuning and relieve ham band congestion. The new Ohmite Model D-100 lists at .................. $5.50

Ask Your Jobber or Write for D-100 Dummy Antenna Data

OHMITE MANUFACTURING CO.
4831 West Flournoy Street Chicago, Illinois, U. S. A.
NOW is the time to rebuild and modernize your transmitter. Vacations are over, and most of us are thinking about firing up the old rig, and getting it into shape for the coming season. If you are rebuilding or redesigning your present transmitter, you can save yourself a lot of time and hard work by using the new Hammarlund Foundation Units. Illustrated are three complete stages, which when combined, make up a transmitter ranging in power output from 100 to 300 watts, depending upon the type of tubes used in the output stage.

"OD-10" is a crystal oscillator-doubler, "BD-40" is a buffer-doubler, and the "PA-300" is a push-pull final amplifier. Each kit consists of all necessary brackets, screws, nuts, lockwashers, and instructions. These units eliminate the usual chassis and the necessary drilling and machining. Units bolt directly to the front panel. Due to the compact arrangement of parts, all leads are short and direct, resulting in a high degree of efficiency and stability.

Don't waste months of valuable time working out the difficult details of transmitter design. Build the modern way, and spend more time on the air this fall and winter. Write Dept. Q-10 for illustrated folder.
NEW NATURAL VOICE
DYNAMIC MICROPHONE

DESK-HAND MODEL 2660-W
WITH 8 FT. CABLE

- RANGE
- SENSITIVITY
- SEPARATE TRANSFORMER TO MATCH GRID INCLUDED
- NO CRYSTAL TO BREAK
- NOT AFFECTED BY HEAT
- NO CARBON TO PACK
- FITS IN PALM OF HAND (or sits on desk)
- RUGGED CONSTRUCTION

List Price $10.00
Subject to regular discounts

Manufactured by
CONNECTICUT Telephone & Electric CORP.
MERIDEN, CONN., U. S. A.

For over forty years originators and makers of fine communicating equipment
Ask your dealer to stock this

INTRODUCTORY ORDER BLANK
Mail with remittance to
Connecticut Tel. & Elec. Corp.,
Meriden, Conn., U. S. A.
Enclosed find money order for $........... for which send me............Dynamic Microphone with Transformer at $6.00 prepaid for each combination.
Name...........................................
Address......................................
City.........................................State.............

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

removed from the actual signal frequency, but operate normally at the latter. In general, it is not necessary to "push" the regeneration for the sake of signal strength. It is there chiefly to increase the signal-to-image ratio, which it does by the process of building up the desired signal. Peak regeneration is needed only when a desired signal is being QRM'd by an image, which happens a surprisingly small number of times in practice.

It is a good plan to spend some time operating the set without attempting to add regeneration to the i.f. stage, in order to attain complete familiarity with the method of handling mixer tuning and regeneration. As a straight super the receiver is, of course, considerably more selective than a t.r.f. receiver, especially to strong off-channel signals. Learn to keep C1 always at resonance or on the low-frequency side of resonance with the incoming signal. Keeping exactly in line naturally requires "two-handed" tuning, but in practice it will be found that C1 need not be touched when tuning over the portion of the band normally covered near the transmitter frequency. This condenser may, in fact, be used as a volume control, in which case it is advisable to keep it on the high-capacity side of resonance so that it will be as far as possible from resonance with the image frequency. Its tuning will not be too critical so long as the regeneration is kept to a moderate value; at peak regeneration, however, the tuning is quite sharp. For operating convenience, be sure to pick out an easy-running condenser for C1—there's no band-spread on this circuit.

The oscillator-mixer coupling condenser, C5, should be adjusted so that pulling of the oscillator frequency at 14 Mc. is negligible as C1 is tuned through resonance with the incoming signal. The setting generally will be with the plates rather far apart. There will always be considerable pulling if C1 is tuned to the oscillator frequency, even on the low-frequency bands. This, however, does not represent an actual operating condition. On 7 Mc. and lower there should be no detectable change in beat note as C1 goes through the signal peak. A few hundred cycles change is typical of 14 Mc.

I.F. REGENERATION

When the operation of the receiver is completely familiar, the i.f. regeneration may be added. The method has already been mentioned; it remains only to describe the operation. The amount of feed-back will be determined by the length of wire inserted in the can containing T2. Optimum selectivity usually will be secured when the regenerative coupling is adjusted so that the 6K7 goes into oscillation with the gain control, R4, fairly well "down"—far enough so that it is well below maximum gain and in the region where, without regeneration, its effect on gain is not great. There are two reasons for operation in this way rather than with the feed-back adjusted so that oscillation takes place when the gain is near maximum. In the first place, the normal tube gain is not needed—the volume will be too great
Whatever may be your interest in amateur radio from 5 through 160-meters, there is at least one type of Bliley Crystal Unit which will increase your operating pleasure. Precise engineering, careful design, painstaking manufacture and accurate calibration all go together to insure long life and trouble-free performance.

In keeping with technical progress, Bliley has just added three new units with outstanding characteristics. The popular priced medium-drift BC3 unit is now available for the 160-meter band. Variable frequency crystals, made practical by the VFI 80-meter crystal unit, are now manufactured for the 40-meter band. For checking the calibration of radio receivers, test oscillators and frequency monitors, the type SMC100 dual frequency crystal unit (100kc.-1000kc.), brings accurate frequency measurements within the scope of every amateur.

For complete information on all Bliley Crystal Units, see your distributor today. Bliley Electric Company, Erie, Pa.
with both regeneration and high tube gain. Second, the selectivity will be considerably greater if the signals are kept at a low level and built up to a peak almost solely through the use of regeneration. Aim to balance gain and regeneration so that the average signal level, at resonance with peak regeneration, is about the same as with normal i.f. gain without regeneration. The off-resonance signals will then be rather far down, giving greater effective selectivity. With the conditions recommended, the i.f. regeneration gives a voltage gain of about 40 on a moderately strong signal; that is, the signal is 40 times as strong with regeneration as without it at the same i.f. gain-control setting.

For single-signal c.w. reception, set the beat oscillator so that when \( R_4 \) is advanced to make the i.f. just go into oscillation the resulting tone is the desired beat-note frequency. Then back off on \( R_4 \) to give the desired selectivity. Maximum selectivity, of course, will be secured with the i.f. just below the oscillating point; noise and miscellaneous clicks and impulses will make a "ringing" sound at this point and the signal must be tuned carefully to be set right on the peak. At the peak the signal strength will build up to a large value as compared with a frequency slightly off resonance. With regeneration reduced slightly the ringing will disappear and the signal peak will not be quite so marked, although the selectivity will still be high. The "other side of zero beat" will be very much weaker than the desired side. A typical measurement, using a 1000-cycle beat note, gave a ratio of 35 db between the desired signal and the a.f. image, or 1000-cycle beat note on the "other side." The ratio will depend somewhat on the accuracy of i.f. tuning; the best method found is to peak all i.f. circuits as accurately as possible without regeneration, then to introduce the regeneration without further adjustment of the i.f. trimmers.

Since the i.f. amplifier works out of the mixer, it is to be expected that the latter will have some effect on the i.f. regeneration, and such is the case if the regeneration is worked too near the critical point. For example, if \( C_1 \) is slightly on the low-frequency side of resonance and \( R_4 \) is advanced to critical regeneration, tuning the mixer input to the high-frequency side may cause the i.f. amplifier just to go into oscillation. To overcome this, \( R_4 \) may be set so that the i.f. does not oscillate at any setting of \( C_1 \); this will give somewhat less than maximum selectivity, but there is still plenty. Another method is to detune slightly the i.f. circuit in the plate of the 6L7, which will "decouple" the circuits sufficiently to make the i.f. regeneration independent of the setting of \( C_1 \). This, however, has an adverse effect on the selectivity because of the staggered tuning.

A regenerative i.f. stage has a quite sharp peak when operated as outlined above. Although the attenuation at frequencies several kilocycles from resonance is not as good as with a crystal filter, the overall selectivity, plus the peak, gives a highly satisfactory single-signal effect—certainly one decidedly worth while not only for c.w. but also for 'phone work. On 'phone, the sidebands are
The merit of these excellent triodes has been established by performance as evidenced by the several hundred testimonial letters received from satisfied users.

**HY 25** $1.45
Fil. 7.5 volts. 2.25 amps. Plate volts 800 max. Plate dissip. 25 watts max.
Ceramic Base and Insulation

**HY 40** $2.75
Fil. 7.5 volts. 2.25 amps. Plate volts. 1000 max. Plate dissip. 40 watts max.
Graphite Anode, Lava Insulation
Ceramic Base

**HY 51A** $5.00
Fil. 7.5 volts. 3.5 amps. Plate volts 1000 max. Plate dissip. 65 watts max.
Graphite Anode, Lava Insulation
Ceramic Base

**OTHER POPULAR TYPES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>HY 57 TRIODE</td>
<td>$3.50</td>
</tr>
<tr>
<td>HY 60 TETRODE</td>
<td>$2.50</td>
</tr>
<tr>
<td>HY 61 TETRODE</td>
<td>$3.00</td>
</tr>
<tr>
<td>HY 615 TETRODE</td>
<td>$1.55</td>
</tr>
<tr>
<td>6L6GX TETRODE</td>
<td>$1.55</td>
</tr>
<tr>
<td>6L6 TETRODE</td>
<td>$2.00</td>
</tr>
<tr>
<td>866 JR. MER. RECT.</td>
<td>$1.05</td>
</tr>
<tr>
<td>866 MER. RECT.</td>
<td>$1.50</td>
</tr>
</tbody>
</table>

HYTRONIC LABORATORIES
SALEM, MASS.
A DIVISION OF THE HYTRON CORP.
YOUR COPY
IS READY
52 PAGES
OF VITAL INFORMATION EVERY RADIO-TELEGRAPHER HAS BEEN WAITING FOR
IT'S FREE
GET YOURS TODAY

Whether you are trying for your license, any grade, or just learning code, here is the answer to all your questions. Contains new F. C. C. rules and regulations, examination questions and answers, valuable advice by leading authorities on how to pass your examinations, etc. World's fastest operators give you speed tips. It took a lifetime to acquire the facts now available for the first time in this free book. To every man interested in radio as a career, this information is essential.

If radio is your hobby, by all means take advantage of this opportunity to add countless hours to your enjoyment.

You'll find his experiences interesting reading ... and a valuable aid to mastering code and acquiring professional technique. Read what McElroy, World's Code Champion, has to say about gaining speed.

L. R. McDonald, W8CW—Winner Code Contest, A.R.R.L. Detroit Convention, Sept. 6, 1937. Copied 60 wpm. without error. "Practice alone will not develop a fast op. Code is a mental process. Candler's Exclusive Mind Training is essential to fast code. And Candler knows the short cuts!"

WRITE FOR YOUR FREE BOOK NOW!

CANDLER SYSTEM CO.
DEPT. Q-10, ASHEVILLE, NO. CAROLINA, U. S. A.

A Six-Band Kilowatt Transmitter
(Continued from page 81)

frequence range will be because of too-high minimum capacity. Also, the condensers should have at least the spacing indicated in Fig. 1, because the r.f. voltage across each circuit is high.

Proper placement of by-pass condensers is of utmost importance. Remember this transmitter is capacitively-coupled to the final amplifier, which makes the plate coil of each stage of the exciter the "grid" coil of the final amplifier, so that by-pass condensers of each stage must terminate at the filament circuit of the final amplifier.

Experience with this transmitter and others leads us to believe that very few push-pull amplifiers are properly balanced with regard to grid current. Few, if any, difficulties have been experienced in obtaining balance in the plate circuit, but the grid circuit is another story. The assumption that the mechanical center-tap of the grid coil or grid circuit is the electrical center-tap is far from the truth. A simple method of checking the balance of a push-pull amplifier is to take one tube out of the socket and then, with the plate lead disconnected, check the grid current to the remaining tube. Remove the tube from the socket and place the same tube on the other side of the circuit. Again check the grid current. Adjust the center tap connection a quarter inch at a time until balance is found. The same procedure would be applied to each stage of the exciter unit. Sometimes the filament by-pass return from the grid circuit must be adjusted for exact electrical symmetry between the two tubes. The grid leads can be made mechanically symmetrical around the center of the coil.

The exciter is capable of supplying to the final tubes a grid current of at least 100 ma. through a 2000-ohm grid leak. The bias voltage and grid current are more than adequate for plate modulation of the final. If some fixed bias voltage is desired in order to key one of the lower powered stages, it is recommended that the smallest bias voltage which will give plate-current cut-off with no excitation be employed. Contrary to popular belief, a large amount of fixed bias is not a safety
HAYWIRE versus CHROME PLATE

We all admire the resourceful ham who can get anything from a balky mule to a 5 meter job working with a piece of haywire placed just where it is needed.

There are stations dotting the globe which are chock full of ingenious gadgets and ideas, yet which always appear to be "half finished." Don't belittle them. More than likely they have an alert owner who is always trying something new. He probably has a fat stack of QSL cards tucked away somewhere.

However, most all of us like to "doll up" our handiwork like a commercial job. If this can be done without losing flexibility, there are many advantages.

1. More stable operation.
2. Less fire hazard.
3. Less danger of a "High Voltage Manicure."
4. It will impress the neighbors a lot more.

We have a nice little unit that will help in that direction. It is a flat wire-wound resistor, molded in bakelite, and is called our M-1034 Bleeder. It has 25,000 ohms over-all resistance with taps at 7,500, 10,000, 12,500 and 15,000 ohms. The rating is 18 watts when mounted flat against a metal chassis, somewhat less on a wood base-board, and 9 watts in free air. The metal chassis helps to radiate the heat. The maximum current in any section should not exceed 28 milliamps. These ratings are based on a 100° C. temperature rise. The mounting bracket attached to the resistor holds it securely and the soldering lugs offer a convenient tie for bypass condensers and wiring. Its virtues are obvious as a bleeder and bias resistor for a receiver or transmitter power supply up to 500 volts.

Since $I = \frac{E}{R}$ and $Watts = \frac{E^2}{R}$, the bleeder current and dissipation, due to the bleeder current, are $I = \frac{E}{25,000}$, etc., as follows:

- **D.C. Volts** | **Bleeder Current-Amps.** | **Watts**
- 200 | .008 | 1.6
- 250 | .010 | 2.5
- 300 | .012 | 3.6
- 350 | .014 | 4.9
- 400 | .016 | 6.4
- 450 | .018 | 8.1
- 500 | .020 | 10.0

To determine which tap to use for bias voltages is easy. Let's take an example — say a 400 volt supply with a tap to give 250 volts at 2½ milliamps.

The bleeder, by itself, draws (from the table above) .016 amps. See diagram "A" below. The tap draws .0025 amps. so the total current in the top section of the bleeder is .016 + .0025 = .0185 amps. See diagram "B." The voltage drop across the bottom section is 250 volts so the voltage across the top section must be 400 - 250 = 150 volts.

Now, the resistance of the lower section should be $R = \frac{E}{I} = 250 / .016 = 15,600$ ohms. The resistance of the upper section should be $150 / .0185 = 8,100$ ohms. Since these values are not critical you can use the nearest tap, which will be 15,000 ohms. The same procedure is followed in figuring for other values of bias voltage and current.

Where neatness and compactness are important these M-1034's should be useful. In high quality speech amplifiers and Government equipment you will find them alongside of their "big brothers," the IRC Cement Coated Resistors.
ENJOY your QSO’s with the tried and tested TYPE HFM PORTABLE OR FIXED CRYSTAL CONTROLLED TRANSMITTER

A fine transmitter for home, car or emergency. 1715–60,000 Kc. CW — Phone — MCW. 20 to 36 watts input to final with 300 to 425 volts. Price ................. $57.50

the new POPULAR PRICED MULTI-BAND FIELD STRENGTH METER

Adjustment of transmitter and antenna output is largely guesswork without a good field strength meter. 1715–60,000 Kc. Six band switch. Phone monitor. Price ................. $18.50

Radio Transceiver Laboratories
8627 115 Street Richmond Hill, New York City

factor for your tubes but is rather a hazard. The reason for this statement is that often during the adjustment or operation of the equipment the grid structure may become overheated because of excessive grid current or perhaps by a sudden flare-up of the anode caused by some misadjustment. The grid can very easily be heated to incandescence or to the point of actual primary emission. If all fixed bias is used, the filament can very easily be destroyed because the filament is highly positive with respect to the grid and the electrons released from the hot grid will overheat and destroy the filament in much the same manner that the electrons from the filament bombard the plate. A minimum of fixed bias coupled with some grid leak will aid greatly in overcoming this hazard.

The transmitter is constructed on a standard iron chassis 10 by 23 by 3 inches, and the panel is of 3/32-inch dural, 7 by 23 inches. The various parts carrying r.f. are isolated from the chassis by small Isolantite insulators. All of the r.f. is above deck, while the supply circuits are underneath the chassis. Two meters are used to measure current in all grid and plate circuits. The use of separate filament transformers makes the meters “cold” so far as voltage is concerned, and also makes possible a simple switching arrangement. One meter is connected in the final negative lead at all times.

Operation is quite straightforward and is entirely conventional. There need be only the flick of a switch to select the proper crystal. The three-position band-selector switch is adjusted for either 1.75–3.5-Mc. operation, 7–14-Mc. operation or 28–56-Mc. operation. Five-meter operation will require changing the coil in the second frequency-multiplying stage. The various tank circuits are adjusted for resonance at the desired frequency after selecting the proper final tank circuit. A quarter-wave line makes an efficient tank for the final on 56 Mc. The line can be rolled up to occupy little more space than the ordinary tank coil. No tuning capacity is necessary when such a tank is used.

A valuable addition to the transmitter is an auto-transformer capable of giving half voltage to the primary of the plate power transformer during the tuning-up operation. An additional refinement would be to have a small neon bulb permanently connected to a small pickup coil adjacent to each tank of the exciter stage. Such an arrangement would make unnecessary the use of the milliammeter as a tuning indicator, since after approximate resonance is found by means of the bulb, exact resonance can be determined by tuning for least visible dissipation on the 3ST plates.

The transmitter has been in constant use since it has been completed and the results have been more than gratifying. In order to obtain all-band operation a long single-wire antenna has been used against ground, but undoubtedly superior performance on any one band could be obtained with an antenna primarily designed for that frequency. Even so, WAC has been made numerous times with this “midget kilowatt.”
MEISSNER SIGNAL SHIFTER

A VARIABLE FREQUENCY EXCITER UNIT FOR REMOTE OPERATION

Offers convenience and utility for the amateur. An electron-coupled exciter unit that has excellent frequency stability. It's variable — you can cover any amateur band right from your operating position. For remote control — there's plenty of excitation available. Hundreds already in operation in "ham shacks" from coast to coast.

THE SIGNAL SHIFTER IS COMPLETELY ASSEMBLED, WIRED AND ADJUSTED. IT IS READY FOR USE (EXCEPT FOR TUBES) WHEN YOU BUY IT. ASK YOUR PARTS JOBBER FOR A DEMONSTRATION. NET PRICE $39.95.

120-PAGE COMPLETE INSTRUCTION BOOK

Detailed wiring instructions! Pictorial Diagrams! Schematics! Alignment Data! Constructional data and operation instructions on 15 of the new Meissner receiver kits; also adapters and converters.

Your PARTS JOBBER SELLS THEM FOR ONLY 50¢ — OR ORDER DIRECT FROM THE FACTORY. ADDRESS DEPT. Q-10.

MEISSNER

MT. CARMEL, ILLINOIS

"A FAMOUS NAME FOR TWO DECADES"

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

this high-powered radio engineering library

sent to you for 10 days' trial —
at a special price and terms

These books cover circuit phenomena, tube theory, networks, measurements, and other subjects — give specialized treatment of all fields of practical design and application. They are books of recognized position in the literature — books you will refer to and be referred to often. If you are a researcher or experimenter — if your interest in radio is deep-set and based on a real desire to go further in this field — you want these books for the help they give in hundreds of problems throughout the whole field of radio engineering.

RADIO ENGINEERING LIBRARY

— especially selected by radio specialists of McGraw-Hill publications
— to give most complete, dependable coverage of facts needed by all whose fields are grounded on radio fundamentals
For home-study and reference. Contains a revised selection of books culled from latest McGraw-Hill publications in the radio field.

5 volumes, 3064 pp., 2000 illustrations
1. Glasgow's PRINCIPLES OF RADIO ENGINEERING
2. Terman's MEASUREMENTS IN RADIO ENGINEERING
3. Chaffee's THEORY OF THERMIONIC VACUUM TUBES.
4. Huln's PHENOMENA IN HIGH-FREQUENCY SYSTEMS
5. Henney's RADIO ENGINEERING HANDBOOK

Special Low Price and Easy Terms

Bought singly, the five volumes comprising this library would cost you $25.00. Under this offer you save $1.50 and, in addition, have the privilege of paying in easy installments beginning with $2.50, 10 days after receipt of the books, and $3.00 monthly thereafter. Take advantage of these convenient terms to add them to your library now.

SEND THIS ON-APPROVAL COUPON
McGraw-Hill Book Co., Inc.,
330 W. 42nd St., New York, N. Y.

Send me Radio Engineering Library, 5 vols., for 10 days' examination on approval. In 10 days I will send $2.50, plus few cents postage, and $3.00 monthly till $23.50 is paid, or return books postpaid. (We pay postage on orders accompanied by remittance of first installment.)

Name .
Address .
City and State .
Position .
Company .

(Books sent on approval in U. S. and Canada only)

Characteristics of Sky Wave
(Continued from page 25)
deal of the time. It also means that there will be more DX on 14 and 7 Mc. on account of the longer skip on these frequencies. In the summer the shortest skip-distance of the day will most likely be in the late afternoon or early evening, instead of at noon as in the winter months. However, there is one thing which sometimes compensates for the lack of $P_2$ reflections, and that is that during the spring and summer months there is much more chance of abnormal E-layer reflections than at any other time of the year. This may give good DX conditions, for a few hours at a time, on 30 and 60 Mc. when otherwise there would be none.

It should also be mentioned that the change from winter to summer conditions is not a smooth one, and the spring and fall months are accompanied by a rather erratic behavior of the ionosphere. This has been noticed particularly by amateurs working regularly on the 30-Mc. band, where they find that unreliable transmission conditions precede and follow the rather poor, but relatively steady, conditions of the summer months.

CRITICAL FREQUENCIES

In most articles on radio transmission reference is made to "critical frequencies." A detailed knowledge of how these are determined is not of much interest to the average amateur, but since the term is so widely used he should at least know what it means. A critical frequency is the highest frequency which will be reflected from a given layer when the signal strikes it at right angles. If a signal will be reflected at right angles it will also be reflected from all other angles, and we see that the critical frequency of the $F_2$ layer, for example, is the highest frequency at which we will find zero skip-distance. It is a direct measure of the amount of ionization in a layer, and can be used to compute skip-distances for any frequency. The noon critical frequencies for Washington, D. C., for the past week are broadcast by WWV every Wednesday, but unless they are copied and recorded regularly to show the general trend of conditions, they will be of little use to the average amateur. His best bet is to listen intelligently on his receiver, and thus determine what conditions are at the actual time he wants to transmit.

Nearly every amateur who has been in the game three years or more has noticed how there was much more DX on 30 and 60 Mc. the past year than in previous years. This is the effect of

5 For work over several thousand miles these general rules are complicated by the daylight-darkness ratio and, in transmission over the Equator, the fact that summer conditions may prevail at one end of the circuit and winter conditions at the other. Generally speaking, DX conditions are most favorable in late winter or early fall, when the best balance of the various factors seems to obtain. —EDM.


7 Unfortunately (in the sense of obscuring to some extent the possibility of exact observation) also a period of increasing amateur activity. Nevertheless, most observers who have been active on those bands continuously will agree that DX conditions showed evident improvement during the period, perhaps more noticeably so on 60 Mc. than on 30 Mc. —EDM.
NEW JOHNSON "HI-Q" INDUCTORS
with ROTATING COUPLING COILS

WORKS DIRECTLY INTO LINE
WITHOUT TUNING NETWORKS
OF ANY KIND

* For the first time a series of inductors with coupling coils capable of working directly into a 600 Ohm Line or less without tuning networks of any kind (10 and 20 meter units — all others will work into 75 Ohm impedances or higher).
* Coupling coil can also be used with tuned feeders or Marconi Antenna.
* Variation of coupling as desired.
* Available without coupling coil for capacity coupled stages, etc.
* Ribbed porcelain forms with extremely low dielectric loss.
* Unaffected by ordinary heat and moisture.
* For all bands 10 to 160 meters.
* Two sizes, 250 and 750 watt rating.
* Compact in size.
* Steatite Mounting Base.

LOWER IN COST.

Here is a new series of Johnson "Hi-Q" Inductors with rotating coupling coils that eliminate the need for antenna tuning networks of any kind. The rotating coils are located at the electrical center of the inductor permitting exact adjustment of coupling in interstage or output circuit. All sizes will couple into transmission lines of 75 ohms impedance, and this value increases with the high frequency inductors so that the 10 and 20 meter types will couple into any impedance up to 600 ohms. After adjusting, the coupling coils need never be disturbed, even when changing bands.

Included in the new Johnson "Hi-Q" Inductor line is a series of small Fixed Coupling "Tube Socket" Inductors, wound on ribbed, low loss, low absorption porcelain of highest grade, equipped with 5 prong base to fit a standard tube socket. These new inductors are available for all bands from 10 to 160 meters and are designed so that a Johnson "Type J" Condenser may be fitted into one end to make a complete, compact LC unit. Rated at 75 watts, these inductors are available with coupling coils at the center or bottom of winding. See these new, more economical and more efficient "Hi-Q" Inductors at your Johnson dealers or write today for catalog 965-J.

E. F. JOHNSON CO.
WASECA, MINNESOTA

MANUFACTURERS OF RADIO TRANSMITTING EQUIPMENT
W2JKY calling!

"The TSS video chassis has everything the 'ham' wants. I've experimented with television for some time, but there's nothing like the real thing - complete, practical and up-to-the-minute. I'm having fun galore, thanks to TSS television."

— DAVID BECK, 35 East 38th Street, New York City.

326 PARTS COMPLETELY ASSEMBLED for the AMATEUR RADIO-VIDEO OPERATOR

MODEL TSS 3: Completely wired television chassis for 3-inch Kinescope, $60; with 13 tubes and 3" cathode ray tube, $90.

MODEL TSS 5: Completely equipped for 5-inch Kinescope, $90; with 15 tubes and 5" cathode ray tube, $135.00.

Features of TSS Chassis:
- Modern All-Electronic
- Tunes throughout Teke Band
- Lowest Cost
- Compact Kit
- Triple tested

Useful for picture reception within range of existing experimental 441-line telecasting stations.

Television Sales and Service Corp.
1650 Broadway, New York, N. Y.

Television Sales and Service Corp.
1650 Broadway, New York, N. Y.

Please ship TSS Video equipment as ordered herein to address below.

Enclosed find M.O. $ for __.
Deliver TSS 3: Chassis only or With tube kit complete or TSS 5: Chassis only or With tube kit complete.

Name
Address
City, State

U.H.F. TRANSMISSION—IONOSPHERE AND ATMOSPHERIC BENDING

In the ultra-high-frequency region we find that the frequency is usually too high to be reflected by the F2 layer. If there are any such reflections, they will usually occur during periods of very high ionization, such as during a maximum in the 11-year cycle of sunspot activity. The appearance of spots on the sun is an index of the activity of that body, and when we find lots of sunspots we also find periods of high ionization in our upper atmosphere. These sunspots have been objects of interest to astronomers for a great many years, and records of the number of spots are available as far back as 1750. These show that the number of spots usually reaches a maximum about every 11 years. The last maximum was during 1927 and 1928, so at the present time we are, or very near, another maximum. It will probably occur sometime in 1938 or 1939, but the peak is rather broad and difficult to determine exactly. This then is the explanation of all our phenomenal high- and ultra-high-frequency transmission of the past few years. The average level of ionization has been increasing for the past five years, and as a result, higher frequencies have been returned to earth by the reflecting layers. It is probable that conditions in the winter of 1938-1939 will be as good as those of 1937-1938, or perhaps slightly better. So if we have increased occupation of the 30- and 60-Mc. bands we may see new DX records made in the year to come. After that, the DX hounds on 30 and 60 Mc. will gradually fall on evil times, and by 1944 and 1945 DX activity on these bands will have reached a new low, and we shall again find 14 Mc. behaving like 20 Mc. to-day, and 7 Mc. will be a real DX band again. After 1945—but what's the use?

Before going to the ultra-high frequencies, a few points might be mentioned in connection with DX transmission at ordinary high frequencies. If you are working a station 1000 or so miles away, you are probably more interested in the status of the reflecting layers half way between you than in those over your head. For example, 14-Mc. stations on the East coast find that European signals begin to be heard in large numbers about sunset, Eastern Time, which means that the sun is no longer shining on the layers over the Atlantic, and they have had time to thin out a bit and stop absorbing so much energy from European signals. At the same time, stations on the West coast, about the same distance away, will not be heard so well because of the high absorption in the layers still in the sunshine over the middle of the United States. For very long distance transmission, such as to Australia for example, the signals will take several hops. That is, they will be reflected off the layer, bounce down and be reflected off the earth back up to the layer, where the process will be repeated. In such a case, during winter in the northern hemisphere the first reflection may be off the F2 layer, while the second may be off a cloud of abnormal E layer in the southern hemisphere, where summer conditions hold.
This message was flashed from Reindeer Point, Greenland. Here the great MacGregor expedition was making final preparation before moving north to the vicinity of the Pole. It is an expedition that will mean much to science because all types of weather phenomena will be studied.

Thus again, the problem of getting dependable portable power hundreds of miles from civilization is solved by Burgess. Here where battery failure might mean disaster, Burgess batteries are proving their superb workmanship.

The same quality, the same dependability, the same value are available to you for your radio and experimental work. Ask for Burgess batteries and be sure of long, economical, accurate service.
MEMBERSHIP SUPPLIES
Available only to A.R.R.L. Members

INSIGNIA OF THE RADIO AMATEUR

In the January, 1920 issue of QST there appeared an editorial requesting suggestions for the design of an A.R.R.L. emblem—a device whereby every amateur could know his brother amateur when they met, an insignia he could wear proudly wherever he went. There was need for such a device. The post-war boom of amateur radio brought thousands of new amateurs on the air, many of whom were neighbors but did not know each other. In the July, 1920 issue the design was announced—the familiar diamond that greets you everywhere in Ham Radio—adopted by the Board of Directors at its annual meeting. It met with universal acceptance and use. For years it has been the unchallenged emblem of amateur radio, found wherever amateurs gathered, a symbol of the traditional greatness of that which we call Amateur Spirit—treasured, revered, idealized.

Do You Wear the A.R.R.L. Pin?

THE LEAGUE EMBLEM, with both gold border and lettering, and with black enamel background, is available in either pin (with safety clasp) or screw-back button style.

In addition, there are special colors for Communications Department appointees.

- Red enameled background for the SCM.
- Blue enameled background for the ORS or ODS.
- Diamond that greets you everywhere in Ham Radio—adopted by the Board of Directors at its annual meeting. It met with universal acceptance and use. For years it has been the unchallenged emblem of amateur radio, found wherever amateurs gathered, a symbol of the traditional greatness of that which we call Amateur Spirit—treasured, revered, idealized.

ALL EMBLEMS PRICED THE SAME

50c postpaid

STATIONERY

Members' stationery is standard 8½ x 11 bond paper which every member should be proud to use for his radio correspondence. Lithographed on 8½ x 11 heavy bond paper.

THE AMERICAN RADIO RELAY LEAGUE
WEST HARTFORD, CONNECTICUT
NEWARK OFFERS NATIONAL RECEIVERS ON EASY TERMS

NC 100XA
New Low Price: $142.50 Cash
Complete with Tubes, Crystal and Speaker in cabinet to match. PAY ONLY $22.50 DOWN and $21.10 monthly for 6 months. Or $14.21 for 9 months or $9.68 for 12 months.

NC 101X
$129 Cash Price
Complete with Tubes, Crystal and Speaker in cabinet to match. PAY ONLY $24.00 DOWN and $18.58 monthly for 6 months. Or $12.50 for 9 months or $7.47 for 12 months.

NEW NC44
$49.50 Cash
Complete with Tubes and Speaker. Not sold on Easy Terms unless included with an order of $60 or more. Order today direct from this Ad.

Oil Filled, Oil Impregnated
FILTER CONDENSERS

Only $1.00
1500 V. D.C. 1½ mfd.

2 mfd., 2000 V. D.C 4½ x 3½ x 1½, 1½ lbs. ......... $1.50
3 mfd., 1000 V. D.C 5 x 3½ x 1½, 1½ lbs. .......... 1.10
3 mfd., 1250 V. D.C 5 x 3½ x 1½, 1½ lbs. .......... 1.25
4 mfd., 1500 V. D.C 6 x 3½ x 1½, 1½ lbs. .......... 1.50
4.4 mfd., 1500 V. D.C 6 x 3½ x 1½, 1½ lbs. .......... 1.75
8 mfd., 2000 V. D.C 5 x 3½ x 2½, 3½ lbs. .......... 2.75
10 mfd., 750 V. D.C 4½ x 4½ x 1, 2 lbs. .......... 1.75
14 mfd., 750 V. D.C 4½ x 4½ x 1½, 2 lbs. .......... 2.00

NEW "FOREIGN ORDER" DEPARTMENT
Special Attention given to FOREIGN ORDERS in this new Export Department. Hams outside the U.S. be sure to WRITE TODAY for Big New Catalog and full details of Newark's New Foreign Order Dept.

HRO
$179.70 Cash
Complete with Tubes and Coils. PAY ONLY $29.70 DOWN and $26.14 monthly for 6 months. Or $17.67 for 9 months, or $14.48 for 12 months.

NC 80-81X
$99 Cash Price
Complete with Tubes, Crystal and Speaker in cabinet to match. PAY ONLY $19.00 DOWN and $14.36 monthly for 6 months. Or $9.77 for 9 months or $7.30 for 12 months.

NEW NC 510
$150 Cash Price
PAY ONLY $25 DOWN and $21.94 monthly for 6 months. Or $14.77 for 9 months, or $11.25 for 12 months. Order today direct from this Ad!

Plate and Filament Transformers
600 VOLTS—200 MILS
Another Scoop by Newark. Famous plate and filament transformer made for us only. Thousands used in Ham rigs. 600-0-600 at 200 M.A.; 2.5 v. at 10 amps; 3 v. at 20 amps; 5 v. at 50 volts. Weight 10 lbs. Use this transformer for your buffer and final amp. stages. Just the thing for 46's, T-20's, $-807's, etc.

YOUR CALL LETTERS IN GOLD
Hams look at this! Your Call letters in impressive three dimensional style. Big shadowed decalcomania letters nearly TWO INCHES high. Put them on your HAM SHACK door, auto window, etc., Send dime for yours today. Be sure to give your call letters.

FREE! Get This Big New
1939 Ham Bargain Catalog
Illustrations, prices and full details on thousands of separate items, sets, tubes, parts and supplies! MAKE UP A $60 ORDER and Buy All the supplies you need at present low prices, AND PAY ON EASY TERMS. Write for this Big 76-page Catalog Today.
ASTATIC
MODEL D-104
Still a Favorite
With the Hams

Famous for low price, rugged construction and quality performance in the "speech range," a favorite with veteran amateurs the world over.

Model D-104 does not overload or "sum up" when used for close talking applications. Performance not affected by handling. Annular ring diaphragm for maximum efficiency. High capacity parallel gapohl bimorph crystal element. Polished chrome finish. Fitted with interchangeable socket connector and 8-ft. single wire shielded cable. Full year guarantee.

LIST PRICE
$22.50

See Your Astatic Jobber or Write for Literature

ROSS A. HULL, and has been described in detail by him in QST. This is the sort of transmission that takes place over distances of from about 50 to 300 miles. On account of the turbulence in the air masses it usually accompanies by fading, just as turbulence in the ionosphere causes fading on lower frequencies. Since the air mass conditions favorable to this kind of transmission generally


TABULATION OF SKY WAVE TRANSMISSION CHARACTERISTICS

<table>
<thead>
<tr>
<th>Condition of I onosphere</th>
<th>Causes</th>
<th>Usual Time of Occurrence</th>
<th>Effect on Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weak ionization</td>
<td>Lack of energy from the sun.</td>
<td>Every night.</td>
<td>Long skip-distance, usually resulting in loss of all 30-Mc. and most 14-Mc. signals, with DX conditions on 7 Mc.</td>
</tr>
<tr>
<td>Summer day (F region)</td>
<td></td>
<td>Night conditions as above being found during the day.</td>
<td></td>
</tr>
<tr>
<td>Minimum in the sun-spot cycle (every 11 years) (nearest one 1944-1945)</td>
<td></td>
<td>Long skip distance on all high frequency bands required, most of the time with DX on 14 and 7 Mc. during the day.</td>
<td></td>
</tr>
<tr>
<td>Strong ionization</td>
<td>Considerable energy from the sun.</td>
<td>Winter day.</td>
<td>Short or zero skip distance on 14 Mc. Zero skip on all lower frequency bands. Good 30-Mc. transmission conditions.</td>
</tr>
<tr>
<td>Maximum in the sun-spot cycle (every return cycle) (nearest one all bands, 1939-1939)</td>
<td></td>
<td>Best conditions of transmission for the highest frequency bands, with 11 yea strong ionsation) most often at fade-out (very known. 5.5-day intervals)</td>
<td></td>
</tr>
<tr>
<td>Daily peak in ionisation</td>
<td>Rotation of earth.</td>
<td>Winter at noon, summer at about local sunrise and sunset (F layer).</td>
<td>These are the times of the day for shortest skip-distance on all frequencies, and the time of day when the highest frequency can be used.</td>
</tr>
<tr>
<td>Abnormal E layer (very strong ionisation)</td>
<td>Not definitely known.</td>
<td>May occur any time but most often in ultra-high frequencies including 60 Mc.</td>
<td></td>
</tr>
<tr>
<td>Temperature movements in lower ionosphere (below ionosphere)</td>
<td>Air mass conditions of unsettled weather.</td>
<td>Precede period of 55-day intervals.</td>
<td>Most often at fade-out of all high frequencies caused by high absorption in low layers.</td>
</tr>
</tbody>
</table>

BARKER & WILLIAMSON
Radio Manufacturing Engineers • ARDMORE, PENNSYLVANIA

98  Say You Saw It in QST — It Identifies You and Helps QST
OVER-MODULATION CONTROL—Optional

Most versatile speech amplifier ever offered amateurs. Adaptable to any transmitter. Automatically prevents over-modulation through 6L7 tube in high gain stage. Complete diagrams and directions for constructing with or without over-modulation control feature. Available with 500-ohm output or driver ratios. Table or rack mounting (see illustrations below). Build with C.H.T. Multi-Match or regular Thordarson transformers. Start with Foundation Unit or Complete Kit of Parts.

COMPLETE INSTRUCTION BOOK

Full layout and constructional data for either over-modulation control or conventional circuit. Includes photos, diagrams, parts lists, performance data and operating procedure. SD-387. List price 15 cents.

SEE YOUR PARTS DISTRIBUTOR OR WRITE FACTORY FOR FREE DESCRIPTIVE BULLETIN SD-389

THORDARSON ELECTRIC MFG. CO.
500 W. HURON ST., CHICAGO, ILL.
Demand 'Power by Thordarson'
You get your money's worth, and more, with the Type TJU Universal Mounting Capacitors. These units are impregnated and filled with non-inflammable, non-explosive Dykanol, the high dielectric impregnating medium used in those big Navy jobs—permitting safe operation of capacitors at 10% above rating.

Get the capacitors that are of proven quality. Remember C-D units have been imitated, copied—but never duplicated!

Described, listed and illustrated in the new 40-page Catalog No. 161 now off the press. Be sure to send for your copy today! Are you on our mailing list to receive "The C-D CAPACITOR" bi-monthly house organ? Absolutely free.

CORNELL-DUBILIER ELECTRIC CORPORATION
1013 Hamilton Blvd., So. Plainfield, N. J.

E. H. RIETZKE, Pres. CREI

How Radiomen...

get more money and better jobs with CREI technical training at home

Do you ever sit down and "look your job in the face"? Are you satisfied with your present position—or anxious to get ahead? Today, you can't afford to be satisfied—because rapid new developments mean that Radio wants only men who are TECHNICALLY TRAINED.

Better Men Get Better Jobs

Right now is the time to start training for money and a better job. CREI offers you home-study training in PRACTICAL RADIO ENGINEERING to equip you with the ability to obtain and hold a better job.

TEAR OUT AND MAIL TODAY FOR FREE BOOK

FREE! New illustrated book, "A Tested Plan for a Future in Radio"

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

Capitol Radio Engineering Institute
Dept. Q10, 3224 16th St., N.W., Washington, D. C.

precede periods of unsettled weather, it will be found most prevalent in the summer, and in sections of the country where thunderstorms and rainy weather are regularly experienced. It will usually occur less frequently in the winter, when meteorological conditions are more stable.

In this article no mention has been made of the characteristics of ground-wave transmission, a factor which is of considerable importance, particularly in ultra-high frequency propagation. Considerations of space have also made it necessary to omit many points that otherwise would have been included, no pretense being made that this article is a complete analysis of sky-wave transmission. Those who are further interested in the subject may find the following list of articles of interest. A good bibliography was given at the end of Dr. Kenrick’s excellent article on the ionosphere in QST for September, 1936, and only articles appearing since then are listed below. Most of them contain considerable material that is neither mathematical nor difficult.


Strays

During a recent 5-meter QSO between W8MVQ and W2DMM/8, the antenna at 8MVQ was blown down. W8MVQ immediately went out on the roof and held the antenna up with one hand while he held the microphone in the other. Not only did 2DMM/8 continue to receive him, but he gave him a report of signal increase of 2 “R’s.” Maybe this is the proper cure for 5-meter antennas that don’t seem to “get out” as well as expected!
As can be seen in the illustration, the log page provides space for all facts pertaining to transmission and reception, and is equally as useful for portable or mobile operation as it is for fixed. The 38 log pages with an equal number of blank pages for notes, six pages of general log information (prefixes, etc.) and a sheet of graph paper are spiral bound, permitting the book to be folded back flat at any page, requiring only the page size of $8\frac{1}{2} \times 11$ on the operating table. In addition, a number sheet for traffic handlers is included with each book. The LOG BOOK sells for 35c per book or 3 books for $1.

**OFFICIAL RADIOGRAM PADS**

The radiogram blank is now an entirely new form, designed by the Communications Department to comply with the new order of transmission. All blocks for fill-in are properly spaced for use in typewriter. It has a strikingly new heading that you will like. Radiogram blanks, $8\frac{1}{2} \times 7\frac{1}{4}$, lithographed in green ink, and padded 100 blanks to the pad, are now priced at 25c per pad, postpaid.

**and MESSAGE DELIVERY CARDS**

Radiogram delivery cards embody the same design as the radiogram blank and are available in two forms — on stamped government postcard, 2c each; unstamped, 1c each.
Your Inquiries Invited...

When you need amateur equipment it is to your advantage to write to Bob Henry, W9ARA. You get personal attention; terms financed by myself so you buy with less cost and more convenience; fair trade-in value for your equipment, ten day trial of all receivers; and my cooperation in every way to see that you are 100% satisfied. No wonder Bob Henry's customers are boosters. You will be too. For the newest equipment, the latest information and technical help:

WRITE TO: BOB HENRY, BUTLER, MISSOURI

Compare Bob Henry’s Terms With Others

<table>
<thead>
<tr>
<th>Model and Cash</th>
<th>Down 12 Monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>Price</td>
</tr>
<tr>
<td>The NEW RME-70</td>
<td>$138.60</td>
</tr>
<tr>
<td>The NEW NC-44</td>
<td>49.50</td>
</tr>
<tr>
<td>NC80X and NC81X</td>
<td>99.00</td>
</tr>
<tr>
<td>Improved NC101X</td>
<td>129.00</td>
</tr>
<tr>
<td>The NEW NC100A</td>
<td>120.00</td>
</tr>
<tr>
<td>Latest RME-69</td>
<td>129.88</td>
</tr>
<tr>
<td>Sky Champion II</td>
<td>99.00</td>
</tr>
<tr>
<td>Sky Champion</td>
<td>49.50</td>
</tr>
<tr>
<td>Sky Gondola III</td>
<td>77.00</td>
</tr>
<tr>
<td>Supel Sky rider</td>
<td>99.00</td>
</tr>
<tr>
<td>Also Supel Pro, HRO, PR15, Breitling 9, Sargent, others.</td>
<td></td>
</tr>
</tbody>
</table>

Similar terms on Harvey, RCA, RME, Temco transmitters and National, Thordarson, Progressive, Utah, kits.

Export orders solicited too

HENRY RADIO SHOP
211 North Main Street  Butler, Missouri

FOR BED ROCK STABILITY—
ON ALL BANDS

THE BL EXCITER TWINS
BL-5G and BL-5P

Build Your Own Band Switching Exciter!
★ 10 to 160 meters at the throw of the switch.
★ Double to 5.
★ High-C grid circuit — High-L plate circuit.
★ Change from EC to crystal at will.
★ EC note cannot be distinguished from crystal.
★ A transmitter in itself.
★ A driver for a 200 watt final.
★ Simple — Effective — Inexpensive.

A CLEAR CHANNEL AWAITS YOU
with This Modern Amateur Equipment

KILL

IMAGE INTERFERENCE on the HAM BANDS

The BL-5-H band switching tuner provides an effective and inexpensive means when utilized in a simple and efficient preselector. A universal tuner giving complete bandspread on the 10-20-40-80-160-meter bands, this versatile unit forms the basis of a receiver, a signal generator, a field strength meter and a host of other apparatus.

See Your Parts Distributor — Write for Details

BROWNING LABORATORIES INC.
WINCHESTER, MASS.
EXPORT DEPT., 461 4th AVENUE, NEW YORK

ARRL. QSL Bureau

FOR the convenience of its members, the League maintains a QSL-card forwarding system which operates through volunteer “District QSL Managers” in each of the nine United States and five Canadian districts. In order to secure such foreign cards as may be received for you, send your district manager a standard No. 10 stamped envelope. If you have reason to expect a considerable number of cards, put on an extra stamp so that it has a total of six-cents postage. Your own name and address go in the customary place on the face, and your station call should be printed prominently in the upper left-hand corner.

W1—J. T. Steiger, W1BGY, 35 Call Street, Willimansett, Mass.
W2—H. W. Yahnel, W2SN, Lake Ave., Helmetta, N. J.
W3—R. E. Macomber, W3CZE, 418 10th St., N. W., Washington, D. C.
W4—G. W. Hoke, W4DYB, 328 Mell Ave., N. E., Atlanta, Ga.
W6—Horace Greer, W6TI, 414 Fairmount Ave., Oakland, Calif.
W7—Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
W9—Roy W. McCarty, W9KA, 11 South Michigan Ave., Villa Park, III.
VE1—J. E. Roue, VE1FB, 84 Spring Garden Rd., Halifax, N. S.
VE2—C. W. Skarstedt, VE2DR, 336 Elm Ave., Westmount, P. Q.
VE3—Bert Knowles, VE3QB, Lanark, Ont.
VE4—George Behrends, VE4RO, 186 Oakdean Blvd., St. James, Winnipeg, Manitoba.
VE5—H. R. Hough, VE5HR, 1785 First St., Victoria, B. C.
K4—F. McCown, K4RJ, Family Court 7, San Juan Pueblo, Puerto Rico.
K5—Norman F. Miller, K5AT, 15th Air Base Squadron, Abilene, Field, Canal Zone.
K6—James F. Pa, K6LBH, 1416D Lunnilo St., Honolulu, T. H.
K7—Dean Williams, K7EML, Box 2373, Juneau, Alaska.
KA—George L. Rickard, KA1GR, P. O. Box 849, Manila, P. I.

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

On July 29, 1938, W7FHX of Lakeview, Oregon, received from W7FQS of Spokane, Washington, a QSL card which was postmarked April, 1936. The card had covered the 600 miles in two years and three months. It had been addressed to Lakeview, Washington, through error.

Did someone say that messages via amateur radio were sometimes slow?
Now! A 5, 10, 20 Meter Kit

with a complete Band Switching System

for only

$69.75

Less crystal, meters and tubes!

Check These Features

1. Complete Band Switching of circuits — no "plug-in" coils
2. Independent Dual Amplifier Stages
3. Provision for Two Crystals
4. 45 Watts Input — CW or Phone
5. High Gain Speech Amplifier — Modulator
6. Two complete power supplies with 3 filters
7. Steatite insulation — "air wound coils"

Here's a highly efficient 5-10-20 meter transmitter kit with plenty of power and instantaneous band switching — no plug-in coils or pruning of condenser capacities to obtain proper L C ratios.

A special low resistance selector switch, used in conjunction with the two separate Class "C" Amplifier stages, automatically selects the proper tube sequence.

All parts are of Utah's high standard of quality, with Steatite insulated R F sockets, condensers, etc. — a professionally styled job throughout.

It's the unit for any amateur who wants to work the interesting 5 and 10 meter bands as well as 20 meters.

Write today for complete specifications and schematic wiring diagram.

Utah Radio Products Co.
Cable: Utaradio, Chicago
"Dependable Since 1922"

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

DAKOTA DIVISION

North Dakota—SCM, Ernest Bloch, W9RZA—WWL holds following appointments: O.P.S., O.B.S., Emergent Traffic Net—also SCM and representative in the Emergency Net, President, of the Upper Missouri Radio Club and Vice-President of the Glacier Park Ham-fest; he also is member of A.A.R.S. State "Phone Net. CGM is rebuilding his 14-Mc. into a 6-Mc.-T-300. OJS is new call in WGLN. FM, he is building to '47 crystal '10 feet high. 3.5 Mc., ZTL is looking for Aria, and 8, Car. QSO’s to complete his W.A.S., also plans on giving 1.75-Mc. "phone a try. JZJ wants to sell his rig, with two r.f. sections, for $35, UGM is the proud owner of a Class A ticket and is rebuilding for 14- and 3.9-Mc. "phone. Grand Forks hams organized a radio club, with LPE, Pres., PTH, Vice-Pres., NAW, Secy.-Treas., and DlW, Activities Mgr. Interest in the club is very high and membership is up about 20.


South Dakota—SCM, Al Russell, W9VOD—AZR, R.M., E.C.: SEB, R.M.: OXC; O.O. S RK worked 20QS, presumably giving him the first G WAS. ZMW left for a radio job in the central part of the state. VPQ entertained half a dozen ham tourists in August, SEB clicked with KG, GS, Z8S and ESS. ZCC says increased power is worth the trouble it brings, hopes the fall season brings the Roundup gang together again. VOD will trade some old Europe, S.W.L., cards for a European QSO, YOB visited VQN, SEB, PLE, OXC and QYV on his vacation trip. QAK has a new Sky Champion. QVY is building new rig. AZR had to return to the "phone transfer.

Northern Minnesota—SCM, Edwin Wicklund, W9IGC—PZU of Staples will start transmitting the Official A.A.R.L. Broadcasts the first Sunday in October: the time will be 7 a.m. C.S.T. on Sundays and Wednesdays on 300 kc., with other stations all over the state, who will broadcast on 150 kc. broadcasts. ZBU has a lot of fun working DX on 14-Mc. "phone. YKD is building new rig using 50, HK-49 and 70. KOA works lots of W6’s on 14 Mc. OCN is new St. Paul ham on 7 Mc. YCR runs 100 watts on 809. NMN has an 809 in final, PZU is building new rig using 250T final, VQA has a T200 in final of new rig. DRK put up a rhombic antenna. ABE is building a rig for ORE with pair of 807’s in final, ZOB, now located at Long Prairie, works 7 and 3.5 Mc. HEO, VQA and ABE are working on the new by-laws for the Min-Dak Radio Club. The Min-Dak Club had its August meeting at your S.C.M.’s place, 73.

South Dakota—Minnesota—SCM, M. L. Bender, W9YNG—DCM will probably handle the S.N.C.S. in the A.A.R.S. this season. VRY is building a new r.f. receiver. TIZ is stepping around with his new 14-Mc. rig. FNK intends to move to his new residence, the Win-Haven Home, this fall for a very nice place. YLQ, YNQ has his new rig going. The Rochester Radio Club has a swap night; it helps keep up interest in meetings. An attendance prize is given at each meeting. The City of Rochester has donated the use of a portable National Electric Liquid plant for a club project. The A.A.R.S. gang is getting their rigs tuned up for the season’s drills. The U. of Minn. Net starts as soon as school starts at the university; this net handles traffic for students attending the "U." YC is the control station. LCT is new O.R.S.; he and ZLZ kept a 1.75-Mc. schedule all summer. SJK is looking for a 70-foot pole; has had the hole dug a year! BP is on the trail of some 30 poles. DCM is kept busy by the gang in Minneapolis getting the power company to put up their mast. LCT wants 3.5-Mc. schedules.

Midwest Division

Iowa—SCM, C. C. Richelle, W9ARE—W9WQW, new O.R.S., is showing fine traffic totals. QVA is new O.R.S. KKN is new ham in Mason City. QCD has new antenna mast. YKQ worked a ZL on 7 Mc. GLR is working ‘phone on all bands. CCY has new Hallicrafters 56- and 28-Mc. receiver. UQI has new HRO. PDi moved to Lincoln. NBD of St. Paul is adding a new P.P. P. to his final. QUAH has new HK-254 final. QGF runs 75 watts into 809 final. GFQ has 1-kw. in operation. REV took first cruise with Naval Reserve. JRY is on 14-Mc. "phone. BYV has new antenna. OC (the Old Crow) reports. QYQ built new power supply with 800 Jr. S. A. P. on 7 Mc. HD moved to Ames (under engineering school). AF and YTJ are active again. YRO has new 14-Mc. doubler using EO1 cable. QLJ and OKJ are new hams in Sioux City. UGT finds new iron-core IF’s in receiver FB. VRG is building 56-Mc. rig. TMY bought ARE’s complete crystal cutting and grinding equipment and is now turning out extra FB “Hawkeye Jewels.” QQ is experimenting with 56 Mc. WNL wants schedules with more power, more callers on any band. WMF is working DX on 7 Mc. GRN, just a ham in Burlington, bought the UNL transmitter. WTD holds office of Pres. in the I-I Amateur Radio Club at Burlington. LAC worked a 28-Mc. "phone in N. J., and hasn’t come out of it as yet. Q09 is assisting LAC with crystal-identified rig and antenna head work. LAC’s crystal-controlled rig—used it in Burlington hidden transmitter hunt with excellent results. NIA entered Burlington hidden transmitter hunt. ARE had a visit from CIIH and WT. UOP has splended QSO with YTJ and reports 30 kw. 1909 kc. Our deepest sympathies to FSH in the passing of his mother. Due to the inactivity and failure to report to S.C.M., it has become necessary to cancel several appointments in this Section. We regret doing this, but feel that in so doing we may be able to impress upon all S.C.M. and A.R.C. holders that we want activity and interest in League work. Each club please nominate your Emergency Coordinator and advise S.C.M.

Traffic: W9WQW 56 QVA 3.

Kansas—SCM, Harry E. Legler, W9PH—Traffic took a new lease on life when FT at National Guard camp was opened up for the summer camps. FRC, CET, APF, KXH, VUV, RAT and WLY were some of those keeping folks at home in touch with the boys at camp. APF moved from Hutchinson to St. Marys. AJS is getting cards for work done by someone using his call. QCA, formerly 5FLY, is now in our Section. ZAW stays on the air with his 10-watt emergency rig while the big rig is not in use. YXJ was called into the picture and hurriedly called back from his eastern trip and missed visit to IAW. LVD (ex-9BSV-4KE) is back in the game after being out for 10 years. UEG reports that BUR and KUZ are new hams in Sterling. QLI reports that he has a new Jr. op. HOG has a new O.R.S. rig and is about to blossom forth with a new rig. QXO handled traffic for the Seventh Corps Area A.A.R.S. this summer, and is planning on giving 1.75-Mc. ‘phone a try. KJI reports that he has turned the borrowed power transformer.

Traffic: W9WQW 56 APF 888 SRF 210 CET 44 UG 17 LVD 11 WJN 8 QLI 3 ZAW 2.

Missouri—SCM, T. W. Atwell, W9ODU—NIP is about to blossom forth with a new rig. QXO handled traffic for the N. G. when it was in Fort Sill, and has traffic schedules more every morning on 3575 kc. OGW is a new ham in Kirksville. W9ZQW is working ‘phone. NWZ can still swing his beam antenna headache; UDG is recovered from car accident. NLR’s reception of new equipment is very high. WBC is at C.M.T.C.; GOW is now call at Fredonia; VAO is adding T5S to his final; BFL is suffering from beam antenna headache; UDG is recovered from car accident. KQG’s reception of new equipment is very high. WBC is at C.M.T.C.; GOW is now call at Fredonia; VAO is adding T5S to his final; BFL is suffering from beam antenna headache; UDG is recovered from car accident. KQG’s reception of new equipment is very high. WBC is at C.M.T.C.; GOW is now call at Fredonia; VAO is adding T5S to his final; BFL is suffering from beam antenna headache; UDG is recovered from car accident. KQG’s reception of new equipment is very high.

Traffic: W9WWL 780 APF SRF 210 CET 44 UG 17 LVD 11 WJN 8 QLI 3 ZAW 2.

Traffic: W9WWL 780 APF SRF 210 CET 44 UG 17 LVD 11 WJN 8 QLI 3 ZAW 2.

Traffic: W9WWL 780 APF SRF 210 CET 44 UG 17 LVD 11 WJN 8 QLI 3 ZAW 2.

Traffic: W9WWL 780 APF SRF 210 CET 44 UG 17 LVD 11 WJN 8 QLI 3 ZAW 2.

Traffic: W9WWL 780 APF SRF 210 CET 44 UG 17 LVD 11 WJN 8 QLI 3 ZAW 2.
middle of September, time and frequency tentatively fixed as 7.30 P.M. and 3775 kc. We invite your participation and cooperation. Those blank spaces on the bottom of report cards are for news, Try 'em sometime.

Traffic: WATGN 502 OUD 180 QXO 50 GBJ 6 UYD 5 BYM 2 QMD 1 VFI 2

NEBRASKA—SCM, S. C. Wallace, WopFAM—ZFC reports the "23" Net is working very well. FB: W: S get on Sundays for rag chews. FFF has new rig with 211. BFW is operating in emergency nets on 1.75 Mc.; phone, and 750 Mc.; QST gives a very lively view of this state. DIU has been acting as central station on phone for the S:rd District Emergency Net in Nebraska. UHT is putting up new Zepp. YDZ reports N. E. Nebr. Radio Club needs only Miss. for W.A.S. ZAR stopped in to say hello and ANH got together on 7 Mc. and did a little planning for cards are for news. Try 'em sometime. 73.


CENTRAL DIVISION

ILLINOIS—W9PQ, Leslie M. Dickson, W9RMN—FFQ is using crystal controlled 56 Mc. KOK is a new ham in Rockford. A new club formed in E. St. Louis—The Colabaek Radio Club, IMB, new O.R.S. in Chicago, is studying for commercial ticket. PLL reports from Maryland, DBO is working DX. QVW is busy for Northbound Airlines in Minneapolis. YFV, the second op at RZU, was severely burned when he got across the antenna on the 28-Mc. rig. PHS has a new 500-watt rig, VS, the Corps Area Cryptographer, has moved to Chicago. ZEW's "23" net on 7 Mc. is working very well. ZEY reports from Chicago. DHO worked G and got an S.W.L. card from Africa. Rep. Carl Steffan gave a talk before N. E. Nebr. Radio Club. YDZ worked So. Car. and needs only Miss. for W.A.S. ZAR stopped in to say hello to FAM; he was hitch-hiking to Colo. FAM, NPL, EKQ and ANX got together on 7 Mc. and did a little planning for trunk line "L" for the coming Season.


CENTRAL DIVISION

ILLINOIS—W9PQ, Leslie M. Dickson, W9RMN—FFQ is using crystal controlled 56 Mc. KOK is a new ham in Rockford. A new club formed in E. St. Louis—The Colabalak Radio Club, IMB, new O.R.S. in Chicago, is studying for commercial ticket. PLL reports from Maryland, DBO is working DX. QVW is busy for Northbound Airlines in Minneapolis. YFV, the second op at RZU, was severely burned when he got across the antenna on the 28-Mc. rig. PHS has a new 500-watt rig, VS, the Corps Area Cryptographer, has moved to Chicago. ZEW's "23" net on 7 Mc. is working very well. ZEY reports from Chicago. DHO worked G and got an S.W.L. card from Africa. Rep. Carl Steffan gave a talk before N. E. Nebr. Radio Club. YDZ worked So. Car. and needs only Miss. for W.A.S. ZAR stopped in to say hello to FAM; he was hitch-hiking to Colo. FAM, NPL, EKQ and ANX got together on 7 Mc. and did a little planning for trunk line "L" for the coming Season.

FOR 10 AND 20 METERS

Vertical Steel Radiators

- FULLY TELESCOPING AND ADJUSTABLE
- QUICK, EASY TO INSTALL
- NO LONG PIPES TO HANDLE
- SIMPLY ERECT 6-FOOT UNIT AND EXTEND TO HEIGHT DESIRED
- SPECIAL DESIGN 25,000 VOLT INSULATOR SIMILAR TO 800-FOOT TOWER TYPE

Made of steel tubing in carefully designed sizes to permit telescoping to 6-ft. unit yet extending to any height up to 34 ft. for 20-meters. Six sections with 3-point locking joints, all heavily copper plated for minimum R.F. resistance.

10-Meter Radiator is of three sections, employing the famous Corulite Elements — extending to 17 feet. Ask your jobber or write direct.

SEND FOR SPECIAL ANTENNA BULLETIN...

Improve Your Rig with Ready-to-Use Transmitter and Relay-Rack Cabinets at Low Cost

Your transmitter and relay rack cabinets have a smart one-piece appearance and new durability when you use any one of the many LeFebure models. Completely welded construction replaces all bolts. Your cabinets are shipped erected... ready to use.

Thousands of users are proud of the modern design and improved features of LeFebure cabinets. Custom-built cabinets to your specifications are a specialty with LeFebure. Model for every purpose at low cost.

Write today for complete details and low factory prices!

LeFebure Corporation Mfrs.
Cedar Rapids, Iowa, U. S. A.

FOR SALE BY A.R.R.L.
STATION OPERATING SUPPLIES;
LOGBOOKS, RADIOGRAM BLANKS
DELIVERY CARDS
Full Details on Page 101

Standard Frequency Transmissions

<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule</th>
<th>Station</th>
<th>Date</th>
<th>Schedule</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 7</td>
<td>A</td>
<td>W9XAN</td>
<td>Nov. 4</td>
<td>A</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Oct. 14</td>
<td>BB</td>
<td>W6XX</td>
<td>Nov. 11</td>
<td>BB</td>
<td>W6XX</td>
</tr>
<tr>
<td>Oct. 15</td>
<td>BX</td>
<td>W6XX</td>
<td>Nov. 12</td>
<td>BX</td>
<td>W6XX</td>
</tr>
<tr>
<td>Oct. 16</td>
<td>C</td>
<td>W6XX</td>
<td>Nov. 13</td>
<td>C</td>
<td>W6XX</td>
</tr>
<tr>
<td>Oct. 21</td>
<td>A</td>
<td>W9XAN</td>
<td>Nov. 18</td>
<td>A</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Oct. 25</td>
<td>A</td>
<td>W9XAN</td>
<td>Nov. 25</td>
<td>A</td>
<td>W9XAN</td>
</tr>
</tbody>
</table>

STANDARD FREQUENCY SCHEDULES

<table>
<thead>
<tr>
<th>Time</th>
<th>Sched. and</th>
<th>Freq. (kc.)</th>
<th>Time</th>
<th>Sched. and</th>
<th>Freq. (kc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>A</td>
<td>3600</td>
<td>4:00</td>
<td>B</td>
<td>7000</td>
</tr>
<tr>
<td>8:08</td>
<td>A</td>
<td>3600</td>
<td>4:08</td>
<td>B</td>
<td>7100</td>
</tr>
<tr>
<td>8:16</td>
<td>A</td>
<td>3700</td>
<td>4:16</td>
<td>B</td>
<td>7200</td>
</tr>
<tr>
<td>8:24</td>
<td>A</td>
<td>3800</td>
<td>4:24</td>
<td>B</td>
<td>7300</td>
</tr>
<tr>
<td>8:32</td>
<td>A</td>
<td>3900</td>
<td>4:32</td>
<td>B</td>
<td>7400</td>
</tr>
<tr>
<td>8:40</td>
<td>A</td>
<td>4000</td>
<td>4:40</td>
<td>B</td>
<td>7500</td>
</tr>
</tbody>
</table>

The time specified in the schedules is local standard time at the transmitting station. W9XAN uses Central Standard Time, and W6XX, Pacific Standard Time.

TRANSMITTING PROCEDURE

The time allotted to each transmission is 8 minutes divided as follows:
2 minutes—QST QST QST (station call letters),
3 minutes—Characteristic letter of station followed by call letters and statement of frequency. The characteristic letter of W9XAN is "O" and that of W6XX is "M."
1 minute—Statement of frequency in kilocycles and announcement of next frequency,
2 minutes—Time allowed to change to next frequency.


W6XX: Don Lee Broadcasting System, Los Angeles, Calif., Frank M. Kennedy in charge.

WWV Schedules

Each Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station, WWV, transmits with a power of 20 kw. on three carrier frequencies as follows: 10:00 to 11:30 A.M., E.S.T., on 5000 kc.; noon to 1:30 P.M., E.S.T., on 10,000 kc.; 2:00 to 3:30 P.M., E.S.T., on 20,000 kc. The Tuesday and Friday transmissions are unmodulated c.w. except for 1-second standard-time intervals consisting of short pulses with 1000-cycle modulation. The Wednesday transmissions, the carrier is modulated 30% with a standard audio frequency of 1000 c.p.s. The standard musical pitch A = M440 c.p.s. is also transmitted from 4:00 P.M. to 2:00 A.M., E.S.T., daily except Saturdays and Sundays, on a carrier frequency of 5000 kc., power 1 kw., 100% modulation. The accuracy of the frequencies of the WWV transmissions is better than 1 part in 5,000,000.

Aerovox Corporation has just made available a new line of silvered-mica condensers for applications requiring high stability.
U. S. Auto Alarms
Approved by F.C.C.
Mackay type 101-A and Radiomarque Model AR-9520 are described in minute detail with complete operating instructions, circuit diagrams and photographs.

ELECTRON TUBE
Various types, characteristics and applications, explained by Robt. Kruse, internationally known expert and radio engineering and technical editor.

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

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

Latest Broadcast Transmitters
R.C.A types 100-B, 250-D, 5 KW type 5-D. Installations, adjustments, operation, and maintenance. Hilbert equalizer and new equalized feedback circuits.

Marine Radio — Telegraph Transmitters
and receivers — latest types. R. C. A type 8053, 8066, 5507 transmitters and 8504 and 8503 receivers, Mackay type 101-A and 142 transmitters.

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

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

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

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

New Information
Never Before Available
This new edition is packed with up-to-the-minute information much of which is available in no other book and all of which is essential to any man whose work or hobby is radio in any of its branches.

Prepared by F.C.C. Expert
The author, G. E. Sterling, is Assistant Chief, Field Section, Engineering Dept., Federal Communications Commission and nationally known as an outstanding authority.

Sent on Approval
Mail This Coupon Today!
D. VAN NOSTRAND CO., 250 Fourth Avenue, New York
Send me on approval THE RADIO MANUAL. Within 5 days after I receive the book, I can return it and owe nothing. If I keep it, I will send you $2.00 as first payment and I will pay $2.00 monthly thereafter for 2 months — $6.00 in all. (5% discount for cash.)

Name...........................................
Address...........................................
City...........................................
State...........................................
Reference...........................................
Address...........................................

For Free Catalog of best books of practical instruction and technical information, check here. If you do not want The Radio Manual cross out paragraph above.

Say You Saw It in QST — It Identifies You and Helps QST
(Continued from page 108)

turned from a trip East and is all set for renewed activity on 3.5 Mc. N12Z gets back to Fort Alexandria. QDL likes 7 Mc. EXF keeps LaCrosse on the map on 3.9-Mc. phone. ZTP is new O.R.S. in Milwaukee. The annual M.R.A.C. picnic was a huge success as usual. UNI finds he can modulate phone and has the final new supply. PQY has new "Bretzel" 9'er receiver. PQY is building clubhouses on his premises. OXZ builds rigs for hams around Superior, WYT gets on occasionally. RJB is heard now and then on c.w.

Traffic: W8JSF 2. (May 10–June 15th: W8TO 70)

WEST GULF DIVISION

NORTHERN TEXAS—SCM, Lee Hughes, W5DXA— is building a rig on the air, 6L6 TT, 607, P.P. T50's, P.P. 888's. ECE has a lot of trouble and is a pair of Transit, 2500. Recently of OK city, is now in Fort Worth at 1508 N. 5th St. Welcome to this section, Bill. EES has now rig. FNP is adding a 6L6 stage to his osc. DNE is on 7 and 3.5 Mc.

Traffic: W5CEZ 20 EOE 1 5EX 9

OKLAHOMA—SCM, Carter L. Simpson, W5CEZ— CE2 received temporary appointment as Alternate Section Coordinator for Section 8, N.C.R. "Mett" of FSK is back from furlough and is making schedules again. FHL erected a new antenna system and is fully equipped to operate on Naval Reserve frequencies of 2484 and 2792 kcs. DAK completed training course for Radioman 2nd Class in Naval Reserve. Guinn, who has been in charge of FGM, is going to Ft. Mch. guill. P.O.S. school in Mch. PM, who becomes Assistant SCM, Forrest W. Dana, W4AGR, N4FM, R.M.: 4DDB. DZT is trying for DX on 56 Mc.

Traffic: W5CEZ 20 EOE 379 FOJ 15

SOUTHEAST DIVISION

ALABAMA—SCM, James F. Thompson, W4DGS— P.A.M.'s 4DHG, 4BMM, R.M.'s: 4DS, 4APU. The season of better conditions and more activity is in full swing, and now is the time to do something to justify your existence on the air. There is no better way to prove that you also be allowed to have a place in the already overcrowded radio spectrum than by taking part in some organized activity. The O.R.S.-O.P.S. appointments identify you as progressive ham. A.A.R.S. is a group of efficient operators. RS at Selma will be glad to hear from all interested in A.A.R.S. (Army Net) work, either 'phone or c.w. There is also an R.R.M. appointment for South Ala. EZU at Greenville is new O.P.S. FLS in the TVY territory applied for O.R.S. and A.E.C. RF0 was among the Ala. gang at KB's lastest. DHG gave FAZ O.P.S. test. He reports two new calls in Mobile as a result of the M.R.C. school: FMH and MIF. The M.R.C. lost another valuable member via the moving route; he is EGU, who becomes Chief Supervisor of Telephones for the Coast Guard, stationed at Washington, D. C. DHG divides time between 1.75-, 3.5- and 14-Mc. phone. EQM has W.A.C., c.e.d. on 3.5 Mc. He has heard from FOS, new at 28Mc. He is getting tickets in Feb. EQM's father has operator's ticket now, and he operated EQM also, FOT is now call at Langdale; he is the youngest ham in the "Valley," being 15. and has 6L6 "Ti-Tex" on 7 Mc. CWX stays on 28- and 14-Mc. 'phone, FOS is building a new rig. GWX stays on 7 and 3.5 Mc. ZS has the fever again; how many remember his old 3.5-Mc. band? 'phone? FOS, new at Samson, uses 801's in final with 46 mod., and has RAMR. EEU was visitor at WPM. ZT has new 14-3.5-Mc. 'phone, and has tickets with tens. EELI works KB cross-band daily at noon. It's about time for the noon gathering each day on 3.7 and 1.75 Mc. EER moved to new part of town. BLG has a new shack there also; he also has 14-7,3.5-Mc. band with rig going. FMR, a new call, has P.P. 6L6 final. KF and FMR took N.C.R. cruise to Mexico and Cuba. EFR took vacation in Winslow, Ariz., and Hollywood. Cal. BIBH has PIT16 and is building rig for camp on the lake. WPL is only 3.5-Mc. 'phone in B'ham. BYK, AUP, and DGS share 3.9 Mc. in M'tgr. ECF says that General beam is really something. HB is gathering parts again. AUP has a new location which is FB for ham work. That will be held Sunday, Oct. 2nd, from 2 to 6 and another of those Ala. QSO Parties. The rules will be spread over the air. Five points are sure to be given for each O.R.S.-O.P.S., R.M., P.A.M. or Director of the Alt. or Assst. Director or the S.C.M. who can pass the word along and let's have everybody on 73-Jim.

EAST FLORIDA—SCM, Lewis A. Connolly, W4DVO— Assistant SCM, Forrest W. Dana, W4AGR, N4FM, R.M.: 4DDB. DZT is trying for DX on 56 Mc. He has his rig and is looking for DX. CTL, CYM, HEC, QB, EQT, ZES, ECC and EKL, traffic now, and EKL reports hearing DX signals on 56 Mc. AFP is on 7 Mc. with new Zepp and new receiver. HCC and EFL sport new receivers. CWV reports good DX on 14 Mc. DE and DVL have new QTH. GDP is working in broadcast station in Roswell, N. M. QD rebuilt rig for 28 Mc. FGM is rebuilding. CGI is building 28-Ac. rig. HEG works 7-Mc. C. W. and 28-Mc. 'phone. GHU works 14-Mc. 'phone. AF8 is on 29 Mc. and AF7 is also. EED and FMR have 6L6 new rig for 28 Mc. GWX is increasing power. FRK worked OA6A using a 6L6 crystal oscillator. FOE is building new kW rig. CVQ-WLJU is building bigger and better portable to operate on special A.A.R.S. frequency 6990 kc. for emergency.

Traffic: W4W 1028 MN 500 CVQ 54 FDR 24 CWN 114 GUY 2 DWN 1 (WLX 110)

ROCKY MOUNTAIN DIVISION

COLORADO—SCM, Glen Glasscock, W9FA—2DRZ runs high honors for traffic during the dog days with "Buck," "WWB," running a close second in spite of the convention preparations. Z1C is all tangled up in a 3.5- and 7-Mc. net, with some of the west coast boys on trans-Pacific traffic, and is fighting desperately for a good eastern outlet, "Cass" was visited by MKN, ESA and NFO. ESA and MKN made a vacation tour of the state during the month and visited a number of the Colorado gang, taking along a portable built by EGA. VCG really made W8VY look good in the Z3A contest. Z3A got a clear green light at Salt Lake City. 5GAR/9 operating in the vicinity of Denver is really getting results on 28-Mc. portable. SEXZ is back in Ft. Collins for a short spell.

SOUTHEASTERN DIVISION

Traffic: W4DVO 43 DNA 114 COV 12 DDB 4 EUN 42 AGR 42 DWU 31.
Looking for a ham station to visit while driving along the road, W8KQZ spied a sign reading “WURMS,” and turned in to give the mystic pass word for a visit. The OM who came to the door, however, “no spik English.”

It developed that the sign had been made with thin paint and part of the second letter had run. The sign was designed to advertise fish bait!

**Strays**

---

**Sulphur Candles and Radio Equipment**

In closing my home for a short time my wife decided to burn a few sulphur candles as a moth-proofing remedy. Upon returning a few days later, I looked at my radio equipment. It looked like something that had been lying on the bottom of the ocean for years! My new receiver had lost its bright finish. The nickel trimmings were all tarnished, the copper was black, and the brass was green with tarnish. I rubbed and polished but found it almost impossible to get it back to the original newness. I was sick.

Then came headache number two. I turned the receiver on and found that it didn’t seem to operate as well as before. I operated the crystal and selectivity switch, but there was no evidence of contact. Many of the switch contacts inside the receiver were inoperative. The sulphur fumes had reached them and corroded the points.

In conclusion, I much prefer the moths—they only eat garments. Such a misfortune as this eats your heart!

—Irving J. Gallagher, 700 Franklin St., Elizabeth, N. J.

---

**Correction**

Fig. 2, page 29, QST for August should show a connecting line between the output of the 30- henry choke and the connection of RFC and R2. In addition, the list of parts specifications for this circuit was omitted, and is given below:

- C1—260-µfd. variable, single-spaced.
- C3—100-µfd. variable, double-spaced.
- C4—0.001-µfd. fixed mica, 600-volt.
- C5—0.001-µfd. fixed mica, 600-volt.
- C6—0.02-µfd. fixed mica or paper, 600-volt.
- R1—50,000-ohm, 2-watt carbon.
- R2—75,000-ohm, 100-watt, slider type.
- R3—50,000-ohm variable.
- T1—600-0-600 volts at 200 ma., 1/2 volts at 10 amperes, 5 volts at 3 amperes, and 6.3 volts at 3 amperes. Suitable data for grid and plate coils are as follows:

For 3.5-Mc. output:
- L1—35 turns No. 18 enameled wire, close-wound, tapped 5 turns each side of center.
- L2—30 turns No. 18 enameled wire, close-wound.

For 7-Mc. output:
- L1—17 turns No. 18 enameled wire, tapped 3 turns each side of center.
- L2—17 turns No. 18 enameled wire.

For 14-Mc. output:
- L1—9 turns No. 14 enameled wire, tapped 2 turns each side of center.
- L2—12 turns No. 14 enameled wire.

For 28-Mc. output:
- L1—6 turns No. 14 enameled wire, tapped 1.5 turns each side of center.
- 7 turns No. 14 enameled wire.

---

**New Data on Direction of Wave Propagation**

At the recent I.R.E. Convention in New York Mr. C. B. Feldman, of Bell Telephone Laboratories, presented a paper disclosing some observations on direction of wave travel which will be of great interest to the many amateurs who work DX. Previous work in this field had shown that waves almost always travel along great circle routes, the greatest departure being of the order of 5 degrees or so. It now develops that under certain conditions the waves may arrive from directions as far as 90 degrees from the great circle route!

The work has been carried on over a period of a year or so using receiving antennas having steerable characteristics in the horizontal plane. Observations were made on two short-wave stations of the B.B.C. located near London: GBC with a directive antenna focused approximately on New York over the great circle route, and GBS similarly directed toward South Africa. Under normal conditions, best signals will be received with the receiving antenna directed toward London to receive GBC, while the signal from GBS will be poor because it radiates comparatively little power toward New York. This is always the case during the daytime and with quiet magnetic conditions.

It has been found, however, that on many occasions just before and just after a magnetic storm, and when transmission is partly or wholly through darkness or a sunset zone, the signals from GBC will be weak and fade badly with the receiving antenna directed toward London. At the same time, a stronger and much steadier signal will be received from GBS when the receiving antenna is directed toward London to receive GBC, while the signal from GBS will be poor because it radiates comparatively little power toward New York. This is always the case during the daytime and with quiet magnetic conditions.

No explanation for the peculiar behavior of the signals is being offered at present. A tentative hypothesis has been advanced, but since there is no experimental evidence confirming it, the authors prefer not to have it published at the moment.

In the future, be a bit careful about labelling a new piece of DX "phoney" if your rotary beam shows him to be in the direction of Africa while he's telling you his location is some off-the-map European country! —G. G.
Refinements in Combination Exciters

(Continued from page 41)

condensers are used, depending on the amount of capacity necessary to tune the circuit to resonance. At first glance, it would seem that this capacity in each case would be too small compared to the 25-µfd. maximum capacity of the parallel band-spread condenser; however, the combined capacity of the tube, circuit, and effective capacity of the coil is in many of the tanks almost sufficient to serve alone as the fixed or padding capacity.

Parallel feed is used in all of the oscillator and doubler plate circuits. This feature leads to neither an increase of efficiency nor one of economy, but is incorporated in this unit to place the fixed tanks at ground potential. If provision is made in a set of this sort for insulating the band-spread condensers and the padder condensers, a small saving will result from use of series feed in these stages. Another way to arrive at this more desirable circuit arrangement is use of blocking condensers of 0.001 µfd. or greater capacity between the B+ connection of the coil and the rotor connections of the condensers. In this way, the 300-volt plate potential is placed across the condensers, but this value, added to the r.f. voltage developed by such stages, is insufficient to cause sparking in single-spaced condensers.

R.F. EXCITER LAYOUT

The sketches of Fig. 3 show a more open arrangement of the r.f. equipment previously discussed. A drum or worm gear dial is used, so that the ganged band-spread condenser may be mounted parallel to the front panel. Removal of speech amplifiers and such additional power supply apparatus as is made necessary by the incorporation of audio equipment makes possible a much more accessible type of construction. Aside from the band switch and crystal switch, with associated flexible and rigid shafts and couplings, all of the below-chassis space is saved for tube and crystal sockets, resistors, small condensers, and wiring. With this layout all connections are confined to the sub-panel area except direct leads through the chassis to the tuning condensers and the plate of the 807 tube.

In order to make the construction of the fixed-tuned exciter tanks less expensive, a shield box of honeycomb construction may be made of thin sheet aluminum. A single variable condenser and a coil either permanently mounted or plug-in may be used for each tank. This may be assembled on a bracket of aluminum sheet two inches wide, bent at a right angle at the chassis for mounting and again at a right angle in the same direction at the top to provide a horizontal surface for the usual single-hole condenser mounting. Such an assembly, with coil mounted on the vertical portion of the bracket beneath the condenser, permits short, direct wiring and easy accessibility for adjustment. A sketch of the details is shown in Fig. 4.
Both VE1IN and W1AUJ were using Harvey UHX-10 transmitters. A proof that low power properly used can really go places. The UHX-10 is not only a good rugged station transmitter, but also compact and light for portable operation. Don't neglect this transmitter because of its low power — write to Harvey Radio Laboratories, Inc., 25 Thorndike Street, Cambridge, Mass., for complete information. Export division, 25 Warren St., New York City. Cable: "Simontrice."
NDISPENSABLES

✓ your receiver
✓ your transmitter
✓ your F.C.C. licenses
✓ your LICENSE MANUAL!

It's against the law to operate an amateur radio station without the required federal licenses for station and operator. The maximum penalty for so doing is a $10,000 fine and two years in a federal penitentiary.

That's the broad basic picture. But within the scope of the federal licensing machinery are many detailed regulations, the violation of any one of which can lead to suspension, cancellation of licenses, or even fines or imprisonment. These regulations change frequently, in step with the rapidly developing art of radio.

There is only one way for the amateur to keep at his finger tips these changing legal requirements—short of maintaining his own Washington legal bureau. That is to keep the latest edition of the Radio Amateurs License Manual in the shack at all times. New editions always contain the latest regulations—and when a new edition appears it means that changes in federal regulations have made its predecessor obsolete.

WE ARE NOW SUPPLYING THE EIGHTH EDITION
TAKE A LOOK AT YOUR COPY!
25 cents postpaid
AMERICAN RADIO RELAY LEAGUE
West Hartford, Connecticut, U. S. A.

One important point to observe is the location of the e.c. oscillator tuning condenser at the extreme right-hand position in the layout of Fig. 3. This means that if the dial is to be accurately and dependably calibrated, a rigid shaft assembly must be provided, as previously discussed.

The crystal switch and the band switch are placed so that short, direct connections are made possible. This is not only good practice from the high-frequency electrical standpoint, but also aids in clearing away the maze of wires which would result if a haphazard layout of parts were followed. The crystal switch is immediately below and to the rear of the 6V6 socket, so that the length of leads from any of the five crystal sockets is limited to a few inches. The band-switch is placed so that the first section is beneath the first doubler grid terminal, succeeding sections are below the following doubler grid terminals, and the final two discs of the switch are below the 807 and associated high-frequency tanks. The 10-meter 807 plate tank is separated from the 10-meter doubler tank by the 20-meter amplifier assembly in order to prevent coupling between the doubler and amplifier.

In the circuit diagram of Fig. 1, a single-pole five-position switch is shown connected so that it selects the output of the e.c. oscillator or one of four crystals, placing the circuit chosen in contact with the grid of the following stage. This system is perfectly satisfactory, if it is carefully constructed and the tanks are carefully tuned to eliminate simultaneous excitation on two frequencies from crystal and e.c.o. Another method of using one switch for the purpose of selecting a crystal and for that of changing from crystal frequency control to e.c. oscillator is shown in Fig. 5. Here, a single-disc switch of the two-pole, six-circuit non-shorting type, costing less than fifty cents and occupying very little space, is used. One pole of this switch is connected to the grid of the 6V6 stage and five of the six corresponding switch points are connected to five crystals. The other pole of the switch is connected in the screen supply circuit of the e.c. oscillator, so that in the sixth position (the position of no crystal connection) the e.c. oscillator is made operative. The major feature of this arrangement is absolute freedom from mixing of the e.c.o. output in the crystal oscillator and freedom from an undesired signal when monitoring the output of the unit.

There is little to be said on the subject of power supply for an r.f. exciter-transmitter of this sort, except that it should be thoroughly filtered and should be nearly free from voltage change resulting from keying. The power supply may well be included in the r.f. unit, especially if a husky transformer and set of chokes which are not inclined to set up strong mechanical vibrations are used. For a layout such as that shown in Fig. 3, the current rating of the transformer and chokes should be at least 250 ma. A good swinging choke should be used as the input choke, and the windings of chokes and transformer should have low resistance. As the four doubler stages take a constant plate current, with or without excitation, and as this value is greater than the current for
THE RADIO AMATEUR'S LIBRARY

Many requests are received for copies of this list so we again present it in QST in its complete form — to give a comprehensive picture of our publishing services to the amateur.

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>QST</td>
<td>$2.50 per year*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-war</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Out of Print</td>
</tr>
<tr>
<td>2.</td>
<td>List of Stations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-war</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Out of Print</td>
</tr>
<tr>
<td>3.</td>
<td>Map of Member Stations</td>
<td>Free to members;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to others 10c</td>
</tr>
<tr>
<td>4.</td>
<td>Operating an Amateur Radio Station</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>The Story of The A.R.R.L.</td>
<td>Out of Print</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See No. 13</td>
</tr>
<tr>
<td>6.</td>
<td>The Radio Amateur's Handbook</td>
<td>$1.00**</td>
</tr>
<tr>
<td>7.</td>
<td>The Log</td>
<td>35c each; 3 for $1.00</td>
</tr>
<tr>
<td>8.</td>
<td>How to Become a Radio Amateur</td>
<td>25c</td>
</tr>
<tr>
<td>10.</td>
<td>Hints &amp; Kinks for the Radio Amateur</td>
<td>50c</td>
</tr>
<tr>
<td>11.</td>
<td>Lightning Calculators:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Radio (Type A)</td>
<td>$1.00</td>
</tr>
<tr>
<td></td>
<td>b. Ohms Law (Type B)</td>
<td>$1.00</td>
</tr>
<tr>
<td></td>
<td>c. Wire Data (Type C)</td>
<td>50c</td>
</tr>
<tr>
<td></td>
<td>d. Decibel (Type D)</td>
<td>50c</td>
</tr>
<tr>
<td></td>
<td>e. Parallel Resistance — Series Capacity (Type E)</td>
<td>50c</td>
</tr>
<tr>
<td></td>
<td>f. Resistance Calculator (Type F)</td>
<td>50c</td>
</tr>
<tr>
<td>12.</td>
<td>Amateur Radio Map of the World</td>
<td>$1.25</td>
</tr>
<tr>
<td>13.</td>
<td>Two Hundred Meters and Down: The Story of Amateur Radio</td>
<td>$1.00</td>
</tr>
<tr>
<td>14.</td>
<td>Building an Amateur Radiotelephone Transmitter</td>
<td>25c</td>
</tr>
</tbody>
</table>

* In the United States and Possessions and Canada. Other Countries $3.00 per year.
** Postpaid in Continental U. S. A. — $1.25, postpaid; elsewhere (SPANISH EDITION HANDBOOK — $1.50, Postpaid)

THE AMERICAN RADIO RELAY LEAGUE, INC.
West Hartford, Connecticut
New RCA 3" Oscillograph Brings You Many New Features at a Popular Price!

This oscillograph, the newest addition to the No. 150 Series of RCA Test Equipment, includes many new features. All the controls, including the spot-centering controls are on the front panel. Smaller size and lighter weight greatly increase its portability. And its new styling and finer performance make it unusually attractive. You'll agree it's a bargain!

SPECIFICATIONS

Radiotrons...1 RCA 906 (improved type), 2-SC6, 2-80, 1-884—Total 6. Sensitivity...without amplifier—20 volts (RMS) per inch deflection with amplifier—0.5 volt (RMS) per inch deflection; Amplifier: Response...Flat, 20-90,000 cycles—Gain 40; Timing Axis, 15-22,000 cycles. Controls...Front panel for all operations, including centering; Power Supply, 110-volts, 50-60 cycles; Input power...20 watts; Dimensions...H 15", W 8", D 14"; Finish...Blue-gray baked wrinkle lacquer—streamlined handle. $63.95 Net. Stock No. 155.

Over 32.5 million RCA Radios have been purchased by Cadets, Officers, Electrons, airports, and home-builders...RCA part of the Magic Key every Sunday, 9 to 11 P.M.E.S.T., on the NBC Blue Network.

RADIO

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

Birnbach
ONE OF THE MOST RESPECTED NAMES IN RADIO

Respected because there is never any compromise with quality in Birnbach Products; because every one of the 3000 Items in the Birnbach Catalog is guaranteed to satisfy because for 17 years Birnbach has pioneered many new products such as Feed-though Insulators, Solderless Jumper, the new Solderless connection for test leads and prods. Before you buy parts to build your new rig Specify Birnbach!

A FEW BIRNBACh LInE S
- Feed-though Standoff Insulators
- Standoff Insulators
- Cone Standoff Insulators
- 10 or 50 watt sockets
- Jacks, Plugs, accessories
- Test Prods and Leads
- E01 cable
- Stretchless Copper-weld Enamel
- Antenna wire or any of the 3000 other Items listed in our catalog.

1 G. F. Wunderlich, "A Deluxe 100-watt C.W. 'Phone Transmitter with Band-Switching Exciter," QST, Nov., 1937.

"Put Your Signal Where You Want It When You Want It There"

THE NEW 1939

MIMS SIGNAL-SQUIRTER

The new 1939 Mims Signal-Squirter is really wonderful. Of course there isn’t room here to describe its many important and unique features such as its new high-efficiency coupling system which makes it unbelievably easy to tune, its remarkable gain (twice or more the gain of previous models), its sturdy Construction to withstand bad weather, its simple and reliable electrical rotating mechanism, and a hundred lesser points where our experience has taught us what to do and how to do it.

Fifty watts into a good antenna will get you a lot more R9 reports than a kilowatt into a bad antenna. To hop up your signal at the receiving end, use a really good antenna.

Write for details on the new Mims 1939 Signal-Squirter.

Price 59.50

Complete

MIMS RADIO COMPANY
M. P. MIMS—W5BDB, P. O. Box 504, Texarkana, Ark.

RADIO COURSES

RADIO OPERATING: Prepare for Gov't License Exam.
RADIO SERVICING: Including Short Wave AMATEUR CODES ELECTRONICS TELEVISION
Day and Evening classes—Booklet upon request
NEW YORK YMCA SCHOOLS
4 West 63rd Street, New York City

LOW COST
STEEL ANTENNA TOWER
Used and Endorsed by
FEDERAL, STATE, COUNTY, CITY GOV'TS.,
FORESTRY, HIGHWAY PATROLS
and HAMS everywhere!

ONLY 60¢ PER FOOT Complete!
This remarkable low price is possible only because we produce many thousands of these towers each year for use with our Wincharger. Price includes necessary guy wires and tower sections of 10 or 20 ft. lengths with 5 ft. tapered stub top.

LIGHT, STURDY, RIGID
Thousands in use as vertical radiators and horizontal antenna supports. Scientifically braced. No points of undue strain. Both vertical angles and cross braces now hot dip galvanized.

SAFELY ERECTS TO 200 FT.
Quickly and easily erected, without skilled assistance, to heights of from 25 ft. to 200 ft. Reasonomably used and recommended by police and broadcasters for thoroughly satisfactory service.

READ U. S. FORESTRY LETTER:
"Your tower was installed on Signal Peak, a Lookout Station on the Yakima Indian Reservation, at an elevation of 5,111 ft. above sea level. We have found the Wincharger tower 100% satisfactory and it has stood up under 70 mile winds, snow and ice which are severe at almost a mile up from sea level." Thomas L. Carter, Forest Supervisor, Office of Indian Affairs, U.S. Department of the Interior, Toppenish, Wash.

Order Direct From
WINCHARGER CORPORATION
Sioux City, Iowa

PRECISION CRYSTALS

Highest quality crystals, one inch square, carefully ground for frequency, stability and maximum output. Be sure of your transmitter frequency — use PRECISION CRYSTALS.

Crystals can be furnished with square holder as illustrated (tite C.R. type jack) or with round holder to plug into tube socket. When ordering be sure to state the type holder desired. C.R. jacks to plug illustrated holder into — 15c pair.

Low frequency drift crystals (Type LTC) supplied within 0.1% of your specified frequency and calibrated to within 0.03% are priced as follows: 1750, 3500 and 7000 kc, bands — $3.50 each. Holder $1.00. (State type desired.)

"X" cut PRECISION Crystals carefully ground for maximum power supplied within 0.1% of your specified frequency and calibrated to within 0.03% are priced as follows: 1750, 3500 and 7000 kc, bands — $3.00 each. Holder $1.00. (State type desired.)

"AT" cut crystals for commercial use quoted on at your request. When ordering our product you are assured of the finest obtainable. Now in our ninth year of business.

PRECISION PIEZO SERVICE
427 Asia Street
Baton Rouge, La.

Say You Saw It in QST — It Identifies You and Helps QST
THE SCOPE OF THE BOOKLET

"BUILDING AN AMATEUR RADIO TELEPHONE TRANSMITTER"

This booklet is addressed primarily to readers who have at least read our companion booklet, "How to Become a Radio Amateur," and have, perhaps, built a simple telegraph transmitter and receiver, have received their license, have acquired some skill and experience as a code operator, and who now feel the urge to explore the possibilities of radio telephony. These people should find this booklet the exact answer to their needs.

Absolutely the first requisite in either building or operating a 'phone transmitter is a solid understanding of what we are attempting to do when we accomplish voice transmission. Understanding the functions of the various parts, we shall avoid difficulties. The saddest thing in amateur radio is a 'phone amateur who does not understand the operation of his apparatus. The book begins, therefore, with a discussion of the principles involved and makes every effort to make this discussion perfectly clear so that the reader can easily make it a part of his own knowledge. It then goes on to the actual construction and operation of an inexpensive but efficient 'phone transmitter.

Priced at 25 cents per copy, postpaid

AMERICAN RADIO RELAY LEAGUE
West Hartford, Connecticut

sentences, this system must be used and compared in operation with other speech amplifiers to be fully appreciated. To begin with, ripple voltage of the plate supply to the amplifiers is applied to the plates of each push-pull stage simultaneously, and thus, if the stages are properly balanced, will be cancelled or effectively reduced at the first plate transformer in the series of stages. Audio feedback due to common power-supply voltage variations, while usually not appreciable in amplifiers having push-pull power stages, is similarly reduced in extent. In single-ended amplifiers the microphone, cord and plug, and the wiring of the first speech amplifier stages usually are susceptible to r.f. pickup from the strong transmitter field and lead to detection in the input amplifier tube, which in turn feeds the detected audio signal to the grids of the following amplifiers. The r.f. pickup of a push-pull stage, being more or less balanced in amount applied to the grids, will be detected in both input tubes, and the audio signal from this source, also, will at least be partially cancelled. Of course, the wiring at the input of these tubes should be shielded thoroughly just as though no suppression of the detected r.f. signal were provided, and in addition, an attempt should be made to keep the exposed wiring in such a position that both tubes will receive equal amounts of r.f. energy. The thorough shielding used for the speech input to the amplifiers of the set pictured is used not because of necessity for ordinarily acceptable freedom from r.f. feedback to the audio system, but to provide far more than the ordinary degree of freedom from this trouble, even with r.f. stages and audio stages combined in one chassis.

The practical advantage of the use of push-pull stages throughout the speech amplifier, then, is the fact that less audio filtering, less power supply filtering, and less r.f. filtering is necessary for operation of an all-push-pull system comparable to a similar system with single-tube input; or much more freedom from these commonly encountered troubles results from the same care in design and construction of a system using push-pull stages throughout.

The circuit of a high-gain speech amplifier and driver incorporating the push-pull input system is shown in Fig. 2. The shielded two-wire cable from the crystal microphone is terminated in a shielded three-circuit microphone plug, with shield grounded to the sleeve of the plug and the two-wire conductors connected to the plug tips. The jack which receives this plug, the r.f. chokes, and the grid resistors for the input stage are mounted in a small aluminum shield can. From this can, symmetrically-placed shielded wires make a short, direct path to the grids of the 6J7 input tubes. The latter are used because of the high amplification and low effective input capacitance. A single 6N7 tube is used for each of the succeeding stages, with the two triode sections in push-pull and the cathode grounded through a bias resistor with no cathode by-pass condenser.

The 2A3 tubes were selected for the fixed-bias power output stage because of their suitability
DON'T BE MISLED!

 Erecting a self-supporting vertical antenna on a rooftop is serious business. A cheap, flimsy product is a dangerous hazard to life and property. That's why ACE antennas reflect their design by competent structural engineers as well as skilled radio craftsmen, in their sturdy, attractive commercial appearance and excellent radiating qualities. Already scores in use by commercial interests and discriminating amateurs...you too, can experience the satisfaction of a sound and efficient radiator that requires less than a square foot of roof space.

Prices are far below what you would expect to pay for a product of this quality. Order direct.

THE VALPEY CRYSTALS

TYPE V8 — Mounted low drift crystal, holder molded from low loss material, plugs into tube socket. Within 5 Kc of frequency specified in the 1.7, 3.5 and 7 Mc. bands...$4.80

TYPE VM2 — Mounted X cut crystal, holder molded black Bakelite plugs into tube socket, within 5 Kc of frequency specified in the 1.7, 3.5 and 7 Mc. bands...$4.60

TYPE VC2 — X cut crystal, less mounting within 5 Kc of frequency specified in the 1.7, 3.5 and 7 Mc. bands...$1.90

TYPE VCH1 and VCH2 — Mounting less crystal. Machined from plano black Bakelite. Special pim for tube socket mounting or may be adjusted for G. R. jacks. VCH1 for 1.7 and 3.5 Mc. crystals...$1.00

VCH2 for 7 and 14 Mc. crystals...$1.00

Complete descriptions and illustrations in our new catalog free upon request

Valpey crystals may be purchased from your dealer or direct

THE VALPEY CRYSTALS, Box 321, Holliston, Mass.

THE GOOD NAME

of Ken-Rad stands for the highest type of material and workmanship in radio tubes. You will be delighted by the performance of dependable Ken-Rad Tubes in your radio. They will increase the enjoyment of your favorite programs.

Ken-Rad Radio Tubes
KEN-RAD TUBE & LAMP CORPORATION - OWENSBORO, KY.
Manufacturers of all types of radio tubes and Ken-Rad Electric Lamp Bulbs
GOOD RESULTS Demand 
Good Instruments!

Select a
TRIPLET
18 Styles

Round • Square
Fan or Twin Cases

4" Modemistic Square Instrument... A.C. and D.C. All Popular Ranges

Most Models Available With Front or Rear Illumination

Today's Most Modern Instruments... New methods and extremely accurate procedures are embodied in Triplette Instruments design. The first considerations are for dependable accuracy, simplicity, and the best application of the latest number of parts. Intimate care in every form is exercised throughout in Triplette's modern, fully air-conditioned plant under the supervision of engineers of long-standing instrument building experience. This unique instrument setup is available to you as a most reliable, complete organization where full confidence may be had in vailing such products to your needs.

ASK YOUR JOBBER OR WRITE FOR COMPLETE CATALOG
Section 2510

TRIPLET ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

College Standards Engineering Accredited Courses

HOME STUDY ON THE COLLEGE LEVEL

FASTEST WAY TO LEARN CODE

Easy, Fascinating — LEARN BY EAR to be a GOOD OP.

The New All Electric Master Teleplex Code Teaching Machine is exactly what thousands are looking for. No experience needed. Ideal for beginners — steps up WPM for ALL Ops. There is no guesswork with Master Teleplex, because it records your sending in visible dots and dashes. You SEE and HEAR exactly how you are making your signals. You learn code the way you'll be using it — by SOUND. Complete course included at no extra charge. Used by many schools for teaching code. Low cost, easy terms. MONEY BACK GUARANTEE. Send now for booklet Q-10, no obligation. Post card will do.

The "Ham" Special

We are the originators of this type instrument
TELEPLEX CO. 73-76 CORTLANDT ST. NEW YORK, N. Y.

for use as driver tubes for a Class-B modulator of appreciable power, and because of the fact that the tubes, with wide tolerance of load impedance, could be used with the Class-B driver transformer to plate modulate the 807 r.f. amplifier included in the r.f.-audio unit. With a maximum value of audio output exceeding 15 watts, and a maximum rated input power of approximately 40 watts for the 807 as modulated Class-C amplifier, the combination of 807 and 2A3 tubes makes an excellent 'phone transmitter of approximately 25 watts output.

Although a great amount of time and effort is involved in the construction of such units as described, the cost to the user is more than repaid in the operating satisfaction given by the flexibility and the assurance of proper operation of the completed assemblies.

Rotary Beam Antennas

(Continued from page 43)

Reducing the thickness of the sections marked "C" to 1" x 2", will not change any of the other measurements, or the size of the bolts required, if the members are set up on edge. This will cut the weight down materially, without reducing the strength enough to be noticed. Unless this is done, the units "A" and "C" weigh thirteen pounds, while all the rest of the assembly, along with the necessary bolts, only weighs sixteen pounds. Further reduction in the weight of the central section may be secured by using redwood or pine instead of the oak for the "C" members, as was used by W2AZ and W2DKJ.

It will be observed that we have suggested two 16-foot lengths of 1½" x 3" redwood. That is a standard-size finished board. The two lengths are run into a rip saw, to produce four lengths each 1½" x 1½" and two lengths which will measure 1½" x ½" (approximate measurements, depending on the thickness of the rip saw).

The square lengths are then cut into four lengths of 9 and four lengths of 7 feet, which are to be used for the sections "D" and "E." The remaining flat pieces can be cut after the rest of the assembly is completed. They are used for the transverse braces, "F." The few little pieces which remain are the only waste.

There are so many different ways in which the platform may be mounted and so many different methods for rotation have already been described that there is little point in discussing them here. It is thought that what we have already written, along with the pictures and drawings, is all that is necessary for duplicating this structure.

How Would You Do It?

(Continued from page 68)

eliminates a slight 'pinging' noticeable with some crystals. Incidentally, the relay must be of a type having low capacity between contacts. It should operate on low current; otherwise the relay circuit itself may be responsible for slight clicks in the immediate vicinity of the transmitter. With a low-current relay, a one-quarter-microfarad...
Handling traffic in crowded amateur bands demands expert operating, and fool-proof equipment. The "Super-Pro" receiver is designed for just such service. Many commercial and government communications systems, both foreign and domestic, employ "Super-Pro" receivers with absolute satisfaction. The wide acceptance of the "Super-Pro" among "professionals" is the result of thorough engineering. Every part of this outstanding receiver is an engineering accomplishment. The exclusive cam-operated knife switch — noiseless and trouble-free, a 12-gang band spread condenser, resulting in constant, uniform band spread, and variable band width control are all features found only in the "Super-Pro." The reason is that this is not an "assembled" job.

Write Dept. Q-10 for bulletin

HAMMARLUND MANUFACTURING CO., INC., 424-438 West 33rd Street, New York City
Canadian Office: 41 West Ave. No., Hamilton, Ont.

DO YOU WANT TO KNOW—
How to Become a Radio Amateur?

The purpose of this booklet is to tell you, as simply and straightforwardly as possible, what amateur radio is, how one can become an amateur, how to build a simple receiver and transmitter, and how to get on the air.

This NEW EDITION of HOW TO BECOME A RADIO AMATEUR contains more pages which means much more elaborate treatment of the subject. The receiver is a two-tube one and operates either on A.C. or from a battery supply. This receiver may be built for approximately $12.00. The transmitter described uses a 6L6 crystal oscillator with the power-supply and antenna-coupling unit on the same board, and will operate on any two bands with one crystal, and with proper crystals may be used on any band from 160 through 20 with an output of approximately 10 watts. This transmitter may be built for approximately $21.00. Information on the various antennas for the different bands is also given. A code-practice oscillator is also described and may be built for a cost of about $2.25.

Price 25c (NO STAMPS PLEASE)

AMERICAN RADIO RELAY LEAGUE  •  WEST HARTFORD, CONNECTICUT

Say You Saw It in QST — It Identifies You and Helps QST
WHEN WE SAY

'LIGHTNING'

We’re thinking of that funny stuff that comes zooping out of the skies, right through the QRM, lighting up everything in a flash!

AND WHEN WE SAY

LIGHTNING CALCULATORS

We mean that these gadgets bring an answer right through mathematical QRM just like that — in a clear flash!

Type A, $1.00 Type B, $1.00

For problems involving frequency, inductance and capacity, in design of radio frequency circuits. Direct reading answers for size of coils and condensers for any range between 400 kc. and 190 mc.

Type C, $.50 Type D, $.50

Gives decibel gain or loss when input and output voltages, currents or power are known.

Type E, $.50 Type F, $.50

Permits measurement of resistance, from 1 ohm to 1 megohm by use of a voltmeter. Makes an ohm-meter of your voltmeter.

Prices include postage from the
AMERICAN RADIO RELAY LEAGUE
West Hartford, Connecticut

condenser across the key contacts (not the relay contacts) removed all trouble from this source. Reports from all stations worked since this oscillator has been installed indicate that the signals are clean and sharp, free from clicks or thumps.” — W1AP.

In Fig. 4 is shown a blocked-grid keying system used by W3GME. This system requires a separate small power supply to provide the blocking biasing voltages.

“The system of break-in keying shown in Fig. 4 has been used successfully at W3GME for over a year with various tubes in all three stages. No keying chirp has ever been reported and complaints from b.c.l.’s have been nil. The taps on the voltage divider are adjusted for normal operation with the key closed; the operating bias for the final amplifier grid is thus provided by its grid leak only. When the key is opened, the bias voltage rises to the no-load value of the bias supply voltage—about 300 volts at W3GME. This voltage is sufficient to block effectively the entire r.f. section. A small resistor and condenser in series across the key eliminate any trace of clicks.” — W3GME.

MISCELLANEOUS HINTS

Wilfred Lowe, New Brunswick, N. J., finds that it helps to eliminate chirps if the oscillator loading is adjusted rather carefully. He uses a small variable coupling capacity between oscillator and the following stage.

Instead of insulating the cathode-circuit coil and condenser of the Tri-tet circuit shown in Fig. 1A, Elbert Benfer, Fort Sheridan, Ill., proposes the use of a 0.01-µfd. condenser between cathode and the tuned circuit and an r.f. choke and the key in series between cathode and ground, thus parallel-feeding the cathode and permitting grounding of the cathode circuit coil and condenser.

W3DSI relates an experience in which dirty key contacts were responsible for chirpy keying.

W2ESO reminds us of the importance of a good holder for the crystal.

W8QAN uses EO-1 cable for long keying leads. He states that it has been his experience that twisted lamp cord will not do if chirpless and high-speed keying are desired.

W1KFN uses a 6J5G triode oscillator with a
A directory of suppliers who carry in stock the products of these dependable manufacturers.

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUTLER, MISSOURI</td>
<td>211-215 N. Main Street Henry Radio Shop</td>
</tr>
<tr>
<td>CHICAGO, ILLINOIS</td>
<td>833 W. Jackson Blvd. Allied Radio Corp.</td>
</tr>
<tr>
<td>DETROIT, MICH.</td>
<td>171 E. Jefferson Ave. Radio Specialties Co.</td>
</tr>
<tr>
<td>DETROIT, MICHIGAN</td>
<td>11845 Woodward Ave. Radio Specialties Co.</td>
</tr>
<tr>
<td>KANSAS CITY, MO.</td>
<td>1012 McGee Street Burstein-Applebee Company</td>
</tr>
<tr>
<td>MINNEAPOLIS, MN.</td>
<td>1124-26 Harmon Place Lew Bonn Company</td>
</tr>
</tbody>
</table>

Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them.
When you do a bang-up job you want the panel instruments to measure right up to the rest of the outfit. At the same time you don't want to spend a fortune.

Right here is where Simpson comes in. It's no longer necessary to pay a premium for panel instruments with the finer bridge type construction and soft iron pole-pieces. The new Simpson Instruments give you these and other quality features at prices no higher than you have paid for the ordinary run of instruments. They are actually the only instruments in the world incorporating these features at low prices.

Write for Catalog No. 10

SIMPSON ELECTRIC CO., 5210 Kinzie St., Chicago

A typical Simpson value is illustrated here—a bridge-type instrument in a beautiful, modern 3"x3½" case with illuminated dial and built-in 6-V lamp at a net price to amateurs in most A.C. and D.C. ranges of only...

$4.65

Another big Simpson value is this 3" bridge type Milliammeter at...

only...

$4.15

Opportunity

TO PURCHASE AT BARGAIN PRICE

A long-established retail radio store. This sacrifice is made because our full time will be devoted exclusively to manufacturing.

GROSS RADIO, INC.
31 Vesey Street
New York City

SPECIAL TO AMATEURS
Piezo-Electric Crystals — $2.50 EACH POSTPAID

Until supply is exhausted ... we offer 80 meter band crystals unmounted; accurate calibration; excellent oscillators.

Limited quantity.

SCIENTIFIC RADIO SERVICE

"The Crystal Specialists Since 1925." University Park, Huntsville, Md.
HAM-ADS

(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in the art of the business.

(2) No display of any character will be accepted, nor can any advertisement be placed which contains all or part of a legal, political, or scientific letter which would be used to make any advertising appeal to the public.

(3) The rate for this advertisement is $1.50 per word, except as noted in paragraph (4).

(4) Remittance in full must accompany copy. No cash or contract discounts or agency commission will be allowed.

(5) This is the last day for advertisements in the second month preceding publication date.

Having made no investigation of the advertisers in the classified columns, the publishers of QST are unable to vouch for their integrity or the quality or character of the products advertised.


RADIO engineering, broadcasting, aviation and radio servicing, marine and Morse telegraphy taught thoroughly, above all fine shape. Make an offer. W8FEU, 35 W. Main St., Q8L'S, all colors. ..cartoons, snappy service. Write for free QSL'S. Best there is. Free samples, Maleco, 1805 St. Johna


TRADE: new 852 never in socket, also valuable Kennedy Type 11 on the block, all different. Only thirteen by twenty inches, and two stage amplifier.—For any standard make only, two amplifiers and sweep circuit and tube not less than three inches in diameter. Must be perfect condition. W8H1.


WANTED: high quality recording head and associated equipment. W1RKL, 1424 Castle Ave., Boston, Mass.

NC01DX complete—A+ condition—best offer. A. Nuzer, 605 Malone Pl., Harrison, N. J.

ATTRACTION imitation gold lettered call signs for your station. Write to Black's Specialty Shop, 105 Arnold Ave., W. Brookfield, N. Y.


BLILY crystals, patronise W8DED.

PATTERSON PRICE—$50, cash or trade for good reflex camera. W. P. Carter, Norco, La.


WANTED: complete outfit, rig and receiver. What have you? Hamcraft Co. for trade. Newly built Winchester Modul 12 pump gun and cash. W9MRJ.


FOR sale; 101 consecutive QST's to date; 31 Radio same as above—all fine shape. Make an offer. WSFEU, 35 W. Main St., Amsterdam, N. Y.

SELL modern 400 watt phone—o.w. transmitter complete. Two units, enclosed. Air demonstration. $355. W8ABE.

TELEGRAPHY, Instructographs, omnigrams bought, sold. Ryan's, Hampnbil, Mo.

QSL'S, Best there is. Free samples. Maleco, 1805 St. Johns Place, Brooklyn, N. Y.

COMPLETE station, W1DLD: 300 watt c.w.; bread-board transmitter; 8A6 oscillator; 47 doubler; 616G buffer; pair HTTPS, 30,000 watt, 5000 watt 6-15 volt, $8. 5000 watt 2000 volt power supplies; FB7X with preselector and power supply; coils for 20, 40, and 80; Baldwin earphones—$125, or will sell separately. Arthur L. Ballou Estate, Uxbridge, Mass.

SWAP: $75. guitar—want F7 or similar receiver. W2HXY, 200 Cleveland Ave., Norwood, Ohio.

QSL'S, custom built, Samples. WS8ZK, Newark, Ohio.

FEATURING popular brands transmitting tubes—write Loughman & Co., Desart, Ill.

REAL, your angle of radiation—dulling head rotary. Tele- scope, alumnum tubing, $500; complete worm antenna using variable speed motor, magnetic direction indicator. Continuous rotation. Save half on your beam, W8ML.


LISTEN for W9XA, high frequency broadcast station, 26,450 k.e. Kansas City.

UNASSEMBLED transmitter, QST Jan., 1935, tubes AT-cut crystal, power supply complete, 4 tubes U.R.F. receiver, monitor. Complete, $50. 20 consecutive QST's to date, perfect condition. If you are a constructor's note: first year's issue of Radio—state cash offer. W2EFP.

CRYSTALS: X-cut, 1750-2000, 3500-4000, five kilocycles, $1.60; spot frequency, $2.50. Three small, 80 meter blanks, including carbon button, $1.30. William Thom, W8EN, 3011 Moorewood St., Cincinnati, Ohio.

MODEL 159 Supreme multi-wave signal generator oscillator—Just off the new, and in all respects a marvel. X-cut and U.R.F. Telegraphy and Telephony, $2.50; Hawk's Electrical Guide. ten volumes, $5. W. Wakeman, Hancock, N. Y.

FOR sale: 112 watt 75 tone transmitter. W8JNY.

SELL: transmitter complete, fifty watter. $40. W8BSJ.

Fritz's QSL's—SWL's lead the field in workmanship. Samples. 435 Mason, Joliet, Ill.

Sacrifice Comet xtal Pro complete: Janette 110 c.e. to 110 a.c. converter 175 watts filter. Wein, Aris, 10 Bridge, N. Y. O.
RECEIVER headquarters. WSANT. TISED a.c. SW3. T'en_s_e-ts_c_o_il_s_. ~w=s-A_N_T _________ 

QUALITY parts, FBXA, preselector, power supply, speaker, phones, 3 sets coils. Miscellaneous station parts, tools, fittings, $300, or best offer. W9NCA.

WANTED: High impendence bone conduction hearing unit, transformer. Price and describe. W3EY.

RECEIVER headquarters. WSANT. TISED new parts. FBXA, preselector, power supply speaker, transformer. Price and describe. W3EYY.

PONES, 3 sets coils. Miscellaneous station parts, tools, fittings. SELL dismantled station. 300 watt fone, c.w. transmitter. $250, or best offer. W9NCA.

USED oscilloscope. W8ANT. --------------­

USED transmitting tubes. W3EY.

BRAND new in factory sealed cartons: Ultra-Skyriders, $59; PR-15s, $59; BX15 Sky-Challengers, $59; ACR-175s, $59; ACR-155s, $44.50; standard Mac-Bugs, $5.50, W9ARA.

LEARN CODE RIGHT

INSTRUCTOGRAPH tapes send you typical messages, Radio or Morse, any speed. Easy, practical way to improve, Senior Model with 10 tapes and Book of Instructions $20.50. Rented at $1.00 first month, $1.00 additional month $25 per month more with transformer and tube socket (oscillator unit). With key and head phones another $25 per month. $100 deposit or satisfactory references required.

Junior Model, with 5 tapes and Book of Instructions $12.00 (not rented). Complete after 12 lessons, equipped with 1 1/2 amp. battery $4.00. Write for details today.

INSTRUCTOGRAPH COMPANY
Dept. Q-10, 912 Lakeside Place, Chicago, Illinois
Representatives for Canada:
Radio College of Canada, 863 Bay Street, Toronto

GO ON THE AIR with the NEW SHURE ROCKET

Enjoy the performance and beauty of this new deluxe communications-type crystal microphone. The ROCKET brings you ultra-modern streamlined design and the world-famous Shure "high-efficiency" speech characteristic. Doubles power on important intelligibility speech frequencies — gives clear, crisp speech that cuts through noise and static. Tiling head finished in rich Satin Chrome. Equipped with new built-in Cable Connector. Desk Mount in iridescent gray.

Ask Your Jobber or Write for New Catalog 150Q

Model 706S. "ROCKET" (as illustrated), complete with Desk Stand and 7 ft. cable with plug attached. List price...........$78.50

Model 706SH. Same, without desk stand. List Price...........$25

Model 705W. "Super-Level" Communications Crystal Microphone, complete with desk stand and 7 ft. cable with plug attached. List Price...........$25

Shure patents pending. Licensed under patents of the Brush Development Company

SHURE MICROPHONES & CABLES

Seven New Models!

NEW SHURE S-50 MICROPHONE

A professionally designed communications microphone for the operator who demands the best. Miller microphone for those who demand the utmost in voice reproduction. The NEW SHURE S-50 microphone is the result of years of research and development by Shure Brothers, Inc., Chicago, Illinois. It is a microphone which will give the operator the utmost in sound reproduction. It is equipped with a special Built-In Transformer which will give you the utmost in flexibility. The NEW SHURE S-50 microphone is available in a complete line of colors. It can be ordered with a variety of types of heads, including the popular "Super-Level" Communications Crystal Microphone. Write for details today.

LEARN RADIO TELEVISION

500 Licensed graduates placed in past 7 years in shipping, broadcasting, aviation, police, etc. We also teach radio servicing and repairing; new term Sept. 15th, Nov. 7th day or eve., 52-page catalog free, oldest, largest and best equipped.

MASS. RADIO SCHOOL
18 Boylston Street, Boston

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

RCA INSTITUTES, INC. Dept. ST-38
A Radio Corporation of America Service

75 Varick St., New York 1154 Merchandise Mart, Chicago
Your Nearest Dealer Is Your Best Friend

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

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

KANSAS CITY, MISSOURI
Radiolab
1515 Grand Avenue
Amateur Headquarters in Kansas City

MILWAUKEE, WISCONSIN
Radio Parts Company, Inc.
538 West State Street
Complete stock Nationally Known products

MINNEAPOLIS, MINNESOTA
Lew Bonn Co.
1124-26 Harmon Place
W9SP—W9TLE—W9HOP—W9DKL—W9LEX

OAKLAND, CALIFORNIA
Offenbach Electric Company
2085 Broadway
"The House of a Million Radio Parts"

SAN FRANCISCO, CALIFORNIA
Offenbach Electric Company, Ltd.
1452 Market Street
"The House of a Million Radio Parts"

SEATTLE, WASHINGTON
Northern Radio Company
2208 Fourth Avenue
W7AWP and W7CR to serve you

ST. LOUIS, MISSOURI
Van Sickle Radio Company
1113 Pine Street
W90WD invites you to amateur headquarters in St. Louis

TORONTO, CANADA
A & A Radio Service Supply
101 Queen Street, West
Canada's foremost radio supply house

TORONTO, ONTARIO, CANADA
Wholesale Radio Company, Ltd.
1133-37 Bay Street
Canada's Largest Radio Parts Distributors — VE-3X8

WINNIPEG, CANADA
Electrical Supplies, Ltd.
305-10 Ross Avenue
Western Canadian Amateur Headquarters for leading lines
You Are Protected When You Buy From QST Advertisers

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

Quoted from QST's advertising rate card.

Every conceivable need of a radio amateur can be supplied by the advertisers in QST. And you will know the product has the approval of the League's technical staff.
introducing...

RME's NEW 70 Series
(Companion to the RME-69 Models)

WITH THESE STANDARD FEATURES:

1. New and Larger Illuminated Indicating Meter
2. New Iron Core I F Transformer
3. Automatic Noise Suppressor
4. Break-in Relay Control Circuit
5. Improved Audio Characteristics
6. One-stage Radio Frequency Amplification
7. Total Complement, 10 Tubes
8. Streamlined Design
9. Crystal Filter Circuit Standard
10. The same sturdy construction, same fidelity to detail in engineering, same high quality workmanship, that have always been characteristic of RME products.

LOWER IN COST
Circular gladly sent on request

RADIO MFG. ENGINEERS
111 Harrison Street, Peoria, Illinois
The new improved UTC PA amplifier and modulator kits incorporate every advanced circuit feature desirable for PA and amateur work.

**TECHNICAL CHARACTERISTICS**

**P-1A**
- PA kit, self bias, 30 watts output, audio and power units on separate chassis for rack or cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120 DB), two low gain (80 DB), VARI-MATCH equalizer and compression controls. Output impedances for line and voice coil as specified.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$87.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$52.50</td>
</tr>
</tbody>
</table>

**P-1M**
- Modulator amplifier kit, same as above, but for modulation purposes. VARI-MATCH output has the following impedances: 200, 400, 1100, 2500, 2800, 4000, 4500, 7000, 9000, 12,000 ohms.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$87.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$52.50</td>
</tr>
</tbody>
</table>

**P-2A**
- PA kit, fixed bias, 50 watts output, audio and power units on separate chassis for rack and cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120 DB), two low gain (80 DB). VARI-MATCH equalizer and compression controls. Output for line or voice coils, as specified.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$97.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$58.50</td>
</tr>
</tbody>
</table>

**P-2M**
- Modulator kit, same as above, but has VARI-MATCH output having impedances of 400, 600, 2000, 4000, 5500, 8000, 9000, 12,000, 13,000, 14,400, 2400, 3700, 4500, 6000, 8000, 9000, 11,000, 12,000 ohms.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$97.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$58.50</td>
</tr>
</tbody>
</table>

**P-3A**
- PA kit, fixed bias, 100 watts output. Audio and power units on separate chassis for rack or cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120 DB), two low gain (80 DB). VARI-MATCH equalizer and compression controls. Line and voice coil output.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$142.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$85.00</td>
</tr>
</tbody>
</table>

**P-3M**
- Same as P-3A, but has VARI-MATCH output having impedances of 270, 500, 1440, 2700, 3700, 5900, 8000, 9000, 11,000, 12,000 ohms.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$142.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$85.00</td>
</tr>
</tbody>
</table>

**P-4A**
- PA kit, fixed bias, 10 watt output. Audio and power units on separate chassis for rack or cabinet mounting. Four jack, dual channel, high impedance input, two high gain (120 DB), two low gain (80 DB). VARI-MATCH output transformers employed in kits for PA, modulator and driver service.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$52.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$37.50</td>
</tr>
</tbody>
</table>

**P-4M**
- Modulator kit, same as P-4A, but with VARI-MATCH output having impedances of 270, 500, 1440, 2700, 3700, 5900, 8000, 9000, 11,000, 12,000 ohms.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$52.50</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$37.50</td>
</tr>
</tbody>
</table>

**P-5A**
- PA kit, fixed bias, 15 watts output. One chassis. Four jack, dual channel, high impedance input, two high gain (120 DB), two low gain (80 DB). VARI-MATCH output transformers employed in kits for PA, modulator and driver service.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$65.00</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$39.00</td>
</tr>
</tbody>
</table>

**P-5M**
- Modulator kit, same as P-5A, but with VARI-MATCH output having impedances of 270, 500, 1440, 2700, 3700, 5900, 8000, 9000, 11,000, 12,000 ohms.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$65.00</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$39.00</td>
</tr>
</tbody>
</table>

**P-7A**
- AC operated pre-amplifier kit designed especially for amateur and PA service. Very efficient filtering assures freedom from hum. Has a gain of 70 DB, and a two channel high frequency, high level mix with jack input for each channel. Output impedances are 50, 200, and 500 ohms.

<table>
<thead>
<tr>
<th>Component</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>List price</td>
<td>$30.00</td>
</tr>
<tr>
<td>Your net cost</td>
<td>$18.00</td>
</tr>
</tbody>
</table>

**P-7M**
- Tube kit required for the P-7A: two 6J7, one 6W7, one 6G5, one 6C5, one 6B6, one 58, one 6X5.
National Transmitting Equipment is ideally suited to the requirements of the amateur. It is moderate in cost, high in performance, and handsome in appearance. But more than this, it also has the versatility that makes ownership a long-term investment. The Foundation Units make it easy to build to specialized requirements, and to adapt to most changing needs. The NTC Universal Coax and Switch Assembly is one self-contained unit offering all the most difficult construction problems in one unit to building a transceiver. With National Equipment, the amateur is constructing a fine transceiver unparalleled only by its economy.
THE RCA 1852 and 1853 were designed primarily for use in the picture channel amplifier circuit of experimental television receivers. But because of their high mutual conductance many amateurs have found these tubes excellent for use as r-f or i-f amplifiers in communications receivers. The high value of mutual conductance results in surprisingly high gain, provides superb signal-to-noise ratio.

At 60 megacycles, the 1852 gives you about three times as much gain as do conventional r-f amplifier tubes. The 1853 has remote cut-off characteristics which permit the handling of a larger range of signals.

Both tubes make fine oscillators for low-voltage applications and both have grid connections at tube base. This construction eliminates grid cap and is important at high frequencies because it provides decreased feed-back and improves circuit stability. Price, only $1.85 apiece. Further details are available on request.

These types are available at your nearest RCA Distributor

RCA presents the "Magic Key" every Sunday, 2 to 5 P. M., E. S. T. on the NBC Blue Network.

<table>
<thead>
<tr>
<th>SPECIFICATIONS</th>
<th>1852</th>
<th>1853</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Volts</td>
<td>6.3</td>
<td>6.3</td>
</tr>
<tr>
<td>Plate Volts (max.)</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Plate Res. (megohm)</td>
<td>0.75</td>
<td>0.7</td>
</tr>
<tr>
<td>Mut. Cond. (micromhos)</td>
<td>9000</td>
<td>5000</td>
</tr>
<tr>
<td>Capacitances (µµF): Grid to plate (max.)</td>
<td>0.015</td>
<td>0.015</td>
</tr>
<tr>
<td>Input</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Output</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
In the three pages that follow you will find a brief outline of National’s Transmitting Equipment for amateur use.

All of the gear described is versatile as well as efficient. The NTX-30 (shown for the first time) is a complete low-power transmitter in itself, yet it provides an ideal multi-band exciter and buffer for driving a larger final whenever you want more power. The foundation units take the “blacksmithing” out of construction. With them it is easy to make a commercial-looking job, custom built to your own requirements. The NTE multi-band exciter and speech amplifier includes in one unit all of the really difficult elements of the transmitter. With the NTE as the basic unit the rest of the job is fun.

All down the line, from condensers to crystal holders, National Equipment is designed to meet your problems squarely — and built to serve you long and well.
**NATIONAL NTE EXCITER—SPEECH AMPLIFIER**

The National NTE Exciter and Speech Amplifier is the ideal answer to transmitter control at the operating position. It includes a versatile multi-band exciter unit with a choice of frequencies in each band, and a high-gain speech amplifier. The exciter can be used with either a conventional single crystal, a National "Vari-gap" variable frequency holder, or a National four-crystal multiple holder. The crystal oscillator is followed by three frequency-multiplier stages using 6L6's, with an RF output of at least 5 actual watts on each band. The crystals can be controlled from the front panel, and the same is true of the frequency multiplier stages which are selected by a convenient interlocking push switch of special low-loss design. The four stage speech amplifier delivers 10 watts output from PP 2A3's with an input of .005 Volts. The NTE is supplied either for relay rack mounting, or in a cabinet as illustrated in the group on the preceding page (on the table at the extreme right). Type NTE-A is for 5, 10, 20, and 75 meters; the NTE-B for 10, 20, 40, and 75 meters. The latter is also available without the speech amplifier.

**NATIONAL FOUNDATION UNITS**

The National Foundation Units consist of panels and chassis completely finished and ready for assembly, together with the necessary special parts and hardware. They form the basis of the 600 watt transmitter assembly shown at the left. This is so thoroughly engineered that even the newcomer can proceed with confidence, yet the units are so flexible that they allow the constructor almost complete freedom in building to suit his own particular requirements. In the rack at the left, the lowest unit is a high-voltage power supply delivering 300 ma at 2000 volts for the final. Above it is a 1250 volt supply for the buffer and modulator. The Class B modulator itself is third from the bottom. Standard Thordarson CHT units are used in the power supplies and modulator. Fourth from the bottom is the NTE Exciter described above. The top unit is the buffer (35T) and final (PP 100TH's). Above the final is a blank 5 1/4” rack, suitable for an antenna matching system. More complete information is given in the National "600-watt Transmitter" Booklet and in the National Catalogue, both available from your dealer.
NATIONAL NTX-30 TRANSMITTER

The NTX-30 is an exceedingly compact and convenient transmitter for CW or Phone, having an output of 30 watts on 10, 20, 40 and 80 meters. It employs the same exciter system used so successfully in the NTE, and like the NTE features a special interlocking push switch in the exciter circuits. In the output stage, a plug-in coil is used, similar to the Type AR coils described on the following page. Four 6L6's are used as crystal oscillator and doublers, and two 6L6G's are used in the final.

The unit is a self-contained transmitter for CW operation. For phone an external speech amplifier must be used. The NSA described below is ideal for this purpose. Terminals are provided at the rear of the NTX-30 for connecting the amplifier.

Structurally, the NTX-30 consists of an NTE Exciter with a final stage substituted for the speech amplifier. All of the features of the NTE are retained, including panel control of crystal frequency, interlocking push switch, meter for circuit adjustments, etc. The NTX-30 thus has the advantages of a proven design in its most important circuits, and is ideally suited for use as an exciter-buffer combination whenever higher power is desired.

NATIONAL NSA SPEECH AMPLIFIER

The National NSA Speech Amplifier has two input channels with electronic mixing. One input circuit provides an overall gain of 125 db, and is suitable for crystal microphones, etc. The other input circuit has one less amplifier stage and is intended for high level sources such as phonograph pickups, etc. The frequency characteristic is flat within less than 1 db from 25 to 10,000 cycles. A separate rectifier supplies bias voltage for the push-pull 2A3’s, which deliver 15 watts output. A tone control is provided.
NATIONAL OSCILLOSCOPES

Cathode Ray Oscilloscopes are available in two models. The Type CRR, illustrated at the left, is mounted on a standard 3½" relay rack panel and employs an RCA-902 (with 2-inch screen) and an 80 rectifier. Type CRM is mounted in a small steel box (shown on the front cover of this folder, between the NC-101 X Receiver and the NTE Exciter). Type CRM uses a 1-inch RCA 913, with 80 rectifier. On either model, a panel switch permits use of either the built-in 60 cycle sweep or an external sweep.

NATIONAL COILS

National offers a complete line of coils, coil forms and coil mountings for amateur use. Air spaced coils such as illustrated at the left with plug-in mount. Ceramic coil forms, such as the one plugged in on the condenser below, or the one in the final at the top of the rack inside this folder. Small low-loss forms, for receivers, monitors and exciters. Chokes, special purpose coils. . . . You will find what you need in the National Catalogue.

NATIONAL CONDENSERS

For finals, buffers or exciters, for receivers or monitors, for padding or trimming, for neutralizing, for high precision. . . . National has a type for every purpose. The TMC Condenser at the left is typical of their clean design and their low loss construction. The way the plug-in coil mounts directly on the tie-bars is typical, too, of their convenience in practical circuits. Look them over at your dealer's.

OTHER PARTS BY NATIONAL

National makes a COMPLETE line. Receivers, crystal holders, low loss sockets. Dials. Racks, cabinets and chassis. Power supplies, insulators, couplings. And so on. . . . At the left, a blank 5¼" relay rack panel (for instance) such as might be used with the coil and condenser above to form an antenna matching system for the 600-watt transmitter illustrated inside this folder.