devoted entirely to

amateur radio

In this Issue—

Further Advances in Transmitter Design
The 30FXR Transmitter is now offered to amateurs who would purchase the 30FXC but who wish to reduce their initial investment. The radio frequency section, modulator, meter panel, control panel and cabinet are identical in both sets. The power supply is also identical with the exception that a smaller plate transformer is used reducing the output power rating to 100 watts. The "L" section antenna matching network is omitted but arrangements are made so that a matched transmission line may be used without a network. The 'FXR Transmitter can at any time be converted into a standard 'FXC. The performance of the 'FXR Transmitter is identical to that of the 'FXC except for the reduced output. It will find extensive application where all the facilities of the more complete model are not needed.

30FXC USERS SAY: "THE MOST OUTSTANDING TRANSMITTER MADE"
ANNOUNCING the WINNERS of the HALLICRAFTERS' MILEAGE MARATHON

After careful checking of the hundreds of logs submitted by the entrants in the HALLICRAFTERS' MILEAGE MARATHON, the judges have finally determined the winners. It has been a tremendous task that has taken far more time than originally anticipated but here they are.

**First Prize — $200**
WILLIAM HALL, Widener, Ark.
"Total Mileage — 6,111,550"

**Second Prize — $100**
I. G. CAMPBELL, 196 Van Houten Avenue, Passaic, N. J.
"Total Mileage — 4,129,380"

**Third Prize — SUPER SKYRIDER**
HUGH MACPHERSON, 95 Devett Road, Rochester, N. Y.
"Total Mileage — 3,534,955"

**Fourth Prize — SUPER SEVEN**
JOHN E. ROBERTS, 4221 Winchester St., Atlantic City, N. J.
"Total Mileage — 3,334,741"

**Fifth Prize — $10**
"Total Mileage — 3,001,650"

**Sixth Prize — $10**
GEORGE McQUISTON, 717 Olin Ave., Indianapolis, Ind.
"Total Mileage — 2,682,490"

**Seventh Prize — $10**
CHAS. W. ROGERS, 155 Main St., Manasquan, N. J.
"Total Mileage — 2,684,020"

**Eighth Prize — $5**
CLYDE CHAMBERS, 519 Foyette St., Washington, Pa.
"Total Mileage — 2,669,916"

**Ninth Prize — $5**
DAVID F. DANSER, 702 Eldridge Ave., W. Collingswood, N. J.
"Total Mileage — 2,624,530"

**Tenth Prize — $5**
"Total Mileage — 2,533,915"

**Eleventh Prize — $5**
VANE A. JONES, 1105 West 31st St., Indianapolis, Ind.
"Total Mileage — 2,425,670"

**Twelfth Prize — $5**
EARL R. ROBERTS, 2308 Roosevelt Ave., Indianapolis, Ind.
"Total Mileage — 2,276,840"

**Thirteenth Prize — $5**
WALLACE H. TRAVERS, JR., 64 Essex Ave., Glen Ridge, N. J.
"Total Mileage — 2,019,945"

To the Winners—congratulations, and our thanks to all who entered to make this contest the success it has been.

Sincerely,

W. J. HALLIGAN, President
THE HALLICRAFTERS

Say You Saw It in QST — It Identifies You and Helps QST
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MARINE RADIO COMPANY
60 Lispenard Street, New York City

Note: During the summer months of July and August offices and factory will be closed on Saturday.
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IN the nation's leading research laboratories, on the air fields, in "ham" shacks, on scientific expeditions, in naval and war departments, coast-to-coast broadcast systems, foreign commercial and government services — everywhere — where the most exacting equipment must be used, Hammarlund "Super Pros" have been unanimously approved and promptly installed! "Super Pros" receive such decided acclamation, for they have every grand, important feature demanded by experts — truly the "ideal receiver." One such feature is the electrostatically shielded input. Then there is that uncanny, exclusive Hammarlund five-band switch, remarkably positive and smooth in action. The unique variable selectivity system affords continuous variation from 1/3 to over 3 times critical coupling. Another feature is the special 12-gang band spread condenser. That cleverly designed "Super-Pro" crystal unit permits selectivity from a knife-like point for C.W. to a wider degree for practical phone reception. And there are dozens of other outstanding features winning new admiration every moment. The "Super-Pro" reaches new performance standards that you've always wanted! The complete story of this "ideal instrument" appears in a profusely illustrated bulletin. Write for your copy today!

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<td>All appointments in the League's field organization are made by the proper S.C.M., elected by members in each Section listed. Mail your S.C.M. (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 get your QST at the newsstands; he wants a report from every active ham. If interested and qualified for O.R.S., O.P.S. or other appointments he can tell you about them, too.</td>
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THE AMERICAN RADIO RELAY LEAGUE, INC., is a non-commercial association of radio amateurs, bonded for the promotion of interest in amateur radio communication and experimentation, for the relaying of messages by radio, for the advancement of the radio art and of the public welfare, for the representation of the radio amateur in legislative matters, and for the maintenance of fraternalism and a high standard of conduct.

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

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

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

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1010 Shoreham Building, Washington, D. C.

Address all general correspondence to the executive headquarters at West Hartford, Connecticut
LADIESZ and gentnen, permit us—the President and the Vice-President of the American Radio Relay League! In the haste to button up last month's QST after the Board meeting, there was time only to mention the names of the distinguished amateurs who have become our new officers. Although they are both well-known figures in the amateur world, a more extended introduction is now in order.

Dr. Eugene C. Woodruff, A.R.R.L.’s second president, is the head of the Departments of Electric Railways and Radio, senior classes, at Pennsylvania State College, located in the city of State College in that state; he also teaches general electrical engineering to a junior class. He started life in St. Clair, Michigan, April 8, 1871, and received most of his schooling at Ann Arbor, graduating from the University of Michigan there with the degree of B.Sc. in general science in 1894. His master’s degree in chemistry, physics and music was received in 1896, to be followed in 1900 by a Ph.D. in physics, mathematics and chemistry. Entering then upon a life of teaching, he has taught practically every scientific subject at schools and colleges in various locations, including—in addition to State College—Bozeman, Mont., Decatur, Ill., and Chicago. He has been much interested all his life in athletics and has coached in football, baseball, track and basketball at various places where he taught.

He has of course left his mark in the scientific world. He is a fellow of the American Association for the Advancement of Science and a member of the American Institute of Electrical Engineers and of the Institute of Radio Engineers. He is also a member of Sigma Xi, Phi Kappa Phi and Sigma Tau, and was a 1935 medalist for Pi Eta Sigma for scientific attainment. He is the inventor of a system of automatic controllers for railway motors and industrial motors of considerable importance. Although the device has not been marketed, it served as the subject for several years of senior research, which was more important!
In a life devoted to investigation and ingenious experimentation, the doctor has been a pioneer in several fields. He has been an enthusiastic photographer since 1899. He began automobiling in 1908 and has since owned twenty-three cars and driven across the continent twenty-five times. His blue Duesenberg, with the call WS9MP on the trunk, has been seen in almost every state of the Union. There is an art side also, for Dr. Woodruff is an accomplished musician, having graduated from the University School of Music at Ann Arbor in 1896. His particular interest is the pipe organ and he was organist in various churches for about twenty-five years.

He started radio in 1897, at the very beginnings of this art. He is in consequence one of the real radio pioneers, the entire development of radio being encompassed within his scientific career. WS9MP has always been an active station. More than that, it is a laboratory, for it is at his home station that Dr. Woodruff conducts his senior class in radio. He is an indefatigable constructor of new and interesting apparatus. Combining this with photography, the methodical habit of making up notebooks of experiments and results, and a lifetime's teaching and lecturing ability, Dr. Woodruff has been much in demand as a speaker at amateur conventions. Lending the aforesaid Duesenberg to these purposes, he has been a convention speaker in almost every A.R.R.L. division. It is probable that no one outside the A.R.R.L. headquarters staff has attended so many ham gatherings, where "Doc Woodruff and his bag o' tricks" have been the highlight of many a program. Elected to the A.R.R.L. Board in 1925, he is the dean of the directors and an able chairman. An ardent amateur himself, he has an intact philosophy on the value of amateur radio in American life, some of which our readers have no doubt glimpsed in the utterances of the Cairo Committee.

George W. Bailey, fifth man to serve A.R.R.L. as vice-president, is a New Englander all the way back. Born May 14, 1887, he graduated from Adams Academy at Quincy, Mass., and from Harvard in 1907. He is the treasurer of his Harvard class. A practical business man, he has spent fifteen years in shoe manufacturing and fourteen years in the manufacturing and selling of rubber flooring. His business connections are the Stedman Rubber Flooring Company and the Bailey Rubber Tile Company, of which latter he is president. In Honolulu in 1913 he married Alice Cooper, distinguished authoress. They have three children, a married daughter, a son who enters Harvard this coming autumn, and a boy of nine who is a real ham already.

George Bailey is a big fellow who radiates good fellowship. He has had an amazingly active career as an amateur. A member of A.R.R.L. for about ten years, he has served the New England Division as its director the past five. He was president of the Eastern Massachusetts Amateur Radio Association for seven years, is a regular member of three New England ham clubs, an honorary member in five others, and an honorary life member of the Chair Warmers Club.

The League's vice-president is a real practising amateur. He holds a W.A.C. certificate, having worked seventy-four countries with a pair of 210's. He has an A.R.R.L. public service certificate for his work in the Viking disaster. He is a member of the A-1 Operator Club, holds A.R.R.L. appointments as O.R.S., O.O., O.B.S., and was formerly R.M. for Eastern Massachusetts. He has kept a schedule at 6:30 A.M. daily for six years with the amateur station of the Grenfell Mission in Labrador and is assistant secretary of the International Grenfell Association. His accomplishments in emergencies have made front-page news and brought letters of commendation from authorities. He is a real ham if there ever was one!

THERE is a third personality about whom we would like to say a few words this month. Arthur A. Hebert, treasurer of the League, has just been released by the Board of Directors from field work, at his own request, after having served the Board in that respect for twelve years. He carries on, of course, in the West Hartford office but will now be able to take things a bit easier after rather strenuous service, while some of the younger fellows in the headquarters gang rotate amongst themselves the business of visiting clubs and conventions.

Some of the statistics on Hebert's travels may be of interest. He covered over 157,000 miles, attended 99 divisional conventions and 189 special meetings, made talks before a total of 35,438 people. A.R.R.L. expended $10,761 sending him on this missionary work. His longest trip was in 1924 when on one journey he covered 23,559 miles, visiting 14 conventions and 34 special meetings.

He is perhaps America's best-known amateur as the result of these travels and in turn himself knows hundreds of hams. In his journeys he has made countless personal friends, and many friends for the League as well. His travels have been a symbol of the fraternal side of amateur radio.

K. B. W.

Strays

W9OKZ, investigating a complaint of ham interference from a BCL, found that said BCL had thrown away all the tube shields because the instruction book with the set said that "cartons on tubes were for shipping purposes only and should be removed." Which is even worse than the BCL, who tightened all the trimmers on his new set because he thought the screws were loose!
MAY 9, 1936, will stick in the minds of many hams for years to come. It is the date of what has been dubbed "The Great Five-Meter Panic." On that night, the band undid the string on its bag of tricks and shot the whole works. Forgetting that it was supposed to limit signals to their immediate neighborhood, the band carried East Coast signals to the Middle West and dumped them down there with an unholy wallop. And, playing no favorites, it carried the Western signals to the East with just as much of a whack. What a night!!

Almost a year ago (May 26th, 29th and June 22nd) five meters gave us the first real showing of its possibilities when a handful of stations exchanged signals between the East Coast and the Chicago area. Many people still doubt that genuine DX signals were heard and worked at that time but we have long since established that they really were. The session of May 9th now proves very conclusively that five meters can and does do things like that and, what is more, that it is becoming more adept at the business. Our tip, based on nothing more than a chat with some of the scientific people who spend their days observing Kennelly-Heaviside layers and such, is that the lower ultra-high frequencies are just giving us a few hints of what is coming. Maybe, before we are much older, five will be doing what ten has done. Anyway, OM's, five is worth watching.

This May 9th affair seems to have started up at approximately 8:30 p.m.—a strange time for the ionosphere to get geared up for very high frequencies. Operators out in the middle of the country, peacefully chewing fat with their near neighbors, were then startled to find the band crowded up with W1's, 2's and 3's. And the peaceful fat-chewing Easterners, no less startled, found their private band choked up with W9's. Then the real fun started. In the three hours that followed, a widespread group of ultra-high-frequency workers soaked up the sort of thrill that they will be telling their grandchildren about in the dim years to come.

Unfortunately, as it happens, many of the participants have apparently been so busy telling their own children about it that they have not had time to report in to Ye Olde A.R.R.L. Hence we are only able to present a few authentic details abstracted from logs. We have had to depend on grapevine telegraphs for the general picture of the "panic."

For the benefit of future historians and as proof that May 9th was not a big spoof night, we include the following outline of work reported:

**Columbus, Ohio**

H. R. Young, W8LEN, between 8:30 and 9:45 p.m. E.S.T. heard W1CEE, W1HQE, W1CMF?, W1ABR?, W1BKE and a host of others signing too rapidly to be logged. P. S. Kaparaff, W8QUP of the same city also logged a group of W1's.

**Des Plaines, Ill.**

G. E. Hart, W9LBP, between 9:10 and 11:00 p.m. E.S.T. worked W3FJW, W3NU and W3CTQ before his mike battery went dead. He heard W1CE, W3EUY, W3FMU, W3EP and W2HWC. His antenna is a directive affair; the transmitter a pair of 59's and the receiver a two-tube superregen. Severe selective fading was noticed, with part of the signal dropping out and the rest remaining.

**Niles Center, Ill.**

James E. Dickert, W9PEI, worked W3GAH, W1DVO, W2AMJ, W2BR0, and heard W3HG, W21IN, W3KW, W3BO, W3AYG, W1ZE, W1EEER, and W1HRZ. A pair of 45's was used in the transmitter with a super for reception. He also reported that W9UAQ, LBP, AI, SQE and LW1 grabbed off some of the DX for themselves.

**Kansas City, Mo.**

George K. Shirling, W9AHZ, who hears 7- to 8-meter DX police signals quite frequently logged on this occasion W2AMJ, W3EUY and heard a host of others operating too snappily to be identified.

**Chicago, Ill.**

George R. Svoboda, W9UOV, as late as 11:45 p.m. E.S.T. worked W3AMW, W3AYG and heard W3FHJ, W3NU, W3EPN, W2CLB, W2HWC, W1ZE, W1HHN, W1HRZ, W1EEER. He reports that many of the signals were R7 to 9. His transmitter—15 watts input.

**Park Ridge, Ill.**

A. H. KnodeH, W9TLQ, worked W1EYM. He heard W3EO, W3EHU, W2AMJ, W1JLK, W1D5V, W2JCY, W2HEJ, W3FJW, W2GKD, W2VE, W2CLD, W1IYX, W3NU, W2INJ and W1ZE. He reported extremely rapid fading at times with frequent examples of selective fading.

**Portland, Conn.**

Rev. Hollis M. French, W1JLK, poked his signals into Chicago but failed to make a contact.

(Continued on page 84)
Simplifying the Push-Pull-Push Crystal Oscillator

An Effective Single-Stage Transmitter Working Two Bands With One Crystal

By J. Stanley Brown, W3EHE

TX OM for ur FB report—rig here is two 802's and 1 xtal push pull grids and doubling output—input abt 50 watts."

And thereby hangs a tale: There is an experimental transmitter here that consists of just the above-mentioned equipment and one 600-volt power supply. It produces 30 to 40 watts of measured output on each of two bands with either 160- or 80-meter crystal, and about 25 watts on 40 and 20 with a 40-meter crystal. Fifty watts can be obtained if you wish to run your 802's at 700 volts (RCA did not suggest this voltage). This circuit has been successfully suppressor-grid modulated as a 10-watt 'phone, on 160 and 80 meters. It has worked all U. S. districts on 40-meter code and, since means were recently found to get some output from a 40-meter crystal, it has been stepping out nicely on 20 meters. All reports have been T9X and R6 to 8 which, considering that no real DX has ever been worked from this station, is rather unusual performance. The old final with a pair of 10's taking 150 watts or so has been removed from the rack to make room for this versatile little rig.

The material to follow is an elaboration and refinement of that presented in May 1935 QST 1 to which article the reader is referred, plus numerous tests and experiments conducted here since that date. Probably 50 or more push-pull crystal and electron-coupled oscillator circuits for both fundamental and second-harmonic output have been set up and evaluated. The findings are of quite some interest and so numerous that the whole subject is best dealt with in two articles. This work is far from complete, but it is hoped that it will inspire brother hams to take up the idea and do something with it.

A SIMPLE TRANSMITTER

The fundamental circuit arrangements are shown schematically in Fig. 1. The diagram of the actual transmitter in use at W3EHE is given in Fig. 2. Circuit constants except as marked in Fig. 2 are not at all critical. Analysis of the circuit will bring out the fact that the screens and suppressors are tied together and serve as the plates for a push-pull triode oscillator. In the same glass bulbs we have all the elements of a push-pull or push-push tetrode amplifier. Notice that we do not mention these tetrodes as harmonic amplifiers because they are not being used as such. They operate much as a following r.f. amplifier would except that electron coupling is used instead of capacitances or links. It should be mentioned at this point that if output at the crystal fundamental is desired, $C_1 L_1$ may be shorted out and some feed-back provided between the plates and control grids in the form of 3-muFd. (max.) variable condensers good for six or seven hundred volts. The circuit will then operate as any push-pull screen-grid oscillator would.

Normal operation is with output at twice crystal frequency, under which condition there is no interlocking of the two tuned circuits. This doubling operation requires that the plates be connected in parallel. Many people believe that this is just another way of tuning to the second harmonic and therefore bound to be less efficient.

than fundamental operation. This is not the case, for under high bias conditions it is theoretically possible to get just as much plate efficiency with a push-push connection as with push-pull; assuming, of course, the same output frequency. Results here, for instance, have been in one case 40 watts of 80-meter output from an 80-meter crystal, and over 35 watts of 40-meter output at the crystal frequency. The tank, because of its fly-wheel effect, iron out any inequalities of impulse excitation and produces a practically pure sine wave.

Now, if we connect the plate tank push-push, both plates are in parallel and the two plate-current pulses occur alternately but in the same phase. Inasmuch as nothing in the driver has been from the same crystal with approximately identical bias and loading of tubes. Plate efficiency of 75% has been obtained while doubling.

Fig. 3 is analogous to the respective operation of push-pull and push-push amplifiers. Perhaps a word or two can explain the statement that for a given bias, it is theoretically possible for them to be equally efficient: Fig. 2 shows the plate current flow when an 80-meter crystal is exciting the circuit of Fig. 1. The grid bias is assumed to be twice cutoff or more. Under this bias condition the excitation voltage on the grids causes plate current pulses to flow during only a portion of the r.f. excitation cycle. If the circuit is wired push-pull these pulses have a phase difference of 180° and "kick" the tank into oscillation. These pulses represent as much energy for the same duration (kilowatt hours if you wish) as they did before the plates were paralleled. All we have to do now is tune the plate tank to twice the crystal frequency and we should and do get just about the same output that we did at crystal frequency. Those who have had trouble with the 1935 circuit,1 and there were several, may be assured that this newer circuit is vastly more simple to operate. It has none of the trickiness caused by the inductive coupling to the crystal and none of its predecessor's tendency towards self-oscillation.

Some of the operating conditions noted are given in Table I. These are reasonably accurate observations and should serve as a fair guide to

### TABLE I

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>1963</td>
<td>40</td>
<td>push-pull</td>
<td>55 watts</td>
<td>73-75%</td>
<td>Less than 35</td>
</tr>
<tr>
<td>1985</td>
<td>3925</td>
<td>35-40</td>
<td>push-pull</td>
<td>&quot;</td>
<td>65-75%</td>
<td>&quot;</td>
</tr>
<tr>
<td>3504</td>
<td>3504</td>
<td>40</td>
<td>push-pull</td>
<td>&quot;</td>
<td>75-75%</td>
<td>35</td>
</tr>
<tr>
<td>3504</td>
<td>7008</td>
<td>35-40</td>
<td>push-pull</td>
<td>&quot;</td>
<td>65-75%</td>
<td>35</td>
</tr>
<tr>
<td>7137</td>
<td>7137</td>
<td></td>
<td>push-pull</td>
<td>No notes made of this</td>
<td>60-80</td>
<td></td>
</tr>
<tr>
<td>7137</td>
<td>14,274</td>
<td>25</td>
<td>push-pull</td>
<td>40 watts</td>
<td>65%</td>
<td>60-80</td>
</tr>
</tbody>
</table>

July, 1936
performance. Outputs were determined by lamp comparisons, and crystal r.f. currents were adjusted by tuning L1C1 to about the values shown.

For 'phone operation it is necessary to bring the suppressor connection out separately, as shown in Fig. 2. The suppressors should be bypassed for r.f. with an 0.002-µfd. mica condenser, with further r.f. filtering through a small choke such as the National R-100. Adjustment for 'phone has been described in QST numerous times and is, briefly as follows: Adjust for maximum r.f. output with the suppressor at 45 volts positive, then cut the bias to a negative value that brings the antenna current to one-half its maximum value, leaving all other adjustments unchanged. In this circuit the correct value is between 40 and 45 volts negative; 45 was used.

In spite of the fact that the screens are above ground for r.f. when doubling, a check for linearity showed up reasonably well, although the range of the test only covered "upward" modulation. The modulator used was a pair of 45's driven by a triode-connected 57. Listeners reported the transmitted quality as excellent and I believe the circuit would make a very good portable 'phone. 'Phone has not been tried yet on 20 meters because of the difficulty of getting much 'phone carrier output from a 40-meter crystal.

The rig here is still of test board construction, but there are some constructional points that the experiments have suggested, and an attempt is made to show them in Fig. 4. The control grids especially should be isolated from any plate circuit feedback because failure to do this may result in a very rough note and even poor keying. The screen tank should be shielded from the plate tank, especially if it is allowed to run on fundamental when the plate tank is also on fundamental (to avoid the use of plate-grid feedback condensers). In making the coils it is believed that it would be better to avoid the standard receiving type plug-ins used here in favor of something about 2 inches in diameter by 3 inches long with side jacks instead of end prongs. It is almost impossible to find the electrical center on a coil connected to end prongs. Symmetry of leads and parts is also quite essential in the circuit. Lack of such care made a lot of trouble here until corrected. Fig. 4 is a longitudinal elevation of the suggested arrangement of parts. The vertical shield is almost a necessity and the other shielding is advisable. Any somewhat similar arrangement that gives short leads should be a good substitute.

If one desires, the suppressors may be disconnected from L1C1 and run 45 volts positive for code operation, but there will be an attendant reduction in output of 20 to 25%.

The coils, specifications for which are given in Table II, should be progressively interchangeable so that each can be used at its designed frequency

(Continued on page 84)
A 500-Watt Transmitter With Band-Switching Exciter
Using 805's in the Final—Complete Transmitter Works From Single Power Supply

By Clark C. Rodimon,* W1SZ

MOST of the transmitters built at HQ are tested rigidly and after being put through their paces they get into QST just about time to go to press. The transmitter to be described was built several months ago in anticipation of the annual DX contest. Since that time the transmitter has been given plenty of "air test" on all bands it was designed to cover, phone and c.w. The original idea was a compact transmitter primarily for c.w. work which could be run efficiently at inputs around 800 watts (exceeding ratings a bit) and still use medium voltage tubes. Band-switching had been planned in all stages. Time and thought did not produce a practical band-switching arrangement for the push-pull final amplifier so this stage turned out to be plug-in.

LOW-POWER STAGE

A glance at the photograph of the low-power unit will show a mass of coils, condensers and crystals. Actually, much time and thought was given to this primary layout. It consists of a 42 crystal oscillator with plug-in crystals and crystal switching; RK20 or 804 buffer-doubler-amplifier (depending on its use at the time). The plate coil of the 42 is tapped for 80-, 40- and 20-meter band-switching (always working on the same frequency as the crystal). Variable coupling to the grid of the 804 or RK20 is obtained by the use of a variable condenser. The aluminum "doghouse," shielding the grid end of the amplifier, was found to be essential to eliminate reaction between the two stages. Nothing but complete shielding would produce reaction-free results. The shielding extends to the metal shield within the tube with at least 1/4" clearance between the external shield and glass, as recommended by the manufacturers.

The plate coil of the pentode amplifier is tapped for band switching, allowing operation on 80, 40, 20 and 10 meters with the use of proper crystals. This arrangement permits doubling from any one crystal frequency. Originally the 804–RK20 stage

LOW-POWER OR EXCITER STAGE

As explained this unit could well be used as a low-power transmitter in its own right. See Unit 1 of Table I. The layout is described in the article.

UNIT CONSTRUCTION

The complete job consists of three different units, "build-upable" one at a time as the pocket book allows. This is in keeping with the trend of the times. The first unit consists of a pentode crystal oscillator and pentode buffer-doubler. This unit makes a complete transmitter of moderate proportions as may be seen in Table I. The second unit consists of a push-pull amplifier giving a power output gain of about 7. The third unit contains a pi-section antenna coupler.

One can build up as many more of these units as desired. The separate cabinets fit one above the other in a sturdy fashion and give the impression of a complete rig rather than a collection of units. These particular cabinets were procured from the Radio Communications Equipment Co. of Maywood, Ill. For a complete transmitter two more units would suffice, one for audio equipment and the other for power-supply gear.

* Managing Editor.
The idea in the final amplifier was to keep within the realm of compactness, simplicity and straightforward design without any tricks. This final amplifier was designed primarily for c.w. operation. For 'phone, the final would either be run as a Class-B linear amplifier or control-grid-modulated. This being the case, high-voltage power supplies necessary for this first unit are: 7.5-volt for the 804-RK20 and 42 (via a 2-ohm dropping resistor for the latter); 1250-volt or 1500-volt plate supply depending on whether one contemplates the 838 or other tubes in the same category, or the 805 which has the 1500-volt plate rating with 125-watt plate dissipation. In any case, it will be wise to look into future possibilities here because the same plate supply is used on the initial unit as used in the high-power amplifier by the use of voltage dividers as shown in the circuit diagram.

HIGH-POWER FINAL AMPLIFIER

The network of combination bleeder-voltage-divider for the high-voltage power supply is mounted underside on the low-power deck. Fig. 1 shows the complete wiring. The crystal selector switch is also underside, as well as plate and grid chokes and all by-pass condensers.
insulation in the amplifier and a huge plate tuning condenser would not be necessary. As seen in the photo of this stage everything is pretty well in its place with room to breathe between \( C \) and \( L \) in the tank circuits. Nonetheless, it is interesting that the final amplifier has been Class-B plate modulated with 1500 volts on the 805's on both 14 and 3.9 mc. (500 watts input) with only rare flashovers on over-modulation peaks. (Insulation of the plate tuning condenser from ground and the use of an r.f. by-pass completely eliminated that!) The carrier was of the order of 300 watts. The Class-B modulator used zero-bias 838's running off the same power supply. As mentioned above, this treatment was not intended when original plans were drawn up but when the going got tough it was decided to try to boost up the power a bit to "see what would happen." The amplifier took to this treatment without a whimper and is in daily use in this fashion. Insulating the rotor completely cured the flashovers. The tubes used were 805's but the following were substituted with equal success when the tubes were run at rating: 838's, 211's and 203A's.

From left to right in the photo of the final amplifier may be seen the grid coil with link around it. The GR plug-and-base arrangement provides outlets for seven connections to the coil—only five are needed. The grid tuning condenser is next and is mounted by brackets direct to the chassis. The neutralizing condensers are insulated from the chassis by mounting on feed-throughs. A high-voltage shaft coupling connects the condensers for single drive. Next come the 50-watt National XM sockets which are sub-base mounted—only the metal shells (which are grounded) appear above the top of the chassis. Then the plate tuning condenser and coil complete the layout above the chassis. Four insulating bushings are used to carry the grid and plate r.f. connections under the chassis to the socket terminals. The criss-cross wiring of the neutralizing condensers is done above the chassis. The plate tuning condenser is mounted on brackets directly to the chassis. This grounds the rotor of the condenser, which means that a flashover will short the power supply. If 'phone work is contemplated it is suggested that the condenser be insulated from the base by mounting the brackets on insulator feed-throughs and grounding via an r.f. by-pass as previously mentioned. There is no photo of the gear underneath the chassis. This is hardly necessary for the only components there are plate and grid chokes, grid resistor and filament by-pass condensers. The terminals at the rear are GR pairs Type 274-Y. From left to right (referring to photo of final) these pairs are as follows: Link circuit; grid circuit for zero or external bias; grid circuit for resistor or resistor-battery bias; filament, and finally, plate connections. Two pair of connections in the grid circuit will not be amiss. They are clearly shown in the circuit diagram. This gives one a variety of combinations, depending on the tubes to be used, whether one is using c.w., Class-B linear or Class-C plate modulated radiotelephony. Resistor bias is recommended for the last inasmuch as grid currents run quite high.

Both the grid and plate circuits are tuned by Cardwell Midway Type MD-100-GD condensers with Micalex insulation. Space limitations and the necessity for a high-voltage low-capacity variable neutralizing condenser started us looking all over for what we needed. Not finding the exact capacity requirement to fit the space available we used the nearest thing which was a Bud type 566 which had high-voltage insulation. It was necessary to remove rotor and 3 stator plates in each of the condensers to reduce the minimum capacity to allow neutralization of the 805's. This operation was accomplished with a hot soldering iron. These condensers are ganged by a high-voltage coupling.

Referring to the photograph of the final amplifier, the pair of leads carrying r.f. to the antenna coupler is shown at the right. These leads connect to the antenna coupler by a pair of GR plugs mounted in a piece of Micalex. This was found quite necessary after burning up bakelite mountings. The r.f. potential of the entire final amplifier is on these two leads, so it can readily be seen that excellent insulation will be necessary. This unit, as are the rest, is complete in itself. Power supply
REAR OF TRANSMITTER UNITS IN PLACE
Without the supply cables attached each unit can be removed with ease as there are no permanent connections between any of the units.

and r.f. leads attach at the rear to GR Type 138-VD binding posts insulator-mounted in pairs. Power supply leads come up the rear of the transmitter in cable form. To pull out the unit, it is only necessary to disconnect the leads at the rear and the entire unit is free to slide out of its cabinet. It will be noted that there is a single meter in each unit, without plugs and jacks for placing in different circuits. As mentioned before, simplicity was the keynote and the meters in their present circuits are sufficient to tune the transmitter. It is a fact that a grid meter in the final amplifier would be helpful and probably essential to initial checking and tuning up.

ANTENNA COUPLER
To cover a wide range of frequencies with efficient coupling into various feed lines, it was decided to construct the pi-section antenna coupler with coil shorting to match impedance variations on different frequencies. Split-stator condensers are used in both the input and output positions. Combining a fairly large amount of capacity with a fairly high r.f. voltage rating called for condensers that at first look out of place with the rest of the rig. Playing around with full output showed that the voltage ratings of these condensers was not entirely out of line. Two Ohmite switches are ganged by means of a National flexible shaft coupling. These switches should not be turned when the rig is in operation, for the r.f. potential may damage the switch when the circuits are opened. Since the switches are only rated for low voltage, they are insulated from the base by brackets and Steatite feed-throughs. The tuning condensers are not insulated from the base. Getting r.f. from the final amplifier to the antenna coupler turned out to be a bit of a special job when making this connection direct. Underneath the base of the antenna is mounted a GR jack (274-AJ) to accommodate the plug from the final amplifier. It was necessary to fashion a hole about 2 inches long and 1 inch wide through the top of the final amplifier cabinet to get the jack through to the plug permanently attached to the underside of the antenna coupler. These r.f. leads are fed through the base of the coupler by a pair of Steatite feed-throughs. An
antenna meter is permanently connected in one side of the coupler circuit. National h.f. bushings come out of the top of the coupler and serve as mountings for the feeders.

To keep a symmetrical layout and keep the two antenna coils separated, it was necessary to mount them above the shorting switches. The coils are mounted on 6-inch stand-offs. The input and output condensers may be mounted directly to the chassis, since the rotors are grounded.

**Antenna Coupler Diagram**

The apparatus from left to right is: output condenser, for setting proper loads; coils are in the center for each leg of the system, mounted on tall Steatite pillars above the band switches; input condenser for tuning to resonance; Steatite feed-throughs bringing r.f. from the final may be seen as two white buttons.

**Keying**

This transmitter may be keyed in several ways. One may key the suppressor of the buffer, center-tap of the buffer, center-tap of the final or both center-taps. The set-up as used keyed the center-tap of the final amplifier. Slight clicks resulted and were eliminated with a small key-click filter (Fig. 100g, '36 A.R.R.L. Handbook) in the keying leads. This was dead simple.

**Miscellaneous**

Dials that would be compact and allow one to jot down dial settings were decided upon. The ones shown are National type BM. GR knobs and pointers were used for the switches. Various switch positions were engraved on the panels by the simple means of a prick-punch mark and some white paint. Coils in the low-power and antenna coupler stages are National. Those in the final amplifier are GR type 677-U. These were chosen because it was possible to get positive plug and jack bases for this type of coil. It is well to take precautions here for a poor contact will result in many watts being lost in heat. The r.f. plug and jack assembly of these coils was not enough to heat them, though there was heating in the coils. When the two r.f. units were finished the final amplifier was mounted above the low-power unit. Then two power cables were made, one for each unit. Packard cable was used for all leads. Each cable was made by wrapping ½-inch cotton strip in a spiral after binding with cord to completely cover the several wires in the one cable. Then orange shellac was applied which resulted in a semi-flexible cable that was very sturdy. At the set end of the cable each lead is cut just long enough to reach its proper terminal. Then the power connections are made. At any time a unit is to be worked on it is merely a matter of loosening all binding posts and pulling the unit out from the front. One need not worry about proper power leads going to proper terminals, for they are all cut to the proper length and one cannot make a mistake. The cables may be connected permanently to the power supplies for they need not be removed.

**Tuning Up**

With the rig assembled and coils wound the time to try it out is at hand. Let’s tune it up for 7-mc. operation. The low-power stage is first put into operation. Either an 80- or 40-meter crystal may be used. One always has a choice of a crystal working on its fundamental frequency or doubling. The plate coils of both stages of the low-power stage were set for 40 meters (if 40-meter crystal—if 80, the oscillator switch is set for 80 meters). When the crystal frequency is reached by the tuning condenser there will be a kick in plate current (probably up, as the following stage will be out of resonance). The meter will read around 130 mils with 1250 volts on the plate and positive suppressor bias. The amplifier plate circuit should be tuned to resonance immediately to avoid the out-of-resonance high plate current. With the amplifier unloaded and tuned to resonance the plate current will be around 40 ma. The single meter in the plate circuit of the amplifier was found to be adequate.

It is now time to complete the link circuit to the final amplifier by means of a pair of leads run between the two sets of binding posts at the rear of the units. The 40-meter grid coil is put in the final amplifier. Plate voltage should not be put on the final amplifier yet. For preliminary tuning up a grid meter is inserted in the place of the shorting bar A in Fig. 2. When the grid current is at maximum the amplifier must be neutralised. The neutralising is done in the well-known manner, with the plate coil in place but without the link attached that goes to the antenna coupler. During this process the grid circuit paths at A and B are closed. The grid current flowing through the grid resistor will be about 200 ma. but will fall to about 120 ma. when the plate
voltage is applied and the antenna circuits are in tune. Before plate voltage is applied one should experiment with the variable coupling condenser to the buffer amplifier for maximum grid current to the final. Too much excitation will lessen the output as has been explained before regarding pentodes. In practice this condenser, $C_3$ in Fig.

![Circuit Diagram](image)

**FIG. 2—CIRCUIT OF FINAL AMPLIFIER**

- $C_1$—100 µfd. in each section, 0.07" air gap. See text.
- $C_2$—100 µfd. in each section, 0.07" air gap. See text.
- $C_3$—Variable neutralizing condensers ganged. See text.
- $C_4$—Output coupling—1500 volt, 0.01 µfd. by-pass. See text.
- $C_5$—Fil. by-pass—0.002 µfd. by-pass.
- $C_6$—1500 volt, 0.01 µfd. by-pass. See text.
- $A$, $B$—Sec. text. Connecting resistor is 1500 ohms, 100 watts.
- RFC1—Receiving type layer-wound choke.
- RFC2—Ohmite Type Z-4. See text for coil dimensions.

1, was found to be optimum at \( \frac{3}{4} \) capacity on all bands. The link circuits, $L_1$ in Fig. 1 and $L_2$ in Fig. 2, should be varied for maximum excitation to the final stage. Two turns were found adequate on all bands for $L_1$. Note the coil table for the data on $L_2$.

Now it is time to apply the high voltage to the final. During the first tuning up it is recommended to use about 800 volts rather than the normal 1250. With the plate coil in place resonance should be found without coupling to the antenna coupler. Still using the lowered voltage, connect the pi-section network and connect the antenna to the terminals.

Tuning the antenna coupler is a paper in itself if one were to attempt to cover all the different feeder systems and possible combinations one might run into. For the two systems in use at WISZ, it was found a simple matter to match the feeder to the network. The shorting switch was set on the middle position, which meant that half of each coil was being used. The output condenser of the network was set for minimum coupling and resonance was found by tuning the input condenser. Then the output condenser was varied, increasing the coupling until the proper load on the final amplifier was reached, always returning the input condenser to resonance whenever the output condenser was varied. During this process the final plate tuning condenser should not be touched. Its setting should be the same as it was when resonance was found without the coupling plug in place.

The above procedure is sketchy at best but it actually is much less complicated than it is to describe. For Class-C phone operation (Class-B modulation of the final) the tuning is identical to that described above. It will be necessary to use fixed bias on the final instead of leak bias for Class-B linear or grid-bias modulated operation. If this is done, the shorting plug at B (Fig. 2) is removed and the rated negative bias is connected to the left hand plug of this pair. The positive, of course, is grounded, or connected in series with the grid meter at A if the current is to be measured.

If the load is proper for the modulator, all meters should remain still even under 100-percent modulation, save the antenna meter which should flicker upward. A neon-stick modulation indicator is used with excellent results. Enough r.f.

### TABLE II

<table>
<thead>
<tr>
<th>Oscillator</th>
<th>Amplifier-Doubler</th>
<th>Final</th>
<th>Antenna Coupler</th>
</tr>
</thead>
<tbody>
<tr>
<td>$L_1$ has shorting sw. for band selection (No. of turns)</td>
<td>$L_2$ has shorting sw. for band selection. Link fixed at &quot;hot&quot; end of coil</td>
<td>$L_1$ No. of turns each side of center tapped for antenna coupler</td>
<td>$L_2$ No. of turns each coil—shorting sw. for band selection</td>
</tr>
<tr>
<td>3.5-4 mc.</td>
<td>26</td>
<td>26</td>
<td>32†</td>
</tr>
<tr>
<td>7.0 mc.</td>
<td>12 turns free</td>
<td>18 turns free</td>
<td>14</td>
</tr>
<tr>
<td>14 mc.</td>
<td>5 turns free</td>
<td>6 turns free</td>
<td>6</td>
</tr>
</tbody>
</table>

* $L_3$ on diagram, Fig. 1.
† It was necessary to get a greater diameter to the coil to hit 3.5 mc. To accomplish this the grooves were filled with \( \frac{1}{4}'' \) bakelite spacers the length of the coil and \( \frac{3}{4}'' \) wide around entire coilform. No. 12 enamelled wire wound close filled the coil. All other coils were wound with No. 12 solid tinned copper wire.

(Continued on page 80)
To all members of the American
Radio Relay League residing in
Notice the Atlantic and New England
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 a member of the A.R.R.L. Board of Direc-
tors, the recent directors thereof having been
elected president and vice-president, respectively,
of the League and consequently resigning their
offices as division directors, as required by By-Law
22. In the case of the Atlantic Division the elec-
tion is to choose a director for the remainder of
the 1936-1937 term. In the case of the New
England Division, the election is to choose a
director for the remainder of the 1935-1936 term.
Your attention is invited to Sec. 1 of Article IV
of the constitution, providing for the government
of A.R.R.L. by the Board of Directors; Sec. 2 of
Article IV, defining their eligibility; By-Laws 11
to 22, providing for the nomination and election
of division directors. Copy of the constitution and
by-laws will be mailed any member upon request.

Voting will take place between July 6, 1936,
and August 3, 1936, on ballots which will be
mailed from the headquarters office in the first
week of July.

Nomination is by petition. Nominating peti-
tions are hereby solicited. Ten or more A.R.R.L.
members residing in either of the above-named
divisions have the right to nominate any member
thereof as a candidate for director therefrom.
The following form is suggested:

(Place and date)

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

Gentlemen:

We, the undersigned members of the A.R.R.L.
residing in the ...... Division, hereby nominate
..........., of ..........., as a candidate for director
from this division for the unexpired remainder of
the current term.

(Signatures and addresses)

The signers must be League members in good
standing. The nominee must be a League member
in good standing and must be without com-
mercial radio connections: he may not be com-
mercially engaged in the manufacture, selling or
renting of radio apparatus or literature. His com-
plete name and address should be given. All such
petitions must be filed at the headquarters office
of the League in West Hartford, Conn., by noon
of the 6th day of July, 1936. There is no limit to
the number of petitions that may be filed, but no
member may append his signature to more than
one such petition. To be valid, each petition must
have the signatures of at least ten members in
good standing.

These elections provide the constitutional
opportunity for members to put the direction of
their association in the hands of representatives
of their own choosing. Members are urged to take
the initiative and file nominating petitions
immediately.

For the Board of Directors:

K. B. WARNER,
Secretary.

May 11, 1936.

Requests

The several requests of the F.C.C.
made by the A.R.R.L. Board of
Directors, notably to widen the
4-mc. 'phone assignment and to increase the ex-
amination code speed, have duly been trans-
mittcd to the Commission. They are under study
in the Engineering Department there but at this
writing there has been no action and there is no
news.

June

Hearings

The major item in the life of
A.R.R.L. headquarters, as this
issue of QST is being written, is our
preparation for the informal hearings of the F.C.C.
which begin on June 16th. The seven commisson-
ers, sitting en bane, will hear the status of the
entire radio art in America reported in a series of
meetings estimated to last a month and expected
to fill a large auditorium in Washington. Prin-
marily these hearings are the long-deferred con-
ference on ultra-high-frequency allocations above
30 megacycles, the future needs of services that
are to occupy that portion of the spectrum, their
relative importance, etc. It also embraces a re-
view of the allocations below 30 megacycles for
the purpose of informing the commissioners on
the present state of the art and as a useful back-
ground for Cairo preparation. The League rep-
resentation at these hearings is in the charge of
General Counsel Segal and Secretary Warner
but the actual presentation will make use of the
services of several other members of the head-
quarters staff as witnesses. At this writing a half-
dozen members of our group are industriously at work writing up the amateur case. We shall explain our present frequencies and the use to which we put them, demonstrate that the national policy of encouraging amateurs in this country has been exceedingly wise and productive of good results in the national welfare, we shall show our need for more normal frequencies and the desirability of assigning us additional bands of frequencies in the ultra-high-frequency region. However, it is important to note that these hearings are not going to allocate frequencies. Indeed it is doubtful if any report will issue from them. In the autumn there likely will be another hearing on a tentative regulation actually allocating frequencies to u.h.f. services, while the matter of the lower-frequency bands will be a subject for the United States committees preparing for the Cairo conference. The preparatory committee dealing with allocations will not hold its first meeting until after these June hearings. The HQ gang is buried to the ears at this writing, getting up charts and arguments. We hope our correspondence won’t suffer delays, but if it does you’ll know it has been in good cause. We should be back to normal by middle July.

**Calls**  On page 15 of June QST there appeared a “Stray” suggesting that when you keep schedules at a borrowed station while away from home traveling or visiting, it would help if you had your own crystal with you, thus automatically putting you on the frequency known to your correspondent. We would like to emphasize that on such occasions it is imperative to sign the call of the station you are using, not the call of your home station. This is important: a station is a station, and each is identified by its own call. Several of the brethren have got into serious trouble over this little matter. Your own call is to be signed only on your own gear.

**Financial Statement**  The League enjoyed an excellent first quarter’s business. By instructions of the Board of Directors, the operating statement is here published for the information of the membership.

<table>
<thead>
<tr>
<th>Revenues</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership dues</td>
<td>$14,452.84</td>
<td></td>
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<tr>
<td>Advertising sales, QST</td>
<td>21,025.48</td>
<td></td>
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<tr>
<td>Advertising sales, Handbook</td>
<td>3,157.05</td>
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<td>Newdealer sales, QST</td>
<td>12,708.84</td>
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<td>Handbook sales</td>
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<td>Booklet sales</td>
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<td>Calculator sales</td>
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<tr>
<td>Membership supplies sales</td>
<td>2,098.57</td>
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<tr>
<td>Interest earned</td>
<td>708.70</td>
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<tr>
<td>Cash discounts received</td>
<td>411.19</td>
<td></td>
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<tr>
<td>Bad debts recovered</td>
<td>213.55</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$76,800.74</strong></td>
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<table>
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<th>Expenses</th>
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<tr>
<td>Publication expenses, QST</td>
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<td>Publication expenses, Handbook</td>
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<td>Publication expenses, calculators</td>
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<td>Publication expenses, booklets</td>
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<td>Salaries</td>
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<td>Traveling expenses</td>
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<td>Telephone and Telegraph</td>
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<tr>
<td>General expenses</td>
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<tr>
<td>Insurance</td>
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<td>Rent, light and heat</td>
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<td>QST forwarding expenses</td>
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<td>Provision for depreciation</td>
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<td>of furniture and fixtures</td>
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<td>General Counsel expenses</td>
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<tr>
<td>Communications Dept. field expenses</td>
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<td>Bad debts written off</td>
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<td>Headquarters station expenses</td>
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<td><strong>Total Expenses</strong></td>
<td><strong>$60,279.92</strong></td>
<td><strong>$60,279.92</strong></td>
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</table>

| Deduct                           |          |          |
| Returns and allowances           | $4,679.94 |          |
| Cash discounts allowed           | 468.14    |          |
| Collection and exchange          | 115.38    |          |
| **Less decrease in provision for** |
| **newdealer returns of QST**     | **36.87** | **$5,226.59** |
| **Net Revenues**                 | **$71,574.15** | **$71,574.15** |

<table>
<thead>
<tr>
<th>Strays</th>
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</table>

W3AOF has a suggestion for those using SW3's on 28 mc.: By leaving the general-coverage grip clips off the composition pillars when using band-spread coils a decided improvement in signal strength was noted. Evidently the dielectric loss in the pillars was enough to affect the signal strength.

**Errata:** In last month’s article on the “Improved Tritet Exciter,” the wire size and coil diameters were omitted. The wire size is No. 18 enamelled, the coil diameters 1½”.

Two bulletins of interest to technically-minded amateurs, “Pentagrid Converter Oscillator Considerations” and “The Relation of Modulation Products with Multi-Tone Signal to Harmonic Distortion with Mono-Tone Signal in Audio Amplifier Analysis,” are available without charge from the Ken-Rad Corporation, Owensboro, Ky. The latter bulletin is of particular interest because of its discussion of a type of distortion peculiar to the Class-B audio amplifier. An engineering bulletin on the 6L6 tube also is available.

20  QST
A "Neon-Stick" Visual Modulation Monitor

By C. A. Campbell, * W9QK

DESPITE the many excellent articles published regarding 'phone adjustment, over-modulation, the most obnoxious of abuses, still persists. Most of us who operate 'phone consistently are so used to it that we develop a tolerance and learn to understand the peculiar sound of speech sliced up with "splashes"; but a talk with several who have given up 'phone for c.w. was so convincing that it seemed a little further investigation was needed.

All of our available accurate measurements are based upon the use of a continuous audio signal of one frequency for modulation when these measurements are made. What happens when we remove the 60 cycles, beat oscillator, or other source of sine wave, and substitute one of the most complex waves known, the human voice? A wholly false but too general impression exists (even in broadcasting circles) that because the average energy in speech is greatest at lower frequencies, the peak values are also; and, consequently, if means indicating either of these at the lower frequencies are employed, full information regarding possible over-modulation is bad. Recent authoritative work has shown that this assumption is not so! Energy peaks occur as often and with fairly equal intensity over the range of 200 to 5000 cycles. The intensities are very nearly equal and maximum between 500 and 2000 cycles.

When a carrier is modulated, no matter how, it is the peak modulating voltage that determines the percent modulation; consequently, even though the amount of average energy is kept low, it is entirely possible and probable that numerous unobserved peaks are over-shooting on the positive half cycle and interrupting the carrier on the negative. As we have seen from too many articles to quote, this interruption causes an extensive series of r.f. side-bands which are spaced apart by the modulation frequency. The fellow with controlled carrier supposedly operates at constant percentage modulation, but in all the schemes so far proposed it can be shown that due to the time constant of the necessary audio filter, it is entirely possible for the higher-frequency audio components to "splash," since the carrier cannot rise as rapidly as a peak of higher frequency which may appear in the modulation circuit.

The Federal Communications Commission has instructed all broadcasting stations, or will shortly, to install monitoring equipment which flashes a light on every modulation peak exceeding a certain value, some of the more progressive stations having done this previously. The device in its commercial form, while excellent, is no doubt beyond the means of practically all amateurs; but it seems that something similar is necessary if we are to avoid needless interference.

Some years ago I saw a piece of neon tubing connected to a modulated r.f. stage and watched the thing flicker with modulation; upon inquiring why it wasn't used as a modulation indicator, I was told that it apparently wasn't linear—or something to that effect—and that, anyway, the operator didn't know just where to let the end of the column shoot on modulation.

Out of curiosity, I obtained a piece of neon tubing myself to find out just how the thing did work and found that, on my particular outfit, if the glow was allowed to extend about half the length of the tube with the carrier unmodulated, 100% modulation was indicated by the tip of the glow just touching the other electrode. Upon passing apparently similar hunks of tubing around, the reports were variable to say the least; some said that they over-modulated with this adjustment, others couldn't make it work, and still others said that they were not "hitting it hard enough." Recently, with better facilities for investigating the neon tube itself, it was found that the bunch of tubes I had passed around were all different in construction and could not be expected to work alike. Maybe if some more were to be made just like the sample I was fortunate to possess, they would all work that way. To make a long story short, we went into the tube design quite thoroughly and found that the diameter and length had to be in the proper ratio, approximately 14 inches of 15 mm. tubing being about correct, and the gas mixture controlled quite carefully to keep the tip of the glow distinct. It was also found that if the tube was to respond linearly to peak r.f. voltage variations, the electrode drop had to be as small as possible (some electrodes may take as much as four or five hundred volts, while those adopted require about fifty). With this construction the life is over 5000 hours.

(Continued on page 70)

* 301 Dodson St., Geneva, Ill.

July, 1936
Inductive Neutralization of R.F. Amplifiers

By L. M. Craft* and Arthur A. Collins*

It is perhaps incorrect to refer to one type of neutralization as "capacity" neutralization and another type as "inductive" neutralization. All neutralization circuits employ some type of bridge involving both inductance and capacity. However, it is common practice to adjust one of the capacities to balance the neutralization bridge, therefore in contrast it may be permissible to use the term "inductive neutralization" to describe a bridge circuit in which a mutual inductance is varied to perfect the balance.

Inductive neutralization circuits are very old, but they have not been widely used in connection with receivers. An application of inductive neutralization has recently been made to transmitter circuits which offers several practical advantages of general interest. An inductively-neutralized amplifier is represented in Fig. 1. The input and output tank coils $L_1$ and $L_2$ are mutually coupled; any simple mechanical means may be provided to vary the degree of coupling. The connections and direction of winding of the two coils are such that the voltages produced in either coil by the mutual inductance and by the grid-plate capacity current are opposed.

A practical circuit may actually be as simple as that shown in Fig. 1, but several precautions must be observed if complete balance is to be obtained. In the first place, the inductances $L_1$ and $L_2$ must be connected directly across the grid-filament and plate-filament capacities of the amplifier tube; that is, there must be no taps on these coils such as might be used for varying excitation or loading. In the second place, if power is to be taken from the plate tank circuit by inductively coupling to the plate coil, the plate tank circuit must have an effective "Q" between 5 and 10; that is, the reactance of the plate tank condenser at the operating frequency should be one-fifth to one-tenth of the load impedance seen by the amplifier tube. There is no restriction as

\[ \text{This is quite in line with usual amateur practice. With a load impedance as low as 2000 ohms (most tubes require a considerably higher load for efficient operation) this requirement would necessitate an effective tank capacity of approximately } 30 \text{ µµfd. At 14 mc., with proportionate values on the other bands, as tubes are normally operated, considerably lower tank capacity values could be used, although excessively low } C \text{ is undesirable because of the increased harmonic output.—Editor.} \]

* Collins Radio Company, Cedar Rapids, Iowa.
to tank circuit "Q" when the load is connected in the capacity branch.

The circuit is readily adjusted for neutralization by any of the common means used to indicate minimum current in the plate tank circuit when it is tuned to resonance. The most convenient method is to observe the rectified grid current appearing in the amplifier with the plate voltage removed. As the circuit is adjusted for neutralization a point will be reached where the grid current does not fall as the plate circuit is tuned to resonance.

Inductive neutralization has two important disadvantages which, although they do not preclude its use, must be borne in mind. The first of these is that the adjustment for neutralization is dependent upon frequency. A limited range of frequencies such as from 14,000 to 14,400 kc. may be used without readjustment of neutralization. When a single set of coils is to be used over a wider range of frequencies, such as an octave, it is convenient to link the neutralization adjustment mechanically with one of the tuning adjustments so that automatic tracking of neutralization is obtained. The most usual case, however, is the one in which a single set of coils will be used for one or, at the most, two fixed frequencies and in which it is possible to have a plug-in coil assembly mounting both plate and grid coils, so that, once the neutralization adjustment is made, it is not disturbed when changing from one set of coils to another.

The second limitation of the system is that the coupling coefficient for neutralization on ultra-high frequencies is very large, and considerable care must be taken in coil design and attention paid to the inductance of circuit wiring. Perhaps the practical upper frequency limit for inductive neutralization is in the neighborhood of 20 to 30 mc., except when amplifier tubes of very low grid-plate capacity are used.

The list of advantages is more impressive. The first of these is the extreme simplicity of the amplifier circuit and the ease with which the neutralization adjustment may be made. In neutralization circuits employing a variable condenser for adjustment, the neutralizing adjusting winding always interlocks with one of the tuning adjustments so that a see-saw procedure must be followed to obtain an accurate balance. In contrast, the inductive neutralization adjustment has an imperceptible effect on the tuning of either the grid or plate circuits.

A second advantage is that an inductively-neutralized amplifier is simpler and more compact mechanically than a corresponding capacity-neutralized amplifier. The plate and grid tank coils themselves form the only components required for neutralization, and no special neutralizing windings, shielding, split-stator condensers or neutralizing condensers are required. A corollary to the mechanical simplicity of an inductively neutralized circuit is that higher operating efficiencies are usually obtained, in most cases an increase of plate efficiency and reduction in driving power is noted when changing from the capacitive to the inductive system. An additional and very much appreciated feature is that parasitic oscillations are rarely encountered in an inductively-neutralized amplifier. This is particularly true of the circuit of Fig. 2 where provision is made to match the grid circuit.

In this transmitter the plate tank condenser and mutual-coupling adjustment are ganged mechanically through a cam arrangement so that neutralization can be maintained over a wide frequency range.

Probable because no splitting of the tank circuits is necessary. With the ordinary capacity-balanced systems either the input or output circuit is working under rather unfavorable conditions, depending upon the type of neutralization employed ("plate" or "grid"). In one case the effective load impedance is comparatively low for a given degree of antenna coupling; in the other only part of the voltage developed in the grid circuit is available for excitation purposes, which makes excitation more difficult even though the neutralizing circuit consumes negligible power.—Eboron.
of a neutralized triode to the plate circuit of a screen-grid driver.

Either single-ended or push-pull amplifiers may be inductively neutralized. A symmetrical coil arrangement for push-pull circuits is desirable to avoid capacity unbalances between the windings. Symmetry can be obtained by splitting one coil and placing the other coil between its halves, or by placing the coils side by side with their axes parallel. The latter arrangement may give sufficient coupling only on the low and medium high frequencies.

**DESIGN DATA**

The following analysis of inductive neutralization is interesting from a theoretical standpoint and is useful when it is desired to calculate the circuit constants in advance. Fig. 3 is a simplified circuit showing one tank circuit consisting of inductance \( L_2 \) and capacity \( C_2 \) which is both inductively and capacitively coupled to the other tank circuit. The capacitive coupling \( C_{gp} \) is the grid plate capacity of the amplifier. The input tank circuit, consisting of inductance \( L_1 \) and capacity \( C_1 \), is for simplicity replaced by the voltages \( E_1 \), the voltage appearing across its terminals, and \( E_2 \), the voltage induced in \( L_2 \) due to the mutual inductance \( M \) between \( L_1 \) and \( L_2 \).

Consider first the circuit of Fig. 3, neglecting any resistance appearing in either grid of plate tuned circuits. Then:

\[
E_1 = I_{L1} \omega L_1 \quad \text{and} \quad E_2 = I_{L2} \omega M
\]

where \( \omega = 2\pi f \) and \( f \) is the frequency in cycles per sec.

And \( I_{L1} \) = current flowing in \( L_1 \).

Further let the mutual inductance coupling be such that with the positive directions of \( E_1 \) and \( E_2 \) as shown by arrows in Fig. 3, \( E_1 \) and \( E_2 \) will be 180° out of phase as shown by the vector diagram, Fig. 4.

Temporarily assume \( C_2 \) to be replaced by a short circuit. Then:

\[
I_{C_{gp}} = E_1 \omega C_{gp} = I_{L1} \omega L_1 C_{gp}
\]

and

\[
I_{L2} = \frac{E_2}{\omega L_2} = \frac{I_{L1} M}{L_2}
\]

These currents are shown in Fig. 4 also. \( I_{C_{gp}} \) leads \( E_1 \) in phase by 90°. Thus \( I_{L1} \) and \( I_{C_{gp}} \) are in phase and if they are made equal in magnitude there is no current flowing in the short circuit. Thus the short circuit may be removed and no voltage will appear across the terminals of \( L_2 \) and no current would flow in a condenser \( C_2 \) when added.

Thus for neutralization \( I_{C_{gp}} = I_{L1} \) or \( M = \omega^2 \frac{L_1 L_2 C_{gp}}{L_2} \).

If the coefficient of coupling between \( L_1 \) and \( L_2 \) is designated as \( k \),

\[
then \quad M = k \sqrt{\frac{L_1 L_2}{L_2}} = \omega^2 L_1 L_2 C_{gp}
\]

Thus \( k = \omega^2 \sqrt{\frac{L_1 L_2}{C_{gp}}} \).

For design purposes the capacity \( C_{gp} \) is known and the inductances \( L_1 \) and \( L_2 \) are chosen first. A parameter

\[
K = \frac{C_{gp} \sqrt{X_{L_1} X_{L_2}}}{1000}
\]

is computed where \( X_{L_1} = \omega L_1 \) and \( X_{L_2} = \omega L_2 \) (\( L_1 \) and \( L_2 \) in henries) and \( C_{gp} \) is the grid-plate capacity in micro-microfarads. For various values of this parameter the coefficients of coupling in percent have been plotted versus frequency in Fig. 5. This chart becomes more useful if it is noted that for a constant \( L/C \) ratio of the tank circuits \( K \) is independent of frequency. A further precaution to be observed in the use of this chart is to keep in mind that coefficients of coupling of more than 50% are difficult to obtain at radio frequencies.

![FIG. 4—VECTOR DIAGRAM OF CURRENT AND VOLTAGE RELATIONSHIPS IN THE CIRCUIT OF FIG. 3](image)

![FIG. 5—COUPLING COEFFICIENT VERSUS FREQUENCY FOR NEUTRALIZATION WITH VARIOUS VALUES OF PARAMETER K](image)
Colloquy ("Hamdom" editor and alter ego):
How about a YL page this month?
OK; how many YL's have we got on the hook, including a pair of sisters.
Oh, the poor things! Take them down instantly, and we'll see what they're like.
Righto. Whom shall we...or...I mean, with whom shall we start?
Why, the Johnson sisters, of course. Two against one! Don't be silly! (Txz, Henry L. Luoma, W9SQB, for the dope.)

ASK any ham in the Great Lakes region about W9PCU and he'll tell you that they are the two finest YL ops in the country—and "regular guys," besides. (At least, that's what we were told!) They are Violet and Vivian Johnson, of Chippewa Harbor, Isle Royale, near the Canadian shore of Lake Superior. Violet, blue-eyed, blonde, and tall, is 21; Vivian, about two years younger, is dark, has hazel eyes, and—well, anyway, since getting their first tickets in October of 1933 they have had nearly 3,000 QSO's and have handled nearly that many messages, all with 3 or 4 watts input to a 112A TNT. Their receiver is a 3-tuber using 30-31-30. Chances to be of public service have been excellent on the island, and the girls have never been found wanting. QST has chronicled several of their feats, including the saving of their brother's life. Their rescue of Isle Royale's moose was dramatized in the A.R.R.L.-N.B.C. series a year or two ago. Isle Royale is entirely isolated in winter time, and amateur radio is the only means of communication. But this summer you'll be able to visit their Dad's tourist resort, and sample some of Violet's famous cakes and pies, and enjoy some glorious hiking, swimming, or trolling. Whatever your forte, you'd be assured a "Royale" welcome at W9PCU!

SAYS Carrie Jones, W9ILH: If I can't get any answers to my calls after this is published, I will know the reason why! Says the "Hamdom" editor: well, if I were you, I wouldn't worry. Anyway, we shouldn't be speaking of W9ILH thus informally, for she is actually Mrs. M. D. Jones, the OM being W9ICN. It was one of those things. The OM, needing code practice in late 1931 while boning up for his ticket (they were married in 1928; note the 3-year lapse!), picked country-and "regular guys," besides. (At least, that's what we were told!) They are Violet and Vivian, Johnson, of Chippewa Harbor, Isle Royale, near the Canadian shore of Lake Superior. Violet, blue-eyed, blonde, and tall, is 21; Vivian, about two years younger, is dark, has hazel eyes, and—well, anyway, since getting their first tickets in October of 1933 they have had nearly 3,000 QSO's and have handled nearly that many messages, all with 3 or 4 watts input to a 112A TNT. Their receiver is a 3-tuber using 30-31-30. Chances to be of public service have been excellent on the island, and the girls have never been found wanting. QST has chronicled several of their feats, including the saving of their brother's life. Their rescue of Isle Royale's moose was dramatized in the A.R.R.L.-N.B.C. series a year or two ago. Isle Royale is entirely isolated in winter time, and amateur radio is the only means of communication. But this summer you'll be able to visit their Dad's tourist resort, and sample some of Violet's famous cakes and pies, and enjoy some glorious hiking, swimming, or trolling. Whatever your forte, you'd be assured a "Royale" welcome at W9PCU!

ALICE FITZGERALD, W1FRO, likes anything where competition is involved. Doubtless that's the reason she is such an outstanding "traffic man." Although she has been licensed but three years, she is O.R.S., O.B.S., R.M., and has one of the most efficient stations on Trunk Line "C." On the air with a flea-power rig in February, 1933, she handled a message and got such a kick out of it she was O.R.S. a year later. The present station line-up is 47-46-10's p.p. with 100 watts. Now 19 years of age, a bookkeeper by occupation, Alice has many avocations and enthusiasms. Swimming, bowling, skating, skiing, rifle shooting—she likes all sports. She is an ardent Red Sox fan, and intersperses radio with attendance at baseball, hockey and football games, wrestling matches and boxing bouts—anything with the earlier-mentioned competitive element. A music-lover, too, her tastes run from musical comedy to opera. Finally, her ambitions: (1) To be a newspaper reporter; (2) a commercial ticket! Perhaps her flood work on behalf of Boston newspapers may help with the first.
HAM radio contests are great stuff! Perhaps you win and perhaps you don't—and you never know until it's all over! But whether you do or whether you don't, you have a whale of a lot of fun and get much good operating experience. The Sixth All-Section Sweepstakes Contest was no exception. From start to finish the

hands buzzed with "CQ SS," "Ur nr 73 ok," "Tnx for new section," "CQ SS," "Hr msg fm .. . ," more "CQ SS," and other familiar phrases found in the "Sweepstakes." There were no lulls (except when one lost a vital piece of the station apparatus!—and what an unequalled opportunity a contest provides to see of what stuff your station is made!!). Operating skill was matched against operating skill. And good operating ability, plus a good receiver, a well-adjusted transmitter and intelligent use of the various hands was the winning combination!

W6JMR expresses well the feeling of the ardent "SS-er": "The SS is a whole lifetime wrapped up in one week. You start out even with the other fellow; you're full of vim and vigor, have certain goals you hope and strive for. As the contest goes on, maybe you get there and maybe you don't. Maybe you get the breaks—maybe you don't. But it's all in the game, and you keep fighting on until the end, then sit back and say, 'There's my record, and rotten or not I'm proud of it.' There are those who give up the battle early and just plain quit; there are those who keep fighting on against hard luck to the bitter end and take joy in the fact that they've done the job just as well as they were able; and, of course, there are Dame Fortune's chosen few whom you just can't beat! That's the SS."

The accomplishments of 676 operators are recorded in the list of scores. In addition to the usual listing of number of sections worked by each participant, the number of different stations worked, power factor used and number of operating hours are also recorded so that a more comprehensive picture of each operator's success may be given. 38% of all scores topped the 10,000 mark . . . 19% are over 20,000! Forty-five scores are above 40,000 . . . 27 above 50,000!! Sixty or more sections were worked at 38 stations! Grasp the significance of these facts and you'll realize that the Sixth National QSO Party—the Sixth SS—was some contest!!

Certificate awards are being made to the leading operator in each of 66 of the 69 A.R.R.L. Sections. No entries were received from Mississippi, Western Florida and the Philippines. Competition was extremely keen in practically every one of the 66 sections where awards are being made and especially so in Illinois, where 55 operators reported scores. The N.Y.C.-L.I. and Ohio Sec-
Leading Scorers

While actual competition in the Sweepstakes is between the operators within any given section (awards go only to the leading operator in each section), it is only natural that contestants should strive to place high “nationally.” This is, indeed, one of the factors that keeps the contest humming and interest high. James W. Ringland, W8JIN, Norwood, Ohio, takes highest honors in the 1935 Sweepstakes with 99,509 points!! One more section and he would have topped 100,000, but every SS'er knows that “one more section” is usually the “one that gets away”!! W8JIN worked 534 different stations in 63 sections in a total operating time of 86 hours . . . a record of which to be proud! The rig at W8JIN consisted of a 53 crystal oscillator, 841 doubler-buffer, P.P. '10's final, running at 96 watts input. Four different frequencies were utilized in each of the 3.5- and 7-mc. bands, and two frequencies on 14 mc. Antenna was a 66-foot Hertz, single-wire feed. Harold C. Pratt, W1EZ, Pownal, Vt., placed second-high with a score of 86,690, working 504 stations in 58 sections in 90 1/2 hours. A single '10 did the business on 8.5 (50 watts) and 14 mc. (25 watts), while an '03A running at 100 watts took care of 7 mc. Not far behind W1EZ comes Cameron Pierce, W6HJT, San Mateo, Calif., with 81,648 . . . the result of contacts with 448 stations in 63 sections in 70 hours of operating. OM Pierce used nine different frequencies on three bands (3.5-, 7- and 14-mc.) and pushed out with a pair of '10's in the final, 95 watts input. To W8JIN, W1EZ and W6HJT: Well done and congratulations! It is interesting to note that each of these gentlemen made use of the 3.5-, 7- and 14-mc. bands. It has been demonstrated time and time again that good judgment in using the “right band at the right time” counts much in making a winning score! R. D. Carter, VE3QD, Toronto, leads the Canadian participants with the noteworthy score of 68,076, based on QSO’s with 375 stations in 61 sections . . . 85 operating hours. He also used less than 100 watts input.

At this juncture it is revealing to “turn back the pages of time” to the First Sweepstakes Contest, held in 1930, and note that the national high score in that competition was only 13,158 (153 stations, 43 sections). At that time that was a real record and W1ADW, whose achievement it represents, should not feel that we are now attempting to be little his accomplishment! We only wish to illustrate how the SS has grown and how much more can be accomplished to-day! Further, the first SS lasted a full two weeks and there was no “time factor” — in 1935 scores were based on only 90 operating hours.

We list here all scores above 50,000. The operators concerned should feel no shame if their hat sizes have increased a notch or two. Who wouldn’t swell with pride at such operating records? W8JIN 99,509, W1EZ 86,890, W6HJT 81,648, W4AG 79,690, W8BYM 76,725, W8FIP 75,509, W3BES 72,215, W4CA/9 70,492, VE3QD 68,076, W9DCB 66,681, W8NUR (W8GUF opr.) 65,056, W5AG 63,612, W8DOD 61,331, W8KUN 59,408, W4PL 58,588, W5CJZ 58,212, W1ELR 57,175, W1DHE 56,917, W9AUH 55,836, W3OZ 55,491, W2HHF 54,312, W2CWE 53,886, W4JB (two oprs.) 53,105, W4BOU 51,480, W5WG 51,153, W1TS 51,125, W3EOP 50,447.

There have been six Sweepstakes but so far no operator has worked all 69 sections in any one of them. That is something to shoot at in future Sweepstakes. W9AUH came within one of hitting the coveted 69 figure in the 1934 contest, missing it only by the Philippines. In this 1935 contest the three operators at W6GPU managed to corral 67

W8AQ

Designed for operating, W8AQ, owned and operated by Ev Gibbs, makes a pleasing appearance. The tube line-up is an RK-20 crystal oscillator and '03A amplifiers, running at 180 watts input. W8AQ was one of the highest scoring Ohio stations.
sections—all except Nevada and New Mexico! The best work of a single operator was that of W7BSU and W9AUH, each of whom snagged 66 sections. W7BSU missed only Mississippi, Western Florida and the Philippines, while W9AUH missed Western Florida, New Mexico and the Philippines. The lads say, “There’s always a next time,” so watch out, records! The complete list of those working 60 or more sections is as follows: 67: W6GPU (three oprs.); 66: W8BSU W9AUH; 65: W3BES W4CA/9 W4IB (two oprs.) W4PL W5LW W6SN WSKKG; 64: W4AG W4APU

W6EPZ W8AQ; 63: W1DHE W1TS W3EJO W4O1 W5CJZ W6HJT W8JIN W9AQD; 62: W2H1IF W5ASG W6GTM W8BYM W8FIP W9DCB; 61: W3EOP VE3QD W8NUR (W8GUF opr.) W6IPT; 60: W1MK (Hal opr.) W4DOU W9BTJ W9VKF.

Three hundred or more stations were worked at 42 participating stations. W3BES leads the procession with contacts with 563 different stations, an average of 6.3 per operating hour. A pile of stations by any man’s count! W8JIN worked an average of 6.2 per hour for a total of 754. W1EZ worked 504, or 5.5 per hour. The complete list of multi-QSO artists is W3BES 563, W8JIN 534, W1EZ 504, W1DHE 486, W6HJT 448, W2H1IF 442, W9AUH 424, W3EOP 417, W4AG 416, W4IB (two oprs.) 415, W8BYM 413, W8FIP 412, W1ELR 408, W8NUR (W8GUF opr.) 397, W9AQD 393, W6GPU (three oprs.) 385, W2BXA 377, VE3QD 375, W4CA/9 371, W9DCB 362, W302 364, W1BVP 353, W8DOD 351, W8KUN 349, W2CWE 347, W8AQ 346, W5ASG 342, W2FIS 334, W4PL 332, W6SKG 330, W5LW 327, W7BSU 319, W2AHIC 318, W8JIT 315, VE3ACS 315, W4O1 313, W1GME 311, W5CJZ 308, W2PY 307, W3EXB 302, W3NF 302, W3BKZ 300. One of the “burning questions” in SS participation is whether to spend time looking for new sections, which increase the multiplier, or whether to work as many stations as possible (thereby increasing the points to be multiplied) and let the multiplier take care of itself. Opinions vary on this and it is not possible offhand to say just which is best. However, and let this be a tip to those who enter future Sweepstakes, we are convinced that it is highly important to build up the section multiplier, but we are also convinced that there is a “turning point” in building up a score, after which additional sections become less important, and when it pays to start working as many stations as possible. Just when this turning point is reached, we don’t know—possibly after working 35 sections, 40 sections, 45 or who can say? The point is, such a turning point exists and the contestant who finds it will have found one of the secrets of highest honors. Get out the slip sticks, boys!

USE OF FREQUENCY BANDS

7 mc. has been becoming more and more the most popular SS band. In this contest 85% of all contestants made full-time or part-time use of 7 mc. 26% made full-time use of this important band. 3.5 mc. was the second most popular band with 55% of all participants operating there either full- or part-time; 11% used 3.5 mc. exclusively. The greatest value of 3.5 mc. lies in its ability to produce the more “local” sections, not so readily obtained on the highest frequencies. 41% used 14 mc. full- or part-time. 21% divided operation between 3.5, 7 and 14 mc., 20% between 3.5 and 7 mc., and 16% between 7 and 14 mc. 28 mc. was used for the first time in an SS and 56 and 1.75 mc. came in for a slight amount of usage. Among those using 28 mc. were W1FRK, W3CHH, VE3DU, W4AJY, W5WG, W6DIO, W7EVV and W8ITK. A careful use of all the most popular bands at the right times is the answer to best results in most cases. Witness that W8JIN, W1EZ and W6HJT each used 3.5, 7 and 14 mc. And that W9AUH and W7BSU, who each worked 66 sections, also used those three bands. The W6GPU operators worked their 67 sections on 7 and 14
An exception to the rule that it is not usually possible to work a great many sections on one band only is W6SN, who worked 63 of his 65 sections on 7 mc.; the other two were worked on 14 mc.

THE POWER FACTOR

There were but two power classifications in the 1935 Sweepstakes—those using “up to and including 100 watts” (who multiplied their basic scores by 1.5 for final scores), and those using “over 100 watts” (who multiplied by 1 for final scores). The final scores of those using power over 100 watts part-time, and under 100 watts part-time, are comprised of the total of their “low power” and “high power” scores, which are computed separately. 78% of all contestants chose to operate in the “100 watts or less” group, taking advantage of the 1.5 multiplier. 24% used over 100 watts, while the remaining 1% operated in both classifications. WSJIN was the highest scorer using the 1.5 multiplier, W3BES highest using multiplier of 1, and W4PL highest operating in both power groups. In order to give an idea of actual accomplishments (number of stations worked and number of sections worked) of those using power under 100 watts and those over 100 watts the following statistics are given. These figures will help to determine the relative merits of the two power classifications. We reach no conclusions, however, since operating ability and use of bands play such a big part in actual results. Of the 42 stations where 300 or more stations were worked, 21 used 100-or-less watts, 18 used over 100 watts, and 3 operated in both classifications. Of those working 60 or more sections, 18 used over 100 watts, 17 used 100-or-less watts, and 1 operated in both classifications. W6GPU (two oprs.), who worked 67 sections, and W7BSU and W8AUH, who worked 66 sections, all used over 100 watts. W3BES, who worked the most stations, 565, used over 100 watts, while WSJIN (534 stations) and W1EZ (504 stations) used under 100 watts. As a matter of record, 46 of the 66 section-winners operated in the 100-watt-or-less group, 18 operated with over-100-watts, and 2 operated in both groups.

LOW POWER RECORDS

The work of several operators, who used what we consider truly low power, is worthy of special mention. W9VES worked 107 stations in 31 sections using only a '45 TNT with 5 watts input. W2BEL worked 124 stations in 22 sections with 6 watts input. W9KCG made 18,075 points (124 stations, 60 sections) using 7 watts to a '71A amplifier. With 8.5 watts to a '12A TNT oscillator, W6BD made 13,455 points (118 stations, 59 sections). WSFDA, using but 10 watts to a single '71A oscillator, made the astounding total of 45,441 . . . contacts with 283 stations in 54 sections! 19,593 points is W8NDG's record using 10 watts on 3.5 mc. and 12.5 watts on 7 mc. into a '45 Hartley. He worked 168 stations in 42 sections. W3FRM used a '45 Hartley on 3.5 and a '45 TNT on 7 mc., each with 10 watts input . . . and he worked 160 stations in 41 sections for 19,250 points. W9AND, using the 3.5-mc. band entirely except for five 7-mc. contacts, and with but 16 watts input to a single 2A5 crystal oscillator, made a score of 30,141 . . . 200 stations in 51 sections! Of interest also is W9AND's receiver—an '01A detector and '01A audio! The records of these operators deserve the praise of everyone who ever sent a CQ!

PHONE PARTICIPATION

VE3ER made the highest score, 4623, of those operators using radiotelephone. He worked 67 stations in 23 sections using the 3.9- and 14-mc. bands; many contacts were 'phone-c.w. W4BZA made 1652 points (36 stations in 22 sections) on 14-, 3.9- and 1.75-mc. 'phone. Thirty-two contacts were on 14 mc. 2 on 3.9 and 2 on 1.75. W4DGS' 952 points were rolled up on 1.75-mc. 'phone; he worked 34 stations in 14 sections. Using 3.9 and 14 mc. W9DMF worked 17 stations in 17 sections.
for a score of 563. In addition to making one of the highest c.w. scores, W8FIP put in a little time on 1.75- and 3.9-mc. 'phone, making 138 points (23 stations, 2 sections). W6HJT made one contact on 3.9-mc. 'phone.

**CLUB AWARDS**

Scores were submitted by amateurs in 83 different clubs. Special certificate awards were offered to the highest scoring participants in each A.R.R.L.-affiliated club where three or more individual club members took part and submitted scores. Awards are being made to the following amateurs in the clubs indicated: W1IOT, Worcester (Mass.) Radio Association; WINE, Connecticut Brassounders Association; VE2FG, Montreal Amateur Radio Club; WSATR, Beacon Radio Amateurs (Philadelphia, Pa.); W3BES, The Frankford Radio Club (Philadelphia, Pa.); W3EOP, The Key Club (Easton, Pa.); VE3QD, Hamilton Amateur Radio Club; W4APU (c.w.), Birmingham (Ala.) Amateur Radio Club; W4DGS ('phone), Birmingham (Ala.) Amateur Radio Club; W5BDI, Houston (Tex.) Amateur Radio Club; W6CIS, Associated Radio Amateurs of San Francisco; W6KBD, Whittier (Calif.) Radio Amateurs' Association; W8BDF, Finger Lakes (N. Y.) Transmitting Society; W9MMX, Rochester (N. Y.) Amateur Radio Association; W9DEW, Central New York Radio Club; W9ASW, Cleveland Heights Amateur Radio Club; W9MCI, Bluefield (W. Va.) Amateur Radio Club; W9AEP (c.w.), The Wichita (Kans.) Amateur Radio Club; W9DMF ('phone), The Wichita (Kans.) Amateur Radio Club; W9LKI, Fort Wayne (Ind.) Radio Club; W9QQW, Southtown Amateur Radio Association (Chicago); W9RCQ, Egyptian Radio Club (E. St. Louis, Ill.); W9RI, Milwaukee Radio Amateurs' Club, Inc.

Members of 62 other clubs submitted scores but, since there were not three or more entrants from their clubs, no awards can be made. If, upon checking, any club finds that it actually had three participants, but no award has been made, we shall correct the situation upon receipt of such advice. There are many cases where contestants did not mention membership in any club so their work could not be credited towards a club certificate.

**ITEMS OF INTEREST**

Probably the closest race of the SS contest was in the Northern Texas section between W5CPB and W5BTS; they wound up with only 31 points difference in scores—W5CPB 17,784, W5BTS, 17,753. Other close battles were in E.N.Y., between W2EWD, 27,669, and W2BMX, 27,284; 385 points difference; in W.N.Y. (the Central New York Radio Club), between W8EMW, 94,-506, and W8AQE, 33,810; 696 points difference; and in N.Y.C.-L.I., between W2HFF, 54,312, and W2CWE, 53,586; 726 difference. W2FIS QSO'd W1AQW, Lewiston, Maine; his next QSO was with W8CHR, Lewiston, Pa. W9AHA did one better by working Lewiston, Pennsylvania, Vermont and Maine. Mrs. Mary Roth, W9TSV, is winner in Illinois; she says she could have made more points, but had to attend to her housework as well as cook a Thanksgiving dinner for six! And yet some of the OM's say we need a multiplier for the married men!!

The texts of all messages originated at W8KXA were titles of popular songs. W9VKF's first QSO of the contest was with W4SV, Florida on 14 mc., and his last was with W7EOF, Tacoma, Wash., on 3.5 mc.—two extremes in frequencies, and two extremes in geographical location. W9IGW and W9OUD, brother and sister, with rigs at the same QTH, had to share time. The "biggest little" report came from W9MMX—a two-foot figure "2" cut out of wrapping paper, carrying a score of "2." Hi, Oddities at W9NUF: Working W8AVH, W9AVH; W8AQE, W8AQE; W3CHH, W9CHH! W8DED will award free QSL cards to the highest national scorer. Says W9KEH, "Please note that stations can be worked on CQ's—only 4 CQ's missed during the contest." First Michigan contact at W3DPU was W8GQB; the very next contact was with W6GQC, also in Michigan! Sour grapes: "This score won't win a prize but then, I didn't try very hard." The average number of operating hours of the 66 Section winners was approximately 65. W4CA, operating portable at Nederland, Colo., is believed to have had the highest location in the SS—8257 feet above sea level. One of the worst locations is claimed by W6BNH, Stanislaus Power House, Stanislaus, Calif. Says he, "I'm down in a canyon on the Stanislaus River with the highest points at about 2000 feet. The camp is on the east side of a horse-shoe bend of the river. It takes a 1500-foot jump to get our east and south. The country is full of mineral deposits, besides all the power equipment!" W8KKG offered a milliammeter to the
West Virginia station contacting more sections than he did—but nobody did it. Proof of a successful contest: 'The few heard calling "CQ No SS"—they couldn't raise anything but! Hi! Break-in operation more than proved its worth to those using it—saved precious minutes and soothed weary nerves. There is keen SS rivalry between North and South Louisiana. Looking ahead, W5BZR says he's going to win the Louisiana award in the next SS and gives the Southern Louisiana gang fair warning. The Wicha (Kans.) Amateur Radio Club was sponsor of a local competition, several equipment awards being donated by local supply houses. Asking one ham if he were in the SS, K6CGK received this answer: "No, OM, I don't hold tickets for any sweepstakes." W8HJT was on the air about ten hours less than in 1934, but he worked about 260 stations and was using over five times the power of the previous year. W6FVD reports, "Using almost same equipment as previous year made about 6000 points more—even with the reduced multiplier. This is mostly due to using two bands instead of one only as in 1934." W3DSC's message to an unknown W9, "Hope you are in Wisconsin!"—back came, "Hr msg fr Milwaukee Wis ... ." W2HHF's message to W9JCW, "There's nothing like an SS experience—the ones we missed—compensated for by the ones we didn't expect. What a game!! "

Atlantic Division

<table>
<thead>
<tr>
<th>Station</th>
<th>Score</th>
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<tbody>
<tr>
<td>W3BZP</td>
<td>4860-27-10-49-10</td>
</tr>
<tr>
<td>W3BQ</td>
<td>4933-29-82-B-16</td>
</tr>
<tr>
<td>W3BP</td>
<td>4936-45-21-65</td>
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<tr>
<td>W3BR</td>
<td>4938-50-56-A-15</td>
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<td>W3BS</td>
<td>4940-52-23-41</td>
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<td>W3BT</td>
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<tr>
<td>W3BV</td>
<td>4952-51-18-91</td>
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<tr>
<td>W3BZP</td>
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<td>W3BJ</td>
<td>4963-51-18-79</td>
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</tr>
<tr>
<td>W3BZP</td>
<td>4967-51-18-77</td>
</tr>
</tbody>
</table>

In the last figure following the score.—... Examined all listings: W3BES 72215-65-563-B-89, or, Final Score of opr, W8FWY; oprs. W8MLM and W8MJV, all from the same club. W8FPM and W8EJO of other clubs.

1 Two ops. Combined score: 72735. 2 Station Score, EffM 4514, CRM 3270. 3 Score of opr, W5FWY; oprs. W5MLM and W5MJY also made 3 contacts. 4 Station score: oprs. W8BDA, W8CAG, W8DIF operating. 5 Station score: oprs. W8UQG, W9AAY. Both power factors; high power: 464, low: 468. 6 Score of opr, W9BKO also made 18 pts, W9BKO operating. 7 Portable at Angola, Ind. 8 Both power factors; high power: 10000, low: 108. 9 Station score; oprs. W9CUC, W9RIK. Individual ops. scores not included at 2%. Minn. award cannot be made while score of highest operator at W9FCK is acquired. 10 Both power factors; high power: 604, low: 608. 11 Station score; oprs. W4IRB, W4XVW, W4CAG. Both power factors; high power: 5760, low: 192. 12 Both power factors; high power: 5840, low: 192. 13 Both power factors; high power: 5840, low: 192. 14 Portable at Newport, Mo. 15 Both power factors; high power: 3627, low: 108. 16 Chief op. Hal Rubbing operating. 17 Massachusetts Broadcasters Association: W1HEE, W1HDE, W1HDD, W1VPU, W1TVU, W1WTO operating. 18 W3ABE, W3ACE, W3AMA, W3AMO, W3AF, W3AP, W3AQ, W3BP, W3BR, W3BS, W3BT, W3BW, W3BY, W3BZP. 19 W3AF, W3AMO, W3AP, W3AQ, W3BP, W3BR, W3BS, W3BT, W3BW, W3BZP. 20 W3AF, W3AMO, W3AP, W3AQ, W3BP, W3BR, W3BS, W3BT, W3BW, W3BZP. 21 W3AF, W3AMO, W3AP, W3AQ, W3BP, W3BR, W3BS, W3BT, W3BW, W3BZP. 22 W3AF, W3AMO, W3AP, W3AQ, W3BP, W3BR, W3BS, W3BT, W3BW, W3BZP.
High-Fidelity Audio at Low Cost

A Simple and Inexpensive Power Amplifier Unit of Striking Performance

By A. G. Hull*

“Broadcast station quality,” we have been recently jolted to realize, is something that most of us hams talk about quite glibly without really knowing what we are talking about. We don’t know what it is because we seldom, if ever, hear real high-quality reproduction. Quite properly, we do not get it with the communication-type equipment we are accustomed to use. But we ought to be exposed to it, at least occasionally, just to give us a proper reference standard for those “broadcast quality” phone reports we pass out so freely, if for no other reason. All this was brought home to us by Mr. A. G. Hull, technical editor of Australia’s Wireless Weekly and brother of QST’s Associate Editor Ross A. Hull, during his recent visit to A.R.R.L. headquarters in the course of a trip around this country and Europe surveying radio and television status for his Aussie readers. He learned some things about ham radio from us and, we frankly admit, we learned some things about quality reproduction from him—which we pass on to Hamdom in this article, written especially for QST by “A.G.” just before his return trip home.—EDITOR.

There is a vast gap separating the hobby of amateur radio from ordinary listening to broadcasting stations. Perhaps this explains why so few hams worry about maintaining any prestige when it comes to the matter of a program receiver for the home. A survey of a typical ham shack may reveal a fine transmitter and perhaps a hundred-and-fifty “bucks” worth of communications type receiver. But here is an idea for those who are just a little fed up with messing around with what they have been doing for the past six months. Give that particular job a rest for the next few days and have a change. They say that a change is as good as a holiday. Try your hand at high-fidelity phonograph reproduction and broadcast reception. You may find it very interesting; and when you return to the 5-meter band, or whatever you are working on, you will find renewed enthusiasm and refreshed energy—along with a better conception of just what “broadcast quality” really sounds like. Apart also from the appreciation of the YF, you may find that the modernized home set sounds very impressive to the neighbors and other visitors who happen to hear it. After becoming accustomed to the tonal quality (?) of any ordinary set with single pentode output, a receiver which has a fairly high degree of fidelity tends to take hold of your ribs and make itself felt. And it doesn’t do the game any harm if the man in the street gets an impression that hams have such brilliant brains that they can make up a receiver which sounds so much better than Mr. Street’s factory-built job.

There are lots of simple ways of getting some reproduction which sounds impressive. The simple audio amplifier suggested for the purpose and diagrammed in Fig. 1 uses a circuit idea which has attained great popularity in Australia, where it has been going strong since 1932, as it has also in England and France. In the latter country they call it a “Kathodyne” circuit, that name being used because the method of obtaining out-of-phase signal for driving a pair of push-pull output tubes consists of taking excitation from the cathode circuit as well as the usual plate circuit of the first tube. And so we obtain resistance-coupled push-pull, with a frequency characteristic which is about as nearly perfect as can be.

FIG. 1—CIRCUIT OF THE HIGH-FIDELITY AUDIO AMPLIFIER

C1—0.1 µfd. 400-volt tubular condenser.
C2—8 µfd. 500-volt electrolytic.
C3—25 µfd. 25-volt electrolytic.
R1—500,000-ohm volume control.
R1—50,000-ohm 1-watt fixed resistor.
Re—100,000-ohm 1-watt resistor.
R5—50,000-ohm 1-watt resistor.
Re—125-ohm wire-wound resistor to carry 150 ma.

34 QST for
desired, along with a particularly low hum level, even with limited filtering—and all at the cost of about a dollar's worth of parts.

The introduction of the new Type 6L6 "beam tube" means that it is easy to get 14 watts of output with 2 percent total harmonic distortion. All that is then needed is the right kind of input for the amplifier, the right kind of speaker to handle the output and shatter-proof glass in the windows of the room in which it is going to be operated.

The actual construction of the amplifier itself is simple—just a couple of hours entertainment for even a novice. We trust that there is no need to go into detail or to give any instructions such as, "take the tip of a hot soldering iron between the thumb and forefinger of the right hand." Layout is quite unimportant, since there are no audio transformers to pick up hum by induction. The main idea will be to get the sockets spaced so that the coupling condensers and various resistors will drop into place and hang by their own pigtails.

The power supply required is also of simple specification, as shown in Fig. 2; but again there is a point, fairly hard to detect but very critical in effect. Unless the voltage regulation is good the tonal quality will suffer. Use a big power transformer with plenty of core, and a choke with heavy gauge wire. Pay particular care to get good filter condensers. If in doubt, see if you can find a couple of good paper condensers of 4-µfd. capacity and ample voltage rating, and use these instead of the more usual electrolytics.

Another big advantage of the amplifier is the way in which voltages can be checked to prove correct operation. Using an ordinary thousand-ohm-per-volt d.c. voltmeter (0-1 ma. meter), the first check is across the two 100,000-ohm load resistors. Both readings should be exactly the same, and about 60 volts. The reading across the 50,000-ohm resistor should be one-tenth; that is, about 6 volts. Also try for a reading across the two half-meg. grid leaks—and hope that you won't find one. There should never be any current through either of these, not even when the amplifier is running full out (if you can stand it that way). The bias of the output tubes can be checked by taking a reading across the 125-ohm resistor. It should be about 16 volts if the plate voltage is 250 volts, measured from plate to cathode on either 6L6.

To those who are accustomed to working on ordinary amplifiers there is another detail about this circuit which is rather different from the usual run. This is in the matter of the input circuit, which is above ground, neither side being returned to B-negative. When using a crystal pick-up this is not even an inconvenience; but it becomes necessary to earth the B-negative in order to eliminate a little sizzly hum which is otherwise likely to be in evidence.

**RECORD REPRODUCTION**

The first problem is to get a satisfactory signal input. A crystal pick-up, operating on a modern recording, will be fairly OK for a start. Two points need to be carefully watched, however.

![FIG. 2—CIRCUIT OF THE POWER-SUPPLY UNIT](image)

**FIG. 3—A SIMPLE TUNER CIRCUIT FOR LOCAL RECEPTION**

To tune the range 540 to 1500 kc. with a 350-µfd. tuning condenser (C1), the coil L1 should have inductance of approximately 350 microhenrys (95 turns of No. 22 d.c. wire on a 2-inch diameter former, winding length 2¾ inches).
The first is the torque of the motor. Unless the motor has powerful torque and runs at exactly 78 revolutions per minute it is quite impossible for overall results to be satisfactory. The use of a stroboscope will tell if the speed is right, but unfortunately will not readily indicate any slowing up which may occur when dragging on low notes with a motor having insufficient torque. The next important point about the use of a crystal pick-up is the question of the impedance of the input circuit. The pick-up should feed into a load of not less than 500,000 ohms. If a volume control is used in parallel with a grid resistor, the effective resistance must be at least 500,000 ohms. Normally a simple volume control will be used; but we mention this point in case anybody builds up this amplifier, finds it desirable to maintain a grid return for the first valve, or perhaps fits a tuner across the input. In all such cases the matter of the impedance must be taken into consideration.

The loud-speaker problem is readily solved, for all that is necessary is one of the modern “high-fidelity” types, such as A12, G12, etc. But the speaker field must be adequately energized and must have ample baffling. It is suggested that great care be taken to see that the speaker gets an effective 15 watts in the field and that a baffle board three to four feet square be used. It may also be worth mentioning that it is useless to expect good results unless the acoustic properties of the room are suitable. Generally speaking it will be found that the usual room, with a carpet on the floor, will work out pretty well. On the other hand, unnatural brilliance, with ear-tearing highs and distressing reflections, will result if the amplifier is used in a bare workshop. Small bare rooms are useful only if it is desired to retain brilliance at low volume levels.

RADIO INPUT

Having once heard the amplifier in operation on a modern recording, the builder will immediately want to hitch it up to some radio tuner in order to get the full benefit of the high-quality broadcast transmissions. This can be readily arranged, but not quite as easily as may be expected.

In some cases where there may be a local 50-kilowatt within a few miles, and if programs from this single station are going to fill the bill, a simple single-circuit tuner can be fitted as suggested in Fig. 3. The incidental non-linearity of the first stage is utilized for detection. If there are two or three powerful stations to be separated it may be worth building up a t.r.f. unit of one or two stages, as suggested in Fig. 4. The tuner of a midget superhet can also be used, as suggested in Fig. 5; but in most cases it will be found that as soon as a superhet tuner of even moderate selectivity is added, the brilliance of the highs will be lost and the broadcast program will not sound as good as reproduction of a recording. To help out in such a case it may be found advisable to shunt a 50,000-ohm resistor across the primary of the second intermediate transformer, from plate of the intermediate amplifier to B-plus. This should help flatten out the intermediate selectivity a little. The actual diode circuit will need to be modified to conform with the first stage for detection. If there are two or three powerful stations to be separated it may be worth building up a t.r.f. unit of one or two stages, as suggested in Fig. 4. The tuner of a midget superhet can also be used, as suggested in Fig. 5; but in most cases it will be found that as soon as a superhet tuner of even moderate selectivity is added, the brilliance of the highs will be lost and the broadcast program will not sound as good as reproduction of a recording. To help out in such a case it may be found advisable to shunt a 50,000-ohm resistor across the primary of the second intermediate transformer, from plate of the intermediate amplifier to B-plus. This should help flatten out the intermediate selectivity a little. The actual diode circuit will need to be modified to conform with

(Continued on page 90)
A New Type of Unguyed "Sky-Hook" for Amateur Antennas

General Features of the Free-Standing Triangular Wooden Tower at W3ZD

By Frank P. Cartwright

The simple "2-by-2" or "A"-type guyed wooden mast originally described in September 1932 QST (and shown in subsequent editions of the A.R.R.L. Handbook) has become practically standard as the sky-hook for supporting amateur antennas at heights up to 40 feet; but there has been no such standardization in structurally proper wooden towers, least of all in self-supporting types running to 70-foot and greater heights. It is true enough that a variety of "lattice" towers have been built by amateurs and described in QST. But it must be admitted that a generally satisfactory structural design has not been supplied. In this article the author introduces a new type of construction which may well fill this long felt need and develop into a state of standardization for amateur use. Since the final design must be influenced by height, suggestions from interested amateurs will be helpful in arriving at two or three typical designs which will meet general requirements for horizontal and vertical antennas. Letters of suggestion concerning heights and other factors may be addressed to QST.—EDITOR.

About the time WRVA built its 326-foot all-wood tower at Richmond, Virginia, Bob Eubank, W3AAJ, transmitter chief of the station, suggested to the writer that such a tower, developed in miniature and economically designed to meet the antenna pull and wind pressure conditions, would fill a long felt need in the amateur field. Many other commitments, however, prevented following up the matter until February of this year, when W3ZD's 88-foot tower blew down in a high wind, and H. Clay Thompson of Chevy Chase, Maryland, undertook to build Roy Corderman a more substantial one from the writer's design.

The reasons soon became apparent why little progress has been made to date in developing light wood towers for amateur station purposes, or that the towers built here and there have not proved uniformly satisfactory from the structural viewpoint. W3ZD specified that his new tower, to be thoroughly effective from a radio viewpoint, must be free-standing (without guys) and not less than 70 feet in height. We soon found that the design of such a tower, which would be not merely a makeshift but which would be permanently adequate to the requirements and at the same time within the reach of the amateur's pocketbook, was no small problem. The selection of sizes to meet the loads, the detailing of connections which would realize the full strength of the members, the selection of suitable and economical hardware items obtainable as far as possible from customary stocks, and the workmanship required to combine these items into a complete and permanent structure, involve almost as much detail, investigation and special experience as the design and erection of the WRVA tower. Numerous improvements on the first design suggested themselves during the fabrication and erection of W3ZD.

It may be a surprise to many amateurs to learn how much pressure the wind can exert on a tower and antenna, even though of no great height. The gradient or pervading velocity of the wind increases steadily from a minimum near the ground surface up to heights of several hundred feet, but due to peculiar local conditions such as the slope of the ground or the relative positions of nearby buildings or trees, the wind pressure here and there close to the earth's surface may be as great or greater than far up in the air. The opinion is spreading among engineers, due both to added

*Structural Engineer, 47 West Lenox St., Chevy Chase, Md.
research in this field and to rather numerous failures of radio broadcasting towers in recent months, that these structures should be designed for greater wind pressures than have been assumed in the past. Corresponding care should be taken to strengthen the smaller towers used by amateurs.

The tower designed and erected for W3ZD was of the same three-cornered type used at WRVA. As compared to a square tower, the triangular type saves about 25% on lumber, fitting and foundations, presents less resistance to the wind and requires fewer sizes and lengths of pieces. It also is not affected adversely if one of the foundations settles slightly or is heaved by frost out of level with the other two piers. This method of tower construction is patented and has been used by the U. S. Government for forest lookout towers in the Pacific Northwest.

The material used for the W3ZD tower was dense, longleaf, all-heart Southern yellow pine, though the plans were so made that any one of several other species also could have been used. It was painted with one coat of aluminum and one coat of grey concrete paint. All connections were made with bolts, except for a few points near the bottom of the tower, where timber connectors of the type employed in the WRVA tower were used for leg splices. Steel gusset plates were used for web member connections but the leg splices were made with wood.

Such a tower, economically designed, requires about 200 feet of lumber, weighing from 400 to 600 pounds, and about forty pounds of bolts and fittings. The footings have to be designed against uplift due to the overturning moment of the wind, and require about one-third cubic yard of concrete for each corner or leg of the tower.

Two alternative methods by which amateurs could avail themselves generally of the advantages of a free-standing tower of this economical type are suggested.

1. A complete set of plans and templates could be provided by which the owner could lay out his own tower members using lumber purchased from local retailers, the builder shearing and drilling his own fittings; or the plans might be accompanied with sets of sheet metal fittings, bolts, and other hardware ready for use.

2. The members and fitting of a complete tower, manufactured at some central point, could be shipped knockdown with directions for foundations and erection.

The former method affords the amateur desiring a wood tower greater opportunity to utilize his own time and energy. It requires considerable care and skill to secure a satisfactory, permanent structure, but is quite feasible if the builder is willing to take the necessary pains.

The small sizes of lumber required for an economical structure are in many cases not stock or standard sizes available from ordinary lumber yards. They have to be ripped from clear stock of larger sizes and care must be taken that the resulting small pieces show no serious cross-grain due to defects which are not important in the larger piece but may seriously weaken the small section. For this work a small 3½- to 4½-h.p. bandsaw is preferable to the big circulars at the lumber yard, which often seem to take as much wood out in saw kerf as they deliver in the desired sizes.

The builder would have to be sure that the lumber was all heartwood, of one of the more durable species, unless he should be in position to have the members pressure treated with a preservative after they are cut to length and bored for fittings, before the tower is erected. The heartwood of trees is much more resistant to decay than the sapwood and, except perhaps in the extreme northern parts of the country, should always be used for towers unless preservative treatment is employed.

Sheet steel fittings should be galvanized. The holding power or load capacity of screws and bolts of different sizes in wood of different species is available in recent publications of the U. S. Forest Products Laboratory. Their bearing capacity in sheet steel of various gages is less well known. The writer secured his information from the American Rolling Mills Company.
Another Crack at Background Noise in C.W. Reception

Class-C Audio System for Reducing Interference

By N. Bishop,* WIEYM

At the recent Connecticut State A. R. R. L. Convention in Bridgeport, I had the pleasure of hearing Jim Lamb describe his development work on noise silencer and diversity reception circuits. One of his remarks prompts me to cast aside my cloak of silence and describe a paper which I read before the Yale Radio Club in New Haven on February 1, 1933.

Mr. Lamb's remark was to the effect that the c.w. telegraph selectivity obtainable by making use of a crystal filter in the i.f. circuit of a superheterodyne receiver could be made so high that any attempt to increase the circuit selectivity further would fill in the intervals between the dots and dashes and make them indistinguishable because of the reduction of the sidebands necessary for the formation of readable characters. Some development work carried on by me in 1932 opened up new possibilities in the beat-note reception of c.w. telegraph signals under such conditions of high selectivity.

The circuit to be described accomplishes the following results:

1. For a given speed of transmission it permits tremendous increase in the allowable selectivity without loss of intelligibility.

2. If the beat-note level is above the existing noise level, it will eliminate all noise between the dots and dashes.

3. Intelligible aural reception up to forty words per minute or more can be obtained through a circuit so selective that only the most stable transmitters will stay in the acceptance band for the duration of a dash or dot.

It would be well at this point to state the premise on which the circuit was developed. The only condition which must be fulfilled for the reproduction of aurally intelligible telegraph signals is that it must be possible to distinguish dots, dashes, and spaces. In other words, we can distort the original signal in any way to our liking as long as the above conditions are fulfilled. In order to illustrate the theory behind the operation of this circuit, let us consider a stable transmitter sending a series of dots at a rate equivalent to forty words per minute. If this signal is fed through an extremely selective receiver, which may have a crystal filter in the i.f. circuit and a sharp audio filter in the a.f. system, we might expect to see the changes shown in Fig. 1.

In Fig. 1-C, the percentage modulation has been so reduced as to render copying impossible. But now let us take the signal shown at C and distort it in such a way as to restore the normal percentage of modulation. As shown in D, by applying this signal to a Class-C audio amplifier with adjustable bias we may restore the depth of modulation at the expense of the length of the dots and dashes.

We now have the dots with nothing between them, unless the peak noise voltage at the output of the filter exceeds the peak value of the signal; in other words, clear dots and no background. The peak value of the noise may be made less than that of the signal in the i.f. system by the Lamb silencer, or limited in the output by using very low plate voltage on the Class-C audio amplifier (i.e., just enough to give comfortable volume). The higher the signal level applied to the Class-C amplifier input, the simpler the adjustment of the cut-off bias, since the voltage increment of the bias adjustment is fixed by the potentiometer control.

Fig. 2 illustrates a simple circuit using readily available parts with which this system may be used on any stable receiver equipped with a separate beat oscillator and an audio power stage. The choice of a resonant frequency for the audio-frequency filter depends on several factors. If cost is no consideration, a multi-section 1000-cycle filter would be ideal; but not many amateurs will have the necessary components available for its construction. Assuming that the filter will be
limited to a single section, the choice of a relatively low frequency simplifies the problem of getting a narrow band-pass in terms of cycles band-width. One successful filter used in the demonstration at New Haven in 1933 was resonant at 250 cycles. This may seem rather low for copying, but it must be remembered that the Class-C amplifier output contains strong harmonics which give a pleasing tone. The resonant circuit is very loosely coupled to the power stage so that it will not be loaded by the plate resistance.

A check of the circuit shows that a high negative grid bias is supplied by biasing the cathode positive with respect to ground. Low plate voltage is obtained from the voltage divider $R_2-R_4$. $C_4$ a.c.w. signal is tuned in, the bias may be increased until no sound exists between the dots and dashes. Of course, if the noise level is as high as the signal level, it will be impossible to leave the spaces clean. If, however, the signal exceeds the noise by only a small amount, the background may be completely eliminated.

For best operation of such a device two conditions must exist. The incoming signal must be stable in frequency and amplitude. If the frequency varies, selectivity will have to be sacrificed in order to hold the signal. The incoming signal must be stable in amplitude as far as the level of the beat note is concerned. Some a.v.c. helps this situation. If, however, the Class-C stage is operating so that the dots and dashes are just showing their heads up above the threshold and the signal fades out, nothing will be heard. It is rather difficult to cover the whole subject of selectivity in a small amount of time. I should like to say, however, that all these methods of getting selectivity after a conversion process are definitely not the final answer (referring to i.f. selectivity after conversion and a.f. selectivity after the second detector or again after a second converter). The ideal receiver would consist of pick-up, selectivity, amplification and detection in the order named. One general rule must be remembered and that is that selectivity is no good to anybody if it occurs after an early stage has been rendered inoperative by a strong interfering signal.

The circuit as described may be used without the audio filter if the individual feels that his crystal i.f. filter provides ample selectivity for most signals. It will then allow him to eliminate noise between the desired-signal dots and dashes so long as the noise level is below the signal level. It’s easier to copy when the spaces are clean and a trial should be ample proof.

Strays

**Meter-Type Modulation Monitor**

In the meter-type modulation monitor described by D. C. Summerford in May, 1936, *QST*, the tube should be connected as a diode rather than as a triode. That is, the grid and plate should be connected together in the diagram of Fig. 1, everything else remaining “as is.”

In the 6L6 story in June *QST*, Fig. 4, the plate transformer was erroneously listed. The correct number is T-5303.

Shall we have another Field Day in late August or early September? Drop us a QSL card at once if you would like another F.D. this summer.

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**FIG. 2—CIRCUIT OF THE AUDIO FILTER AND CLASS-C AMPLIFIER**

- $C_1$—1-µfd, paper blocking condenser.
- $C_2$—0.01-µfd, filter coupling condenser, paper or mica. (Depends on $L_1$.)
- $C_3$—1 to 4-µfd, filter tuning condenser, paper. (Depends on $L_2$.)
- $C_4$—1-µfd, a.f. by-pass, paper.
- $C_5$—1-µfd, cathode by-pass, paper.
- $R_1$—100,000-ohm, 1-watt.
- $R_2$—25,000-ohm, wire-wound potentiometer.
- $R_3$—500-ohm, 2-watt.
- $R_4$—30,000-ohm, 2-watt.
- $R_5$—25,000-ohm, 2-watt.
- $L_1$—Inductance which will resonate at 250 cycles (1.5-henry choke).
- $S_1$—D.p.d.t. switch to cut out audio filter.

provides a low impedance path around the bias and plate voltage supplies for the audio frequencies in the plate circuit.

The filter may be adjusted best by tuning the receiver to some steady carrier, say on the broadcast band. The bias on the Class-C stage is reduced until it is above cut-off. The resonant frequency may be judged as the beat-note and plate should be connected together in the dial setting.

Increasing $C_1$ will reduce the coupling between the power stage and the filter and hence give a sharper response curve. Incidentally, the tuning of a receiver so equipped is so sharp that a smooth vernier beat note adjustment is essential. After
A High-Power Three-Stage C.W. Transmitter
With Beam-Power Crystal Control

By Frank W. Edmonds,* W2DIY

SINCE the advent of the new beam power tube, known as the 6L6, there has been considerable interest shown in the possibilities of its use in r.f. circuits. Because of the good efficiency of this tube as an oscillator, and its higher power output capabilities, it seemed desirable to put it to work in a high-power c.w. transmitter.

Operating the 6L6 as a crystal oscillator with 400 volts on the plate, with a power output of over 30 watts, it is possible to drive a rather large involved. With sufficient output from the oscillator and with the new crystals now available there is really no necessity for use of transmitters with more than three stages for usual c.w. use.

In order to construct a three-stage transmitter which will perform satisfactorily at high power levels on all of the commonly used amateur bands, starting out with an oscillator having sufficient power output, it is advisable to select tubes for the other two stages which have not only low interelectrode capacities but also high efficiency and low excitation requirements. As shown in the photograph and diagrammed in Fig. 1, the combination selected for this particular transmitter was a 6L6 crystal oscillator, an Amperex 203-H buffer-doubler and, for the final, a pair of HF-200's. Other combinations will no doubt work equally well, provided the characteristics are such as to meet the above requirements.

The 203-H, which is a 203 type of tube with the plate lead brought out on top of the envelope, thus reducing the interelectrode capacities and raising the permissible plate voltage, is quite easily driven, even at 14 mc. The power output from this stage when doubling is adequate for ex-

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*Engineering Dept., United Transformer Corporation, 72-78 Spring St., New York City.
citation of the push-pull HF-200's used in the final. Link coupling was used throughout in order to provide maximum efficiency in coupling and to improve the flexibility of the transmitter. The antenna tuning system is not shown in the photo since this was located some distance away and link-coupled to the final plate tank. The entire

r.f. section is built up on two decks with the condensers mounted below deck to provide the shortest possible leads, and to conserve space. These two units fit very nicely into a 30-inch cabinet or rack. Another 30-inch cabinet or rack takes care of the two plate supplies and the bias supply.

Now let's look at the back view of the transmitter and consider it step by step. In the lower left-hand corner is the 6L6 with its associated crystal and tank coil. The screen of the 6L6 is fed from a tap on the power supply bleeder, both to provide oscillator keying and to prevent power output fluctuations due to changing screen voltage. The power supply for the oscillator should have a capacity of between 150 and 200 ma. in order to obtain good efficiency from the 6L6 oscillator. It is wise to put a milliammeter in the screen lead when first setting up the oscillator and to adjust the screen potential to a value such that the screen current does not exceed 15 ma. since drawing too much screen current may cause disintegration of the cathode. Both metal shell and glass types of the 6L6 were tried in this setup and with the shell floating on the metal variety there was found to be little or no difference in performance between the two. The tank coils should have as large a ratio of $L$ to $C$ as will permit tuning across the band selected, in order to provide a maximum voltage swing for the grid of the succeeding tube. The ground returns for each stage should be brought back direct to the cathode or filament center tap ground. A value of 10,000 ohms was found to give best results as a grid leak for the crystal oscillator. Fixed bias was used on the buffer and final stages. Incidentally, the transformer used for the bias supply should be capable of considerable current drain so that the bleeder may have a low resistance; otherwise the bias voltage is likely to vary considerably under keying conditions. It is far cheaper, in the long run, to invest in a good Husky bias supply than to use batteries, which, incidentally, have a nice habit of charging up, due

(Continued on page 78)

DIXIE JONES’ OWLJUICE

HAMS that ain’t had no bringin’ up and hafto sorta git what polish they git as they go along are cautioned that whereas it used to be the proper caper to curl up the little finger into a knot like a grub worm when guzzling a dish of tea in an assemblage of strange and uppity white folks, it is now very de trop to follow such a procedure and it ain’t bein’ done no more except by guys which don’t know no better which is why I am tellin’ you. It is very disencouraging for a guy that’s just begun to git his little finger so it will kink some and then hafto stop doin’ it, but that’s the edict. Nowadays when your hostess shoves a mug of beverage at you wye you just grab it natural and let the little finger take part or trail off according to whether what she hands you is hot or not. Also when you’re walking along with a dame that thinks she amounts to sumpn and you come to a pebble in the road and you wanta help her over it as she is a frail thing only 18 years old and big as a small horse and you couldn’t kill her with a club wye insteada grabbing her by the arm like you was starting in to choke a cat you let her clamber over this here obstruction by herself. The new regs don’t require you to give no dames a boost unless they date back and are sorta wobbly on their pins. Shucks. I wisht they’d let things alone so when you learnt sumpn it would stay learnt.

—W4IR of the “Dixie Squinch Owl”
A Simple and Inexpensive QRP Transmitter

We all realize that a large part of the QRM on amateur bands is caused by the use of high-power transmitters for local and other short-distance communication. The average amateur, however, is not financially able to put more than a few dollars into an auxiliary transmitter; he always needs every dollar he can spare for improvements on his main rig. There is one way, however, in which a very inexpensive low-power set suitable for short-distance communication can be built in a few minutes' time. It requires no additional power supply; only the key, crystal, and antenna from the main transmitter.

I have built two such transmitters, using the circuits in Fig. 1, and have had very pleasing results with them. The simpler antenna system, I contacted a station 407 miles away and received an RST349X report; this was done merely by answering his CQ, not by the usual "low-power" method of contacting a station on high power and then shifting the crystal to a flea-power transmitter.

—Carl C. Drumeller, W9EHC

For the benefit of those not familiar with the 12A7, the tube consists of a pentode and power rectifier, with separate cathodes, in one bulb. W9EHC's circuit uses the rectifier to convert the 110 a.c. to half-wave d.c., the filter being condenser C1. The r.f. part of the circuit is the familiar pentode crystal oscillator. A line cord with built-in 350-ohm resistor drops the 110 volts to the proper value for the heater of the 12A7.

—EDITOR.

Changing Antenna Directivity

Several times in the past I have noted in QST various methods of switching a full-wave center-fed antenna so as to change the directional properties by feeding the two sections of the antenna so that they are either in or out of phase.

W3AKU gave some very good connections for accomplishing this in November, 1935, QST; however, they have their objections in that with one system the feeders radiate and with the other three feed wires are required.

For several months I have been using at W5EBP on the 20-meter band a system of feeding the two ends of the antenna out of phase, without radiation from the feeders, with series tuning at the transmitter, and with two feed wires. The ar-

July, 1936 43
Adapting Inductive Neutralization to the Low-Power Transmitter

INDUCTIVE neutralization of triode r.f. amplifiers has recently come into use in commercially-manufactured transmitters.1 A trial of this method has convinced me that it can be easily and profitably adapted to apparatus of the home-grown variety.

Following are some details of its use in the final stage of a portable rig consisting of 59 Tritet, 59 neutralized buffer and two 46’s as either push-pull straight amplifier or back-to-back doublers. The plate coils of the last two stages are both wound on the same 7-prong coil form. The diagram, Fig. 3, shows the connections for straight amplification and for doubling. Direct coupling between buffer tank and amplifier grids may be unorthodox, but it works and has the advantage of simplicity.

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Below are coil specifications for the three main bands, using 100-100 µfd. split-stator tank condensers in both buffer and final stages.

All coils are wound on ribbed ceramic forms which plug into a small 7-prong socket. For straight amplification the two windings are wound in opposite directions and for doubling they are wound in the same direction. After the coils are wound some adjustment of the spacing between windings is usually necessary to obtain perfect neutralization, and when the correct position is found the windings should be fastened in place with coil dope.

Coupling to the antenna tuner may be by means of a small coil wound on celluloid and placed so that it slips inside the amplifier tank coil when the form is plugged into its socket. One or two turns wound directly over the amplifier tank coil, terminating in flexible leads fitted with G.R. plugs, may also be used.

Estimated outputs, using an 80-meter crystal, range from about 20 watts when doubling to 20 meters in the final stage, up to nearly 50 watts on both the 40- and 80-meter bands. The use of this scheme results in a saving of several pieces of apparatus with their attendant losses and space requirements. It also allows optional doubling in a push-pull stage and facilitates band changing.

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QST
Amateur Radio STATIONS

W8ACY, Rochester, New York

UNLESS there has been a change in QRA since the accompanying photo was taken, W8ACY is located at 36 Earl Street, Rochester, New York. Frequent changes in location since 1929 have caused the transmitter to be developed into a semi-portable affair. Bruce Kelley, the owner, has only one object in amateur radio—low-power 14-mc. DX. Considering the fact that the station is set up in a new location on the average of every six months, quite remarkable work has been accomplished. The original transmitter consisted of a single 45 in a series-fed Hartley with approximately three watts output. All continents except Asia were contacted with this layout.

In 1935 a more modern transmitter was constructed using a 59 Tri-tet oscillator, 46 doubler, and a single 210 final with an output in the vicinity of ten watts. A single wire about 100 feet long, without feeder, is directly-coupled to the tank through a Collins network. Two power supplies are used, each with an 83 tube. Occasionally grid-bias modulation is used for 'phone work. The receiver has always been the DX'ers standby type, consisting of a 24 detector and a 2A5 audio. This transmitter WAC has been made innumerable times and the operator is looking for the 70th country. Besides low-power DX, considerable interest is shown in photo collecting. Photos have been swapped with stations in all continents. A similar transmitter under the call W2ICE is also used at another location. This station is also WAC.

W5VU, Dallas, Texas

STATION W5VU is located at 5712½ Marquita Avenue in the northern outskirts of Dallas, Texas, and is owned by Durward J. Tucker.

The layout shown in the photograph is the latest version of that endless circle from the shack to the ham store that started with spark gadgets back in 1919.

Each of the two transmitter cabinets houses a complete transmitter. The large cabinet contains the crystal-lock 40-meter transmitter described in June 1934 QST. However, since the publication of the dope on this transmitter in QST another 212-D has been added to the final amplifier and the whole layout has been revamped and changed from breadboard to cabinet style. The complete transmitter layout consists of an eighty-meter crystal oscillator using a UX-112 tube, a 46 doubler, and two W.E. 212-D's in the final amplifier. The 212-D's are in a push-pull tuned-plate fixed-grid circuit with the grid circuit r.f. voltage in synchronization or locked with the r.f. voltage of the 46 doubler plate circuit. The tremendous ratio of power between the 212-D's and the 46 provides a very economical means of attaining high power, since the two 212-D's normally operate at about 500 or 600 watts input.

The smaller transmitter cabinet contains a transmitter normally operated on 20-meter

(Continued on page 90)
Devoted to the interests and activities of the
INTERNATIONAL AMATEUR RADIO UNION
Headquarters Society: The American Radio Relay League, West Hartford, Conn.

Conducted by Byron H. Goodman

Executives:

The A.R.R.L. Board of Directors elected for their new president Dr. Eugene C. Woodruff, W8CMP, of State College, Pa., and for vice-president Mr. George W. Bailey, W1KH, of Weston, Mass. These gentlemen assume similar positions as the new heads of the I.A.R.U. Biographical data on our new officers will be found on page 7.

Reseau Belge:

Mr. Rene Kerse, ON4GW, is the new president of the Reseau Belge, succeeding Paul de Neck, ON4UU, who has headed the society since 1926. Mr. de Neck was accorded the title of honorary president, in recognition of his excellent work. Mr. Paul Antheriens, ON4PA, continues as general secretary, and all correspondence for Reseau Belge should be sent to him at LA PINTE, lez Gande, Belgium.

Regret:

The headquarters society joins with the other member-societies in expressing their sincere sympathy to the J.A.R.L. upon the loss of Kunio Shiba, J2HJ, secretary of the J.A.R.L. Mr. Shiba died in April, after a short illness, and was but 26 years old. Widely known throughout the amateur world for his splendid work on 28-mc. as well as the lower frequencies, his was the first Asian station to work North America and Africa on ten meters.

Denmark:

From an interesting letter from OZ7Z we learn that there are now 240 licensed amateurs in his country, and that the EDR boasts over 400 members. In an effort to gather further data on the 28-mc. band, the EDR is sponsoring a Danish ten-meter test, to be held from May 1st to August 15th.

England:

The Annual Convention of the R.S.G.B. will be held in London from September 3rd to 5th. Foreign amateurs in England at that time should avail themselves of this opportunity to meet many of the English amateurs. Further details can be obtained from the R.S.G.B., 53 Victoria Street, London, S.W. 1.

WAC:

Does DX depend upon location, competition, accessibility of equipment, lack of YL's, etc., or is it simply a measure of the amateur population, of which a certain fixed percentage will always be the DX men? This question has been the subject of many debates in amateur circles and, in an effort to arrive at an answer, the number of WAC certificates awarded to each call area has been compiled. We leave it to you to draw your own conclusions.

Since 1926, when the first WAC was awarded, up to December, 1935, the following certificates have been awarded:

American Radio Relay League
Associazione Radioamatori Italiani
Canadian Section, A.R.R.L.
Czekoslowacki Amaturlischer Verein
Deutscher Amateur Send- und Empfangs Umfang
Epleps
Experimenterende Danske Radiomaterater
Irish Radio Transmitters Society
日本アマチュア無線界
Liga Colombiana de Radio Aficionados
Liga Mexicana de Radio Experimentadores
Liga Nederlandse Vereeniging voor Internationale Radiomateraten
Nederlands-Indische Vereeniging Voor Internationale Radiomateraten
New Zealand Association of Radio Transmitters
Norsk Radioselv Liga
Oesterrichtischer Versuchsmelder-Verband
Polish Zwiazek Krokiokolowcow
Radio Society of Great Britain
Rede dos Emissores Portugueses
Reseau Belge
Reseau des Emetteurs Francais
South African Radio Relay League
Svenska Radiomateraternitetet
Union Schweizer Kurzwellen Amateure
Wireless Institute of Australia

WAC

J2HJ

QST for
At a later date, the number of certificates awarded to the other countries of the world will be listed. Prepare yourself for a few surprises.

QSL Bureaus:

This column inadvertently erred when it listed OZ2M, THE FIRST DANISH 28-MC. WAC received a heard call from Solhov, Baumanabad, Tadjikistan, U.S.S.R., Asia, but “even the National Geographic Society has not been able to locate the darn place!” Can anyone help him?

... Jack Anderson, VE3JA, has been receiving QSL’s from W stations acknowledging QSO’s on the 3.5-mc. band during February. As VE3JA has not been operating on that band for some time, he asks that the pirate acknowledge the QSO’s so the W’s won’t be disappointed!

... SU1CH, the 300 watt ‘phone on 14,285 kc. is giving many of the ‘phones their first African contact. SU1CH, who has been in Egypt since 1931, used to be a W7...

... C. A. Shoyer, ZS1H, has several 28-mc. “firsts” to his credit, working J2HJ for the first Asia-Africa, VK6SA for the first Oceania-Africa, and LU1EP for the first South America-Africa contacts. His WAC was the second achieved on ten, running second by only nine hours to W3FAR.

... USAG recently worked 51 W stations in one day, a notable achievement in view of the fact that the time during which contacts are possible is necessarily limited by conditions... W4CCH reports a rare one for the lads to tackle: FK8AA in New Caledonia. Look for a T8 signal at about 14,360 kc. at 1 a.m., E.S.T.

... Anton Habsburg, Archduke of Austria, took time out long enough to sign OE3AH in the DX Contest.

OK2AK, recently FBTOC with W2DC, uses a four-element array on 14-mc., which probably accounts for his wallowing signal in this country...

In these days of super-powered ether-busters, we like to meet fellows like D. C. Blake, W5EZA. Inading his cards for WAC, he mentions the fact that his transmitter is an e.o. ’36 oscillator driving a ’12A final, input 8 watts! What price high-power?

Ham Humor—the W8 who called CQ on 14-mc. signing call letters “HI,” and then came back with the informative statement, “I just wanted to see what it was like to have the whole band laughing at me.”—W9FYK/7.

As W2HFO remarks with some reason, the only winner in the DX contest is the power company!

Well, it seems we can file dimes and pennies for various ham purposes all we want. Several of the gang have written in response to W9EHG’s Stray in February QST that there is no law against mutilating U. S. currency so long as it is not placed back in circulation. W4AKH quotes B.I.O.N. Ripley as his authority.
REBUILDING is now the watchword. Activity reports from all over the country already show plans and progress in this annual pastime. Of course a certain amount of building is always under way. To keep up with the times and insure that our amateur technique stays “out in front,” we amateurs are always necessarily trying out new ideas, improving stations and modernizing equipment. While new construction and rebuilding are always in the back of a ham’s mind, summer is the logical and normal season for major building activities.

It seems timely to suggest making outside changes now instead of waiting to risk life and limb during the high winds and icy blizzards of next season. Stations need periodic overhaul. Don’t put off examination of the condition of tubes, equipment, antennas until the outfit folds up, but “do it now.” In summer comes the best time to replace worn antenna ropes and rusted guys, avoiding interruption of skeds and operation during the more active operating season ... and when unseasonable weather, or sleet and snow put a sudden quietus on ham work, and replacements are difficult, hazardous or even impossible.

Some 80% or more of our telegraphing readers could well consider the advantages of BREAK-IN, and change rigs to key-the-crystal with general benefit to themselves and all amateur radio! Snappier operation would make more QSOs and more pleasurable effective work possible. There are many also who could to advantage wire up a simple monitor. This would permit better keying and, in addition to improvement in “fists,” would assure the operator of his signal characteristic at all times. Constructors of all kinds of transmitters will find rack-and-panel unit construction justly popular. It makes future changes possible without complete rebuilding, and accessibility for servicing and testing is in its favor.

Phone stations can be similarly improved by modification for push-to-talk capability. Also mikes of the communications type can be installed or existing mikes modified by placement to improve the ratio of signal to background. Understandability is too often reduced during QSOs by an undesired bedlam from broadcast receivers, children, pets and “aside” conversation. The photograph on page 96 of June QST gives a good idea of what needs to be done to some mikes. Ours are not “broadcasting” but real “communicating” stations, and the readability and efficiency in action should be improved accordingly. A push-to-talk arrangement using a push-button switch or telegraph key for “phone break-in will at once put your station above the average ham class.

Simple changes sometimes produce amazing improvement and convenience at little or no cost. Give study to your situation and look for easy and logical ways to improve matters. Plan alterations and new equipment early; he who plans carefully and builds leisurely builds well for his amateur station of the future.

The pleasures of 56-mc. operation and work in the open on other bands reach a maximum at this time of year. Summer is a good time to experiment with directive antennas on the higher frequency bands. Don’t overlook the summer building and testing of portables ... for work at the seashore or in the mountains ... and for year-round readiness for communications emergencies.

Amateur radio builds to ever higher standards of two-way communication performance. Your QST file is full of station ideas, the Handbook full of reliable reference “dope.” Let us then look over our equipment and remedy weak points and determine the possible improvements for next season. Summer is rebuilding time. To be ready for next season start the good work today.

—F. E. H.

Briefs

Schooner Morrissey

The Schooner Effie M. Morrissey is leaving on June 21st for another summer trip to the Arctic. The party will be headed by Capt. Bob Bartlett. Clifton Foss, W2OF, is the radio operator. A 100-watt phone transmitter will be used as well as c.w. Frequencies are not yet known. The call of the Morrissey is W1OXFP.

WMMN Ham Programs

Starting Sunday, July 5th, 2:00 A.M. EST, and on each Sunday thereafter, WMMN will broadcast a special program by radio amateurs under the auspices of the Mountaineer Amateur Radio Association, Fairmont, West Virginia. All amateurs are invited to listen to these programs each Sunday at the same time.
DX Notes

WITH the closing date for receipt of DX contest logs just past and with all reports in, save the usual few late stragglers, work has started on the compilation of final results. In looking through the logs we find numerous items that rightfully belong in this DX Notes column, and we’re passing them along this month.

CPIAC (Yacuba, Bolivia), who is ex-W2CDA, provided a welcome additional country for many... 2B1E at 14 and 28 mes; and W2GD at 14 mc; those fortunate enough to snag him were FIWJ, W2UK, W2BI, W3FYR, W3JM, W4DHZ, W2GRA, W4CEN, W1CJP. G5YG, Scotland, entered the contest lacking 14 states for W.A.B.; at the close he lacked only 4. . . Did you know that VK4YL is truly a YL—Miss Madeline Mackenzie?

. . . HB1AD, using 3.5 mc, only, worked 36 stations in the W1, 2, 3, 5, 8 and VE1 districts. . . As an example of the kind of band 28 mc. has been in 1939: From January 1st to March 23d, OA4J worked all W and VE districts with a total of 400 QSO's, and in addition had 60 QSO's in 30 other countries; he had 228 QSO's on 28 mc. in the contest alone. . . . FM8D, well-known Markine station, now has the call FM8AD. . . In the Queensland area of Australia there is a group that calls itself the "U gang," consisting of VK4UJ, U4S, 4UR and U4V W. . . . The operators at KA1US will be recognized by many U.S. hams: C. C. Larres, owner, has W1CMA, W2L, L. B. Larres (BN), ex-W3CL-W3CMX; Sgt. P. W. Blair, ex-W1CIF; J. L. Moriarty, ex-W1GILT. . . For 28 mc. work CX1CG uses a vertical copper pipe. . . YYYYFP, active on 14 mc., gladdened the hearts of VK4H, W2UDJ, W6UQCI, VK4WC, W3SI, W1FH and W4OC with contest contacts. . . VP9AE at Montpellier, Jamaica, is ex-CMBRAF. . . YR5AA, Roumania, worked 55 W/VE contestants on 7, 14 and 28 mc. providing contact with one of the elusive ones. . . VS6AH's contest DX totalled 1,212,000 miles.

DXCFI gave numerous of the boys a chance to work a DJ. . . W3CAY heard a rare one on 3.5 mc.—TG1AR, Ceylon. Reports were also heard from W1BEA, ZE1A and T44A (worked). . . Quite a bunch of FBTOC's (Four Band-TOC's) were made or completed in the contest, making the old TBTTOC seem commonplace. . . W7AVV made FBTOC with K5GCK. . . W3SI and K4KD got together on an FBTOC, and W3SI also worked EA3EG on 3.5 mc. to complete another. . . W3AHH's contacts on 3.5 and 7 mc. with HB9J made him eligible. . . HB3J FBTOC'd with W2BYF. . . From that FBTOC'd to all in the question of WAC and the work for WAC was completed with K2PL. . . FASBG and WTS also did the Four-Band stunt. . . K5GCK worked FBTOC with W6ORL and W7AVV. . . K4KD went right to town with his Four-Band FBTOC with K5GCK and K4KD worked W6DHZ, W9TB, W3CHE. . . Still another Four-Bander: OK2AK and W2DC. . . And G2PL claims the honor of VE1EA, W4A8 and W1BWD. . . WIWV and W1KH completed FBTOC with EA4AO. . . The bands concerned were 28, 14, 7 and 3.5 mc. in every case. . . W6CUH is now TBTTOC with all continents. . . A contact with YR5AA in the contest and one with CPIAC on March 26th brought W4NP's countries to 79. . . W2AYJ reported his total countries as 85 at end of the contest. . . W4AH, Charlotte, N.C., lists his DX (as of contest ending) as WAC, 92 countries on e.w.; 6 continents, 38 countries on phone. . . The contest noted W6ORL's new countries, bringing his total (as of April 17th) to 100 countries worked. . . W8BST added one, making 95 countries total. . . YM4AA had the contest to himself in Danzig and made 321 W/VE QSO's on 7, 14 and 28 mc. . . W2GTZ's contacts were 28 and 14 mc.; those fortunate enough to snag him were FIWJ, W2UK, W2BI, W3FYR, W3JM, W4DHZ, W2GRA, W4CEN, W1CJP. G5YG, Scotland, entered the contest lacking 14 states for W.A.B.; at the close he lacked only 4. . . Did you know that VK4YL is truly a YL—Miss Madeline Mackenzie?

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Knowledge Is Power
By John N. Boland, *W3HY

In order to enjoy this game of ours, we must get a maximum of efficiency from our equipment and ourselves. This does not necessarily mean that the last tenth of an amp in the antenna is the main requisite for enjoyable operation. What is meant is that all component parts of the station must be used with a maximum of knowledge or common sense. There is where the difficulty starts; what is common sense? We have set it equal to knowledge and therefore have have gone a long way toward using some common sense. Knowledge breeds proficiency and proficiency breeds efficiency. The ham station must be operated efficiently in terms of gear and tuning, as well as the last drop in the antenna.

To sum all of this up, we may say that in all fields of ham radio, KNOWLEDGE in the form of its COMMON SENSE applications plays a large part in the efficient and enjoyable operation of a Ham Station. Knowledge itself is, of course, highly desirable, but it does us little good, if we do not apply it. First learn the hows and whys, then couple them with common sense and put them to work.

O.B.S.
The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in November QST (page 60): W1JDU, W1SIP, W2HON, W3FO, W8LJ, W8NW, W8FYV, W8AJJ, W9UJZ, W9WFV, VE5DD.

of one order or another that may be solved by piecing together the particles of information we have come into contact with. That is engineering; the practical application of knowledge. So store up the information you gather from all component parts of the station that is about your equal in operating ability and territory. That is engineering; the practical application of everything. Increase your knowledge to make your participation in the various activities of amateur radio most enjoyable.

The Gold Rule applies to hams as well as to anyone else and the ham should apply it to all whom he encounters (including B.C.L.'s). Cooperation is essential in order to maintain your self-respect on the air and carve yourself a niche in the ranks of those who enjoy something because of what is in it and not because of what they are able to put over on the other fellow. Operate your station efficiently and wisely. If you do, you will observe the rights of others and still be able to partake of your own privileges with the certainty of getting the most fun, kick, or whatever you feel you are getting. The B.C.L. rates some attention when you are interfering with him, and the neighboring ham deserves likewise. Cooperation with the government in maintaining its laws regardless of having done no one wrong and of having done the best for himself.

To sum all of this up, we may say that in all fields of ham radio, KNOWLEDGE in the form of its COMMON SENSE applications plays a large part in the efficient and enjoyable operation of a Ham Station. Knowledge itself is, of course, highly desirable, but it does us little good, if we do not apply it. First learn the hows and whys, then couple them with common sense and put them to work.

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The article by Mr. Boland, W3HY, wins C.D. article contest prize this month. Each month we print the most interesting and valuable article received marked for the contest. This contest may be on any phase of amateur operation or communication activity (DX, telephone, traffic, ragchewing, clubs, fraternization, etc.), which adds constructively to amateur organization work. Prize winners may select a 1958 Wodehouse, six logs, six message files, six pad blanks, or equivalent credit toward A.R.R.L. supplies. Send your contribution today.

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Knowledge breeds proficiency and proficiency breeds efficiency. The ham station must be operated efficiently in terms of gear and tuning, as well as the last drop in the antenna.

Now that we have dug into technical whys and wherefores without actually dissecting something, let's see if we can't do the same thing for our operating activities. Some of us play with DX, others monkey with rag chewing, still others handle traffic. Whatever your interest, there are certain more or less recognized procedures to be followed. The great part of these are dictated by experience and are well taken. The radio work in our bands themselves teaches most excellent lessons if we can find them out. Here again, knowledge is the criterion of station operation. For DX, it is the knowledge of the times and frequencies that foreigners may be found and contacted on and the proper operating procedure to contact them with. In rag-chewing, it is the choice of a station that you know you like to chew the sock with. Traffic handling requires good schedules with reliable stations and a thorough knowledge of the routes that are scheduled by your own station, with a knowledge of the connecting links and good operating ability on the part of the operator; not necessarily a 20 or 25 w.p.m. man, but one who has a working knowledge of traffic procedure. In every case then, knowledge of some factor or another plays an important part. A good, all around op should have a working knowledge of all types of operating. Increase your knowledge to make your participation in the various activities of amateur radio most enjoyable.

The Golden Rule applies to hams as well as to anyone else and the ham should apply it to all whom he encounters (including B.C.L.'s). Cooperation is essential in order to maintain your self-respect on the air and carve yourself a niche in the ranks of those who enjoy something because of what is in it and not because of what they are able to put over on the other fellow. Operate your station efficiently and wisely. If you do, you will observe the rights of others and still be able to partake of your own privileges with the certainty of getting the most fun, kick, or whatever you feel you are getting. The B.C.L. rates some attention when you are interfering with him, and the neighboring ham deserves likewise. Cooperation with the government in maintaining its laws regardless of having done no one wrong and of having done the best for himself.

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OBERVERS' HONOR ROLL

Cairo Commercial Occupancy Survey For May 1936

6000-6000 kcs.

Ron Allard W2QSH W2UHZ W2BF
W2VBE W2WVS W2XCA W2YOH W2ZL
W2PEF W2DKO W2DGC W2DW
W2AEP W2BZQ W3ERF W2BFR W6BFP
W2ALB W2BJS K2BFO W4JZ
W3ETM W3SLX W8STI W6GGO
W3NQ W2HAY W6A8W W6CT
W2AJP W2FCQ P. R. Randolph W7PFS
W2BYS W2F8W W7GJP W3AP
W2GDC W2KEL W3AJJ W2EC
W2EHZ W2DQD W3ZK W3EJ
W3EJS

4000-4000 kcs.

W8KNB W3EOP W1CJP W8AEJ
W1AXE W1JCN W8TGS W8BJ
W1INT V5ABW W1ZO W8QE
W1GIV Northwest W2HJB W8NQ

Brief

The Great Lakes Amateur Radio Committee, sponsored by the Northeast Amateur Radio Club, Cleveland, Ohio, and a council of all the clubs in that vicinity, will have an amateur radio station in operation at the Great Lakes Exposition, which starts June 27th and lasts 100 days. A large number of operators will be needed to man the station. Schedules will also be wanted. Any ham having spare time as to times available for schedules or times available to help during the period in question is invited to send W8Cl0 position, which starts June 27th and lasts 100 days. An interesting competition for all O.R.S. has been worked out. During this petition. W1TS worked most different A.R.R.L. Sections of 20 operating hours with others close behind in the competition. W2000-4500 kcs. and W4RA at the key of W4NC contacted 47 Sections (48) and W4RA at the key of W4NC contacted 47 Sections during this get together. The figures have been carefully tabulated showing performance of all the leading stations in detail.

Fun in traffic handling and pride in schedules ready for any emergency job is a large part of the regular tradition and practice of each Official Relay Station appointee. Quarterly, however, time is appointed for an O.R.S. nation-wide get together at which contacts with brother O.R.S. are renewed in a station and operator testing radio get together. Hundreds of O.R.S. take part and operators consistently better their own best previous records. Next season an interesting competition for all O.R.S. has been worked out. Results in monthly traffic handling will count part, and the records in three O.R.S. parties will also count, and the leading operators will receive A.R.R.L. watch-awards for. The Winston-Salem Amateur Radio Club are donating a 23-inch high sun-gold Trophy, a beautiful cup with handles surmounted by a figure awarding a wreath to the winner! There is room in A.R.R.L.'s field organization for more qualified traffic handlers. To receive recognition by O.R.S. appointment shows that you are a keen operator, and a top notch in amateur organization. Regular bulletins and activities for O.R.S. keep this group at the front. Drop a line to A.R.R.L. Headquarters or to your S.C.M. for an application blank and details on O.R.S. appointment if you are interested in regular doings and plans for next season. A card will bring you dope and a sample bulletin besides.

Here is a tabulation of the work of the leading stations in April:

Station QSOs Sections Heard Score Power Section
W3EOP 171 45 172 47,385 — E. Pa.
WITS 157 45 44 40,922 800 Conn.
W4NC(W4RA) 149 47 42 38,194 800 N. C.
W2PY 138 47 123 30,117 400 N. Y. & L. L.
W1MF(W1UE) 135 42 72 32,424 250 Conn.
W2BMP 142 45 100 31,159 150 Ohio
W2FPO 92 34 41 20,572 150 W. Va.
W2JTS 130 33 81 20,672 150 So. N. J.
W3RAK 145 45 48 27,549 100 Indiana
W3FIP 184 48 15 27,048 600 W. Pa.

W2NHNP Leads in O.P.S. Tests

In the April station tests by Official 'Phone Station operators W2NHNP made a record number of contacts placing N.N.J. at the top of the list. W2HSF, using switching to electronic oscillator for rapid frequency change (5 seconds from any frequency as he puts it) stands second in the listings and puts Indiana at the top once again. W2JTI is in third place for Ohio. 18, 16, and 12 different A.R.R.L. Sections were worked respectively by the leaders. Three bronze medalion awards will be made by A.R.R.L. Sections next season to those Official 'Phone Station operators who over the operating year have the best all around record achievement being rated half on operating and half on equipment factors. We invite all voice operated stations (any ham band) to consider the advantages and prestige of O.P.S. appointment and to drop a card to Headquarters or to your S.C.M) for further details, a sample O.P.S. bulletin, appointment blank, etc. O.P.S. aim to set the example and find pleasure and profit in forming a national group dedicated to better 'phone operating ethics. As W6BZEF says, "In the parties, new friends are made in all Sections in addition to ascertaining the performance of the equipment in practical, regular operating tests." He is in favor of a bonus for stations operating two bands and ideas from the gang on this point will be appreciated. W2NHNP expresses enjoyment in the doings and would extend the operating time in quarterly parties. W9HSF and many others look forward to the next season competition which will be open to all new O.P.S. appointed during the summer. Get lined up for O.P.S. appointment today if you have a good 'phone.

There follows a tabulation of the results of leading stations in April:

Station QSOs Sections Heard Score Power Section
W2NHNP 35 18 7 3,102 100 No. N. J.
W8HSF 27 16 10 2,460 800 Indiana
W7JTI 24 12 17 1,849 100 Ohio
W8MOL 25 19 13 1,812 150 W. Va.
W8MG 20 13 11 1,668 75 E. Pa.
W3ECX 20 13 12 1,626 75 Ohio
W2CBO 17 12 5 1,140 500 E. N. Y.
W2DC 15 11 10 1,045 500 E. N. Y.
W8ENF 15 8 9 913 150 Mich.
W8HOF 15 11 14 913 140 Missouri
W8JZ 18 8 4 784 — Ohio

Call QSOs Power Score Call QSOs Power Score
W8JRE 51 350 756 W4ANU 12 100 420
W8QO 51 250 694 W8MOP 8 80 430
W3EFZ 11 140 694 W4ANH 12 100 344
W2MIZ 13 125 621 W2GYY 7 125 295
W4BYA 15 175 600 W8NM 7 75 189
W2QDH 15 125 690 W2HFR 9 75 172
W2QHT 12 100 524 W2HFR 7 100 125
W5KL 14 200 400 W5CQD 4 85 112

*Score of 3492 reduced to a "6 hour basis."

July, 1936 51
VE1ET, an excellent operator with keen ability for copying weak signals, F. R. Fraser, VE1HJ, Halifax, operating his own station, took one dispatch from VE1DQ. Difficulty was experienced at times in copying VE1DQ’s signals in Halifax. This problem was overcome by establishing a relay station.

More Re Moose River Mine

Supplementing the report in June QST (page 23) of the cooperation of radio amateurs in transmitting press from the Moose River mine concerning the three men entrapped there, J. M. Morton, VE1JM has submitted a complete account of the work from which we have obtained some further facts.

In instrumental in organizing the party to provide communication for the Canadian Press at Moose River was Gordon Arthur, VE1AX. The party itself consisted of Arthur Crowell, S.C.M., VE1DQ; William Horne, RM, VE1GL; and Trevor Burton, VE1CP. The emergency station served by these men at the mine consisted of a 25-meter oscillator and 42 filter for transmitter (property of VE1CP) and an SW3 receiver (VE1GL’s). Batteries were used for power. VE1AW, the station of Clifford Shortt at Halifax, was designated as the receiving station of a “press circuit.” For a period of over ninety hours VE1DQ/ portable and VE1A W were in communication; thousands of words of copy were handled. All work was on 3.5-mc. c.w. Practically all of the operating at VE1AW was by Walter Wooding, VP1ET, an excellent operator with keen ability for copying weak signals, F. R. Fraser, VE1HJ, Halifax, operating his own station, took one dispatch from VE1DQ. Difficulty was experienced at times in copying VE1DQ’s signals in Halifax. This problem was overcome by establishing a relay station.

HALIFAX AMATEURS WHO PARTICIPATED IN
AMATEUR RADIO EMERGENCY NEWS REPORTING
CIRCUIT IN CONJUNCTION WITH THE
MOOSE RIVER GOLD MINE DISASTER IN APRIL,
1936

Left to right: Walt Wooding, VE1ET; Art Crowell, S.C.M., VE1DQ; Trevor Burton, VE1CP; Cliff Shortt, VE1AW; Bill Horne, R.M., VE1GL.

Free code instruction is given under the WFA Adult Program at the Bronx Vocational High School, 320 East 152d Street, N. Y. City. Hours are from 9:30 to 12:30 P.M. until September, at which time hours will be from 6:00 to 10:00 P.M.

The Moncton (New Brunswick) Amateur Radio Club will hold the “Hamfest of Hamfests” at Moncton, July 4th, 5th, 6th. It promises to be “tops.”

The North Newark (N. J.) Amateur Radio Club has inaugurated a code practice program on the 56-mc. band. Each Monday and Tuesday W2JAS will transmit at a very slow speed from 7 to 7:15 P.M., and W2JBY from 7:15 to 7:30 P.M. Both will use automatic tape transmission. Groups of letters, not standard words, will be sent so that guesswork cannot be used. Copies of these lessons may be mailed to the club secretary, Bob Salisbury, 112 Lincoln Ave., Newark, N. J.; the averages will be reported on the following week’s transmissions.

W5ERU, Littlefield, Texas, is originating a special QSL card and will be on the air regularly each evening from 9 to 10 C.S.T. and each Sunday from 2 to 6 A.M. (7100 kc.) throughout the period of the Texas Central Centennial Exposition at Dallas, which opens June 6th. The QSL will carry a picture of the Alamo and buildings around the Exposition grounds and will be mailed to all stations worked by W5ERU. The cards will be stamped with Centennial stamps and will be mailed at one of the Centennial cities having a special cachet for cancelling the stamps. These cards will be worth having so watch for W5ERU!
DASD Jubilee DX Contest

Get ready now for the DASD's first DX Contest to be held during the five week-ends of August. The idea of the contest is to work as many German and other European amateurs as possible. Complete details will appear in August QST.

ONTARIO DIVISION

ONTARIO—SCM, John Perdue, VE39K—R.M.'s: 3WX, 3TM, 3QR, 3DU, 3GT, 3SG, 3GG, P.A.M.: 3NX. By this reading NX will have been relieved of his appendix. JKtraffic Report: This report will be sent out nightly by the SCM for DX contest when no other traffic is being handled except for DX. The SCM also desires to encourage more traffic to be handled by the DX contest. JK will be active in DX contest as was 3HM. Lc has donated a year's subscription to N.A.R.A. including VO News to the VO station getting the highest score in the B.E.R.U. portable tests in June. IC comes on every Monday night with a short broadcast to all N.A.R.A. members on about 3800 kc. e.w. transmitted at 15 words a minute (for code practice); this is repeated on Tuesday nights by IF on 3950-kc, phone. IC tried M.O.P.A. with a '45 and '46, but is back to his 'lO's in P.P. osc. with 590 volts on the plates.

Traffic: VEIER 40 HH 64 GL 40 HJ 34 EV 16 IV 2 GU 14.
ON is now at Little Longan Mine where he says another tyro is about to bud. RK, formerly of Ottawa, is gold hunting by day and brass pounding by night at Schumacher. HV dreams of becoming O.R.S. BG and ADZ may be found around town with a high-powered Broadhead, Jenny Ireland, of HY is buzzing around again on 3.5 mc.


QUEBEC DIVISION

QUEBEC—SCM, Stan Comach, VE2EEE—The Eastern Division A.R.R.L. Convention is over, and it is the general consensus of opinion that the sponsors deserve heartiest congratulations on its unquestionable success. The Convention Chairman, VE2DU, and his various committees did a real job, and we rate the whole affair "Five Stars." The send in envelopes, gang. D

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Congratulations!

State of Connecticut
Executive Chambers
Hartford

Dear Mr. Warner:

One of the redeeming features of the recent flood disaster was the very real cooperation exerted by all the various agencies, departments, and organizations who participated in the relief and rehabilitation work.

Certainly one of the most important volunteer activities was the prompt and efficient assistance rendered by the American Radio Relay League. The necessity for maintaining communication with the outside world at that time was vital. There is no way of determining the inconvenience and cost of carrying on in such a crisis without your aid.

As Governor of Connecticut, I want to thank you and the members of your League for your fine response to the situation.

Most sincerely yours,

/ s / Wilbur L. Cross

Treasury Department
United States Coast Guard
Washington

Gentlemen:

During the recent tornado disaster relief operation at Tupelo, Mississippi, the Coast Guard had a radio Communication truck detail at the scene cooperating with the Red Cross. The Officer in Charge of the detail, Radio Electrician R. W. Finley, makes the following statement in his report of operations on April 8th and 9th, 1936:

"Arrangements were made via Headquarters and the American Radio Relay League, in Hartford, Connecticut, and amateur station W4DEP at Memphis called us on the 80-meter band that afternoon. He proved to be an expert operator and worked with us most efficiently. On the following day he could not stay with us but arranged for W4LN to handle our traffic until 1400 when his services were no longer required."

The Commandant takes pleasure in informing you of the helpfulness and efficiency of the operators of stations W4DEP and W4LN and requests you to convey his thanks to them for their efforts in this case.

/ s / P. W. Lauriat,
Acting Commandant

QSL Manager's Troubles

Lanark, Ontario, Canada

Editor, QST:

The A.R.R.L. QSL Forwarding System has been running smoothly enough here in Ontario but there are a number of points which I believe would help the QSL managers.

About one half of the amateurs here are sending the correct size of envelopes. The size asked for by the A.R.R.L. is a No. 8. As far as I myself am concerned, I don’t know what size a No. 8 is, but the size which will take almost all the cards is one that is four inches by six inches. An envelope smaller than this, as a rule, makes it necessary to either trim the cards or enlarge the envelope. Also an envelope opening on the end should not be sent.

At the Ontario office a number of QSL cards are received monthly direct from U.S.A. hams and SWL’s. The sender asks on the card that it be forwarded at once. Well, gang, the Canadian postal regulations do not allow this (reforwarding with original postage—EDITOR) so the card is put into the file, perhaps never to be sent. For U.S.A. hams and SWL’s I put on the necessary Canadian postage if they enclose the card with either 2¢ in money or two one cent unused U.S.A. stamps. (A used $1.00 stamp will be accepted until further notice, as VE3QB is a stamp collector.)

To U.S.A. hams: It costs two cents to send a postcard from the United States to Canada. If full postage is not put on we are charged twice the amount of postage that is lacking. In one week I received five cards to forward and had to pay two cents on each.

To Ontario Hams: If you are working much DX or if you are on the 14,000-ke. band very much enclose an extra 2¢ stamp in the envelope. If the letter is over the three-cent weight limit I have the necessary postage and you are not charged 4¢ postage due—and believe me, OM’s, the Lanark postmaster weighs every letter I mail. Hi!

—W. Bert Knowles, VE3QB
Ontario A.R.R.L. QSL Manager

Biggest complaint from all QSL Managers is that hams don’t send in envelopes. Result: thousands of unclaimed cards on hand. See list of QSL Managers this issue and send your envelope NOW.—Edron.
For over two years I have been operating a portable station at various locations in the second and eighth districts. In this period of time I have found by actual checking that 95% of all foreign stations contacted questioned me as to the meaning of the portable suffix BT or BT2. The other 5% accepted me as a refined "booklet" station trying out something original. Canadian stations are in the same category; practically every VE is ignorant of the meaning of our portable sign. To make matters worse, I have had local stations interrogate my call with a series of question marks.

Why not publish the fact that the BT sign plus a district number following the station call designates the station as a portable in that district?

-B. Kelley, W3CAY/8—W3CEB/8

**QCDX? No!**

R.F.D. No. 1, Brockport, Pa.

Editor, QST:

I would like to express my opinion on CQ DX. My transmit power is decided low power, using a 60 final with 10 watts input. All my DX which includes 40 countries has been worked by answering CQ's. In fact, only one DX contact has resulted from calling CQ DX.

Referring to VE3GG's statement that he only has a 15-tube transmitter, I would like to say that calling a VK by calling him, is very true, but I think his chances would be even smaller by calling CQ DX for the simple reason that when a VK can get fifteen answers to a CQ why should he take a chance on raising VE3GG by calling him?

A VK or G invariably raise a W station when they CQ but they don't really consider us DX in a way due to the large number of W stations they work. When they really go after DX such as SU, PY, J, etc., they call them and not CQ DX.

---Louis E. Bundy, W31WQ

**Re VE3GG'S Plan**

Editor, QST:

After reading VE3GG's letter and some of the answers to it I have come to the conclusion that it is about high time to put my bit. Having been a reader of QST since 1922 and a member of the A.R.R.L. for the past few years I find that there are two types of amateurs. The radicais who would send 13 and 22 w.p.m. and I cannot see where the slower sending gives him his opportunity in QRM. Since Grammer brought out the one-tube crystal-controlled transmitter, VE3GG's troubles ought to be much reduced.

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---Louis E. Bundy, W31WQ

**It Looks Like a Boom**

3920 Elmwood, Cleveland Hts., Ohio

Editor, QST:

I agree with W4AT on ham television. I have thought about this for several months, but don't know where to start or what I need. Several other hams around here have the same opinion. I think if QST started some television articles it would be well worth while. QST can easily start the ball rolling and, incidentally, standardize the apparatus. I believe much can be done when things get started.

---James B. Bamberg, W5OPX

---

**Good Fellowship**

14135 S. Orange Grove Ave., Los Angeles, Calif. Editor, QST:

A good number of people have already deplored the lack of real fellowship in amateur contacts etc. This is an active licensed "ham" since 1921 I have long since ceased to worry about what others get out of their investment of time and money in radio, and concentrated on making it enjoyable to me and those whom I contact on the air.

But I would like to widen my range somewhat. I am in a profession that includes many members of the ham fraternity in its ranks, but I have never been able to find more than a scattered handful of them. The profession I speak of is the stock and bond business, and it is one which by its very nature brings together all those engaged in it regardless of their position or geographical locale. We communicate daily with other brokers all over the country by wire, teletype and telephone. How nice it would be if you should discover some man you had been doing business with in Podunk had a ham set at home! And you could get together in the evening for a good talk in the same language!

So here's an invitation: If you're in the financial game just give W6SN a buzz any time on 7031 kc. or 14,062 kc. and we can talk about the gold movement, the technical position, the Dow-Jones Theory, that defaulted dog you own, or anything else that we both know about. So here's to the future of the "Wx hr" and "CUL 73" stuff we're all fed up with.

---William A. Lippman, jr., W6SN

Remember, Mike, raising the sending speed is not going to improve the lid's technical knowledge and make him a better operator. He won't be practicing only with experience and practice. Your statement that "any irresponsible kid who swears that he can send 10 w.p.m. and draw a diagram can secure a license" proves that you have not looked at the F.C.C. regulations for some time. I suggest that you do so. You will find that you have to do a little more than just draw a diagram to get a ticket today.

In conclusion would like to say that your letter is unfair to those amateurs who want to do work with 'phone, especially those on 66 mc. and above. They are kicking now that they have to study code, for which they have no use once they are on the air. I do think that exams for Class "C" tickets should be revised, inasmuch as this ticket is too easy to get and is therefore not appreciated. Instead of an amateur giving them a test, why not a traveling inspector who could make a round of his district 3 or 4 times yearly and give exams to invalids and shut-ins?

---Bill Hobart

For reasons of space limitations, no further space in QST will be devoted to this question of the present.

---

**EDITOR'S NOTE**—Pressing, in general, similar opinions are B. J. Curair, W2JQN; Charles J. Uher, W2ONR; DeForest F. Richardson, W9WRO; and Leon Hill, W7FJE.

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(Continued on page 68)
LAST MONTH the article on this page ended with a formula for determining the capacity for final amplifier tank circuits. To refresh our memories this formula is

\[
I(\text{ma}) = \frac{E(\text{volts}) \times Freq (\text{mc})}{K} = \text{Tank Capacity (mmf)}
\]

where \( K \) = 2600 for single ended C.W., 5200 for single ended phone, 650 for push-pull C.W., and 1300 for push-pull phone. As a conclusion to this discussion, we are offering the chart above which will prove a convenient means for determining the correct coil form and number of turns of wire to use with the calculated capacity. There are five groups of curves (one for each ham band) plotted for three of our coil forms. The XR-13 is our 1\( \frac{3}{4} \)" dia. Buffer Coil Form, the XR-12A (4" dia.) and the XR-10A (2\( \frac{1}{2} \)" dia.) are our Transmitter Coil Forms. As an example of the use of the chart, suppose the calculated capacity is 60 mmf and the operating frequency of the rig is to be 7 megacycles. Then for this frequency we refer to group "C" of the curves and at this capacity we find that the XR-12A requires 13 turns, the XR-10A requires 18 turns and the XR-13 requires 18 turns.

If the transmitter is to be operated only on one band, the type of coil form will be determined by individual requirements. However if plug-in coils are to be used then it will be convenient to use only one type of form throughout. The best type can be determined by calculating the capacity required for each frequency and by referring to the chart to see which coil form can be used in all cases.

There is one thing to remember when selecting the tank condenser: the chart capacities are the sum of the tube, wiring and the tank condenser capacities.

JAMES MILLEN
THE NEW

R K-36

A new triode designed for high plate efficiency and power output at all amateur frequencies. Like other Raytheon tubes designed for amateur service, the R K-36 has high mutual conductance and is easy to drive.

CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
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<tbody>
<tr>
<td>Filament Voltage</td>
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<tr>
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<tr>
<td>Output Capacitance</td>
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<td>Typical Operation / Class C Amplifier</td>
<td>Power Output</td>
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<td>Plate Current</td>
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<tr>
<td>D. C. Grid Current</td>
<td>30 M. A.</td>
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<td>D. C. Grid Voltage</td>
<td>-360 Volts</td>
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<tr>
<td>Required Driving Power</td>
<td>15 Watts</td>
</tr>
<tr>
<td>Power Output</td>
<td>200 Watts</td>
</tr>
</tbody>
</table>

Write to the office near you for full technical data.

RAYTHEON PRODUCTION CORPORATION
490 Lexington Ave. . . . New York, N.Y.
445 Lake Shore Dr. . . . Chicago, Ill.
415 Peachtree St. N.E. Atlanta, Ga.
555 Howard St. . . . . . San Francisco, Cal.
55 Chapel St. . . . . . Newton, Mass.

RAYTHEON
AMATEUR RADIO TUBES

Correspondence

(Continued from page 58)

and the hams sit around chewing the fat on "phone and c.w.;
or the hams going to get in and get going on it? That is probably
the reason they are having such a hard time of it; they need some help
from the hams. So what say—please publish some dope in QST on the
subject.

—Roy Seccomb, W6LWN

QRR/SOS

480 Windemere Ave., Toronto, Ont., Canada

Editor, QST:

I wonder if any of the gang would be interested in hearing
of an experience that happened to me back in 1923, or
if anything of like nature has ever happened to others, wherein
a broadcast station, a ham, and a commercial operator, all
cooperated in getting assistance to a ship.

In 1923 I was operator on the S.S. Canadian Adventurer,
XWD, carrying grain on the Great Lakes. One night, after
declearing Chicago, we had the misfortune to pile up on a
sandbar, about five miles north of the city. After trying to
refloat ourselves, the attempt was given up and the old man
filed a message to a salvage company in the city, requesting
the services of a tug. The commercial station was not in
operation that year. Great Lakes naval station was operat­
ing part time and the nearest coast stations available were
Ludington and Frankfort. The equipment on board was the
proverbial crystal receiver and a 2-kw. ice box xmtr with a
very small antennae, and 75 miles was DX daytime range.
Hi! To make matters worse the QRN was terrific and there­
fore couldn’t even hear Frankfort or Ludington. What to
do? What to do?

Just previous to the pile up I was listening to what I be­
lieve was WMAQ broadcasting a program of music. Couldn’t
help it, as he was coming in on 600 on my receiver. I reasoned
that surely some ham who knew the code must be listening
to the program too. Working on that theory I put the ash
can on 300 meters and blazed away with something like

"Calling CQ CQ QST, etc."

"If any ham in Chicago hears this please telephone the
Salvage Company and tell them to send a tug to the assist­
ance of S.S. Canadian Adventurer, aground, South Chicago.
Sig XWD XWD." I repeated this several times and in be­
tween calls WMAQ was coming in better than ever and I
just idly listened to the music. The old man came in to get
the low down. I told him what the dope was and offered him
one of the "Baldies" to hear the program. He sat down and
just got a big kick out of it as we very seldom heard broadcasts
in those days. As we were listening the announcer told us
that they were going to interrupt the musical program and
use their test call "9XN"—"This is 9XN calling XWD
XWD, etc., etc." I thought I was hearing things, but as the
announcer continued, the old man thought there was some
joke. His eyes bulged and the old jaw sagged. "We are tak­
ing this chance in hope that you may hear 9XN and inform
you that a tug was dispatched fifteen minutes ago
and is on its way to your assistance." I acknowledged the message
on 300 and after an interval "9XN" came back and assured
us that if needed, they would QRX until tug arrived,
if not they would resume the prog.

Very soon after this the tug bumped alongside and then
got to work. While she was pulling away along comes the
whole gang from Great Lakes Naval Station in a large surf
boat. They took one look around, came aboard, said "Hello."
and then scrambled (the midnight lunch was missing imme­
diately after and I have grave fears as to where it disap­
peared. Hi!), They sure gave good service, anyway. I
thought the whole U. S. Navy was paying us a midnight
visit. Hi!

I never did find out the ham who relayed the dope to 9XN
or WMAQ, but whoever it was, he sure helped us out of a
Jam. . . .

—S. J. Deemer, VE8BB

More Frequencies

241 Lake Ave., Greenwich, Conn.

Editor, QST:

... I agree 100% with the idea of asking for a 20-mc.
band (or 21 mc. for 7 mc. 3rd harmonic work), rather than
asking for additional frequencies in any of our present bands.

Say You Saw It in QST — It Identifies You and Helps QST
GROSS RADIO, INC., 51 VESEY STREET, NEW YORK CITY

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

20% DEPOSIT WITH ALL C. O. D. ORDERS

Cable Address: GROSSINC

A NUMBER OF THE LEADING LINES ALWAYS STOCKED

AEROVOX
ALADDIN
AMERICAN
BARR
BEIDE
BIRNBACH
BLINKY
CARDWELL
GOTO
DU MONT
EIMAC
ELECTRAD
GENERAL ELECTRIC
GUARDIAN RELAYS
HALLICRAFTERS
HAMMARLUND
H & K
HOYT
J R C
JOHNSON
WESTINGHOUSE
JONES PLUGS
KENYON
LEAEG
LYNCH
MAC-KEY
R C A
PATTERSON
PYREX
RAYTHEON
R M E
SANGAMO
SHURE
SIGNAL
SUPREME
THORDARSON
UNITED ELECTRONICS
UNITED TRANSFORMER
UNITED
VIBRPLEX
WARD LEONARD
YAXLEY

GROSS Recommends — For the Best "Buy" of the Season

CW-60 (Uses New Eimac 35T)

Crystal Control Transmitter

OUTPUT: 60-100 WATTS

Complete Kit, Less Tubes and Crystal

$20.95

P-60 DUAL POWER SUPPLY KIT for CW-60 Transmitter — with matching chassis $25.95

Descriptive Bulletin on Request

GROSS C C TRANSMITTER — OUTPUT 25-30 WATTS

The "CW-25" transmitter kit due to its low cost makes it possible for anyone to own a modern crystal controlled station. A schematic book-up and parts layout sheet, as well as tuning instructions are furnished, thus enabling the most inexperienced operator to wire and put the set on the air, for real results. The "CW-25" is supplied with a shrivel finished sturdy metal chassis under which all parts are mounted, making the wiring and components dust-proof. A plug-in crystal holder is furnished with the kit. Only one millimeter is required for tuning the transmitter and each stage is provided with a jack for this purpose. The "CW-25" uses one 47 as crystal oscillator, one '46 as buffer or doubler and two '46's in the amplifier stage, set of three coils supplied with kit for 20, 40, 80 or 160 band. Additional coils 75c each.

Complete kit, less tubes and crystal

$14.95

GROSS CASED CLASS "B" TRANSFORMERS

Heavy Duty — for use with 10', 46' or 4-46's in push pull push per part... $7.50

For 2-46's only, per part... $3.95

BARR DB3 TRANSCEIVERS

less tubes, batteries and accessories... $16.20

KEYING RELAY

will operate on any dry cell. Can be used as Single Pole Single Throw or Single Pole Double Throw. Sturdy construction, has 14" diameter Solid Silver Contacts. Compares favorably with expensive types. Special... 59c

GUARANTEED TUBES

ISOLANITE TOPS

800 Carbon Plate... $5.35

866-A 10,000 volts inverse Peak... 1.85

203-A Carbon Plate... 8.45

THORDARSON CASED TRANSFORMER

600 volts each side of C.T., 200 MA 255 V, 10 amps, C.T., 3 V, 3 amps, 75V V, 3 amps, C.T. $2.45

THORD. CHOKED 12 H 250 MA., $1.95

EIMAC UNSURPASSED TRANSMITTING TUBES!

Performance — Ruggedness — Power — Price

35-T Output 38 to 112 watts... $8.00

50-T Output 75 to 250 watts... 13.50

100-T Output 150 to 450 watts... 24.50

300-T Output 350 to 700 watts... 60.00

500-T Output 500 to 1350 watts... 175.00

Exactly 46% more than a Paragraph

PERFECT FOR YOUR AMATEUR EAGLE

"EAGLE" Three-Tube Short-Wave Receiver

"Band Spread" over any portion of the tuning range — only linear material used throughout. Employs one '32 R.F., one '32 detector and one '33 Pentode Audio — 15 to 200 meters. Four coils supplied. The "EAGLE" is economical — two dry cells will operate the filaments. "Eagle" completely wired and tested $11.95

Three tubes tested in your receiver... $3.00

THORDARSON CASED ELECTRONICS

GUARANTEED TUBES

TRANSFORMERS

Gross Recommends — For the Best "Buy" of the Season

POWER OUTPUT DEPENDS ON PLATE VOLTAGE USED

TUBE LINEUP: 47 crystal oscillator — 53 Buffer and Eimac 35T in output stage.

POWER SUPPLY REQUIREMENTS: Filament voltages 2 3/4 volts at 4 amps. — 5 volts at 4 amps.

PLATE VOLTAGES: 400 Volts at 100 MA and 500 to 1250 volts at 100 MA.

COILS: One set of three coils are furnished with kit for operation on any one amateur band. Coils for 1.2; 3.5; 7; 14 MC may be purchased separately at $2.75 per set.

SIZE: Overall dimensions of the unit are Height 4 3/4 inches, width 11 inches, length 19 inches.
The A B C of Good Volume Control

A Resistor strip on inner circumference of Bakelite case has longest possible length to insure smooth volume control and low noise level.

B Highly polished non-rotating metal band contacts the resistor over a large area. Result, low contact resistance with light pressure, low noise level, no resistance change or wear.

C Oilless wood bearing provides the contact pressure and glides over the polished metal band when control is rotated. Permanently quiet and smooth turning.

These exclusive Centralab contact features are covered by U. S. A. patent Nos. 1653745, 1650879, 1704154.

Centralab
MILWAUKEE, WISC.
BRITISH CENTRALAB, LTD.
Canterbury Rd., Kilburn London N.W.6, England
CENTRALAB
69-70 Rue Amelot Paris, France

Of course, this plan may be entirely impossible due to international complications, but with my limited knowledge of the subject I see no reason why it would be any harder to put over than more frequencies around 7 me.

What about an additional Cairo survey on 20-21 me? It's not too late if we get busy right now!

---John K. Barber, Jr., W1AVB
2 Willow Road, Woodmere, N. Y.

Editor, QST:
While we are clamoring for more frequencies we never give a thought to the lower frequencies. Why should we not get the ones above S.O.S. and ship lanes. These are not in use at present and they might prove useful for short haul work, being more stable than five meters. Twenty years ago nobody thought that wavelengths below 200 meters were good for anything. Well maybe the lower frequencies are the same besides think of the nice harmonics we could put on the broadcast band. III

---Fred Crystal, W2JKE

England's Norm.—W2JKE has evidently not been doing much listening above 500 meters recently. Several hundred stations in the government, point to point, coastal, ship and aviation services are in operation in that region. Too, the entire useful frequency range below 500 kc. is less than is contained in our 3500-kc. band alone. And imagine a half-wave antenna at 1000 meters!

---

New Receiving Tubes
1F4, 1F6, 5W4, 6N7

RECENT additions to the receiving-tube group include two new 2-volt tubes and two more in the metal series. None of the four involve new principles, but help round out each series in making available special-purpose types already included in other cathode groups, and in offering wider freedom of choice to the set designer.

Of the 2-volt tubes, the 1F4 is a pentode power amplifier taking less plate and filament power than the 33, and likewise having lower output. The 1F6 is a duo-diode-pentode similar in application to the 2B7 and 6B7. The pentode section can be used either for radio-frequency or audio-frequency amplification. Tentative ratings on the 1F4 are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament voltage</td>
<td>2.0 volts d.c.</td>
</tr>
<tr>
<td>Filament current</td>
<td>0.12 amp.</td>
</tr>
<tr>
<td>Plate voltage</td>
<td>125 volts max.</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>150 volts max.</td>
</tr>
<tr>
<td>Grid voltage</td>
<td>4.8 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>9 ma.</td>
</tr>
<tr>
<td>Screen current</td>
<td>2.6 ma.</td>
</tr>
<tr>
<td>Plate resistance</td>
<td>200,000 ohms</td>
</tr>
<tr>
<td>Amplification factor</td>
<td>450</td>
</tr>
<tr>
<td>Mutual condensancy</td>
<td>1700 micromhos</td>
</tr>
<tr>
<td>Load resistance</td>
<td>16,000 ohms</td>
</tr>
<tr>
<td>Undistorted power output</td>
<td>340 mw.</td>
</tr>
</tbody>
</table>

The 1F4 has a 5-pin base, the connections being the same as for the 33.

Tentative ratings on the pentode section of the 1F6 are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament voltage</td>
<td>2.0 volts d.c.</td>
</tr>
<tr>
<td>Filament current</td>
<td>0.66 amp.</td>
</tr>
<tr>
<td>Interelectrode capacitances:</td>
<td></td>
</tr>
<tr>
<td>Grid to plate (with shield)</td>
<td>0.007 µfd, max</td>
</tr>
<tr>
<td>Input</td>
<td>4 µfd</td>
</tr>
<tr>
<td>Output</td>
<td>9 µfd</td>
</tr>
<tr>
<td>Plate voltage</td>
<td>180 volts max.</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>67.5 volts max.</td>
</tr>
<tr>
<td>Grid voltage</td>
<td>-1.5 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>2.0 ma.</td>
</tr>
<tr>
<td>Screen current</td>
<td>0.6 ma.</td>
</tr>
<tr>
<td>Plate resistance (approx.)</td>
<td>1 megohm</td>
</tr>
</tbody>
</table>

(Continued on page 68)
WHERE LOSSES COUNT

USE THE G-R TYPE 568 VARIABLE CONDENSER

PARTICULARLY designed for high-frequency circuits where accuracy of setting and low losses are essential, the General Radio Type 568 Condenser is ideally suited to amateur and experimental use. These many important features contribute to the continuing popularity of this excellent condenser.

• Exceptionally rigid construction
• Heavy, moisture-proof isolantite ends
• Rigid frame supports
• Heavy brass plates soldered to decrease losses
• Conical bearings
• Hollow shaft for simple ganging

These condensers are rated at 500 volts, peak, consequently they are adapted to low-power transmitter use.

Two sizes are stocked:

Type 568-D, 175 μf maximum, 12 μf minimum, straight-line-capacitance plates.

Type 568-K, 50 μf maximum, 12 μf minimum, straight-line-frequency plates.

Price, either model: $4.00

Write for Bulletin 8-Q for a description of these condensers and many other amateur parts and accessories

GENERAL RADIO COMPANY
30 State Street Cambridge, Mass.

Amplification factor (approx.) .......... 650
Mutual conductance .................. 650 micromhos
Mutual conductance at -12 volts bias .......... 15 micromhos

The two diode plates are placed at the negative end of the filament. Pin connections in the 6-prong base are as follows: Pin 1, filament +; pin 2, plate; pin 3, screen; pin 4, diode plate No. 1; pin 5, diode plate No. 2; pin 6, filament -; control grid connection is to the top cap. Pin numbers are according to the RMA system, given in the 1936 Handbook.

The two new metal tubes include a rectifier, the 5W4, and a Class-B twin amplifier, the 6N7. The 5W4 fits in between the 6X5 and 6Z4 in power ratings. The 6N7 is practically equivalent to the 53 and 6A6. The following ratings have been placed on the 5W4:

- Filament voltage .................. 5.0 volts
- Filament current ............... 1.5 amps.
- A.C. voltage per plate, r.m.s. .......... 350 volts max.
- D.C. output current ........... 110 ma. max.

The 5W4 has the octal base with 5 prongs. Connections are as follows: Pin 1, shell; pin 2, filament; pin 4, plate No. 2; pin 6, plate No. 1; pin 8, filament.

The following tentative ratings have been placed on the 6N7:

- Heater voltage .................. 6.3 volts
- Heater current ............... 0.8 amps.
- As Class-B power amplifier:
  - Plate voltage ................. 300 volts max.
  - Peak plate current, per plate .......... 125 ma. max.
  - Average plate dissipation ........ 10 watts, max.
- Typical operation:
  - Plate voltage .......... 350 volts
  - Grid voltage ........ 0 volts
  - Zero-signal plate current (per plate) .......... 14 ma.
    Effective load resistance (plate to plate) .......... 8000 10,000 ohms
    Power output, approx. .......... 8 watts
- As Class-A driver (elements paralleled):
  - Plate voltage .......... 280 volts
  - Grid voltage ........ 5 volts
  - Plate current ........ 7 ma.
  - Plate resistance ........ 11,300 11,000 ohms
  - Amplification factor .......... 35
  - Mutual conductance .......... 3200 ohms
  - Plate load between 20,000 and 40,000 ohms.

The 6N7 has the octal base with 8 pins. Connections are: Pin 1, shell; pin 2, heater; pin 3, plate No. 2; pin 4, grid No. 2; pin 5, grid No. 1; pin 6, plate No. 1; pin 7, heater; pin 8, cathode.

Characteristics of the 6N7 are identical with those of the 53 and 6A6, and the tube can be used in circuits designed for the glass types.

Missouri State Convention
(Midwest Division)
July 25th and 26th at Jefferson City, Mo.

The Capitol City Amateur Radio Association extends a cordial invitation to the amateurs of Missouri to attend the yearly convention to be held at the Missouri Hotel, Jefferson City, Mo., on July 25th and 26th.

An interesting program has been prepared and as an added attraction to the convention there will be a parachute jump made from an aeroplane.
Many of Western Electric's tubes are ideal for amateur use

...for example

304B—The outstanding triode for ultra high frequency work

THE Western Electric 304B is a triode designed especially for ultra high frequency applications. This tube is a redesign of the now famous 304A (the original "ultra-hi" transmitting tube) and will deliver more power at increased efficiency at the upper frequency limit. The 304B will oscillate up to 400 megacycles and is capable of an output of 50 watts at 110 megacycles. This tube is indispensable to amateur builders of ultra high frequency transmitters—see page 237—1936 Radio Amateur's Handbook.

$12.50
in U. S. A.

...and

307A—Ideal for suppressor modulated applications

THE Western Electric 307A is a filamentary power pentode suitable for suppressor modulated applications. With this tube carrier power output of 5½ watts (peak power 22 watts) can be suppressor modulated directly from a microphone without intermediate audio amplification; peak power output with positive suppressor 27 watts. Also suitable for crystal oscillator. An ideal tube for the amateur's one-tube phone transmitter—see page 130—1936 Radio Amateur's Handbook. (Because filament requires only few seconds to heat, transmitter may be completely shut down when not in use and is instantly available when needed, thus conserving power and tube life.)
639 questions and answers covering all radio operator license examinations

This new edition of Nilson and Hornung's well-known book will help you pass examinations and to know your stuff better in any field of practical radio. Brought completely up to date. Enlarged to cover more amateur work; also police, aeronautical and other radio.

Just Published
1936 Sixth Edition
Nilson and Hornung's
RADIO OPERATING QUESTIONS AND ANSWERS

427 pages, 5 1/2 x 8, 106 illustrations, $2.50

Covers transmitting, receiving, power-supply, general theory, and legal and regulations, as applied to marine, broadcasting, aeronautical, police, and amateur radio. Every question is typical of those you meet on examinations; answers are complete, illustrated, and give the information essential to meet every situation. For amateurs, short wave fans, men who are preparing for operator examinations or technical positions. Radio companies give preference to licensed operators for all positions. This book gives quick, direct preparation for all examinations. Examine it free.

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Standard Frequency Transmissions

<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 1</td>
<td>C</td>
<td>W9XAN</td>
</tr>
<tr>
<td>July 3</td>
<td>B</td>
<td>W9XAN</td>
</tr>
<tr>
<td>July 8</td>
<td>BB</td>
<td>W9XAN</td>
</tr>
<tr>
<td>July 10</td>
<td>BB</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Nov. 14</td>
<td>A</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Nov. 21</td>
<td>B</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Aug. 5</td>
<td>BB</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Aug. 7</td>
<td>BB</td>
<td>W9XAN</td>
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<tr>
<td>Aug. 8</td>
<td>BX</td>
<td>W9XAN</td>
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<tr>
<td>Aug. 9</td>
<td>C</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Aug. 14</td>
<td>C</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Aug. 26</td>
<td>C</td>
<td>W9XAN</td>
</tr>
<tr>
<td>Aug. 28</td>
<td>B</td>
<td>W9XAN</td>
</tr>
</tbody>
</table>

STANDARD FREQUENCY SCHEDULES

<table>
<thead>
<tr>
<th>Time (p.m.)</th>
<th>Sched. and Freq. (ke.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>3500, 7000</td>
</tr>
<tr>
<td>8:08</td>
<td>3900, 7100</td>
</tr>
<tr>
<td>8:16</td>
<td>3700, 7200</td>
</tr>
<tr>
<td>8:24</td>
<td>3800, 7300</td>
</tr>
<tr>
<td>8:40</td>
<td>4000</td>
</tr>
<tr>
<td>6:24</td>
<td>7300</td>
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<tr>
<td>6:16</td>
<td>7200</td>
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<td>7100</td>
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<tr>
<td>6:00</td>
<td>7000</td>
</tr>
<tr>
<td>6:00</td>
<td>7000</td>
</tr>
<tr>
<td>6:16</td>
<td>7200</td>
</tr>
<tr>
<td>6:24</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 W6XK, Pacific Standard Time.

TRANSMITTING PROCEDURE

The time allotted to each transmission is 8 minutes divided as follows:
2 minutes—QST 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 W6XK is "M.
1 minute—Statement of frequency in kilocycles and announcement of next frequency.
2 minutes—Time allowed to change to next frequency.


W6XK: Don Lee Broadcasting System, Los Angeles, Calif., Frank D. Urle in charge.

Schedules for WWV

EACH Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station WWV will transmit on three frequencies as follows: noon to 1:00 p.m. E.S.T., 15,000 kc.; 1:15 to 2:15 p.m., 10,000 kc.; 2:30 to 3:30 p.m., 5000 kc. On each Tuesday and Friday the emissions are continuous unmodulated waves (c.w.); and on each Wednesday they are modulated by an audio frequency. The audio frequency is in general 1000 cycles per second.

Strays

W9HDU is really crystal-controlled—Crystal is his wife's name!
A SEASONED DESIGN

The type UM Ultra Midget Condenser is designed for use in ultra high frequency receivers, transmitters or exciters where a small efficient padding or tuning condenser is needed. Its wide acceptance for such use is founded on its small size for mounting in shield cans, on its shaft extensions on each end of the rotor for convenient ganging, and on its universal type of mounting. These features when used in conjunction with our flexible couplings (a few from our complete line are illustrated below) make a unit that is easily adaptable to unusual layouts. At the right in the illustration above, is one model of the UM condenser (a balanced stator model is also available). At the left are two of the many convenient methods of mounting and ganging. Other features include a staked and soldered construction which, together with the "self locking" rotor design, makes the UM condenser virtually proof to vibration. Prices are extremely low, ranging from $.75 (net) for the 15 mmf size to $1.14 (net) for the 100 mmf size.

NATIONAL COMPANY, INC., MALDEN, MASS.
YOU NEED THESE CARDWELL COMMERCIAL UNITS designed for Ultra HF!

**JD-28-GD (above)**
- .084" gap — 28 m.m.f. per section
- $9.75 NET TO AMATEURS

**JP-48-GD**
- .084" gap — 48 m.m.f. per section
- $3.60 NET TO AMATEURS

**NP-35-GD**
- .084" gap — 35 m.m.f. per section
- $3.60 NET TO AMATEURS

IMPORTANT FEATURES!
1. NO CLOSED METALLIC LOOPS.
2. MINIMUM SURFACE LEAKAGE LOSSES.
3. VERY LOW MINIMUM CAPACITY.
4. MYCALEX & ISOLANTITE INSULATION.
5. THICK PLATES—BUFFED, POLISHED and EDGES ROUNDED.

THE ALLEN D. CARDWELL MFG. CORP.
83 Prospect Street, Brooklyn, N. Y.

CARDWELL Condensers

---

The New England Division Convention

RECORDS galore were broken when the New England Division Convention was held at the Hotel Bradford, Boston, on April 18th. W1XK, of Westinghouse, was on the air all day long broadcasting the various events to the world; NBC put the Army and Navy representatives on during the banquet; a record crowd of 1,289 registered and there were over 300 prizes. All of which proves it was the best ever!

Many were present Friday night for the reunion. Saturday started off with a bang as A.A.R.S., N.C.R., A.R.R.L., I.A.R.U., DX and N.E.D.R.A. meetings were held in the morning. Mrs. William Gagnebin, YF of W1DQD, was chairman of the Women’s Committee and conducted the ladies through WEEI at noon, where “The Goofs” were seen in action. Bridge was played in the afternoon. Technical talks were given by Shermund, of Raytheon; Corderman, W3ZD; DeMars, W11BA, of the Yankee Network; Rhodes, of Aerovox; Fleming, of Translab; and Arthur Lynch, W2DKJ.

W1ZE put up a one-kw. five-meter rig and gave road directions to mobile units coming in. Ted McElroy, “The Champ,” gave an interesting demonstration of high-speed sending and receiving, throwing in some snappy Japanese for good measure. W1AKY had charge of the contests, which were well attended. The most amusing was the Milkotron event, proving what suckers some hams are!

P. C. McGaughey, W1ND, of RCA, gave a fine illustrated talk on ailments of ‘phone and c.w. transmitters for those unable to attend the banquet.

The banquet was a huge success. Admiral Gerhardi, of the First Naval District, and Col. Moore, of the First Corps Area, were put on the Red Network. Messrs. Kolster, Hebert, Handy, Bailey, Mullen, MacAdam (chairman of the convention committee) and others prominent in the division said a few words. All listened with rapt attention to a dissertation on the relationship of the amateurs and the commercials, by one of the latter, Mr. Herbert Randall, of General-Western, of Iowa. His sudden demise was narrowly averted by the toastmaster after a vitriolic blast on the operation of amateur stations in general and the obvious imbecility of the operators. Saltshakers, glasses, plates and silverware were poised for instant use when Randall removed his glasses and moustache and emerged as Bud Diehl, W1INC.

Director (now Vice-President) Bailey did his usual fine job as toastmaster and performed a miracle when he transferred Col. Moore from the Army to the Navy and back to the Army again in about ten seconds!

The prize drawings were held in the main ballroom and the grand prize—a Super-Skyrider—was won by a Junior Operator who was quite upset when he found it was too heavy for him to carry. His OM soon came to his rescue. Before the drawings were finished telegrams were re-
During JULY and AUGUST

A Year’s Membership in ARRL

A Year’s Subscription to QST

The Radio Amateur’s Handbook

\[ \text{THE VALUE IS APPARENT} \]

Enclosed please find $3.00 (foreign $3.65) for one HANDBOOK and one year’s membership in the ARRL including 12 issues of QST beginning with the issue (please state whether new, renewal or extension).

Name: ..............................................
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Call if any: ..............................................

THE AMERICAN RADIO RELAY LEAGUE, INC.
West Hartford, Connecticut, U. S. A.
Newark’s
SETS ON PAYMENT PLAN
at New Lower Rates

The receivers listed below are the best money can buy. Our time payment plan, at the new low rates, makes it easy to own one. COMPARE our rates with others. THE EASY WAY: Send in your down payment with your order. Set will be shipped as soon as credit is OK’d. Entire transaction: One week. TRY US. Write for complete catalogue.

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<tr>
<th>Product</th>
<th>Down Payment</th>
<th>6 Months Payments</th>
<th>10 Months Payments</th>
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<td>NATIONAL HRO JR.</td>
<td>$99.00</td>
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<td>NATIONAL HRO JR.</td>
<td>$124.80</td>
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<td>$167.70</td>
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<td>$183.60</td>
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<td>RCA ACR</td>
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<td>HAMMARLUND SUPER PRO</td>
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Full Details of Any Set Listed, Mailed Immediately upon Request

WELL KNOWN OIL FILLED, OIL IMPREGNATED FILTER CONDENSERS

Our Special OIL IMPREGNATED-OIL FILLED CONDENSERS are guaranteed at rated voltages. All ratings are DC working voltage. These are well-known condensers. We have a few left of each capacity. Send in your orders at once.

Cap. Voltage Size Weight Price
1 mfd. 2000 V. DC 5 x 3/4 x 1 1/8 Lbs. $1.25
2 mfd. 2000 V. DC 5 x 3/4 x 2 1/2 Lbs. $2.50
4 mfd. 2000 V. DC 5 x 3/4 x 5 3 Lbs. $4.25
8 mfd. 2000 V. DC 5 x 3/4 x 4 4 Lbs. $2.75
9 mfd. 2000 V. DC 5 x 3/4 x 11 9 Lbs. $7.25

(Including 2½” bakelite standoffs)
4.4 mfd. 1500 V. DC 5 x 3/4 x 1 1/4 Lbs. $1.75
5 mfd. 1500 V. DC 5 x 3/4 x 1 1/4 Lbs. $1.90
5.2 mfd. 1500 V. DC 5 x 3/4 x 3 2 1/4 Lbs. $2.00
10 mfd. 1500 V. DC 5 x 3/4 x 3 3 3/4 Lbs. $2.75
20 mfd. 1500 V. DC 5 x 3/4 x 3 3 3/4 Lbs. $4.50

Use the 10 and 20 mfd. for perfect filtering in class B modulation Power supply.

Newark Paper Filter Condensers
1 mfd. 1000 V. DC . . . . . . $0.56
1 mfd. 1500 V. DC . . . . . . $0.66
These condensers have standoff insulators and mounting feet.

Thordarson No. T6877 Heavy Iron Choke, 15 Transformer - 2500 V. insulation for 860’s . . . . . . . . . $3.05
HIGH VOLTAGE TRANSFORMER, 1000-750-500-0-500-750-1000-3000 MA. 3/4 x 4/4 x 5 3/4 . . . . . . . . $45.95

NATIONAL RADIO SHOW
affiliated with
CENTRAL DIVISION ARRL CONVENTION
Chicago, Sept. 5-6-7, 1936
See our booth and visit our store. Only three blocks from Hotel Sherman. Write for program!

NEWARK ELECTRIC CO.
FASTER SERVICE—BETTER REBATES
226 W. MADISON ST. DEPT. Q CHICAGO, ILL.

receiued from distant hams who had enjoyed the program via short-wave broadcast.

All who attended claimed they had a swell time, and many promised to be on hand for the Boston hamfest next year.

—G. D. M.

Rocky Mountain Division Convention
August 1st and 2nd at Denver, Colo.

FOR years amateurs from every state have been coming to cool and colorful Colorado to enjoy summer vacations at their best. Fellow amateurs, plan an ideal amateur’s vacation—attend the Rocky Mountain Division convention and then proceed to Jenny Lake Hamfest which will be held a week later. The exclusive Lakewood Country Club just west of Denver on the Lookout Mountain Highway has been chosen by the Central Colorado Radio Association as Headquarters.

Good meetings have been arranged so that those attending will be more than satisfied with the program. Entertainment and contests will predominate. Dancing, prize drawing and an initiation of the Royal Order of the Wouff Hong will take place at Mysterious Red Rock Park.

Important! Every amateur who sends in his $2.50 registration fee and QSL card to the club treasurer, Paul Johnson, 3730 Franklin St., Denver, Colorado, before July 29th becomes eligible for a prize drawing of $15.00 net value.

For further information write Charles Sibley, 1555 Monroe St., Denver, Colo. Chairman.

Ohio State Convention
(Continental Division)
August 1st and 2nd at Columbus, Ohio

ONE of the most elaborate programs ever presented at an A.R.R.L. state convention is now in preparation for the Ohio State Convention to be held at the Deshler-Wallick Hotel, Columbus, Ohio, August 1st and 2nd, under the sponsorship of The Columbus Amateur Radio Association.

There will be an elaborate display of exhibits by leading manufacturers and we are assured of an unusually large list of prizes. The speakers are well known radio celebrities and amateurs.

The gala banquet Sunday evening includes a floor show with Bill Bennett’s dance band. Don’t forget to bring the Y.L. and the ex-Y.L. as the committee has prepared a fine program as well as prizes for the ladies.

Registration tickets are $2.00 and includes banquet and prize drawing. Register early. Further information may be obtained from the general chairman, J. M. Bayes, W8BZY, 371 Olentangy St., Columbus, Ohio.
6L6 or Eimac tubes will do their best! THORDARSON transformers have the heritage of tested design, craftsmanship and materials and "CAN THEY TAKE IT!"

T-8459. Driver transformer push pull 605's or 76's to AB 6L6's. List $3.76
T-8470. Modulation transformer AB 6L6's or class B Eimac 35T's (500 volts) to 2,500 ohms—250 M.A. D.C. through secondary 5,000 ohms—200 m.a. or 7,500 ohms—150 m.a. List $10.00
T-8208. Class B. Output Modltn. Transformer plates of Eimac 50T's (100 watts audio pwr.) to R.F. load. List $16.00
T-8209. Class B. Output Modltn. Transformer Plates of Eimac 50T's (250 Watts Audio) to R.F. load. List $24.00
T-8210. Class B. Output Modltn. Transformer Plates of Eimac 150T's (500 watts audio) to R.F. load. List $50.00

C. Q. Booths 6 and 7—Cent. Div. Convention, Chicago—Sept. 5, 6, 7

THORDARSON ELECTRIC COMPANY
500 W. HURON STREET, CHICAGO, ILLINOIS, U. S. A.

NEVER BEFORE HAS THERE BEEN SUCH A BOOK VALUE!

MORE THAN 256,000 WORDS—OVER 500 DIAGRAMS, CHARTS AND PHOTOGRAPHIC ILLUSTRATIONS, 53 BASIC DESIGN FORMULAS, 42 CHARTS AND TABLES IN THE NEW

TWICE-AS-BIG 480-PAGE

1936 HANDBOOK

It's the equal of a two-volume $7.00 textbook

It's EASY to get one, too—use the coupon

A.R.R.L.
West Hartford, Connecticut, U. S. A.

Your statistics overwhelm me. Here's my dollar—or $1.15, I live outside of U. S. A. proper). Please send to:

NAME _______________________
ADDRESS ____________________

Say You Saw It in QST — It Identifies You and Helps QST
A "Neon-Stick" Visual Modulation Monitor
(Continued from page 51)

Regarding the operation of the tube, all that is necessary is to connect one electrode to a point in the modulated r.f. circuit which is at sufficient potential above ground; this need be nothing but a tap on the final tank circuit. The other electrode is allowed to dangle, or is secured to an insulator or otherwise separated from r.f., the tube being placed in a position convenient to observe. If the tap on the r.f. circuit is adjusted to such a point that the glow extends exactly half the distance between electrodes with the carrier unmodulated, 100% modulation will cause it to just touch the other one, full illumination indicating overmodulation. If the carrier only lights the tube for one-third of the distance, it is too difficult to observe this phenomenon since the electrode drop is a greater portion of the column and it is rather difficult, besides, to estimate two-thirds (or whatever 100% might require) of the distance. Anyway the power consumption is only about 0.9 watts, a 210 lighting it easily. Some 'phones using grid modulation do not have a capability of 100% and these 'phones should allow the illumination to extend about five-eighths of the distance between electrodes, allowing the tip to just touch the other electrode as before, insuring no more than 85% modulation.

The response of a neon column is linear as far as audio frequency is concerned up to 40,000 cycles and consequently will respond to any peak occurring in the audio frequency range. It was pointed out that a column of this sort responds both to positive and negative halves of the r.f. envelope. While this would be undesirable for use in an oscilloscope, nevertheless used as a peak visual indicator, this characteristic is very desirable since if the transmitter is adjusted so that unsymmetrical modulation exists, the maximum peak will never exceed double the average value (providing of course the operator watches the column). Likewise it will be found that, on some transmitters, the tube may go out during modulation for appreciable intervals of time. This indicates that the average value of carrier has been decreased below the ignition point of the electrode. Such a condition may occur when the modulation capability is exceeded and indicates a very serious break in the carrier.

As has been pointed out, the number of peaks occurring at high frequencies is approximately equal to those in the low end of the audio spectrum, on speech. In looking at the carrier with the inexpensive neon oscilloscope, a string oscilloscope, or a cathode ray tube, all with low-frequency scanning, a peak with very short duration is so narrow as to be unnoticed in the background of the many other wave shapes. Conversely, if the scanning mirrors or linear sweep be operated at a quite high frequency, low-frequency peaks are so broad as to be "spread out thin," and may be unnoticed in the general high-frequency hash. For this reason these devices are not so suitable for continuous observation. It is not intended to
An Open Letter to All Amateurs:

June 20, 1936.

Constant research, development, and improved manufacturing techniques have brought the benefits of reliable crystal control units to within the reach of more amateurs than ever before.

Today you can get precision Bliley Crystal Units that give you far more value, dollar for dollar, than could be obtained even a year ago. Frequency drift has been lowered, oscillation power increased, and new high-frequency units made available.

Quality products always include every tested improvement—choose your crystals on this basis.

Very truly yours,

F. D. Bliley
General Manager

BLILEY ELECTRIC COMPANY
UNION STATION BLDG.
ERIE, PENNA.

LEARN RADIO
New Classes Now Forming! Send for 40-page catalog, explains fully, 300 licensed graduates placed in past 4½ years in broadcasting, shippping, police radio, aviation, etc. We teach all branches. Oldest, largest and best equipped school in New England. Equipped with Western Electric sound and broadcasting equipment and RCA marine transmitters. Course prepares for United States Government telegraph or telephone license.

MASS. RADIO SCHOOL, 18 Boylston Street, BOSTON

The VIBRopleX
New
GENUINE MARTIN

ONLY $10
with All Standard Improvements

Vibroplex Bug . . . Provides greater precision in adjustment—clearer, stronger signals and easier manipulation. . . . Quickly establishes the user as a GOOD, RAPID sender with less than half the effort of ordinary key sending . . . May be operated as slowly as 5 w.p.m. or at any speed desired . . . Easy to learn . . . Easy to use . . . Easy to own at this low price . . . Over 100,000 Vibroplexes in use . . . Other models in Black or Colors, $17; Nickel-Plated, $19. Remit by money order or registered mail.

THE VIBROPLEXX CO., INC.
832 Broadway
New York, N. Y.

The Model D-2 Watch Case Model utilizes the exclusive Astatic Dual Diaphragm principle operating on a Gradoil Bimorph Crystal; resulting in an essentially NON-DIRECTIONAL Crystal Microphone of high quality and ruggedness.

The Astatic Microphone Laboratories, Inc.

ASTATIC MICROPHONE LABORATORIES INC. & YOUNGSTOWN, OHIO

Say You Saw It in QST — it Identifies You and Helps QST
STATION ACTIVITIES

(Continued from page 64)

ROANOKE DIVISION

NORTH CAROLINA—SCM, H. S. Carter, W40G—has W.A.C.'d. ZH has worked Asia about 40 times in the last month and worked W.A.C. once in one hour and thirty-five minutes. Greensboro: AGX reported for the Greensboro gang. FB. He has W.A.C.'d after being on the air some time. NDY waits keeping his good schedule. Durham: CUR is QRL Broadcast Station. Raleigh: BRT led the State in traffic this month. FB, OM. DW has been QRL with Board Meeting, and also went to the hamfest in Lebanon last week. HAI reports: BWC, BX, BLN and CXO went to the State Convention at Columbia, S. C., BLN, an o.w. ham, won a velocity mike. Wilmington: DIE has joined the Navy. BPL is rebuilding his transmitter. BRK is still going strong. NY moved to a new QRA. CDF needs about six miles of the mobile travel worked. Washington, D. C., to Florida. BPL and GPT received letters from LA2X giving the dope on the hams in Peru and Chile that he met on his tour; he plans to stop in Wilmington on his return tour. Winston: DDI, COY, IY, IWC, RA and OG are holding down 14 mc, camping on the DX. CFR and DDB are on 7 mc. regularly. ABY, NC and OKU are working on 3.5 mc. CTA is working between 7 and 3974 kc. HCH has been heard on the O.S. pile-up in Texas and had a swell time. BOZ is the most consistent 14-mc. 'phone in Wilmington. FT is on 28 mc; he is modulating his 150-T running as a doubler. AF is on 14 mc, 'phone working fine. CBX reports working VE's in the early morning hours. 73.

Traffic: WA8RT 56 DW 60 CYY 36 ANE 35 ABT 22 NC 15 BHS 5 CUB-OPT 2 AGX 1.

VIRGINIA—SCM, John W. Singleton, W1CDX—QGJ says his new pre-selector for his FBXA is great. INW has new Comet Pro receiver. CDX was away from home most of the month. INW has new KICD/1 in an air bus. BPL has new units on the way to the dinner. Franklin, INW, 111J, won 3 of the 40 odd prizes! As this is written "CTNITE," May 20th, has just been completed. From the great amount of activity we know the new hams have the material for a good competition for the Billy crystal offered by W1BHM to the high scorer. "Hal!" can't be kept down; INP leads the section in traffic. GME likes R.M. job. JIK moved to Vernon. JAI, DPW and JST are DX'ing on 14 mc, JBG and CHW expect to add them to their 'phone schedules. JAI is getting in on some rare ones. EXI is open for schedules on any band. Tune, W1EER/1 was on the air with his new "Millie". HCH is working fine on 4 meter. 73.

Traffic: W1NFH 158 DMP 153 GME 70 JHK 53 IKE 46 CCM 48 FAF 52 JUD 29 DOW 28 GTX 25 UE 17 DLX 14 DRE 13 W1CDX 8 AFG 7 C1T 6 GYV 4 BND 3 BQJ 2 RDJ 24 TD 23.

MAINE—SCM, John W. Singleton, W1CDX—QGJ says his new pre-selector for his FBXA is great. INW has new Comet Pro receiver. CDX was away from home most of the month. INW has new KICD/1 in an air bus. BPL has new units on the way to the dinner. Franklin, INW, 111J, won 3 of the 40 odd prizes! As this is written "CTNITE," May 20th, has just been completed. From the great amount of activity we know the new hams have the material for a good competition for the Billy crystal offered by W1BHM to the high scorer. "Hal!" can't be kept down; INP leads the section in traffic. GME likes R.M. job. JIK moved to Vernon. JAI, DPW and JST are DX'ing on 14 mc, JBG and CHW expect to add them to their 'phone schedules. JAI is getting in on some rare ones. EXI is open for schedules on any band. Tune, W1EER/1 was on the air with his new "Millie". HCH is working fine on 4 meter. 73.

Traffic: W1G0J 117 INW 14 CXD 20 IKC 9 EZR 8.

EASTERN MASSACHUSETTS—SCM, Albert N. Giddis, W1ABG—AGB has new job. WH schedules daily on 28 HZS and 156 mc. WH has new "Millie". KICD/1, in a car, is going to the New York World's Fair. W1EER/1 is going to the New York World's Fair. WH and W1EER/1 are going to the New York World's Fair. WH is going to the New York World's Fair. WH and W1EER/1 are going to the New York World's Fair. 73.

Traffic: W1AGB 158 EVJ 103 IWC 79 IHF 78 60 HXZ 57 PRO 49 RE 43 ISM 59 BCH 26 JL 26 C1K 24 QW 23 ASI 18 HCH 14. The following A.A.R.S. Stations reported traffic: ECR 825 DCX 617 (W1GJ 350) AKS 842 JSK 513 IHF 145 CLN 355 DDE 205 ZQ 112 (W1G0J 87) BMG 21 79 74 1NT 605 BDC 399 JHI 814 HCH 813 JSX 909 JSX 577 195 198 JQH 806 CKY 80D 15 IS 797 UX 86 AGR 45 AIX 60 JOR 51 INA 48 JJS 44 KI 41 AAR 27 CCL 21 LIO 18 W7 74 GBW 6. The following N.C.R. stations re-
ported traffic: CGIC/QW 45 CX1B/I1RH 101 CX1G/INK 27 CE1I/LAKE 29 CAIC 35 CBIC/IOQA 51 CFIC 29 CBIC.


AFO received JXA. We also learn that since DDY can't charm forming a Green Mt. Net for c.w.-'phone work; write to him and band work, IQG is leaving for Ohio to complete his for the summer. HPX and JEH have 56 mc.rigs going. !DY is back from Florida. BJP reproduced with AJD's schedules. BAP is building portable job.

O.O.'s. AVP is going to check for overmodulation with his "broadcast quality" he's taken up "tripping with AJD's schedules. BAP is building portable job. JOT has new rig, and the mumps. FB--too bad! All West Mass. A.A.R.S. members of the Vermont Section unite in wishing every success to anyone who has one. ILK says 56 me. is going strong at for the port.ports visits from BDX-IQG-IT, and visited IQG-DQK. A VP is now P.A.M., and things are going to hum; he is working portable. AAZ can be heard on 1.75 mc. t.r.f. receiver. HXT had an FB trip thru Texas, stopped off at BEQ. of O.R.S. LIAISON R.M.: L. Baunach, W2AZV--All O.R.S./O.I',S. appointees must report regularly on the 15th of each month, for publication in this column. A VP is now P.A.M., and things are going to hum; he is working portable. AAZ can be heard on 1.75 mc. t.r.f. receiver. HXT had an FB trip thru Texas, stopped off at BEQ. of O.R.S. LIAISON R.M.: L. Baunach, W2AZV--All O.R.S./O.I',S. appointees must report regularly on the 16th of each month or they will automatically be dropped from the list. Out for O.R.S. N.O.R. LIAISON R.M.: DOH; DDK, DIE, EOB, GUO, IJR; O.B.S.: IZG, BUO, DDK; DAP, DUZ, GZL, HJR. O.R.S.: DDK; DAP, DUZ, GZL; DAP, DUZ, GZL, HJR. O.P.S.:


Traffic: W1BVR 146 (WLG 114) IZW 117 JAH 102 IOT 68 BYG 58 (WG6 69) JNR 22 ASU 17 EOB 10 HJR 9 DDK 6 APP-ARH-DIF 5 ATK-IOR-NS 4 COI-DJQ-ICP 7.

NEW HAMPSHIRE--SCM, Robert Byron, W1AVF--FFL is taking a month off and rebuilding. IMB is on 7 mc. for the summer. HFX and JFR have 56-mc. rigs going. IDY reports new WWV. HPX and JFR are on 7 mc. FDL is going strong. IZH is receiving JSL. EZW's new QRA is nearly completed, with special radio quarters built in special. AFO received JXA. We also learn that since DDY can't charm forming a Green Mt. Net for c.w.-'phone work; write to him and band work, IQG is leaving for Ohio to complete his for the summer. HPX and JEH have 56 mc.rigs going. !DY is back from Florida. BJP reproduced with AJD's schedules. BAP is building portable job.

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SELECTING
TRIPLETT JEWELS
AND PIVOT POINTS

Precision Without
Extravagance

Triplett
Model 421
4" Square
Instrument

Square in-
strument
now made in
3" size also.
Both 3" and
4" square in-
struments
are available
in all popular
ranges.

Accuracy in delicate instruments requires
infinite care. Jewels and pivot points might
look satisfactory to the unaided eye but in the
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important part in selecting each pivot point and
jewel.

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ness of pitch and polish. Likewise, the sapphire
jewel in which the pivot rides must undergo the
same careful examination for polish and finish.

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built a reputation for precision not only when
new but also after use over long periods of time.

TRIPLETT MANUFACTURES
a complete line of all sizes and styles electrical measuring
instruments for radio, electrical and general industrial
purposes both standard and custom built. If you have an
electrical instrument problem write to TRIPLETT.

A TWO-HOUR EARLY-MORNING QSO WITH
AUSTRALIA JUST FINISHED

If these two gents look hungry it's because they have not
yet had breakfast. They are, according to the General
Electric Company's publicity release, the "Radio broth-

ers." The guy on the left is A. G. Hull, Technical Editor
of Australia's "Wireless Weekly." On the other side of
that very un-ham looking mike is Ross A. Hull, QST's
Associate Editor. "A.G." was on his way back to Aussie
after a world tour studying television and things when he
stopped off at WZXAF to do a relay broadcast via XAF
and VK2ME over some Australian B.C. stations.

Sweepstakes Contest Results
(Continued from page 55)

VE2JO 6159-31- 75-A- VE5JC 6006-42-74-B-23
VE2AA 4783-24-72-A-41 VE2HI* 12-2-2-A- -

VE2AA 4783-24-72-A-41 VE2HI* 12-2-2-A- -

VE5GI 6006-42-74-B-23 VE4GR 1596-19-28-A- 7
"It takes a Thoroughbred to Win!"

FLASH!

Official DX Contest Results

GAMMATRONS USED BY WINNER OF FIRST PLACE IN THE U.S.A. . . .

91,000 POINTS!

YOU TOO CAN OWN A WINNER

See your dealer or write for Data Sheets 354-K

HEINTZ AND KAUFMAN
SOUTH SAN FRANCISCO CALIFORNIA U.S.A.

JACOBS ADJUSTABLE SEPARATOR (Improved)

U.S. Patent 1,950,170 — March 6, 1934 — others pending
Using this improved glass separator 2 wire R.F. feeders of any separation from 1" up to and including 9" (used in conjunction with Heintz Antenna Systems) may be rapidly and efficiently constructed. $1.45 for a set of 6.

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AMPLIFIER FOUNDATION KIT

Give that amplifier a factory built professional appearance by building it on one of these units.

No. 699 — 9-1/2" x 5-1/2" x 8-1/4" high. List . . . . . $2.25
No. 1126 — 13-1/2" x 5-1/2" x 8-1/4" high. List . . . . . $2.75
No. 1126 — 17 " x 7-1/2" x 8-1/4" high. List . . . . . $3.50
No. 1127 — 17 " x 10" x 8-1/4" high. List . . . . . $4.35
No. 1128 — 10 " x 10" x 8-1/4" high. List . . . . . $3.50

40% Discount to Amateurs

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Cleveland, Ohio

LEARN CODE

Quickly and Easily at Home As 9 Year Old Champion Jean Hudson Did with Candler Scientific Code Course

Increase your Code Speed and Technique as Champion McElroy did with High-Speed Telegraphing and "Mill" Courses.

CANDLER SYSTEM teaches you quickly to read code by sound as easily as you read print by sight, to copy behind at high speeds without strain or confusion — to qualify for that com'ticket!

FREE—1936 BOOK of FACTS

If you're "stuck," want to learn code RIGHT, or to increase your speed and technique for that com'ticket, this book will help you. Send for it. No obligation.

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JEAN HUDSON, W3BAK,
Official Champion of the World in Class E
Two months after beginning Candler Code Training Jean could copy 30wpm on her typewriter.

FREE—1936 BOOK of FACTS

If you're "stuck," want to learn code RIGHT, or to increase your speed and technique for that com'ticket, this book will help you. Send for it. No obligation.

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Dept. Q-7
Asheville, N. C.

Say You Saw It in QST — It Identifies You and Helps QST
operating frequencies: EAR 3540, BYL 3370, EYS 3640, KI 3655, HGO 7066, BGO handled traffic with 4CD during the Georgia tornado disaster.

Traffic: W2BWT--W.E. EQO 159 SC 155 (WLW 128) KI 119 PF 74 IZU 68 HRS 36 HBO 34 AVZ 24 IHT 27 EAR 23 AHC 22 ING 19 IOW 17 CYX 16 EYS 12 HYL 12 CCD-GDF 12 FLD-HRP 11 US 10 AA 12 ADW 9 BMM 7 HGO-BXT-CIT-FIP 8 LC 7 ALZ 6 HRA 5 IZ4 4 IFD-GEA-FPS-DEE 3 4C1 L

NORTHERN NEW JERSEY--SCM, Chas. J. Hammerman, W2FBP--GGW is acting as net control station for N.C.R. GGE is having trouble with self-oscillation in his final. Details were not available.

Traffic: W2BCX 136 WLBZ 129 KUN 106 YA 57 (WLMA 278) KOB 48 !OH 3 CMP 24 IAP 18 CCM 12 G2E 7 (WLMX 07) AEY 7

Traffic: W2BCX 135 TNL 124 WLBZ 129 KUN 106 YA 57 (WLMA 278) KOB 48 !OH 3 CMP 24 IAP 18 CCM 12 G2E 7 (WLMX 07) AEY 7

Traffic: W2BCX 135 TNL 124 WLBZ 129 KUN 106 YA 57 (WLMA 278) KOB 48 !OH 3 CMP 24 IAP 18 CCM 12 G2E 7 (WLMX 07) AEY 7

Atlantic Division
EASTERN PENNSYLVANIA--SCM, James M. Bruning, W3EZ--R.Z.'s: 3AKB, 3AQN, 3EOQ, 8ASW, P.A.M. 3EOZ, 3AGS is back on with a Class A ticket. 3AMR has resumed O.R.S. rating. 3AQN is taking his first radio vacation this year. 3BGO needs more QSOs and continues as our most active all-band O.P.S. operator.


MARYLAND-DELAWARE-PORTLAND of COLUMBIA--SCM, E. L. Hudson, W3ABK, R.Z.'s: 3CQG, 3CXL, 3EOQ, Chief R.M.: 3BWT. P.A.M. 3WJ. BWT has been on the sick list. EZN has a new HRO receiver. EFD has been working lots of DX. EHW worked his 74th country, which makes him W.A.C. CDG worked U9MF and made W.A.C. CJZ has a new Oldsmobile, ABA, CWB and W3CDQ report. CDG will be operating from CMA in November. The Atlantic Division Convention, FEG and FKT have been working the West Coast consistently from Reehoboth Beach, Delaware, on 3.5, me., with low power. JZN experiments with 115 watts on 40 meters, then FZN and W3ABK sent their first reports. EAEQ has a new receiving antenna. DTO is still on the West Coast. We are sorry to learn that AOS has been confined to his bed with rheumatism for quite some time. CWX/LW reported some new machines and equipment. KUW has had a number of QSLs, equipped for operation on auxiliary power supplies.


W3ABK, SCM--J. Franklin, W3SABK--PTK, QL, BEI, FBM, BYR and APV report via the S.N.J. Net. FXM, Hammonton, sends his first report; he uses 25 watts on all bands. FFE is on his way toward O.R.S., and visited DSO. DNU gave lightning service on message from NNN, whom he QSO'd in O.R.S. party. Z1 is operating portable-mobile rig in car all over New Jersey. BIR reports 50 me. very active in Trenton. The last O.R.S. party gave us big totals now that his shack and transmitter have been erected a 10' final, 70 watts input. HGQ is going to V.C.A. night school. GJK is going on high-power phone with 1607 final. HNP reports new R.M. for the N.J. Section. GAO received his first O.R.S. appointment. Chief R.M.: 3BWT. P.A.M. 3VJ. BWT has been on the summer air. 3EGC moved out to the Broadcasting Operator license and is looking for a job as Chief Op. at WJZ or WLW. 3EGK has been busy taking the kids out of his new rig. 3EPJ discovered his final tank coil unwound itself. Details were not available.


Watch for Your Local G-E Radio Dealer's Display of G-E Focused Tone Radio Models Early in July

You'll ALWAYS Be Glad You Bought a General Electric Radio
LEEDS Leads
WITH SUMMER BARGAINS

Our Vacation Special

ATWATER KENT Model No. 48 TRF broadcast six tube battery receivers, in sealed cartons. These receivers may be operated from 6 volts with 201 A's, or 2 volts with 230's with 90 volt B battery. Ideal for the summer camp "beyond the power line." Quantity limited — better order early. Less accessories

$4.95

WESTINGHOUSE AND SANGAMO Watt Hour Meters

110-120 volt; 60 cycle 2 wire meters. The meters are used instruments in perfect condition, tested and reset to zero. A fifteen dollar value, at the extremely low price of

$3.50

Shipping weight 15 lbs.

IMPORTANT ANNOUNCEMENT

On Our NEW LD-5 Mounted Crystals

These low drift plates, factory sealed in the new LEEDS metal holder are outstanding from the standpoint of stability, accuracy, high output and low cost. Low Drift — 3 cycles per million per degree. Accuracy of calibration — better than 0.5%. Orders filled plus or minus two lo, of specified frequency. Last but not least, the price of the mounted crystals, anywhere in the 160-80 and 40 meter bands is only $3.50

Money back guarantee if you are not completely satisfied.

Thousands have discovered noise silencer adapters are a great help on reducing natural static too. Leeds "QUIET CAN" and "SILENT CAN" also provide freedom from ignition noises and afford an ideal arrangement for push to talk phone and break-in CW.

Leeds "QUIET CAN" for receivers with two IF stages; complete with tube and instructions ...

$8.55

Leeds "SILENT CAN" illustrated herewith, for receivers with one IF stage; complete with tube and instructions...

$10.95

A High-Power Three-Stage C.W. Transmitter

(Continued from page 18)

to the grid current flow, and going sour just when they are needed most.

The remaining power supply is the high voltage unit which provides the plate voltage for both doubler and final. This supply is provided with an overload relay for the protection of the power equipment and the tubes. The filter in the high voltage supply is a single section affair consisting of a 5- to 25-henry swinging choke and a 2-µfd. 3000-volt oil filled condenser in conjunction with a 100,000-ohm 150-watt bleeder. Incidentally, a high voltage power supply is not a thing to be careless with. Make certain that you have a good bleeder on it and always take the extra precaution of shortening the condenser with a well insulated piece of wire before you go poking around in its innerds; being sure, of course, that the supply is disconnected from the line first.

Since this rig is intended primarily for c.w. operation the ratio of L to C in all circuits was made purposely high. One turn at each end of the link coupling the oscillator to the buffer proved sufficient, the turns on the other link circuit being more or less a matter of experiment and being adjusted to provide maximum drive to the HF-200 grids with minimum loading of the buffer stage.

The bias on the 203-H was set at 135 volts and that of the HF-200's was set at 180 to 225 volts. The efficiency of the final amplifier stage should, with reasonable care in construction and wiring, run around 75 to 80%. The power output on the crystal frequency is 750 to 800 watts.

Hams having access to one of those little stapling gadgets used in offices for fastening sheets of paper together have at hand the means for making a neat job of fastening QSL cards together for wall mounting. W0HTUO, who suggested the stunt, fastens them together in strings of 15 or 20, the top and bottom cards being stuck to the wall with the usual thumb tacks. The cards can be readily cleaned without danger of tearing down the row when a cloth is run over them, and can be disconnected without much trouble and no damage.

W1IKE writes that not only was Noah one of the first hams because of his "arc," but that he also had a son named Ham!

Suggestion for signal reports: W3ETI says that so long as we tack an "X" on the RST report to indicate a crystal sig, why not use "C" to indicate a chirp? Logical enough—and saves spelling it out.

While discussing DX during one of their regular QSO's, W2ECL asked W2HMJ if he thought a YL ever worked an OM!
TUNING THE CRYSTAL

A new device providing crystal control at an easily-adjusted fixed-frequency.

Net Price (less Crystal) — $5.70  
With Hollister Crystal — $19.50

National presents a new adjustable-gap crystal holder with front-of-panel control of frequency. It is designed particularly for use with special Hollister A-cut crystals, and when properly installed will provide a frequency range of 6 kc. at 3500 kc. nominal frequency. Frequency spread is proportionately greater when operating on harmonics, as for example 24 kc. in the 20 meter band. Crystals specially selected for this service should be used, as some A-cut crystals are wholly unsuitable for variable frequency use. Holders are sold either without the crystal, or with a genuine Hollister 80 meter crystal for doubling into the 20 meter band. Crystals for other bands will be available later.

FEATURES:
- Frequency change of one part in 600.
- Low loss R39 Housing, totally inclosed.
- Flexible shaft drive for convenient panel control.
- Locking device for fixed-frequency operation.

NATIONAL COMPANY, INC., MALDEN, MASS.

HANDY MIDGET Electrolites

Series GLS 1" dia. can units half height of former units (to save space) or twice capacity for given size (for better filtering). • Inverted mounting. Color-coded leads. • In 200 and 450 v. working ratings. Several capacities. And inexpensive. • Send for catalog.

J. Bliley BC3  
CRYSTAL UNITS  
40-80 METER BANDS

Radio Operator’s Course  
Complete in  
Telegraphy —  
Telephony

P. A. C. is an endowed, educational institution — not privately owned, not operated for profit, college rank maintained. Course consists of maximum knowledge necessary to secure Commercial Telegraph Second-class, and Radio-telephone First-class government licenses. Course includes Wireless Code, Radiophone, Announcing, Microphone-Studio Technique, Service, Police, and Aeronautical Radio. We are authorized to teach RCA tests. At the completion of course you receive practical studio technique experience in our commercial broadcast studios located in the administration building, and experience as an operator on K P A C (350-Watt Commercial transmitter located on the campus, owned and operated by the college), and inter-departmental marine communication experience. If interested, write for Bulletin R.

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Port Arthur (World-known port) Texas

Say You Saw It in QST — It Identifies You and Helps QST
WE'RE INTERESTED IN
MEN WHO HAVE JOBS...
BUT WANT FUTURES!
If you're a man who wants to rise above the ranks of the average — who has ambition to reach "the top" —
then you'll be interested in the CREI Practical Radio Engineering course.
Our one-year Residence Course, begins Sept. 14
or by home study at any time.

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GET BETTER JOBS AND SALARIES
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C A P I T O L  R A D I O
ENGINEERING INSTITUTE
Dept. Q-7
WASHINGTON, D. C.
NEW YORK CITY
14th and Park Road
29 Broadway

A 500-Watt Transmitter With
Band-Switching Exciter

(Continued from page 18)
to ignite half of the column is obtained by a 3-turn loop around one of the antenna feeders.
Such an indicator certainly indicates the modulation, while the antenna meter pointer hardly
budges while talking.

After the set has all the "bugs" removed, the plate voltage may be raised to 1500 without fear
of any breakdowns, if 805's are used.

For other methods of 'phone modulation, such as grid-bias on the final or linear Class-B opera­
tion of the final (suppressor-modulating the
pentode) the tuning follows the practice previ­
ously referred to.

RESULTS
This transmitter was originally constructed
with the idea of being a compact transmitter for
use when the regular high-power job was not in
service. Since it was first put on the air in early
March, however, no other rig has been used at
W1SZ. This rig made WAC 8 times during
March on c.w. Although it has been on 14-mc.
'phone only three weeks, countries have been
**5-METER SPECIALS**

- **R.C.A. Transceiver** .......... $19.95
- **Sickles 5 M. Kit.** ............. $1.20
- **Judge and Audio Trans.** ...... $1.20
- **Output Trans.** ................. $0.90
- **5 M. Pole with 5000 Volt Condenser.** $1.50
- **E.O.I. Cable, per foot** .......... $0.06
- **Dunco D.P. St. Relay** .......... $2.00

**ACCESSORIES**

- **Elmac 35 T.** $8.00
- **Astatic Crystal Microphone, KJ.** $22.50
- **Astatic Crystal 104.** $13.50
- **Amperite Velocity Mike.** $19.20
- **Tobe 3 Mfd. 2000 Volt Condenser.** $2.45
- **Tobe 1 Mfd.** $0.70
- **Tobe Communication Receiver Kit.** $7.40
- **Complete Air Trimmers.** $47.40
- **Tubes R.C.A.** $3.32
- **R.C.A. 952-$3.75 R.C.A. 954-$5.80

**Used Tubes and Equipment**

- **R.G.A. 204A** .......... $20.60
- **R.G.A. 852** .......... $9.00
- **Sylvania 860.** $9.00
- **W.E. 276A** .......... $7.90
- **R.C.A. 849.** $50.00
- **Sky Rider TRF** .......... $20.40

We have the largest stock of amateur essentials in New England. We can supply it all and with snappy, prompt, satisfying service.

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**THE RADIO SHACK**

**INTERNATIONAL PLATE TRANSFORMERS**

<table>
<thead>
<tr>
<th>Model</th>
<th>2000 - 300 Mills</th>
<th>300 - 800 Mills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>$13.50</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

**INTERNATIONAL CASED CHOSES**

| Value | 2.5V-12A. Trans. (case) for 866's | $1.50 |

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**PYRANOL**

- **2 MFD. 2000 VOLTS UNCONDITIONAL GUARANTEED for 2 years.** $9.95

- **SUPER SKY RIDER (Crystal)** ........ $89.50
- **SUPER SEVEN** .................... $49.50
- **NEW SKY BUDDY** ................. $29.50

**THE RADIO SHACK**

46 BRATTLE STREET 
BOSTON, MASS.

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**STEP BY STEP PRECISION MADE**

- **Type VM2.** Mounted crystal within 5 Kc of specified frequency 1.7, 3.5, 7 Mca Bands. $1.95
- **Type VG2.** Unmounted cut x cut within 5 Kc 1.7, 3.5, 7 Mca Bands $2.25
- **Type VG2 in 1.7, 3.5 Bands only.** Plus or minus 30 Kc. $1.45
- **Type VG2A.** AT cut mounted, Drift less than 0.05 per cent per deg. C 1.7, 3.5, 7 Mca Bands. $4.50
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The Valpey Crystals 
377 Summer Streeet, Medway, Mass.

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Collins, RCA, RME, Marine Transmitters 
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RME-69s, .................................. $115.80
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National HROs .................................. $107.70
RCA AM-566s ................................. $119.50
P-10Cs complete prepaid ...................... $191.65
Crystal Super Pro .................. $241.40
99 metal tube Super Skyriders ................ $79.50
The new Sky Buddy .................. $204.00
The new Ultra Skyrider ................. $99.50

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**HENRY RADIO SHOP**

211-215 North Main Streeet 
BUTLER, MISSOURI

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**THE RADIO SHACK**

**INTERNATIONAL PLATE TRANSFORMERS**

FULLY CASED

- **Model 2000 — 300 Mills** $5.95
- **750-1000 each side** $8.95

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**ACCESSORIES**

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- **Type VG2A AT cut unmounted drift less than 4 cycles 1.7, 3.5, 7 Mca Bands.** $4.50

The Valpey Crystals 
377 Summer Streeet, Medway, Mass.

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**CORNELL-DUBILIER**

**TYPE 86 TRANSMITTING MICAS**

Based upon experience gained through more than twenty years of specialization in the manufacture of condensers, C-D Mica Capacitors achieve a standard of perfection that is completely unrivalled!

Check these definite advantages of the Type 86 High Voltage Mica Condensers for use in tank circuits, plate blocking, grid, antenne coupling and other important functions in the " ع " where dependability is essential.

V Loss of power flowing through capacitor is only 1/100 that of ordinary or flint glass dielectric capacitors.

V Ceramic casing insulates condenser from interfering ground capacity.

V Ceramic casing prevents field absorption, hence lower R.F. resistance.

V Capacity remains constant at high frequencies and at temperatures that would materially damage glass dielectric capacitors.

Write today for Catalog No. 128 listing in complete detail these and other transmitting condensers.

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**CORNELL-DUBILIER CORPORATION**

4373 BRONX BOULEVARD 
NEW YORK
THE 60-X CW TRANSMITTER is hard to beat in price and performance
• Rated input 80 watts • Band switching and crystal selection • Compact size • Immediate delivery
  • Net price as shown above... $69.50
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PIEZO-ELECTRIC CRYSTALS
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AMPERITE Leads Again—
New! EXTERNAL INPUT TRANSFORMER
Cable Type Model EC32
NOW ENABLES USE OF LOW IMPEDANCE MICROPHONE WITH AMPLIFIERS HAVING HIGH IMPEDANCE INPUT
Up to 2000' of cable can be used
Hum trouble is entirely eliminated by special balanced windings. Extra heavy coils will withstand mechanical abuse... Not to be confused with ordinary input transformers.

New! DUAL-IMPEDANCE MICROPHONE
FOR HIGH OR LOW IMPEDANCE AMPLIFIERS
Can be used with high impedance input with cable lengths up to 1000'; or low impedance input with cable lengths up to 500'. Use Philco in the ordinary way for low impedance input. Also works with high impedance input on models limited to 150 WPS—therefore, minimum alteration for low or high impedance operation.
FREE COMPOSITE DIAGRAM OF MICROPHONE Modes is valuable for design of external connections. See Note.

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• Rated input 80 watts • Band switching and crystal selection • Compact size • Immediate delivery
  • Net price as shown above... $69.50
  • All tubes and two LD2 crystals 27.00
Write for Full Details
HARVEY RADIO LABORATORIES, INC.
12 Boylston Street
Brookline, Mass.
Export: 25 Warren St., N. Y. C. Cable: "Simontrice"

"The Crystal Specialists Since 1925"
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Guaranteed Accurate to BETTER than .01%
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FREE COMPOSITE DIAGRAM OF MICROPHONE Modes is valuable for design of external connections. See Note.

AMPERITE RADIO, 611 BROADWAY, N. Y.

worked, scattered in all continents, including nearly two dozen VK contacts. This was accomplished with Class-B plate modulation of the final. Naturally one cannot expect the best results without the best possible antenna system permitted by the location. This rig is used on a vertical system consisting of two vertical sections stacked one above the other, working as half-waves in phase on 20, as two full waves on 10, and as a center-fed half-wave 40 meters. For lower frequencies a separate horizontal Zepf is used.

A.R.R.L. QSL Bureau

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

W1—J. T. Steiger, W1BGY, 35 Call Street, Willimansett, Mass.
W2—H. W. Yahnel, W2SN, Lake Ave., Hel- metta, N. J.
W3—R. E. Macomber, W3CZE, 418 10th St., N. W., Washington, D. C.
W4—B. W. Benning, W4GBY, 520 Whiteford Ave., Atlanta, Ga.
W6—D. Cason Mast, W6KHV, 423 East E Street, Ontario, Calif.
W7—L. W. Kelly, W7BPC, 4919 So. Prospect St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
W9—George Damman, W9JO, 319 Sherman Ave., Evanston, Ill.
VE1—J. E. Roue, VE1FB, 84 Spring Garden Rd., Halifax, N. S.
VE2—W. H. Oke, VE2AH, 5184 Mountain Sights Ave., N. D. G., Montreal, P. Q.
VE3—Bert Knowles, VE3QB, Lanark, Ont.
VE4—Dr. J. J. Dobry, VE4DR, Killam, Alberta.
VE5—E. H. Cooper, VE5EC, 2024 Carnarvon St., Victoria, B. C.
K4—F. McCown, K4RJ, Family Court Rd., San- turce, Puerto Rico.
K7—Frank P. Barnes, K7DFV, Box 297, Wrangell, Alaska.
KA—George L. Rickard, KA1GR, P. O. Box 849, Manila, P. I.

Strays
W3FLC reports that W3FOX, prior to getting his ham ticket, worked on a fox ranch!
**THE RADIO AMATEUR'S LICENSE MANUAL**

Going after your first ham ticket? You need the manual for its instructions on where to apply, how to go about it in the right way — and, most important of all, for the nearly 200 typical license exam questions and answers. All the dope on every phase of amateur licensing procedure, and, of course, the complete text of the new regulations and pertinent extracts from the basic radio law.

A necessity for the beginner — indispensable to the licensed amateur.

Order Four Today, 25¢ postpaid (no stamps, please)

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**NEW MASTER TELEPLEX**

For beginners, experienced operators, and schoolroom. The sure easy way to learn code and to step up your speed. This amazing new instrument will record your own sending on double row perforated paper and repeat it back to you at any speed you desire. 10,000 words can be recorded on one tape.

**NO BATTERIES**

**NO WINDING**

**ALL ELECTRIC**

It is the same in principle and in operation for this service is equal to the Wheatstone Perforator and Transmitter, which cost over $1,000.

**BUY IT OR RENT IT**

Send for Folder Q-7, which tells you how to get the use of this instrument without buying it. No obligation. We furnish complete course and personal instruction with a money-back guarantee. Low cost, easy terms. Write today for information.

**TELEPLEX CO.**

72 Cortlandt St. New York City

The New Master Teleplex "The Choice of Those Who Know"
Simplifying the Push-Pull-Push Crystal-Oscillator

(Continued from page 18)

in locations $L_1$ or $L_2$. For 160 and 80 meters practically full condenser should be used. For the higher frequencies the coil should be trimmed to use progressively smaller capacity settings. Very small wire was used for the 160- and 80-meter coils here and, when loaded, no heating was apparent; however, larger wire is specified in the coil table. Coupling to the load can be by means of coil taps or from a link wound tightly over the coils. The coils have been carefully computed for the various capacitances in the circuit, but don’t expect that a little trimming won’t be necessary. It will be well to put on a few extra turns, remembering that the plate coil must serve for both push-pull and push-push duty. The push-push connection has considerably more capacity “padding” effect than the push-pull.

It is hoped that builders of this simple transmitter (or exciter) get as much enjoyment out of it as I have. It is easy on crystals and it takes but a moment to change bands. If you want more output try a couple of RK-20’s in the same circuit using an A-cut crystal.

The second part, describing a number of “trick” circuits for crystal oscillators and frequency multipliers, will appear in a coming issue.—Erron.

Five Meters Again Shoots the Works

(Continued from page 9)

He heard these nines: JHY, CC, PKU, JDK, LBP, TLQ. He also reports hearing W9UAQ working W1FJN and says that WIDVO managed to get a contact with Chicago.

John E. Knight, W3GAH, contacted W9PEI and heard W9PKU, W0BIR, W9WN, W9UAQ, W9PMQ and WSNUR with a two-tube superregen. He reports rapid fading on all stations from R9 to about R4. W9PMQ’s signal, he reports, was the last one to drop out—at 11:43 p.m.

These reports, of course, do not paint the whole picture. We know that scores of stations around New York and, for that matter all along the coastal states participated in the orgy of DX. “Yeah,” we hear someone say, “now tell us why it happened and when it will happen again.” At which point we get thoroughly stuck. Without much doubt the period was one during which an unusually heavy sporadic E-region ionization occurred (as one ionosphere specialist puts it), but there is nothing much more to offer.
Introducing New Automatic CODE X-MITTER

Uses Kleinschmidt Perforated Tape
Automatic Rewind 3 to 15 w.p.m.
12 x 8 x 7 inches  All parts nickel plated

A scientific and useful apparatus designed particularly to fill the needs of amateurs. Sensitive polarized relay, AC or DC; 1/2 h.p. motor with hash filter; smart crackle finished black cabinet; 2000 words of press tape FREE with each unit. Specially priced to hams at $50.00, F.O.B. New York City.

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On your phone rig HiLevel performs efficiently and gives you a full HUMAN voice.

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It is unnecessary to cripple a microphone with such clear clean response. However, if you prefer the extreme sharpness characteristic of communications type, shunt a 1/2 megohm resistor across the microphone terminals or any convenient place in the line or input.

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---

Unfortunately, it would appear that no ionosphere measurements were being made at the time (we are trying to find out definitely). We do know that conditions in the lower atmosphere over most of the path were right for effective bending in the atmosphere itself and there is the possibility that this situation served as a happy companion for an unusual ionosphere condition.

It is certain that the condition will be repeated again soon and it is quite probable that the phenomenon will become much more common in the near future. In the meantime, we can only urge all ultra-high frequency workers to keep their ears cocked for DX and to cultivate the habit of signing their calls more frequently and more clearly. Complete reports of all work done are of tremendous value to us. We request with all the enthusiasm we possess, that they be sent in by all stations playing a part in this weird and wonderful phase of ham radio.

—R. A. H.

---

**56-mc. DX Contest**

With the advent of a considerable amount of DX work on 56 mc., within the past several weeks, particular attention is called to the rules of the M.B.A.C.-A.R.R.L. 56-mc. International DX Contest (page 27, January QST) and the beautiful 10-inch loving cup offered the winner. Those who wish to compete are referred especially to rules 5 and 6 as outlined in the January issue, especially as those rules require reports to headquarters. Those who have been fortunate in participating in some of the fine DX contacts recently and wishing to receive credit in the contest should report their accomplishments in accordance with the rules. Be sure to mark your reports "For the 56-mc. Contest" when mailing.

---

**Inductive Neutralization of R.F. Amplifiers**

(Continued from page 24)

\[ E_1 = \frac{\bar{M}}{\bar{C}_2} \]  

Writing Kirchhoff's Law equations for Fig. 3.

\[ I_{L_1} \left( R_1 + j\omega L_1 \right) - j I_{C_2} \left( C_{cp} \right) \left( \frac{1}{\bar{C}_2} \right) + I_{L_2} \left( R_2 + j\omega L_2 \right) = 0 \]

Solving these equations for \( I_{C_2} \) and substituting for \( \frac{1}{\bar{C}_2} \) the value of \( \omega L_2 \) since \( L_2 \) and \( C_3 \) are tuned to resonance gives

\[ I_{C_2} = \frac{-j I_{L_1} \left( \bar{M} + R_1 C_{cp} \omega^2 L_1 L_2 C_{cp} \right) + j R_1 \left( R_1 + R_2 \right) \left( R_1 + R_2 \right) \left( \omega^2 L_1 L_2 \right)}{R_1 \left( \omega^2 L_1 L_2 \right) + j \omega L_2 C_{cp}} \]

If \( M \) is varied, minimum \( I_{C_2} \) or best neutralization is obtained for

\[ M = \frac{\bar{M}}{\bar{C}_2} \]

It is readily observed that if \( R_1 R_2 \) is very much less than \( \omega^2 L_1 L_2 \), the value of \( M \) is the same as that determined neglecting resistances. This condition is true in practically all tank circuits. It is common practice to have the effective "Q" of tank circuits of the order of 5 to 10 where effective "Q" refers to the ratio of reactance to effective resistance.
WHERE TO BUY IT

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

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H. Jappe Company
46 Cornhill

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One or more of the following considerations will influence the choice of your next transmitting tube:

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No Power Supply. New low prices and improved performance should be of interest to all amateurs who wish to improve the quality of their stations.

PRICE $29.00

RADIO RECEPTOR CO., INC.
110 Seventh Ave., New York City

High-Fidelity Audio at Low Cost
(Continued from page 36)

the circuit shown herewith, but in most cases this simply amounts to lifting off a couple of soldered joints from the tube socket.

In the circuit shown as a suggestion for coupling in a t.r.f. type tuner, it will be noticed that a form of link circuit is used. The third coil $L_3$ may be a hundred turns or so of fairly fine wire on a former small enough to slip inside the secondary of the coil unit.

In all cases it will be found rather difficult to arrange to have a.v.c. voltage taken from the same diode as used for detection. If a.v.c. must be fitted, one solution is to use a tube like a 6B7 for the intermediate amplifier and take some r.f. from the plate circuit of this valve back to its diodes to develop the necessary a.v.c. voltages.

Station Description
(Continued from page 46)

'tphone, but which can be operated on 50, 40, 20 or 10 meters since all coils are plug-in type. The radio-frequency tube line-up in this transmitter consists of a 59 Tri-tet crystal oscillator, 59 regenerative doubler, two 46's in parallel in the buffer stage, and two 801's in push-pull in the final-amplifier stage. The audio line-up consists of a double-button carbon microphone, 56, 56, two 45's in push-pull and two 210's in Class-B as modulators. The modulator and final amplifier tubes are operated at 850 volts. The normal input to the final stage is 135 watts. Each panel unit is complete with terminals at the rear of the chassis. This makes it possible for any unit to be removed should the necessity arise.

A 66-foot flat-top 40 feet high pointing north and south, fed by Zeppe feeders, is used with both transmitters. The large 40-meter transmitter has put signals into many foreign lands but as yet is not quite WAC. On 14,200-kc. 'phone contacts with United States, Canada, Central America and West Indies are comparatively easy. The best 'phone DX to date has been a ZL contact and numerous New Zealand and Australian SWL reports.

The receiver is a Hammarlund Comet Pro with a receiving antenna in the attic.

The meter boxes seen on the operating table contain a combination voltmeter, ohmmeter and milliammeter, a vacuum-tube voltmeter and a modulation analysis meter.

W9WGH mounts his filter chokes on pivots to get that "swinging" effect!—W9SA.

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Heard on 20-meter 'phone: W9—, "Sorry, OM, you got my call letters balled up. Listen, W2-er—say, what the deuce is your call? . . ."
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SEE June QST Ham-ad for prices etc., on crystals. William Threm, W8SN, 4051 Davis Avenue, Cheviot, Ohio.

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THICKER than X-cut blanks $1, Faberadio, Sandwich, Illinois.


BARGAIN—AOS complete in good condition, with power supply and coils for 20, 40, 80 and 160. $67. Also bargain in band amplifier $75. For more information write Box 25, Walls, Wyo.

SELL IFXJA Leslie's Noise Silencer and National Preselector with tubes, phonograph, forty BS and F coils. All condition. Best cash offer. W6EBT.

4-band receivers General Electric model A-82, senate box control, only $99.50. For description see QST December 1935 page 126. Write, W5EBT.

804 power tubes. Venus, 7N12, 6J3, 6L6, 6N8, 6N9, 6B9. Editon's, 1439 South Michigan Ave., Chicago, Illinois.

QSLs, 3-meter Print, Escanaba, Mich.

BARGAIN list—amateur and broadcast equipment and transmitter parts. Send for list. Eidson's, Temple, Texas or W2GWS, 8314 South Michigan Ave., Chicago, Illinois. Also bargain in band amplifier $75. For more information write Box 25, Walls, Wyo.

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GLOUGH Brengle CRA oscilloscope. New, complete $65. W6DDB.

NOW 40 meter X cut and low drift cuts—Southwest Pico Service, Abilene, Texas.

McMURDO Silver masterpiece receiver number two with crystal laboratory and two sets of filters, with two large two fifty amplifier chassis. Glenn Watt, Chanute, Kans.

QSLs-SWLs—finest obtainable. Attractive, distinctive, modern, quality, stock, lines, samples, prices (stamps). W6NOS.


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20A and socket $17.50, 211 and socket $6.50. 2 Jewel RT meters 9-10 $4.50 each, Jewell DC voltmeter 0-1500 $8. Hammond 700 100A condenser $7. 2 Allen Bradley Radiostats $2.50 each, 400x working volts 2 mil. Morrill $10. No trade...

WSUX.

QSL's. Mile-hi quality. 300 2-color $2. W9TOS.

FIVE meter equipment receivers $9.50, transmitters $7.; alternators $4, single 1P, $5. We build equipment to order. Precision Radio Laboratories, 109 East 94 Street, Brooklyn, N.Y.


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"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.

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Say You Saw It in QST — It Identifies You and Helps QST
Helping Ears to "See" Farther

Burgess Portable Power

America goes to war. "Enemy planes" dive on New York. A "protecting fleet" wraps the city in smoke and soars on to victory.

Below on the ground it's impossible to tell what's happening — but at the tip of the Empire State Building, James Wallington watches every move. He draws the maneuvers in his "mike" scene by scene. Even thousands of miles away this spectacular broadcast enables us to "see" our air army in battle.

Burgess Batteries were there, too. They furnished radio power to the voice that commanded the squadrons. Their portability aided the nation-wide broadcast.

Use the portable power the veterans use in your own experimental or radio work —Burgess Batteries.

BURGESS BATTERY COMPANY
Freeport, Illinois
NEW ... UTC ULTRA COMPACT AUDIO UNITS...

Designed as companion units for acorn and metal type vacuum tubes. They measure up to good broadcast standards, having a response of plus or minus 2 db from 30 cycles to 20,000 cycles. The average weight is 6½ ounces, and the overall dimensions are 1\(\frac{7}{8}\) x 1\(\frac{7}{8}\) x 1\(\frac{7}{8}\). These units are primarily intended for noise meter, aircraft and remote pickup work. Full description of these units is contained in the new U1100D bulletin.

### THREE TYPICAL ULTRA COMPACT AUDIOS

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<tr>
<th>Type</th>
<th>Application</th>
<th>Primary Impedance</th>
<th>Secondary Impedance</th>
<th>List Price</th>
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<tr>
<td>A-12</td>
<td>Multiple line or microphone to 2 grids</td>
<td>500, 333, 250, 200, 125 or 50 ohms.</td>
<td>80,000 or 20,000 ohms.</td>
<td>$10.00</td>
</tr>
<tr>
<td>A-16</td>
<td>Single plate (6C6, 955, 262A, etc.) to single grid</td>
<td>15,000 ohms.</td>
<td>60,000 ohms.</td>
<td>8.00</td>
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<tr>
<td>A-24</td>
<td>Single plate (6C6, 955, 262A, etc.) to multiple line</td>
<td>15,000 or 3,750 ohms.</td>
<td>500, 333, 250, 200, 125 or 50 ohms.</td>
<td>10.00</td>
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Ask your distributor for U1100D bulletin describing all of the new ULTRA COMPACT AUDIOS.

### VARIMATCH transformers are designed to match all available modulation tubes to a class C, RF stage

<table>
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<th>TYPE</th>
<th>VARIMATCH Modulation Transformer</th>
<th>List Price</th>
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<td>VM-1</td>
<td>Will handle any power tubes to modulate a 20 to 60 watt Class C stage</td>
<td>$8.00</td>
<td>$4.80</td>
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<tr>
<td>VM-2</td>
<td>Will handle any power tubes to modulate a 40 to 120 watt Class C stage</td>
<td>12.50</td>
<td>7.50</td>
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<tr>
<td>VM-3</td>
<td>Will handle any power tubes to modulate a 100 to 250 watt Class C stage</td>
<td>20.00</td>
<td>12.00</td>
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<tr>
<td>VM-4</td>
<td>Will handle any power tubes to modulate a 200 to 600 watt Class C stage</td>
<td>32.50</td>
<td>19.50</td>
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<tr>
<td>VM-5</td>
<td>Will handle any power tubes to modulate a 450 watt to 1 KW plus, Class C stage</td>
<td>70.00</td>
<td>42.00</td>
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The secondaries of all Varimatch transformers are designed to carry the class C plate current.

THE VARIMATCH TRANSFORMER NEVER BECOMES OBSOLETE

GOING TO PRESS! Our Research Department has just completed a thorough study of Transmitter and Public Address hookups, circuits and applications. This valuable information has been compiled into an attractive 44-page illustrated bulletin. A limited number of copies will soon be available at your local distributor. ORDER YOURS NOW... SPECIAL PRICE........25c

UNITED TRANSFORMER CORP.
76 SPRING STREET NEW YORK, N.Y.
EXPORT DIVISION – 15 LAIGHT STREET, NEW YORK, N.Y.

QST for July, 1936, EASTERN Edition
ANY night on the amateur bands you will hear a better advertisement of the Standard HRO than we could write. The unqualified enthusiasm of men who have spent years mastering the fine points of high frequency communication counts for more than a long list of unusual details, even though those details include such items as the PW Precision Condenser, calibrated band spread and a crystal filter as effective on phone as c.w. The demands of modern radio are rigorous, and the proof of the pudding is in the eating.

THE attractively priced HRO Junior is the Standard HRO stripped down to its straight superheterodyne circuit by omission of the calibrated S-meter (and associated circuit), the single-signal crystal filter, the extreme electrical band spread, and the engraved aluminum relay rack panel. The chassis, all other parts, and the fundamental circuit are identical. The general performance of the HRO Junior is in every way equal to the magnificent performance of the HRO. The crystal filter and the S-meter, may be added at any time.

An illustrated folder describing both receivers will be mailed on request.
FOR BEST RESULTS AT HIGHER FREQUENCIES USE RCA Transmitting Tubes

During the summer months interest in the higher frequencies is at a peak. For full enjoyment of ultra-high frequency operation you must use the right tubes. RCA offers a wide variety for both 5 and 10 meter operation. Use this table in selecting the type to meet your particular requirements.

<table>
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<th>Type</th>
<th>Rated Maximum Plate Input Watts (Class C Telegraphy)</th>
<th>Amateurs' Net Price</th>
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<tr>
<td></td>
<td>at 20 Meters</td>
<td>at 10 Meters</td>
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<tr>
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<tr>
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<td>42</td>
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<tr>
<td>RCA-802*</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>RCA-803*</td>
<td>350</td>
<td>290</td>
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<tr>
<td>RCA-804*</td>
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<td>RCA-834</td>
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<tr>
<td>RCA-838</td>
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<tr>
<td>RCA-852</td>
<td>300</td>
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* Indicates Pentode Type

In addition there are the RCA-955 acorn triode at $3.75 and the RCA-954 acorn pentode at $5.80 for the ultra-high frequency receiver or "flea-power" transmitter. For information on the RCA types mentioned or any other RCA tubes see your distributor or write to AMATEUR RADIO SECTION RCA MANUFACTURING CO., INC. CAMDEN, NEW JERSEY A Service of the Radio Corporation of America