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Editorials ............................................................... 9
Another Storm Weathered ............................................. 10
Rationalizing the Autodyne .......................................... 11
A Portable that Works at Home and Abroad ....................... 17
A Japanese Hamfest .................................................. 24
Standard Frequency Transmissions ................................. 26
Silent Keys .................................................................. 26
Election Returns — de W1MK ......................................... 26
Combining the Frequency Meter and Monitor ...................... 27
A Complete Self-Contained Frequency Meter-Monitor .......... 30
Series-Parallel Feeder Switch ........................................ 31
Amateur Observations During the Total Eclipse of the Sun ..... 32
The Delta Division Convention (Report) ........................... 38
QRR, 1932 .................................................................. 39
Modulating the Screen-Grid R. F. Amplifier ........................ 43
Tunable Hum .................................................................. 46
A New Handbook ........................................................ 48
Experimenters’ Section 
Detectors with Screen-Grid Feed-Back — Key-Click Preventer — A Novel Class B Modulator — A Neutralizing Kink ................................................................. 49
Announcing the Fifth Annual International Relay Competition .... 51
Calls Heard .................................................................. 53
I. A. R. U. News .......................................................... 54
The Communications Department .................................... 57
Correspondence Department .......................................... 76
Election Notice ............................................................ 84
New Frequency Meter-Monitor ....................................... 86
Financial Statement ...................................................... 88
Information Service Rules ............................................. 88
Hamads and QRAs ....................................................... 92
QST’s Index of Advertisers .............................................. 94

JANUARY 1933
VOLUME XVII NUMBER 1

Kenneth B. Warner (Secretary, A.R.R.L.), Editor-in-Chief and Business Manager; Ron A. Hull, Acting Editor; James J. Lamb, Technical Editor; George Grammer, Assistant Technical Editor; Clark C. Rodimon, Managing Editor; David H. Houghton, Circulation Manager; F. Cheynne Beckley, Advertising Manager; Ursula M. Chamberlain, Assistant Advertising Manager.

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GOOD TEXTBOOKS and operating manuals should be on every amateur's bookshelf. We have reviewed practically all the books in which the amateur would be interested, and have arranged to handle through the QST Book Department at A.R.R.L. Headquarters those volumes which we believe to be the best of their kind. Take pride in a small but good radio library; buy a few good books and get into the habit of reading them.

**Principles of Radio**, by Keith Henney. This book is chock-full of meat for the experimenter. The subjects treated range from the fundamentals of electricity to the most modern concepts of modulation and detection. 477 pp., 300 illustrations. 

**Elements of Radio Communication**, by Prof. J. H. Morecroft. This is a new book by the author of the "Principles" listed below. It is about half the size of the larger work, and the subject is treated in more elementary fashion. Simple algebra is sufficient. An excellent book for the "first-year" student. 200 pp., 170 illustrations. 

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**The Manual of Radio Telegraphy and Telephony**, by Commander (now Admiral) S.S. Robison, U.S.N. This is a laboratory manual, describing 128 excellent experiments designed to bring out the principles of radio theory, instruments and measurements. 150 illustrations, 220 pp., 5¼ x 7. 

**Radio Data Charts**, by R. T. Beatty. A series of graphic charts for solving, without the use of mathematics, most of the problems involved in receiver design. 82 pp., 8½ x 11. 

**Thermionic Vacuum Tube**, by H. J. Van der Bijl. For many years this has stood out above all other works as a theoretical and practical handbook for the vacuum tube and the vacuum tube designer. A thorough knowledge of higher mathematics is required. Not a book for the beginner, but for the laboratorian and engineering student it is without a peer. 


**How to Pass U.S. Government Radio License Examinations**, by Duncan and Drew. A practical handbook, especially valuable to the commercial license, and covering theory and apparatus. A practical handbook. In size it is approximately the same as the two listed just previously, and the subject matter generally follows along the same lines. A good book in this class. 950 pp., 408 illustrations. 

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**Radio Frequency Electrical Measurements**, by R. T. Beatty. Another work along the lines of a general text on radio theory, instruments and measurements. 150 illustrations, 220 pp., 5¼ x 7. 

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**Radio Traffic Manual and Operating Regulations**, by Duncan and Drew. A book for students, amateurs, or radio operators who contemplate entering the commercial field; it will enable you to learn quickly and easily all the government and commercial traffic rules and operating regulations. 181 pp. 

**Manual of Radio Telegraphy and Telephony**, by Commander (now Admiral) S. S. Robison, U.S.N. Published by the Naval Institute. Covers both the theoretical and practical fields. 761 pp., 6½ x 9. 


**Below Ten Meters**, by James Millen and Robert S. Knise. The contents include chapters on ultra-high-frequency oscillators, radiating systems, receivers, theory, measurements, television reception and other pertinent subjects, abundantly illustrated with photographs and diagrams. 64 pages. 

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RECTIFIER CIRCUIT INFORMATION

<table>
<thead>
<tr>
<th>Type</th>
<th>Circuit “A” (CW ONLY)</th>
<th>Circuit “B” (CW OR PHONE)</th>
</tr>
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<tbody>
<tr>
<td>Group</td>
<td>For Operating</td>
<td>D.C.</td>
</tr>
<tr>
<td>II</td>
<td>4-10</td>
<td>2-66</td>
</tr>
<tr>
<td>III</td>
<td>2-03A or 2-10</td>
<td>2-66</td>
</tr>
<tr>
<td>IV</td>
<td>2-10</td>
<td>2-03A or 2-10</td>
</tr>
</tbody>
</table>

Note 1. Circuit “B” is made by adding L2 and C1 to Circuit “A” and moving bleeder to termination. Value of bleeder given in tables is sum of R1 + R2 and value of R1 is determined by tap-voltage and R.F. or A.F. Note 2. Filament transformers have multi-windings for both rectifier and transmitter tubes. For rectifiers only use AD15, or AD17.

TRANSFORMERS

Acme-Delta transformers are designed and constructed with the same care and attention as the units described in Delta Bulletin 200A. All units are assembled with static shields between primary and secondary to minimize "tunable hum," key-click interference, and R.F. radiation from lightning lines. They will deliver their rated voltage within limits of plus 0 plus 5%. This is important in filament excitation to obtain maximum tube life.

They will operate continuously at full load without the temperature rise exceeding 50° C. This gives long life and the ability to stand large temporary overloads, Their mountings are simple to reduce cost, but due to careful design are nevertheless attractive and adequate. All terminations are non-rotating and mounted on engraved bakelite panels. Separate transformers are provided for plate and filament excitation. This permits leaving filaments on while receiving to facilitate quick changeover. Every unit before shipment is carefully tested for insulation, shorted turns, and voltage output.

ACME-DELTA PLATE TRANSFORMERS

Standard Primary Input — 115 Volts — 60 Cycles, 1 Phase

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Type</th>
<th>D.C. from Filter</th>
<th>A.C. from Secondary</th>
<th>R.M.S. Ampt.</th>
<th>Power VA</th>
<th>Sec. VA</th>
<th>Insulation</th>
<th>Wgt. lbs.</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD20</td>
<td>A</td>
<td>400</td>
<td>480-0-480</td>
<td>470</td>
<td>95</td>
<td>50</td>
<td>9,500</td>
<td>40</td>
<td>$5.05</td>
</tr>
<tr>
<td>AD21</td>
<td>B</td>
<td>750 or 500</td>
<td>900-0-900</td>
<td>.150</td>
<td>200</td>
<td>125</td>
<td>4,000</td>
<td>11½</td>
<td>7.60</td>
</tr>
<tr>
<td>AD22</td>
<td>C</td>
<td>1,000 or 1,250</td>
<td>1,500-0-1,500</td>
<td>.350</td>
<td>85</td>
<td>1140</td>
<td>8,500</td>
<td>29</td>
<td>17.25</td>
</tr>
</tbody>
</table>

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NEW ACME-DELTA
TRANSFORMERS . . . SWINGING-CHOKES . . . SMOOTHING-CHOKES . . . PYRANOL CONDENSERS

ACME-DELTA FILAMENT TRANSFORMERS

<table>
<thead>
<tr>
<th>Cat. No.</th>
<th>Type</th>
<th>Tubes</th>
<th>Output</th>
<th>Volts</th>
<th>Amps</th>
<th>Insulation</th>
<th>VA</th>
<th>Wgt. lbs.</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD-10</td>
<td>A</td>
<td>(Note 5.) '82, '45, '46, '47</td>
<td>9.5 C.T.</td>
<td>3.0</td>
<td>2,500</td>
<td>25</td>
<td>25½</td>
<td>$2.95</td>
<td></td>
</tr>
<tr>
<td>AD-11</td>
<td>A</td>
<td>'66</td>
<td>9.5 C.T.</td>
<td>3.5</td>
<td>2,500</td>
<td>25</td>
<td>25½</td>
<td>5.50</td>
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<tr>
<td>AD-12</td>
<td>B</td>
<td>'03A, '11, '17C, '59, '00</td>
<td>9.5 C.T.</td>
<td>3.25</td>
<td>2,500</td>
<td>25</td>
<td>25½</td>
<td>6.00</td>
<td></td>
</tr>
</tbody>
</table>

Note 5. Also made for 63 Rectifier, type AD18, Price $3.00

ACME-DELTA SWINGING CHOKES

The first filter choke should swing with load between definite inductance limits. * Acme-Delta swinging chokes will operate at lower voltage than listed, but should not be used for higher voltage without special recommendation. * See Bull. 200A, Page 12.

ACME-DELTA SMOOTHING CHOKES

Delta test methods give the actual inductance as obtained in filter circuits. Most commercial choke ratings are obtained by tests not comparable to operating values. Both rating values are listed herein. * See Bull. 200A, Page 14.

PYRANOL CONDENSERS

American manufacture. Used by Delta in all its commercial heavy-duty broadcast equipment.

COUPLING TRANSFORMERS CLASS "B"

Cat. No. AD70 Type A, Class "B" Input Transformer. For coupling '45,"50 or "65 to '03A, "11 or W.E. 242 | $4.90

Cat. No. AD71 Type E, Class "B" Output Transformer. For coupling '03A, "11 or W.E. "03C 1000 v., 0.4 amps. max. or 2000 v., 0.5 amps. max. | $15.40

Circuit diagram, information and operating characteristics are contained in Bulletin AD71. Send for your copy.

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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 world and has a history of glorious achievement as the standard-bearer in amateur affairs.

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

A directory of the amateur societies affiliated with the League, showing their times and places of meetings, is available upon request.

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There has been an unprecedented increase in the users of amateur radio during the past year. Last year (1931) there were 28,750 licensed amateur transmitting stations. This year there are 50,874, an increase of 76.25%.


The above excerpt from the annual report of Mr. W. D. Terrell will be of keenest interest to every follower of amateur radio. For the third successive year amateur radio in the United States registers a big increase over the previous year. Thirty thousand of us—and still going strong!

Back in the fall of 1928 there was much viewing with alarm of the dawn of 1929 and the beginning of the era of reduced operating territory on “20” and “40” as a result of the Washington radio conference. Many were the gloomy predictions at that time as to the future of our hobby. Amateur radio, so the pessimists informed us, was headed for the skids; the following years would see a steady decline in the number of licensed operators. The terrific interference conditions, supposedly inevitable under the new conditions, would drive hams by the dozen out of amateur radio into collecting butterflies instead of QSL cards, and dancing instead of DX on Saturday nights.

What actually happened was that right from the start we began to chalk up the biggest yearly increases in numbers in our history! At the beginning of 1929 there were approximately 16,000 licensed amateurs in this country. To start the ball rolling there was an increase of 21,155 during that year, and the figure has been jumped up in the second successive year amateur radio in the United States registers a big increase over the previous year. Thirty thousand of us—and still going strong!

From the 1929 increase of 21,155, we have an increase of 41,724 in the number of stations licensed this year. This is an increase of 100%.

The foregoing figures are to be considered from the amateur standpoint. New receivers, new concepts of frequency calibration and control, diversified activity on five bands instead of three and new technique in station operation have kept the old interest and verve in the game alive. Let's consider some of these factors. Receiver progress has made tremendous strides since 1929, with nearly every amateur receiver now either a superhet—a more and more of them becoming single-signal—or having a good, sharp stage of tuned r.f. True, a ham today getting on the air with a 1929 receiver will get more interference than he did at that time. It is necessary to grow with the times in technique and apparatus, is even more satisfactory than it was three years ago. Interference there is, to be sure, but nowhere near as much as would normally be expected as a result of doubling the number of stations on the air; QSO's are in many ways easier and more satisfactory.

The secret of keeping interference at a standstill while the number of stations doubled can be explained in a word—technical development has kept pace with the growth in amateur radio. New receivers, new concepts of frequency calibration and control, diversified activity on five bands instead of three and new technique in station operation have kept the old interest and verve in the game alive. Let's consider some of these factors. Receiver progress has made tremendous strides since 1929, with nearly every amateur receiver now either a superhet—a more and more of them becoming single-signal—or having a good, sharp stage of tuned r.f. True, a ham today getting on the air with a 1929 receiver will get more interference than he did at that time. It is necessary to grow with the times in technique and apparatus, is even more satisfactory than it was three years ago. Interference there is, to be sure, but nowhere near as much as would normally be expected as a result of doubling the number of stations on the air; QSO's are in many ways easier and more satisfactory.

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groups of clustered stations as there are on the dial and the problem disappears — unless another cluster forms around you. But a couple of different crystals, or the use of good MOPA's, preferably with electron-coupled oscillators, minimizes even this problematic difficulty.

The last but by no means least important factor in our present conditions has been the diversification of amateur activity throughout five bands in contrast with the concentrated three-band activity of 1929. Perhaps we're being kind to credit 1929 with even three-band activity; the big crush then was on "40," with "80" taking most of the remainder and "20" getting only a small share of attention. Now our active stations are distributed much more equably between the 7000-ke. and 3500-ke. bands, with about the same number still on 14,000 ke. and thousands of stations working on 50 me. and 1715 ke. where there were practically no stations at all three years ago. The increasing trend of activity into these last-mentioned two bands has been one of the most significant developments of the last year or two and is making amateur activity even more satisfying and intriguing.

No concern need be felt as to the future of amateur radio, or of our ability to handle new situations as they arise. We know we are still on the increase, so far as numbers go, and that the total today is some thousands greater than the figure given in Mr. Terrell's annual report. These new thousands of amateurs, and the thousands to be added to them in the years to come, will create new problems in apparatus and technique, problems that will have to be faced and licked if we are to continue a happy existence. But we'll lick 'em! Our record of past performance guarantees that. — A. L. B.

Another Storm Weathered

A NOther International Radio Conference has come and gone and Amateur Radio remains unchanged. Secretary Warner, assisted by General Counsel Paul Segal, so handled our affairs at Madrid that every one of our amateur bands has been preserved, as well as our other rights and privileges. In short, "Madrid" is over and Amateur Radio is still the same old Amateur Radio.

The average amateur who pounds his brass and leaves the rest to A.R.R.L. may not appreciate what this means. But the directors and officers appreciate what it means. For two long years they have studied and planned, wondering if the decisions they made were wise ones or not, dreading some kind of misstep that would shatter our hopes. To know that we have come through with all our privileges intact is an immense relief. We know now that we planned well and decided wisely, and that the men selected to fight our battles before an unsympathetic world were well selected. It was no easy job we handed Warner and Segal. Their brilliant victory was achieved only by hard fighting and skillful maneuvering. They deserve our heartiest congratulations and thanks.

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Rationalizing the Autodyne
A Three-Tube Regenerative Receiver of Unusual Performance

By George Grammer, Assistant Technical Editor

The development of the autodyne receiver for c.w. reception has been a continuous battle for sensitivity and more sensitivity. From the days when a low-loss detector and one-step was the last word in ham receivers to the present era of screen-grid r.f. amplifiers and screen-grid detectors the chief object has been to build sets which would give more noise output for the least signal microvolt input. The latest contribution is the new 56-57-58 series of tubes, which undoubtedly have it "all over" their predecessors.

In the meantime some other rather desirable characteristics that receivers should possess seem to have been lost in the shuffle. To be sure, amateurs who have built new receivers whose operation has delighted them, occasionally put forth a few half-hearted claims about "selectivity"—not particularly because the receiver is really more selective but because it's the conventional thing to do. The fact of the matter is that in the set which has become the standard amateur receiver—one r.f., regenerative detector, and one audio—sensitivity and effective selectivity just don't go hand in hand. When you get one you don't get the other, and vice versa. Since both are desirable, it ought to be possible to select whichever of the two is needed under any particular conditions. Then our autodyne receivers would be in a position to give us some real service.

Where R.F. Amplifiers Fail

Superficially it might seem that unlimited sensitivity would be the height of desirability but, as in all things, there is a limit. That limit is the noise or background level. If a signal is down below that level no amount of amplification in the world will bring it up to readability. This noise level, it should be understood, is not only noise picked up on the antenna, which may at times be very low, but also includes tube noise. Almost any tuned r.f. receiver will give out a hiss that can be heard a couple of feet from the phones with the detector oscillating even if the set is completely shielded and the antenna is disconnected. A lot of it comes from the r.f. stage, as taking out the r.f. tube will show. Our old receivers didn't do that, but the same noise was there, nevertheless. We hear the signals a lot louder to-day, but it is questionable whether we hear any weaker ones than we used to. The old receivers used to get down to the background level, too.

This is not an argument against using r.f. amplifiers nor against high sensitivity, but an r.f. amplifier may not be all beer and skittles. It happens that a regenerative detector is at its best when the incoming signal is weak; that is, the sensitivity decreases rapidly as the signal becomes stronger. R.f. amplifiers therefore don't give the increase in signal strength that might be expected, because the detector sensitivity goes down as the r.f. gain goes up. This would be distinctly favorable were it not for the fact that the detector can't work right on both weak and strong signals. If the circuits are adjusted so that the detector is highly sensitive to weak signals it will be highly unsatisfactory on the strong ones, and vice versa. The unsatisfactoriness arises from the fact that an oscillating detector adjusted for maximum sensitivity will be "pulled in" by a moderately strong signal—that is, the frequency of oscillation tends to become the same as that of the signal—and it is, therefore, difficult to heterodyne the incoming signal to get a beat note.
Strong signals, instead of becoming loud in proportion to their strength, simply sputter out over several divisions on the tuning dial and are often harder to copy than weak ones. Worse still, in the course of sputtering they wash out any weaker signals in their immediate vicinity. Thus the strange result that a tuned r.f. stage, simply because it brings practically all signals up to good strength, may decrease the effective selectivity of the receiver in spite of the fact that it is supposed to add to it.

SELECTIVITY

Now that the question of selectivity has been brought up, we really ought to get straight on just what we mean by the word. There are several kinds of it. Usually one thinks of r.f. selectivity as a measure of the ability of the receiver to separate two signals of about the same strength on adjacent frequencies. The difference in this respect between any two tuned r.f.-regenerative detector receivers of the same general type is rarely worth talking about. It depends upon factors not readily overcome in this type of receiver, as James Lamb has pointed out in a previous article.\(^1\) We can wipe this kind of selectivity out of the present discussion — it takes a "Single-Signal" receiver to get enough of it to be worth while.

But there are other types of selectivity that can and should be obtained in the autodyne receiver. One of these is freedom from interference from local stations working on frequencies somewhat removed from that of the desired signal. This includes interference from local broadcasting stations. If you have a ham neighbor a few blocks away you should be able to copy signals within at least 20 or 30 kc. of his frequency. But very few autodyne receivers we have seen will do it. Local stations usually cut a large swath out of the band and their key clicks can be heard over most of the rest of it, whether the receiver has a tuned r.f. stage or not. As for local broadcasting stations, either you hear them or you don't. If you do, there is no need for us to point out that type of interference is to put it mildly, annoying.

A second type of selectivity is that which prevents the receiver from causing interference to itself. Queer words, but true. If you get loud harmonics from nearby ham stations or local broadcast stations, make sure that they aren't being generated in your own receiver before telling the other party his transmitter needs some things done to it. A straight autodyne detector coupled to the antenna, and especially a receiver with an untuned r.f. stage, may bring in lots of signals that actually don't exist. A strong local signal will overload the detector or untuned r.f. stage, which then will work as a frequency multiplier and generate harmonics of its own. It would seem that we already have enough legitimate interference without going to the trouble of manufacturing more of it.

Selectivity type number three has already been mentioned — the prevention of spreading of moderately strong signals (or so-called "blocking" of the detector) which not only makes them difficult to read but also wipes out weaker signals nearby. This is simply a case of too much signal at the detector. We have seen receivers in which this was so bad that the use of a good-sized antenna when listening on the 3500-kc. band at night was absolutely out of the question. All the signals blocked the detector to such an extent that not a single one of them could be copied.

All these things can and should be remedied in the 1933 autodyne receiver. If we can get real "single-signal" performance from the regenerative set we can at least get the next best thing to it — elimination of practically all interference except that two-beat tuning peculiar to the autodyne detector. Once this is done audio selectivity will be of real help.

ELIMINATING AVOIDABLE INTERFERENCE

Harmonic generation in the receiver can be prevented or at least made negligible by utilizing the selectivity offered by a tuned r.f. stage. Since this type of interference occurs only when the interfering signal is on a frequency which is at the most half of that of the desired signals, a simple tuned circuit will be sufficient to keep out the fundamental frequency of the interfering transmitter. If a harmonic remains in spite of the tuned r.f. stage, then is the time to start blaming the transmitter.

The effectiveness of the tuned r.f. stage in cutting out interference from local broadcast stations and nearby amateurs is also unquestioned. Only on detector blocking do we have any quarrel with r.f. amplification. And even this can be overcome by the simplest means imaginable — providing the r.f. stage with a gain control so that a strong signal can be cut down to the point where the detector does not block. An audio volume control is helpless to do anything except keep the phones from rattling.

There are two obvious ways of controlling the r.f. gain of a receiver. One is by controlling the signal input, which does not actually change the gain but has an equivalent effect. When we cut down our receiving antennas we are really reducing the signal input, but an antenna of adjustable length would be a rather cumbersome affair. A method used for years in certain broadcast receivers was to connect a potentiometer between the antenna and ground and run the variable arm to the antenna coil on the first r.f. transformer. The potentiometer acts as a voltage divider and permits some regulation of the strength of the signal fed to the r.f. tube. This method, although easy enough to apply, has its disadvantages for ham-band receivers. In the

\(^1\) "What's Wrong With Our C.W. Receivers," J. J. Lamb, QST, June, 1932.
first place, it brings the r.f. right out to the panel, and in the second place the r.f. tube is working its hardest even though the signal input is cut down. In other words, although the signal has been weakened, the r.f. tube is turning out just as much hiss as ever, making the signal-to-background ratio even more unfavorable than it is normally.

A better method is to vary the mutual conductance of the r.f. tube so that the actual amplification of the stage is decreased when the gain control is turned down. Then the tube noise will decrease in about the same ratio as the signal strength, leaving it possible to copy weak signals. The actual effect of this sort of gain control is to make an apparent improvement in the signal-background ratio, because to the ear it seems as though the noise decreases a great deal more than the signal does. The characteristics of variable-mu tubes are ideally suited to this type of control. It is only necessary to provide some means of varying the grid bias.

Simple though this may seem — and r.f. gain control really does prevent detector blocking and enormously increases the effective selectivity of the receiver — controlling the grid bias of the r.f. amplifier may cause detuning of the detector circuit if the receiver is not properly built. Inter-locking in tuning between r.f. and detector should be just about eliminated to get full benefit of r.f. gain control, because if there is regeneration in the r.f. stage the amount of it will depend on the mutual conductance of the tube. Furthermore, the detector should be a stable oscillator. These things mean good shielding and proper choice of circuit constants. Before we tried the thing we anticipated that the change in plate resistance of the r.f. tube with varying grid bias might be the cause of an unavoidable change in the tuning of the detector circuit, but experience has shown that detuning from this cause is not noticeable at high frequencies. If detuning exists it can be traced to remediable causes.

**DETECTOR STABILITY**

Getting away from selectivity for the moment, we've had a pet peeve about regenerative detectors for a long time, especially regenerative detectors in a.c. operated receivers. Most of them are far from being stable-enough oscillators. The slightest change in plate voltage will cause the beat note on a received signal to wobble around, a thing which has driven a lot of amateurs to using “B” batteries for plate supply. And when an a.c. supply is used, the way crystal-controlled signals can develop wobulation is something weird. Unfortunately no oscillator working right on the ragged edge of oscillation, as a regenerative detector does, can be wholly stable, but a lot can be done about it. And the most effective thing to do is a stunt we have been using for years in our transmitters — put some capacity in the tuned circuit. A detector circuit with the largest possible coil and the smallest possible condenser may give the greatest sensitivity, but then the frequency of oscillation is also extremely sensitive to small changes in plate voltage — to say nothing of its penchant for blocking or spreading out on any
of any other tuned-r.f. receiver. The real difference will be in its performance.

A PRACTICAL RECEIVER

These advantages have been incorporated insofar as possible into the receiver shown in the photographs. Although five controls have been brought out to the panel, the set is in reality a single-control-tuning affair. The two upper knobs (provided with pointers) are band-setting condensers; they are set when coils are changed and need not be touched after that. In the lower right-hand corner is the r.f. gain control. The regeneration control is diagonally below the tuning dial; it, too, need be set only once when coils are changed, since the detector will stay at the "just-oscillating" point over a whole band.

To get a fairly high-C circuit for the detector, the parallel-condenser method of band-spreading is used. This, as most of us know, consists of using a fairly large constant capacity in parallel with a small variable capacity. The degree of band spreading will depend upon the ratio of the two capacities and the size of the inductance used for a particular band. The circuit diagram is given in Fig. 1.

The panel is of ⅜-inch aluminum and measures 7 by 14 inches. The sub-base is made of a single piece of ⅜-inch aluminum with the corners cut out and edges bent down so that the top surface is 13½ inches by 7½ inches and the vertical sides are about two inches high overall. The sides were bent down with an ordinary small-size bench vise, first being scribed on the under side along the bending line and then worked down to position a little at a time. The two shield boxes are made of ⅜-inch aluminum, each measuring 4½ inches high, 4½ inches wide and 7 inches deep. The panel constitutes the front of both boxes. The pieces making up the sides of the boxes are fastened together by being screwed to vertical pieces of ⅜-inch square brass rod which has been drilled and tapped to take small machine screws at appropriate points. Similar rods are also used for fastening the boxes to the panels. The lid fits over the tops of both boxes and is held in place by small pieces of phosphor-bronze spring strip which pressess against the backs of the boxes when the lid is put on. Although working in aluminum may look difficult to the ham with an ordinary cellar workshop, it requires more care and patience than it does skill. All the work on this receiver was done without much but a hacksaw, a bench vise, an ordinary hand drill, a file, a ten-cent kitchen knife, and a few taps.

The tuning condensers are 35-µfd. Hammarlund midgets, mounted on the left-hand side of each shield box as shown in the top-view photographs of the set. This type of condenser is readily adaptable to ganging because the shaft projects about a quarter-inch beyond the rear bearing. The condensers should be lined up carefully so the shafts and the center of the drum dial are on the bending line and then worked down to position a little at a time. The two shield boxes are made of ¼-inch aluminum, each measuring 4½ inches high, 4½ inches wide and 7 inches deep. The panel constitutes the front of both boxes. The pieces making up the sides of the boxes are fastened together by being screwed to vertical pieces of ¼-inch square brass rod which has been drilled and tapped to take small machine screws at appropriate points. Similar rods are also used for fastening the boxes to the panels. The lid fits over the tops of both boxes and is held in place by small pieces of phosphor-bronze spring strip which presses against the backs of the boxes when the lid is put on.

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bending them down and breaking them off. When this is done it is necessary to make the contact to the rotor plates through the front bearing on the condenser. The rear bearing does not fit tightly enough to make good contact and the condenser will be noisy if an attempt is made to use it. Leave the rear bearing unconnected. The two condensers are connected together mechanically by two small flexible couplings (National) and a piece of ¼-inch round bakelite rod of appropriate length. A metal rod could be used just as well. The dial is also connected to the first condenser through the medium of a flexible coupling. When lined up properly the whole assembly turns with surprising ease.

The two 100-µµfd. padding condensers, also Hammarlunds, are mounted on the panel in the positions shown. The coil sockets (and the tube sockets as well) are of Isolantite. These sockets are used not particularly because of any electrical advantages but because they are mechanically rigid and will stand the strain of changing coils without getting bent out of shape. The coil sockets are mounted on small pillars of ¼-inch metal tubing, just long enough to allow the contacts under the sockets to clear the base. The grid condenser and leak for the detector stage are held from the base by a small metal pillar and are just behind the coil in the detector compartment.

Another photograph shows how the parts are placed under the chassis. R.f. rather than artistic considerations dictated the locations of the various parts. For example, there is only one common ground connection for r.f. on the whole set; around it are clustered all the .01 by-pass condensers in the r.f. circuits and all the other r.f. grounds come to this same point. Resistors and audio condensers are mounted wherever it is most convenient to put them, especially if the pigtails provided on them can be used. Occasionally there is an insulating terminal made by riveting a soldering lug to a small piece of fibre which in turn is fastened to the base.

The audio choke, a small audio transformer made for broadcast replacement purposes, is mounted on the edge of the chassis at the right. Its primary and secondary are connected in series. This particular transformer has a rather definite peak in the vicinity of 1000 cycles and, as a result, contributes a little audio selectivity to the set.

There is little more to be said about the mechanical arrangement of the set. The tuning dial is placed on the left because it is convenient to be able to tune the receiver without getting in the way of copy paper and log books and leave the right hand of the operator free. If you're left-handed, modify the layout to put the dial on the right-hand side. The regeneration control knob is near the tuning knob so both can be worked with one hand conveniently, although not simultaneously.

INFORMAL — BUT EFFECTIVE

A view underneath the base. No particular precautions here except to keep r.f. leads short and all r.f. grounds at one point.

SOME HELPFUL HINTS

A few electrical pointers should be of help, especially to those who have not previously attempted to build a regenerative receiver with a tuned r.f. stage. Don't try to build a shield for the r.f. and detector stages with a single partition between the two compartments. A common partition, instead of acting as a shield, actually will couple the two circuits together. As a result the r.f. stage will break into oscillation whenever it is tuned to resonance with the detector. This is not theory; we tried it that way first. Separate boxes, as shown in the photograph, not only stopped the oscillation but also took out practically all tendency toward interlocking of tuning in the two stages on all but the highest frequencies.

As has been mentioned before, all the r.f. grounds in the set come to a single point. Not only that, all parts of the r.f. circuits that of necessity are connected to the panel or chassis at different points — such, for instance, as the connections made by mounting the tuning condensers — are also connected to the common ground through copper wires. No dependence should be placed on contacts to aluminum for r.f.

The circuit used for the detector differs a little in this receiver from the ordinary tickler circuit. It was used because we felt it desirable to use 5-prong coil forms, and in order to use magnetic coupling between the r.f. stage and detector it was necessary to use an oscillating circuit which requires only three connections. The circuit is a
Hartley, using the screen and plate in parallel as the anode and having the cathode tapped up on the coil for regeneration. It somewhat resembles the electron-coupled oscillator—several suggestions for this type of circuit have been received from different amateurs and are described in the Experimenters' Section in this issue—but so far as can be told from ordinary observation its performance is not greatly different from the ordinary regenerative circuit. It is used here largely as a matter of convenience. If 6-prong coil forms are available, the use of the regular tickler circuit is recommended, because then condenser regeneration control, which has much less tuning effect than screen-grid voltage control, can be used. Condenser control does not work with this circuit because the plate and screen are in parallel for r.f., and even if there is no by-pass capacity from one to the ground, the other will take charge and keep the detector oscillating; hence the screen-grid voltage control shown in Fig. 1.

The band spread with the variable condensers specified in Fig. 1 is not "full-dial" on any band, running about 60 degrees (100-division dial) on 3.5 mc., 40 degrees on 7 mc., and 25 degrees on 14 mc. More spread can be obtained by using a smaller tuning condenser. The Hammarlund 3-plate, with a maximum capacity of 20 µµfd., will widen out the bands considerably. Personally we do not care for the larger spread for a receiver with ordinary selectivity because cranking a high-ratio vernier dial over its whole scale to cover a band is a rather lengthy and laborious operation. This is a matter of individual preference, however. Changing to the smaller tuning condensers will not affect the sizes of the coils nor make any changes in the other circuit values.

The Hartley circuit in the detector is a facile oscillator; so much so that the "tickler"—we might call that part of the coil between ground and the cathode tap the tickler—is matter of fractions of turns on the high-frequency bands. The right place for the tap has to be hunted out if the detector is to be controllable with a reasonable value of screen voltage. In this particular set the tap is three turns from ground on 1.75 mc., one turn on 3.5-mc., ½ turn on 7 mc. and ¼ turn on 14 mc. The taps are made by boring a small hole in the form alongside the point where the tap is to be placed, running a wire through the hole to the pin on the coil form, and soldering to the turn on the coil. All the coils should be "doped" with collodion or a similar material. The 1.75- and 3.5-mc. coils are wound with d.c. wire with no spacing between turns; the 7- and 14-mc. coils are wound with enamelled wire to the length specified in Fig. 1, spaced out by hand and then doped to hold the turns in place. A fairly even job can be made when the coil has a dozen or less turns.

With coils of the sizes specified, the amateur bands will be located with the padding or band-spreading condensers set near maximum on the 7- and 14-mc. bands, and at about ½ capacity on 3.5 and 1.75 mc. There will be no need for cut and try if the coil specifications are followed; this band-spread system is an easy one to get into operation because slight variations in coils can be compensated for by the condenser settings. Once the right settings of the padding condensers have been determined for all bands appropriate marks can be put on the panel or small paper or metal scales can be made up and calibrated. Setting the padding condensers is not by any means a hair-line adjustment unless it is necessary to have exactly the same dial readings every time one returns to a band. This is a receiver, however, not a frequency meter.

Antenna windings on the r.f. coils run about as with other sets. The primaries for the detector coils are not critical as to number of turns; the values specified give plenty of gain and cause no undue interlocking of tuning. Primaries are close-wound at the bottoms of the coil forms, grid coils at the top.

Strictly speaking, the r.f. gain control is not a volume control and it will not reduce all signals to zero strength, since with only one r.f. stage the range of control is limited. Actually, however, it controls volume nicely even though complete cut-off is not obtainable. The purpose of the resistor \( R_4 \) in Fig. 1 is to increase the range of control over that available by the use of \( R_6 \) alone in the cathode circuit. With \( R_4 \) connected as shown, there is a voltage drop across \( R_6 \) because of voltage divider action, which acts in addition to the normal drop caused by plate-current flow. The total bias with all of \( R_6 \) included in the circuit is in the neighborhood of 50 volts.

A voltage divider consisting of a pair of small resistors (5-watt size) is included in the receiver so that only two plate leads, plus and minus 200 volts, leave the set. The filaments of the tubes are wired in parallel and are brought out to the power supply through another pair of leads, making only a 4-wire cable necessary. The center-tapped resistor across the filament supply should be included in the power pack. This arrangement, which is used by National in their a.c. short-wave receivers, has been found very effective in keeping r.f. out of the power supply cable and in eliminating hum caused by stray r.f. wanderings.

If batteries are to be used for plate supply, resistors \( R_4 \) and \( R_6 \) can be omitted and a separate lead brought out for the regeneration control. There should be a switch in the negative battery lead to cut off the current drained through \( R_6 \) and \( R_5 \) when the set is not in operation.

The antenna input on the set is arranged so that a doublet antenna can be used, both terminals on the antenna coupling coil being brought out to binding posts which are insulated from the

(Continued on page 83)
A Portable that Works at Home or Abroad
By Murray J. Douglas, W6CUG*

HERE often has been a need at W6CUG for a portable station that could be used at various sources of traffic as well as on vacation trips. But the idea of tying up a lot of good parts for occasional use seemed too much for Scotch instincts; on the other hand, cheap, junky parts were out of the question because the set had to be capable of standing up on auto trips of great length. It was therefore decided to design and build the set so it could be used both for portable work and as the regular set at W6CUG for the rest of the time. This was accomplished by making the portable an m.o.p.a. using '10's, and the home unit a 100-watt push-pull amplifier which can be inductively coupled to the portable.

There was no necessity for building the set in a box of hand-baggage size because the ear would be available for any trips taken, so effort was bent toward making the portable unit as complete as any home-used set. There is therefore a built-in power supply for 110-volt a.c., allowing the set to be used wherever a.c. is available; in addition to this a pair of dynamotors furnishes emergency power for the transmitter when needed. A separate receiver and phones are used at home, so to prepare for a trip it is only necessary to pull the 110-volt plug on the portable, unclip the feeders, put it in the box and be away.

There seems to be a necessity for having a circuit to start with in building a transmitter, so the low-power m.o.p.a. outfit described in September, 1928, QST, was selected, since such a transmitter is entirely in keeping with present-day practice. The shielding has the added advantage of keeping dust out of at least part of the set.

The photograph shows how the transmitter looks when ready for a trip. The whole outfit, including the a.c. power supply, is behind the bakelite panel, which measures 12½ inches high by 15½ inches wide by 5½-inch thick. The three dials are, from left to right, the antenna condenser, the amplifier tank condenser, and the oscillator tank condenser. The small knob just below the middle dial is the neutralizing condenser, which has a 3-inch fibre extension shaft to eliminate body capacity when neutralizing. The switch at the bottom controls the primary of the power transformer. The meters, from right to left, are the oscillator plate milliammeter, filament voltmeter and amplifier plate milliammeter. Two small knobs in the lower corners assist in getting the set in and out of the case. The base, on which the power supply is mounted, is 14 by 9 inches and is covered with sheet zinc 1/16-inch thick. This is shown in the rear view. The power transformer, a Thordarson T2900, is on the left. Beside it is a Silver-Marshall 331 Unichoke, on which is mounted a 50,000-ohm bleeder. On the right is a bank of six WE-21AA condensers, and between them and the panel is the 10,000-ohm resistor which drops the plate voltage for the oscillator. The filter condensers are held to the base by a strip of steel 3 inches wide and bent so that when the six screws through it are tightened, the tension on the condensers pulls them to the baseboard.

THE PORTABLE M.O.P.A. TRANSMITTER IN ITS CASE, WITH THE FRONT COVER DOWN

The wavemeter is lying on the cover just in front of the transmitter panel. The field-strength meter is at the left in the small space above the panel, with the monitor just behind it. The receiver, lying on its side, can be glimpsed in the compartment to the right of the field-strength meter.

For the benefit of anyone duplicating the set, I would suggest adding a few inches more to allow making the two small 22-volt "C" batteries a part of the unit and adding a separate filament transformer so the amplifier alone could be keyed in the center tap. The present arrangement has proved very satisfactory, however.

The shelf above the power supply is 8¾ by 14¼ inches and is also zinc covered. The rear central portion is cut away to clear the tops of the '81's. At the left on the shelf is the oscillator shield, measuring 4½ by 8¾ by 5½ inches, also made of zinc. Care must be used in forming the zinc because it cracks easily. Soldering also must be carefully done, since a slight excess of heat may melt a patch out of the can, but its clean-out appear-

January, 1933 17
ance is better than that of copper. The objection to aluminum, of course, is that it cannot be soldered.

Cardwell condensers are used throughout for tuning. Small angle brackets support fixed condensers and other small parts, which are fitted in wherever space is available. The small r.f. chokes are mounted on ¼-inch fibre pins and small brass angles to keep metal out of their centers. The pins are pressed into the choke forms and one end tapped for 6-32 brass machine screws ¼-inch long. The filament by-pass condensers are mounted directly at the sockets. The neutralizing condenser is mounted on a small piece of bakelite which in turn is fastened to the base by a brass angle.

The amplifier socket is mounted on a small bakelite shelf which is fastened to the back of the tuning condenser by an angle bracket. The center-tap of the filament by-pass condensers is a strip of brass which also acts as a support for the rear end of the shelf which holds the socket.

A small tumble switch in the amplifier high-voltage lead allows the amplifier voltage to be cut off for neutralizing. This switch is mounted on the shelf at the rear of the amplifier tank condenser, insulated, of course, from the zinc.

The coils, described in Fig. 1, are fitted with compression fittings procurable from any automotive supply house. The coupling type is used, filed flat to fit the angle brackets on the condenser and screwed in place.

The antenna condenser is mounted on two General Radio stand-off insulators by two pieces of brass bent in the shape of an “L.” Holes are drilled in these pieces corresponding to the screws which hold the stator plates of the condenser in place. A binding post is fastened to one of these brass pieces for the antenna lead in. The antenna condenser extension shaft is also fibre, the hole in the panel through which it passes acting as a guide to keep it from wobbling. Since it is close to the amplifier coil, it should not be of metal. One end of the antenna inductance is mounted on a stand-off insulator; the other end is flattened and screwed directly to the condenser.

All leads through the shelf run through rubber grommets (eyelets). A knot in each lead just above the shelf prevents its being pulled loose by an accidental yank. All d.c. leads below the shelf are cabled and all leads are flexible, mostly fixture cord. The fixture cord is skinned, scraped, and an eyelet crimped in place. The end is then dipped in solder. This keeps loose strands from getting too familiar with the zinc shields. The shelf is mounted on Benjamin brackets, reinforced by a piece of brass ½-inch thick by 1 inch wide, which acts as a vertical support.

There are two 5/16-inch tapped holes in the base to line up with two holes in the case. In the event that the set is to be shipped by rail there are two hex-head cap-screws that hold it in place. The ribs on the door of the case, visible in the photograph, press the panel against two cold-rolled steel strips mounted in the case in the proper places, thus also contributing to rigidity when the set is ready for shipment.

To make sure the transmitter frequency is set correctly, a fixed-tune wavemeter is part of the equipment. It is visible on the door of the case in the front-view photograph, and consists of a bakelite tube two inches in diameter on which
the coil is wound, a small Sangamo fixed condenser screwed to the inside of the tube, and a Christmas tree light socket in another bakelite tube also screwed to the 2-inch tube. The coil has three turns of No. 22 wire cemented in place with collodion. By experiment the thing was adjusted to 7100 kc. and serves as a check in tuning the set to the frequency of the antenna. A final check is taken with the monitor. More of that later.

THE PORTABLE ANTENNA

The antenna is a Hertz affair figured for operation at 7100 kc. For insulation there is a pair of 3-inch Pyrex strain insulators each fitted with a small loop of flexible antenna wire put through the eye of the insulator and through the hole in the end of a male compression fitting and soldered. At the ends are the nuts for the compression fittings, and there is also one at the feeder position of the antenna wire. The feeder is a quarter wavelength long. Another wire the same length as the feeder makes possible the use of either the Hertz or the antenna-counterpoise system. The advantage of this is that if a 210 goes west, just disconnect the amplifier feeder clip and hook the Hertz to the oscillator tank and you are all set for low-power high-C operation.

FIELD STRENGTH METER

A field strength meter also is part of the regular equipment at W6CUG, and is too handy to be left at home. It consists of a 4-inch by 5¾-inch metal plate on which is mounted a 0–1 d.c. milliammeter, a fixed crystal detector and a small basket-weave coil. The method of carrying it will be seen in the photo. It is merely a metal clip that slides into a compartment in front of the monitor. There is also room on top of the monitor for the pair of W.E. phones, and they are prevented from shifting by a false front to the monitor that reaches to the top of the can. The field strength meter has stood many trips without a sign of an injury, and is used more than any other piece of apparatus in the tuning of the set.

THE MONITOR

The monitor is part of the regular equipment at the station and is small enough to fit nicely in the case with the transmitter and receiver, so is always taken along. It fits back of the field strength meter and is not visible in the photograph.

FIG. 1—WIRING DIAGRAM OF COMPLETE PORTABLE TRANSMITTER AND AUXILIARY POWER SUPPLY

All parts shown above the dotted line are included in the transmitter case. Those below the line are in the dynamotor housing.

C1, C2—350-mfd. variable condensers.
C3—500-mfd. variable condenser.
C4—50-mfd. midget or 100-mfd. with alternate plates removed.
C5—250-mfd. mica condenser.
C6—250-mfd. mica condenser.
C7—0.001-mfd. mica condenser.
C8—250-mfd. mica condenser.
R1—10,000 ohms.
R2—10,000 ohms, 100-watt size.
RFC—Three sections of 50 turns No. 30 d.c.e. wire wound in ¾-inch slots in a 1-inch wooden form, sections connected in series.
L1—6 turns 3/16-inch copper tubing, 3¾ inches inside diameter.
L2—6 turns same tubing, 1¾ inches inside diameter.
L3—6 turns same tubing, 1¾ inches inside diameter.

Data for coils for other bands will be found in September, 1928, QST, and in the Handbook.

Values of power supply components are shown on the diagram.
This unit is built in a zinc box 4 by 4½ by 8 inches — just large enough to take a 22-volt “B” battery and a 4½-volt “C” battery, and leave a small space in the front for the tube, coil, condenser, etc. A Type '99 tube is used in an ordinary regenerative circuit. A 5-plate Hammarlund midget is used for tuning and a 14-plate Silver-binding posts for battery connections to the dynamotors and the filaments, and also the d.p.d.t. switch shown in Fig. 1 which connects the batteries to one dynamotor or both in series. The plate switch, filter chokes, filter condensers, and output binding posts are mounted on the opposite end.

The problem of holding the dynamotors rigidly was solved by mounting them in the two aluminum castings shown in the photograph. A wooden pattern was first made and then the finished castings were machined to 6¼ by 12½ by 1½ inches thick. They were then bored out to the diameter of the dynamotors after removing the band that covers the brushes. Before sawing the supports, they are drilled and tapped for ¾-inch by 24 studs and the top corners of the aluminum blocks are cut away to allow room for the nuts. The blocks are then sawed through the holes to allow the generators to enter, the stud nuts tightened and the whole fastened to the angle iron frame with steel machine screws. Care must be exercised to keep the units square so they will set level and present a workmanlike appearance. The important thing is to square the sides before welding and see that the welder doesn’t warp them out of shape.

The whole unit is covered with a piece of galvanized iron that is in turn given a good priming and three coats of lacquer. It is fastened to the sides and top by machine screws and is readily removable for oiling, etc.

It will interest some fellows that live near either coast to know that many of the essentials of the portable can be obtained from obsolete army and navy equipment available at various ship and marine junk yards. The filter system, switches, dynamotors and paneling in this job came from there.

The receiver

Originally the set was equipped with a t.r.f. receiver, but as it was for portable work a great deal of gain was unnecessary. The present receiver was evolved in the attempt to get the smallest, most rigid and foolproof receiver. The front and rear view of this unit are shown in accompanying photographs. The wiring diagram is given in Fig. 2.

The base is made of 16-gauge aluminum, six inches long and just high enough to take a pair of the old Thordarson b.c. audio transformers and the Bradleystat which controls the filaments of the two audio tubes. On it is mounted a bakelite strip 2½ inches wide by ¾-inch thick.

The Cardwell taper-plate condensers are mounted vertically, using the panel spaces for legs. The holes at the ends of the stator strips are
drilled and tapped for 8-32 machine screws to give strength to the assembly where the condensers are fastened to the base. A piece of brass 2¾ by 3½ inches screwed to the condenser backs acts as a support for the detector tube socket, as well as the common connection from the tuning condenser to the regeneration condenser. The r.f. choke is back of this plate. The front-view photograph shows clearly the location of the detector Bradley-stat, grid leak and condenser.

The top shelf, also of bakelite, measures 2¾ by 3¼ by 2 inches and is drilled to take the mounting jacks for an 80-meter Aero coil which has been cut down to 12 turns. This coil, in conjunction with $C_1$, covers the 7000-ke. band nicely.

The little antenna condenser, $C_2$, allows very nice control of the input signal. It is mounted on a small brass arm and has a phone tip jack soldered to it to take the receiving antenna, which rolls up on a small bakelite reel.

No ground is used. The filament control jack and a Yaxley cable connector permit the use of the same batteries that are slung under the car for a b.c.l. receiver. For a stay of a few weeks in camp, a few of the small blocks of "B" batteries are taken along.

The dials are the small Marco, and are mounted on ¾-inch aluminum pads cut to the same size as the dials. This protects them from rough handling and furnishes a support for the position screw. They are screwed to the original mounting holes on the condenser. Every possible wire has been eliminated and the supports or frame used instead, to minimize loose connections and consequent grief.

The receiver is set in a wooden frame in the case, cut out to the contour of the base.

THE HOME AMPLIFIER

The 100-watt amplifier is the novel feature of the set in that it changes it from a portable to a year-round affair. The photograph shows the layout, and Fig. 3 shows the wiring. The frame measures 13 by 11 inches deep and the panel is 9 inches high, all being made of ½-inch bakelite. There is a tube shelf 3½ inches wide through the center, and this arrangement leaves room for the blocking condensers and chokes out of sight in the chassis.

The tuning condensers are made from .001 General Instrument broadcast type, double-spaced, and are ganged back-to-back. The gang

FIG. 2—THE RECEIVER CIRCUIT

$C_1$ — Cardwell 3-plate taper-plate condenser, spaced 7/32-inch between rotors.
$C_2$ — 6-plate Cardwell taper-plate condenser.
$C_3$ — 2-plate Hammarlund midget, plates spaced 5/32 inch.
$C_4$ — 150-µµfd. mica condenser.
$R_1$ — 2-megohm grid leak.
$R_2$, $R_3$ — Bradley-stats.
$R_4$ — 50,000 ohms.
$RFC$ — S.M. 277 choke.
$J$ — Filament control jack.
$L_1$, $L_2$ — 80-meter Aero coil with grid coil cut to 12 turns.
Audio transformers are small Thordarsons.

should be carefully worked in place, using the frame support rods for nuts. They are paralleled with ¼-inch copper strip ½-inch thick, fastened to the stators by machine screws.

The inductances are ¼-inch copper tubing terminating in compression fittings screwed to the condenser frames and sweated just as the screw is tightened. For the benefit of the inexperienced the method of doing this is as follows: Tin both the fitting and the frame with a good coat of solder; file the high spots off the solder and retap the holes, then screw the fittings in place. Heat them with a Bunsen burner or a large hot iron until the solder melts, then tighten the screws so as to ooze the excess solder from the joint. When it cools you have a shakeproof job.

The nuts for the compression fittings and the glands are obtainable separately, so a set can be had for a few cents for each set of coils if a QSY is desired. Coils can be changed with the help of a small open-end wrench.

The two neutralizing condensers are Pilot midgets cut to 6 plates and double-spaced. They are symmetrically mounted on the frame. All wiring is done with ¼-inch by ½-inch copper strip.

The r.f. chokes are made of 1-inch hard-rubber rod slotted ¾-inch wide by ¼-inch deep, three slots per choke. All are wound with No. 30 d.s.c. wire and peaked with a grid meter driver to 75 meters. They are tapped and fastened to the rear

January, 1933 21
frame with a brass machine screw short enough so it doesn’t enter the coil properly.

This amplifier was used as a push-pull t.g.t.p. oscillator for months, and conversion back requires only the addition of a grid leak and disconnecting the neutralizing condensers.

**THE MOUNTING FOR THE DYNAMOTORS**

This is an angle-iron frame, with two aluminum castings for holding the machines. The filter to take out commutator ripple is mounted in the space at the left. This unit is mounted on the running board of the car, and is covered with a sheet metal housing on trips.

No details of the power supply will be given as they are familiar to anyone building a set of this size.

**TUNING THE TRANSMITTER**

The tuning process applicable to the m.o.p.a. portable has been thoroughly covered in September, 1928, *QST*, and in the Handbook, so there is no need of repeating it here. Only those special adjustments made necessary by portable work will be discussed.

Select the type of antenna best suited to the space available. It has been found at times that a Zepp was best fitted to the job, so it was put up, using the two feeders and the Hertz, but generally the Hertz alone will fit. Attach the insulators to suitable supports with a piece of string and screw the antenna to the insulators with the fittings provided. Plug the 110 in the socket, remove the cover of the oscillator shield, put in the tubes, throw off the amplifier switch and tune the oscillator shield, couple the field-strength meter to the amplifier tank and tune the amplifier dial for maximum response. Then turn the neutralizing condenser to get minimum reading of the field strength meter. Retune the amplifier tank to maximum field reading and re-neutralize to zero reading. Then throw the amplifier plate switch on and tune the amplifier to resonance, indicated by a dip in the amplifier plate current. Next, get the monitor out and plug in the 'phones. Tune in the signal on the monitor and zero beat it to the receiver so as to be dead certain that the transmitter is in the band at about the natural period of the Hertz. Then give the neutralizing condenser a slight turn to get the cleanest possible signal. It should approach crystal in clearness and purity. Hook the antenna and tune for normal plate current on the amplifier and the set is all ready to go. With a little practice the thing can be tuned in three or four minutes. When beating the monitor to the receiver, the dummy plug is plugged into the monitor and the phones are used for the receiver.

In tuning the 100-watt amplifier at home, the portable is first tuned as described above. The antenna coil is then connected to the grid coil of the final amplifier with a couple of heavy strips of brush braid. With the plate voltage off the final amplifier and the filaments lit, couple the field meter to the final plate coil and neutralize. The method used with other push-pull amplifiers will apply to this one, and the Handbook and *QST* should be studied before attempting to put the set on the air.

**WHAT THE PORTABLE HAS DONE**

A few words about the performance of the portable should not be amiss. The best DX with it was WFBT, using the 210's only. East Coast stations from California were regular diet as the later hours of the evening approached. It is hard to get to the East Coast in the early hours because so many stations are on the air. With the m.g. con-

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**FIG. 3 — THE 100-WATT HOME AMPLIFIER**

- C6, C7 — 43-plate receiving condenser, double-spaced.
- C8, C9 — Faradon 1846 mica condensers, 72 µgfd.
- C10, C11 — Pilot midgets, cut to 6 plates, double-spaced.
- RFC — Form made of 1-inch hard-rubber rod with 3 slots ¼-inch wide and ½-inch deep. Wound full of No. 30 A.C.
- L1 — 6 turns ¼-inch copper tubing, 3½ inches outside diameter.
- L2 — 9 turns same.
The set has been available for the usual run of dairy shows and flower shows in which either the Oakland Radio Club or the section put in booths, and hundreds of messages have been gotten off with it.

As for its mechanical construction, the writer carried the set over 8000 miles on a trip East and did not have a single wire come loose — this in spite of roads so rough at times that upon return it was found that the filament coating of one of the '31's was all shaken loose!

Rationalizing the Autodyne

(Continued from page 16)

chassis. The ground post is connected to the common r.f. ground. To use the ordinary antenna-ground connection one of the antenna posts is connected to the ground post and the other used for the antenna. More doublet antennas should be used, however. They improve the signal-noise ratio considerably, as has been pointed out in QST several times, besides doing a better job of picking up DX signals than the 10-foot indoor antennas that many of us use. A good antenna is worth more than an r.f. stage in bringing up the gain has not been controllable.

How it works

A word about the performance of this receiver. On all but 14 mc. the tuning of the r.f. stage and detector are almost completely independent; that is, the r.f. stage can be swung through resonance without causing more than a slight change of beat note on a received signal and without affecting detector oscillation. The 14-mc. band does not do quite as well, but even here the interlocking is not as bad as on most of the tuned r.f. receivers we have seen. The gain control does not affect the detector tuning so long as it causes no change in the voltage applied to the detector plate; in other words, with battery supply the gain control would be entirely independent of frequency. With a conventional a.c. plate supply in which no attempt has been made to improve the voltage regulation there will be a slight frequency change in the beat note of a received signal, its magnitude depending upon the extent to which the plate voltage changes when the gain control is operated. The gain control changes the plate and screen-grid current of the r.f. tube from a maximum of something like 11 milliamperes down almost to zero, and with the particular power pack used in testing the receiver this difference in load caused the plate voltage on the detector to swing something like 15 volts — enough to cause a perceptible frequency change even though the circuits are fairly high-C. Some neon-bulb voltage regulation evidently would be in order. 2 The frequency change is rarely bothersome, however, because the gain control usually is set for a level which gives desirable volume and then left alone.

The set as it stands is not perfect, of course; nothing ever is. It is a real pleasure, however, to operate a receiver in which the detector does not block, and on which the signals stay put despite normal variations in the power line voltage. It is satisfying to be able to work distant stations almost within beat note of a local ham station. And it is even more satisfying to be able to use a decent-sized receiving antenna and know that when it is necessary to go after the weak fellows the r.f. gain is there and the antenna will be big enough to do some good.


About the S. S. Receiver

Judging by the questions asked in a goodly proportion of the hundreds of letters that have come in regarding the Single-Signal Superhet described in August and September issues, many readers seem to have missed a few points in reading the articles.

Number one question seems to be, "What's the frequency of the filter crystal?" Answer: The same as the intermediate frequency, around 525 kc. — as stated under Fig. 5 of the August article.

Another question commonly asked is, "Can a 175-ke. intermediate frequency be used instead of 525 kc.?" Answer: Yes, it might be — if the receiver was another receiver and if the factors pointed out as making the 525-ke. i.f. desirable can be ignored.

Others still ask, "What's the capacity of Cn?" (inadvertantly missed in August article), even though it is specifically given under Fig. 1, September QST.

And the next guy who insists that he reads every word of QST, "from cover to cover." . . . ! ! !

Possibly of interest to some constructors are the specifications of the Sickles i.f. filter transformer (L2-L4). The primary inductance is 5.5 millihenries, the secondary inductance 1.3 millihenries. The coupling between these two universal-wound coils is not critical and is rather tight, a separation of about \( \frac{1}{4} \)-inch being generally satisfactory.
A Japanese Hamfest

By W. S. Upson, Ex-W6IP*

It's been a long time since I grabbed the old mill to shoot anything through to HQ, but this is so darned good it's about time something was done about it. So little has been said about foreign hamfests and so much about our own affairs that I hope this will even things up a little.

Just by way of explaining how I happen to know anything about Japanese hamfests, let it be known that KDNV, sometimes known by the uninitiated as the President Pierce, would have a hard time behaving herself if it weren't for the juice pumped into her 5-kw. pot and her 1-kw. tube. I'm de guy wot does de pumpin'. Well, we hit Yokohama and Kobe twice each trip and get enough time there to make us want a little more. In good plain English, we like it a lot.

This time we arrived at Yokohama with twelve long hours ahead with nothing to do. We decided to call up Mr. Tauto Ishii (JIEM), who is one of the engineers at the Yokohama telephone repeater station. We got a rickshaw boy to haul us to "California Frank's" where we hoisted a few. And then from there we sent the boy to Ishii-San with a note. Dunno what Ishii-San told him, but in nothing flat he was back running as if all the demons in China were riding his 'shaw. He herded us into his and another and took us to the telephone office. Oh yes, as part of the introduction, let me say the famous W6ASH, one time high-class ham traffic handler for the Eastbay Section, is now our gallant kid third op and, in case anyone should ask, tell 'em I'm ex-W6IP, but please don't spread it around the waterfront.

Ishii-San was waiting for us, all smiles and bows and with three women (old ones), waiting for us with trays of tea and cakes. That's one good thing about Japan. If you're hungry, call on a friend. You're sure to get a cup of tea, and it sure hits the spot sometimes. For about a year, J1EO, Mr. Shima of Tokio and myself have been trying to click. Either he has been QRL or I have. This time we got through to him on the 'phone from Ishii-San's office and, wonderful, he was home. He said he'd wait for us to get there and, although we were not dressed for any fancy calling, or high-class receptions, we had no time to change, so off we went. On the way to the Yokohama station, we picked up Mr. Seiichi Nozaki, also of Yokohama, who has as yet no transmitting license but only a permit to receive. He expects to be on the air soon, however. We got on the train finally and, about forty minutes later, dropped off at Tokio. Here Shima-San, J1EO, was waiting. Hot Dawg, you should have seen the bowing and scraping that went on. Poor "Ash" hadn't ever met any Japanese people before and didn't know how to bow or say anything. He is only a kid and blushes like a school girl. Of course I broke out my two words of Japanese greeting and then forgot the third. Oh well, we all have our little difficulties.

Up the hill we started toward Shima-San's home, and, believe me, you've only lived half your life until the time you walk up a narrow little lane in some Japanese town, lined on both sides with hedges or fences just high enough so one can get

* 2622—25th Ave., Oakland, Calif.
one degree, has invented a new "mike" that's a wow, and designed and installed the public address system used in conjunction with the Far East Olympic Games held in Japan a year or so ago. He's not the only one, either. J3CT of Osaka uses a single 210 and gets across to the States as one of the four loudest "J" stations, and it is seldom his input exceeds forty watts. Poor "Ash," he was sure up in the air. He had expected to see power, and lots of it, and that little aluminum can was a sad disappointment. He was trying to juggle a cup of tea, eat a tea cake and take in receiver and transmitter at the same time. It nearly proved too much for my sense of dignity and decorum, but I managed to hang on.

After we'd seen all the sets and equipment, Shima-San invited us to chow, the universally understood word in the ham language and the most appreciated. We went to another room where the table was set just one foot above the floor level, where the chairs were cushions, and the plates lacquered wooden dishes. The chow was strictly Japanese, served by two very pretty little Japanese maids. (Too darn much QRM in Nippon to make eating altogether a pleasure.) Rice and fish, cooked in the little lacquered dish, seaweed soup and a sauce. Believe me, if you want good chow, come to Japan—but take those twenty easy lessons first. After finishing up everything in sight, Shima-San invited us to take a look at the view from the window of this room. He is way up on a hillside and, looking out, one sees Fuji, Japan's sacred mountain, in the distance, beautiful Tokio and its environs in the foreground and, immediately below, Shima-San's own garden with his little brother and sister playing.

In a few moments we were asked to seat ourselves again and finish our meal with strawberry juice and Japanese watermelon. During the meal a very learned discussion on the relative merits of Japanese and American YL's was held, which only goes to prove that hams are hams the world over and, anyway, you should see some of these Japanese YL's. Finally it was all over and, with a sigh of pure contentment, we arose; that is, all but "Ash." He was so cramped from sitting cross-legged on a cushion that it took three men and the ship's cook to get his legs straightened out.

Well we only get twelve hours in Yokohama and I had a heavy date in Kobe, so we had to leave. Say, you want to take a ride in a Japanese train if you want a real thrill. I've been in China coast typhoons, in Tahantapeac gales and Hatteras blows, but never have been seasick except on a Japanese train. Wham!! go, say, the only thing that makes 'em slow down is a red signal, and they only show them on the first day of May and next week at two o'clock. We hung on to straps, stanchions, bags, hats, and the ladies' hair and finally reached Yoko right side up and undamaged. The whole gang was with us. I lost count after a while, but I think there were ten of them all wanting to see the ship's s.w. set and to bid these two great hulking noisy foreigners bon voyage. The Quartermaster at the gangway thought it was an invasion and I had to promise him beaucoup trinkets before he'd let us aboard. The gang thought the ship's layout hot stuff and sure had a swell time looking over the ship, my room, including many photos on the bulkheads and the shack. We left Yoko finally to a chorus of banzais and sayonaras from this great gang of chaps on the dock.

The whole thing took me back to the old days when a feller walking down the street of a strange town and seeing an antenna, especially if it had four wires and a white pole, immediately went up and punched the front doorbell and asked to see

January, 1933
the op. Them days is gone forever in the States, but you still are sure of a welcome if you pull it over here. Talk about friendship; say, I'm going to need a third op one of these days, and you want to come over. I'll guarantee you all a heck of a good time and a copy of the JARL Mag.

### Standard Frequency Transmissions

<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule</th>
<th>Station</th>
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<tbody>
<tr>
<td>Jan. 1, Sunday</td>
<td>C</td>
<td>W6XK</td>
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<tr>
<td>Jan. 6, Friday</td>
<td>A</td>
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<tr>
<td>Jan. 8, Sunday</td>
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### STANDARD FREQUENCY SCHEDULES

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<tr>
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<th>Elevation Schedule</th>
<th>Afternoon Schedule</th>
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<td>8:06</td>
<td>3600</td>
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</tr>
<tr>
<td>8:40</td>
<td>4000</td>
<td>7500</td>
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</table>

The time specified in the schedules is local standard time at the transmitting station. WIXP uses Eastern Standard Time, W9XAN, 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 de (station call letters).
- 3 minutes — Characteristic letter of station followed by call letters and statement of frequency. The characteristic letter of W1XP is "G"; that 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.

### THE TRANSMITTING STATIONS

- **WIXP**: Massachusetts Institute of Technology, Round Hill Research, South Dartmouth, Mass., Howard A. Chinn in charge.
- **W9XAN**: Elgin Observatory, Elgin National Watch Company, Elgin, Ill., Frank D. Urie in charge.
- **W6XK**: Don Lee Broadcasting System, Los Angeles, Calif., Harold Peery in charge.

### REPORT BLANKS

Blanks for reporting on the S.F. transmissions will be sent postpaid upon request. Just send a card or message to Standard Frequency System, QST, West Hartford, Conn., asking for s.f. blanks.

### WWV 5000-KC. TRANSMISSION

The 5000-kc. transmissions of the Bureau of Standards station, WWV, are given every Tuesday from 10:00 a.m. to 12 noon and from 8:00 to 10:00 p.m., E.S.T. The accuracy of these transmissions is to better than 1 cycle (one in five million). Information on how to receive and utilize the signals is given in Letter Circular LC-335, obtainable on request from the Bureau. Communications concerning these transmissions and reports on their reception should be addressed to Bureau of Standards, Washington, D. C.

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**Silent Keys**

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

- Henry L. Krichbaum, ex-W8BWZ, East Cleveland, Ohio.
- Norvell W. Matthews, W5CMA, Abilene, Texas.
- Willard J. McElree, W9FBO, University City, Mo.
- Frank B. Minor, W1B2, Derby, Conn.
- Thomas B. Norris, W2BFC, Richmond Hill, N. Y.

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**Election Returns—de W1MK**

THANKS, gang, for your telegrams, radiograms, QSLs, and letters reporting in detail on reception of the election-evening transmission addressed "to all A.R.R.L. Members and Radio (Continued on page 69)
Combining the Frequency Meter and Monitor

Adding an Output Detector to the Electron-Coupled Frequency Meter

By Clyde J. Houldson*

SEVERAL years ago if our wave exceeded 200 meters, one of our brother amateurs merely told us that it was approaching that of the (few) broadcasting stations — then we calmly retuned the old sure-fire circuit and started all over again. Now the problem is entirely different. With some 150 A.R.R.L. Official Observer stations and several government monitoring stations listening and checking for off-frequency operation, it behooves every amateur to have some sort of frequency measuring device in order to know that his signals are within the channels set aside for amateur operation.

One of the stabllest oscillators known at the present time is the electron-coupled type, previously described for frequency meter use in July, 1932, QST. Because of its frequency stability with large changes in plate voltage, its ability to generate harmonics and to retain calibration over a long period of time, as well as the many other points of superiority that have been set forth, this oscillator is finding increasing use in the heterodyne frequency meter. When the new frequency meter was planned, it was desired to eliminate the monitor then in use and to replace it with a unit that would serve as a combined frequency meter and monitor. This, at first, presented difficulties. However, after experimenting with several breadboard model electron-coupled oscillators it was found that the phones could be connected in the screen-grid or plate lead and give a fairly satisfactory signal. This permitted the electron-coupled oscillator to be used alone and promised to accomplish the work equally as well as the two separate units ordinarily required. Using the oscillator alone, the phones should be connected in the plate lead, as this seems to have the least effect on the frequency stability.

Desiring a huskier signal than that given by the incidental detection of the oscillator, a separate detector tube was added, with small r.f. coupling to the oscillator's plate. This gave a completely satisfactory signal and did not complicate the operating procedure. Connecting the phones in the detector plate circuit in no way disturbs the oscillator circuit. The detector being of the linear type, its output is nearly independent of the signal from the oscillator and proportional to the strength of the signal being monitored, since the outside signal is of much less amplitude at the grid of the detector than the strong signal from the oscillator to which the detector grid is coupled.

THE E. C. FREQUENCY METER-MONITOR DESCRIBED BY W1KP

From left to right below the tuning dial are the phone tip jacks, indicator light and "B" supply switch. The engraving and blackcrackle finish give the finished product that professional touch.

It was decided to shield the unit completely and it is therefore mounted in a cast aluminum box that measures 10 by 6 by 5 inches and has sufficient space to house both the oscillator and the detector. The wall thickness of this box is approximately 3/16 inch and it is 3/4 inch at the points where the front and back covers meet. This makes a solid and well-shielded job to start with. If a cheap and flimsy shield is to be used plenty of trouble can be expected. It is necessary to make the job as rigid and as mechanically strong as possible. Sheet aluminum having a thickness of 3/8- to 1/4-inch might be used if the box is to be constructed. Aluminum angles should be used in assembling the sheet aluminum and be drilled and tapped for 8-32 screws. If riveting, welding or any other means can be employed in making the box as strong as possible, it should be used. Enough regarding shielding.

Many condenser-coil combinations could be

worked out for covering the 1715-ke. band and giving, at the same time, the desired band spread. This one employs a Cardwell "Midway" Type 517 and a "Midway" 518 assembled as a single unit. The larger condenser has a maximum capacity of 50 μfd, and a minimum of 8 μfd. It is adjusted so that the oscillator tunes to the low-frequency end of the 1715-ke. band and is then locked into position by means of a lock-nut on the shaft. The tuning is done by adjusting the small three-plate unit, which has a minimum capacity of 7 μfd, and a maximum capacity of 26 μfd. Other condensers that would be suited for this purpose would include the General Radio Type 557, National Type 40-75, REL 157-E and the Hammarlund Type MC-20S combined with the MC-75M. Needless to say, the condenser assembly should be rigid and one having end or side thrust should not be used. If possible, a condenser having fitted bearings both front and rear should be used.

The circuit is shown in Fig. 1 and employs a Type 24-A tube as the oscillator and a Type 56 as the detector. In order to make leads as short as possible, the 24-A was mounted at the rear and the 56 near the front of the aluminum shelf supporting the tubes and sockets. This aluminum shelf, by the way, is mounted on brackets connected to the front panel, which tend to make it rigid and prevent any movement of parts due to vibration or when tuning. The grid condenser, which has a capacity of 100 μfd, is mounted on one of the stator terminals of the tuning condenser. A small ½ by ½-inch brass angle is used in mounting the grid condenser. The small one-half watt 100,000-ohm grid resistor is connected between the terminals of the grid condenser and is supported by its pigtails. A short lead from the top of the grid condenser connects to the grid of the 24-A by means of a grid clip.

The coil consists of 79 turns of No. 20 wire wound on a bakelite tube one inch in diameter. At the 23rd turn from the grounded end of the coil a tap should be made for connection to the cathode of the 24-A. After the coil is finished it should be given a good coating of collodion, "airplane dope" or clear Duco, which will prevent it from becoming loose on the form or absorbing moisture and thereby changing its characteristics. Also, it is always a good idea to wind on a few extra turns for the grid-to-cathode portion of the coil. These turns can be removed when the coil is adjusted in order to obtain the desired band spread. The exact number of turns will probably differ to a slight degree, due to the capacity existing between the wiring, condenser, etc. But the coil can be adjusted very easily and requires only a few minutes of time. By using this coil and condenser combination the spread obtained on the 80-meter band is nearly 100 dial divisions.

The 1-inch coil form is mounted at the bottom stator terminals of the variable condenser by small brass angles. Originally the coil was mounted on the top stator terminals, near the grid condenser, but by mounting in the position shown, the cathode lead was shortened approximately 3 inches. This lead runs from the top on the coil directly across the set to the cathode terminal on the 24-A socket. Since it is "above ground," it should be as short and as rigid as possible. Probably it would be a good idea to mount the coil so that it would be even nearer to the socket terminals. In this particular set-up, however, this was not possible.

By-pass condensers of several different sizes were tried, the .01-μfd. seeming to give the best results. As can be seen, the four .01-μfd. condensers are mounted directly below the oscillator coil. The common or "grounded" ends of the by-pass condensers are connected by 6-32 screws approximately 2½ inches long, the condensers being threaded on the screw and also spaced by using lock washers and nuts. By adjusting the nuts it is possible to lock the condensers in the desired position and also make them rigid. The entire assembly is then mounted by using ½ by ½-inch brass angles and secured to the bottom of the shelf with 6-32 screws. The other terminals of the condensers go to the heater, plate and screen-grid leads where they enter the cabinet on the Yaxley plug.

Several values were tried for the coupling condenser between the 24-A and the 56, ranging from 40 μfd. to .01 μfd. However, it was found best to keep the load on the oscillator as low as possible and, therefore, the 40-μfd. size is used in this unit. It is mounted by pigtail leads between the 24-A plate and 56 grid circuit. Most of the parts and the method of their mounting can

THE ESSENTIALS ARE ALL SUPPORTED FROM THE FRONT PANEL

The screen-grid oscillator tube and triode detector sit side by side to the right of the double-section tuning condenser, the rear section of which is adjustable by the knob shown. The coil is on the other side of the condenser. By-passes, resistors, etc., are below.
be seen in the rear view photo, incidentally.

Amateurs usually have shielding of a variety of dimensions around their respective radio shacks and, therefore, the mechanical layout must depend somewhat on the cabinet material available. The size of the cabinet in this case prohibited the large 6-inch type dial, so its smaller companion, the 4-inch dial, was pressed into service. This makes it possible to read to one-tenth of a dial division, an especially helpful feature for re-set purposes.

The red indicator lamp on the front panel is a very handy device and reduces the possibility of leaving the meter on over night as was done several times before the light was added. If more outside pickup is desired, a lead can be brought out from the grid of the 56-detector. By attaching a short "aerial" extending outside the box, plenty of pickup for nominal headphone operation can be obtained.

In choosing the detector, first a Type '27 was used, but this was soon discarded in favor of the Type 56. This seems to work considerably better than the '27 and at the same time draws a lower plate current, making the load easier for the batteries or power pack. With 135 volts on the plate of the 56, 90 on the plate of the 24-A and 45 on the screen grid, the combined current is 2 milliamperes. The onemegohm grid resistor is recommended for use with the Type 56 tube and is used. This resistor, together with the 100,000-ohm cathode resistor and the .25-µfd. fixed condenser, are mounted by their pigtail connections and, therefore, are self-supporting. The phones are connected in the plate circuit of the 56 by means of phone tip jacks, mounted on the front panel. A small toggle switch is connected in the negative B lead so it is possible to stop the oscillator but leave the 2.5-volt heaters on during the listening period. Otherwise, when working a station near your own frequency it will be necessary to detune the oscillator in order to hear the incoming signal on the receiver. Closing or opening the switch makes it possible to listen to your own transmitter and then cut off the oscillator when receiving. In order to monitor the signals of the transmitter, some means of quickly changing the phones from the output circuit of the receiver to the output of the monitor must be employed. This is accomplished by a double-pole double-throw switch, conveniently mounted on the operating table.

**CALIBRATION**

After the meter is finished and the coil adjusted for the desired band spread it should be calibrated against a frequency standard. Several means can be used, such as A.R.R.L. Standard Frequency signals from WIXP, W9XAN and W6XK; WWV transmissions, or harmonics from broadcasting stations. Originally, this meter was designed for operation on the broadcast band (880 to 1000 kc.), but the broadcast receiver was in-

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**FIG. 1 — CIRCUIT OF THE WIXP FREQMETER-MONITOR**

- $C_1, C_2, C_3, C_4, C_5, C_6,$ - 3-plate Cardwell Midway Type 401-B, maximum capacity 26 µfd., minimum capacity 7 µfd. (See text.)
- $C_7$ - 5-plate Cardwell Midway Type 402-B, maximum capacity 50 µfd., minimum capacity 8 µfd.
- $C_8, C_9, C_{10}$, $C_{11}$ - .01-µfd. fixed by-pass condensers.
- $C_{12}$ - .025-µfd. fixed coupling condenser.
- $C_{13}$ - .05-µfd. fixed capacitor.
- $R_1$ - 100,000-ohm 1/2-watt size.
- $R_2$ - 100,000-ohm 1-watt size.
- $R_3$ - 1-megohm 1-watt size.
- $R_4$ - 100,000-ohm 1-watt size.
- $L_1$ - 7 turns No. 30 d.c. wire on a 1-inch diameter tube. Cathode tap should be at 23rd turn from "ground" end. The heater and "B1" supplies may be from the receiver power pack.

**WIXP'S FREQMETER-MONITOR UNIT INCLUDES ITS OWN POWER SUPPLY**

It is generally similar in other respects to the one previously described.
adequate and it was not possible to pick up enough stations to obtain the desired calibration points. The electron-coupled oscillator being an excellent harmonic generator, the harmonics were unusually strong on even the 20-meter band. This type of calibration could be made to work out very well, however, since the Federal Radio Commission’s General Order Number 116 requires the broadcast stations to be within 50 cycles of their assigned frequency. With a good broadcast receiver it would be possible to check the meter any time one might desire. After the broadcast set failed, the coil was revamped for 1715- to 2000-kc. coverage. To date the meter has been checked four times against the 3500- and 7000-kc. signals from W1XP and W9XAN, respectively, and holds calibration very well. Before calibrating or rechecking, the meter should be turned on and allowed to warm up. This allows the tubes to reach a constant operating temperature and eliminates the possibility of frequency drift during calibration. Usually 30 to 45 minutes is more than sufficient time for the meter to “settle down” to a constant value.

**PRECAUTIONS**

Actually, it is hardly necessary to set forth the troubles that a constructor might encounter. Very few exist. If the parts are not defective (especially the 24-A) and are wired correctly, then the oscillator usually starts right off. A few amateurs have written in stating that they could not obtain strong harmonics from this type of oscillator on the 7- and 14-mc. bands. The strength of these harmonics can be increased somewhat by enlarging the portion of the coil between the cathode and negative “B” or ground connections. This lack of strength on the 7- and 14-mc. bands seems to be the exception, since meters that have been built here all deliver very strong harmonics. The 14-mc. band harmonics from this one nearly block the receiver. If the cathode-ground section of the coil is made too large, the result will be excessive feed-back and instability. This can be detected, by listening to the oscillator in the receiver, when the note sounds like it had several r.a.c. signals each side of the main frequency. It can be corrected by decreasing the resistance of the grid leak or moving the cathode tap down on the coil. As a rule the cathode-ground portion of the coil should consist of approximately one-third of the entire coil, which proportion minimizes the possibility of getting the r.a.c. signal effect and in most instances gives good husky harmonics on the 14- and 7-mc. bands.

All in all, the electron-coupled type frequency meter is an excellent unit, especially when combined with a good detector to provide monitoring, and is recommended for use at all amateur stations—whether they use self-excited or costly m.o.p.a. crystal sets.

**A Complete Self-Contained Frequency Meter-Monitor**

By Fred H. Schnell, W9UZ*

LOOKING for a transmitting station in any of the much used amateur bands is like looking for the bottom of the ocean. You can find it if you stay close to the shore, but when you get into deep water it is something else. With the number of operating stations increasing every day, the business of hunting for a station with which you have a schedule is almost a hopeless task, unless you know the frequency of the station and have a means of knowing when your receiver is tuned to that frequency. Further, any amateur who is

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* 4915 N. Sawyer Ave., Chicago, Ill.
without a good frequency “standard” is missing many joyful opportunities which are available.

Frequency meters and monitors have not been all that is expected of them, if judgment may be made on casual remarks heard here and there around the country. Either the gadget doesn’t stay put, or the batteries are dead or the signal from the transmitter is too weak when using it as a monitor. Each one of these things is true in one case or another. Many different types have been used at W9UZ and finally this present one cleared the room of everything else that had been used. During a ten-hour test for frequency drift (after warming it up for a half hour) and checking every two hours or so, the greatest change and which might easily be an error in reading the calibration curve, was less than 1 kilocycle. The frequency range (for the 7-mc. band) is from 90 dial divisions to 30 dial divisions, making a satisfactory spread for this amateur band, using the National Type VND (100-0) dial.

Since the output from the oscillator at the fundamental frequency was more than ample for the receiver, the circuit actually tunes to one-half the frequency range given above. At this harmonic, the generated signal can be made sufficiently strong to block out any incoming signal which will still permit the receiver to function. Operating as a monitor, the signal from the transmitter is kept at an audibility approximating average readable signals. It doesn’t knock the ears dumb nor does it make one squint to read the signals.

The simplicity of this device can best be understood by looking at the wiring diagram of Fig. 2 and photos. The power transformer has three secondary windings; two 2½-volt filament windings and one 100-volt plate winding. The 82 rectifier takes 3.0 amperes at 2½ volts. This tube requires one of the filament secondaries. The other two tubes, oscillator and detector, and the red indicator light are connected to the other heater secondary. The oscillator plate voltage is 105 and the screen-grid 80. Changing from about 90 to 120 volts on the plate made no perceptible change in frequency.

The ratio of coil inductance is 3 to 1; that is, one-fourth of the total turns are used between cathode and ground. There are 60 turns in all, tapped at 15 turns.

Note. — Using a National Type 35-70 (band-spread) condenser and an inductance of 38 turns, with the cathode tap at 11 turns, the fundamental frequency range is 3400 kc. to 4375 kc.

Series-Parallel Feeder Switch

AFTER seeing the Zepp feeder switching arrangements in QST some months ago, W3CBM contributes the one herewith for those of us who are coupling to push-pull oscillators or amplifiers with two coils and a single tuning condenser, instead of the usual single coil and pair of condensers. It requires a double-throw three-pole switch. In the diagram, with the switch in the lower position the condenser is in series, midway between the two coils, while in the upper position the condenser is across the feeders, the coils being connected in series.
Amateur Observations During the Total Eclipse of the Sun

By R. W. Woodward, WIEAO*

The total eclipse of the sun on August 31, 1932, afforded a wonderful opportunity for the radio amateur to contribute to our scientific knowledge of short-wave transmission phenomena, and more particularly to obtain information which would lend support to one or the other of two rival theories concerning the origin of the Kennelly-Heavyside Layers.

One theory supposes that the ionization of the reflecting layers (both the so-called E and F layers) in the upper atmosphere is caused, for the most part, by ultra-violet light from the sun. The other theory holds that the ionization of the lower, or E layer, is produced by neutral particles or corpuscles streaming from the sun at a rate of a thousand miles per second. If the first theory is tenable, any effect on radio transmission during the eclipse should correspond approximately with the time of the visible eclipse. On the other hand, if the corpuscular theory is acceptable, the effect on radio propagation should precede the visible eclipse by some two hours due to the slower velocities of the corpuscles coming from the sun as compared to the speed of light. Whereas the visible total eclipse cut a swath only about 100 miles wide across a part of New England and eastern Canada, the "corpuscular eclipse" would be maximum on a path starting from Spitsbergen, through Greenland, the mid-Atlantic Ocean, and ending at lower Spain. It would cover a path about 1600 miles wide, not touching the United States.

As requested in QST, by Official Broadcasts and by letter to Official Observers, a great many A.R.R.L. members all over the country and in some European countries sent in reports to headquarters on their observations during the eclipse. Particular attention was directed to the transmissions of W1EKL, a portable station located at Douglas Hill, Maine, in the path of totality by a party from the Warner & Swasey Observatory of Cleveland, Ohio. Prior announcements indicated that this station would transmit c.w. on 3550 or 7100 kc. between the hours of 1400 G.C.T. (9 a.m. E.S.T.) and 2300 G.C.T. (6 p.m. E.S.T.), but implied that the 80-meter (3550-kc.) wave would be used. Observations on intensity of received signals, preferably by means of a suitable output meter, throughout the entire period were desired. On the day before the eclipse it was determined that the 80-meter signal was not strong enough for automatic recording in Cleveland, so that it was necessary to use a frequency in the 40-meter band. Actually during the eclipse transmission a frequency of 7150 kc. was used. Because of this change in the frequency practically no reports on reception of W1EKL were received at headquarters as many of the reports indicated that watch was kept for W1EKL on 80 meters. Also because of skip distance the station on 40 meters could not be heard in the eastern part of the U. S. A. It is understood, however, that very satisfactory automatic records were obtained in Cleveland and also that many reports of reception were received directly by W1EKL.

Possibly also many of the eastern observers did as the writer, who, after spending several days arranging equipment to take intensity measurements during the eclipse, and in spite of rain at the time, hopped in the car a few hours before the eclipse and drove to Maine for a ring-side seat. At any rate, many A.R.R.L. emblems were seen on the road.

W1BZI operated by F. S. Huddy at Chepachet, R. I., where the eclipse was 98% total, made special eclipse transmissions on 3896 kc. between 80- and 160-meter amateur bands, broadcast several of whom gave very complete readings of the light intensity. R. I., where the eclipse was 98% total, made submitted interesting data on accompanying phenomena 1 much as static conditions, atmospheric pressure, temperature, clouds, wind, and light intensity.

In spite of the request to take observations throughout the day, the majority failed to do so, reporting only for a short period before totality and a still shorter period after totality. This was important not only from the standpoint of testing the "corpuscular" theory, but also, particularly involved, the time of the maximum of the eclipse was quite different in the several sections of the country. Thus the maximum of 38% totality occurred in Seattle, Wash., at 1927 G.C.T. (2:27 p.m. E.S.T., 11:27 a.m. P.S.T.), at Tallahassee, Fla., the maximum of 68% was at 2047 G.C.T. (3:47 p.m. E.S.T.), while the time of totality in New England was approximately 2030 G.C.T. (3:30 p.m. E.S.T.).

The following contributed reports on their results to headquarters:

W1- AFC, AGA, APK, ASP, ATW, AZQ, BBM, CIG, DCC, DJJ, MX, ST, VF; W2- BJJZ, EBB; W3- AAJ, AXJ, CL, DZ, QL; W4- ADA, AJ, AYF, PM; W5- AAQ, AR; W6- DLY, RJ; W7- AJ, AKJ, ATN, CB, DED; W9- ABS, AKJ, AN, AO, BN, EGE, EOM, FMX, RS, Chas. E. Dewey, Jr.; VE4EL; F8RJ; G2JA at sea on S.S. "Rangitiki"; ON4AU.

The reports received showed that the following stations were heard during the eclipse period, many transmitting special test signals. A great many reports did not list individual stations but classified their results by districts so that no doubt hundreds of additional stations also contributed to the results.

W1- ABM, ABY, ADN, AHK, AKI, API, ARI, AT, AVK, AYR, BBT, BCD, BDW, BIC, BGY, BTZ, BWF, BXC, BZB, BZD, BZI, CAC, CB, CKT, OKU, CLH, CMX, CNC, CFC, CPT, CVJ, CVR, CYN, DJJ, DZF, EKL, FH, GB, GE, HI, JJ, MX, SI, ST, SZ, ZC; W2- ABT, ABE, AIS, AWF, BHZ, BJV, BOT, BPV, BRO, BTZ, CUM, COJ, COK, DNG, DTO, DZ, GO, GT, NV, ZC, ZT; W3- AGI, ANA, AO, AQR, AQR, AUA, AXR, AZC, BIN, BLE, BMA, BNB, BOL, BXN, BYN, CDG,

CEU, CGU, CLG, CNU, COZ, CUP, DIR, DB, LA, OA; W4- ADA, AGD, AJX, API, ATS, AUA, AWP, BTO, BL, BOJ, BQO, DV, CH, OI, OT, QQ, UT; W5- AAK, ABW, AOT, ATS, BBR, BBD, CAL, COC, JY, LP; W6- CTM, CXW, DOB, DZZ, USA; W8- AFQ, AGU, AHP, AKU, APQ, AZQ, BAS, BM, BOG, BTB, CBF, CBM, CDY, CI, CIE, CIP, CSH, CTE, CTF, CXH, DHC, DIL, DJW, DMW, DVW, DEY, ECD, EEN, ELF, EUY, FBT, FGE, FNN, FQZ, FXM, GCF, GFT, GTE, HEL, HIL, SE; W9- AN, ARK, AUH, BBR, BHH, BOF, CII, CMZ, CMZ, CNG, DGN, DLK, DYG, ENR, FPA, FKK, FMK, FPA, FWD, FZL, GIX, GJC, HOS, HPQ, HUE, IBM, IPP, IZP, JBM, JBU, JHL, JX; AB1; K5AA; VE- 18E, 2AW, 2BF, 2GH, 3AQ, 3BT, 9AA; CM- 2FM, 2WD, 3GE; EAR- 96, 155, 185, 224, 228; F8- BS, OL, RJ; G- 2BM, 2OP, 2ZP, 5NF, 5OJ, 6CL; HAF3FV; HK1Z; LU3DE;

OK2CM; ON4AU; PY2BN; VP2- DB, DD; SU1EC; and the following commercials on which listening tests were made: DGG, FYL, GID, GSW, HJO, KDA, KFYR, KZT, TIR, VE9GW, WAZ, WEAF, WQP, W2XAD, XDA.

From the mass of heterogeneous data submitted, involving so many variables, the problem of digesting and condensing the results so as to put them in a form for simple presentation can well be appreciated. Some of the variables encountered are time, location and extent of eclipse at transmitter, location and extent of eclipse at receiver, frequency of signal, transmission distance, power of transmitter, intensity of received signal, method of measuring intensity, and the ever present personal equation including such items as possible errors in time recording, operation of receiver at optimum sensitivity, and the estimation of intensity of signal where the R system was employed. Not the least confusing factor was the failure of many to report the system of time used.

The scheme finally adopted was to show typical

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January, 1933 33
graphs of change in intensity of the received signal plotted against time for several conditions in each of the amateur bands. The sub-conditions are the extent of the eclipse over the transmission path, including areas having 90-100% totality, 75-90%, 50-75%, and less than 50%; and the transmission distance, including local, an intermediate distance where skip effect would be expected under night conditions, and longer distances up to the maximum range of the band.

The intensity changes are reported as decibels above or below a normal level. Where the R system was used a change in one number, such as from R8 to R7, or R5 to R6, was considered as a change in received energy of four decibels. The above or below a normal level. Where the R

the Greenwich Civil Time is also shown on the basis of totality occurring at 2030 G.C.T. (3:30 p.m. E.S.T.). At Douglas Hill, Maine, the computed times of the various phases of the eclipse were: first contact, 1920; second contact, 2028:47; third contact, 2030:24; and fourth contact, 2134 G.C.T.

All the data were examined and found to agree very well with the typical curves shown with only scattered confictions. A few unusual transmissions were reported but they must be considered as freaks which so often occur in short-wave work, their occurrence being increased by the greater number of stations on the air during the daytime and the extra vigilance of receiving operators.

**GENERAL CONDITIONS**

Cosmic data supplied by "Ursigram" * messages showed that the 24 hours from 1400 G.C.T., August 31st, to 1400 G.C.T., September 1st, was classed as a quiet day as far as terrestrial magnetism data was concerned. The preceding two days were days of moderate magnetic disturbances, and August 27th and 28th were classed as days of great disturbances. One sun spot, with a Wolf number of about 8 was visible on August 31st and passed from the face of the sun on September 2nd. Prior to this, two sun spot groups had crossed the face of the sun beginning on August 23rd and reaching a maximum Wolf number of about 24 on August 26th. The aurora displays for the days in proximity to August 31st were faint to moderate as observed at College, Alaska. Parenthetically it might be mentioned that the writer has observed on days when brilliant aurora were visible in New England, accompanied by violent magnetic storms, that the skip distance was greatly reduced; 15-meter signals were heard at a distance of 100 miles that under normal conditions were never heard.

The weather maps for the period of the eclipse showed a tropical storm progressing inland in the Gulf States. Rain occurred in the northeastern states, the Gulf States, and the Middle West. No pronounced isotherms were indicated for the eastern part of the country but temperatures were mostly above normal. Pressure was low in the Gulf States and high in the Middle West. There was no sharp pressure gradient in any part of the country except in the vicinity of the tropical disturbance. Scattered thunderstorms occurred over most of the eastern half of the United States on the afternoon of August 31st. The western half was mostly clear with temperatures below normal.

From these data it may be reasonably concluded that on August 31st radio transmission should have been approximately normal and that marked variations from normal could be associated with the solar eclipse. From the many local thunderstorms irregularities in QRN could be expected. Those observers who mentioned the fact confirmed that transmission was normal on August 30th, August 31st, and September 1st.

**160-METER BAND**

As is usual during the daytime, there was little activity on this band and too few reports were received to allow drawing any conclusions regarding any change in conditions during the eclipse.

**80-METER BAND**

A great many reports were received on observations in the 80-meter band and since the transmission distance was generally such as to include an area of nearly uniform solar coverage, the results are easier to interpret. Although both phone and c.w. stations were on the air with test signals, the best data received were on the c.w. signals since with the equipment usually accessible to the amateur it is more difficult to measure variations in intensity of modulated carriers. The curves shown are for c.w. signals but are equally applicable to phone transmissions.

*See QST*, Sept. 1932, p. 35.
Fig. 1 gives results in the area of 90 to 100% totality, all reports on reception of W1BZI. The A curves are typical of results at less than 50 miles, or little more than local distance. The solid line is reception reported by W1AGA at a distance of 40 miles in the zone of 99% totality, while the dotted line indicates the readings of W1AFC at 38 miles, also in the 99% zone but in a different direction from the transmitter. These show irregular “sunset” effects or fading in the early and late stages but with a general rise in level at totality. The dotted line indicates a decided peak lagging behind totality.

The B curve records the results obtained by W1ASP at a distance of 75 miles in a zone of 96% totality, and is typical of results from 50 to 200 miles. This distance, which at night would be expected to show skip on 80 meters, also shows irregular “sunset” fading but a greater rise in signal strength than the A curve. Lagging about a minute behind totality was a pronounced dip or tendency towards skip, for a short interval. This was followed by a large increase after which the signal rapidly returned to normal volume.

The C curves show results typifying distances greater than 200 miles which is about the maximum distance possible within the limit of 90% totality which was set for Fig. 1. The full line is the data reported by W3DZ and W3CL, the dotted line those of W3QL, all in zone of 93% totality and about 225 miles from the transmitter. Tendency towards skip is shown in the early phases and after totality. Signal strength was considerably raised over normal, in this case peaking about three minutes before totality without a corresponding peak following. The observations for the dotted line were not taken at as frequent intervals as for the other curves and hence show less irregularity.

Fig. 2 indicates results in the area of 75 to 90% totality for the 80-meter band. Curve A was submitted by W9BN on reception of W9AN at a distance of 44 miles with the eclipse about 76% total. Irregular fading is shown with peaks of increased signal before and after the maximum of eclipse and a pronounced dip between the two peaks, all lagging behind the visible eclipse.

Curve B is a composite of several reports at distances of 50 to 200 miles. It appears to be somewhat parallel to A. Curve C was submitted by W3AAJ on reception of W1APJ at a distance of 390 miles and the eclipse about 90% mean totality over the path. Signal strength is well above normal and peaks about seven minutes after the maximum of eclipse. In addition to this curve C, in the 75 to 90% zone R6 signals were reported at 600 miles, R3 at 800 miles, and DX at 1000 miles at the greatest extent of the eclipse.

In the area of 50 to 75% totality, insufficient data were obtained to admit of plotting, but the individual reports showed results similar to the 75-90% zone but to a lesser degree. On the Pacific coast where the eclipse was about 15% total conditions on the 80 meter band were reported as normal.

40-METER BAND

On the 40-meter band skip distance was such that very few stations at distances less than 200 miles came through at any time of the day. W1EKL could not be heard at W1EAO a distance of 200 miles at the beginning of their schedule at 1400 G.C.T. (9 a.m. E.S.T.) with the aid of a frequency meter set on 7150 kc. After listening 3 hours, W1ATW (220 miles) heard W1EKL for five minutes at 1700 G.C.T., when he was lost and heard no more. In areas of greater than 75% totality what few stations that were heard at distances up to about 200 miles fell out completely near the maximum of the eclipse.

In Fig. 3 is shown results obtained in the range of 200 to 1000 miles for various degrees of eclipse.

These curves are composite averaged results from a great many observers and show general tendencies omitting specific fading irregularities. Curve A shows that near the path of totality signal strength was reduced, the maximum reduction peaking approximately with totality. As indicated in curve B for regions of 75 to 90% totality, signals at first increased and then decreased rapidly at the maximum of eclipse coverage. Reverse effects were observed as the eclipse receded.

In regions of 50 to 75% eclipse, curve C, there was at first a slight increase in signal strength as the eclipse came on. This was followed by a dip to somewhat below normal and then a maximum increase was observed lagging somewhat behind the maximum of the visible eclipse. On the Pacific coast with 15% totality, curve D, signals gradually increased with the partial eclipse and then slowly decreased again to normal.

Distance reception of greater than 1000 miles was also reported in the region of about 50% totality at various times throughout the progress of the eclipse.
20-METER BAND

The distance of transmission on the 20-meter band is such that widely different extent of eclipse was present at the transmitter and receiver. In addition, contacts with European stations were over a sunset area as well as the path of the eclipse. No attempt has been made to differentiate between the results secured depending upon whether the transmitter or receiver was at the location of maximum eclipse effect. Undoubtedly a difference does exist, but there was insufficient data to make comparisons.

Many reported on reception of high-powered commercial stations with varying results. W1AFC at 99% totality reported no change in DGG on 22 meters from 1830 to 2125 G.C.T. (1:30-4:25 p.m. E.S.T.). W1VF at 100% totality reported a noticeable increase in signals from GID on 24 meters during totality. In the region of 70% totality W9ABS kept watch on WAZ, XDA, WQP, KKZ and HJO. From 1400 to 1800 G.C.T. the eastern stations were R5-R7 with marked variations, west coast stations R6 and steady. At 1800 the east coast stations rose to R8 very steady, but at 1900 dropped out altogether. The west coast stations increased to a very loud signal. From other sources we learn that the Canadian Marconi Company found no definite change in 22- to 37-meter transatlantic reception.

Fig. 4, curve A, shows the variation in reception of XDA (about 20% totality) on 20.7 meters by Charles E. Dewey, Jr., in Jefferson City, Mo. (71% totality), at a distance of about 1400 miles. Between these two points there was a time difference of about 20 minutes in the phases of the eclipse. It would have been interesting if these observations had been continued for at least an additional hour, as in all probability another peak intensity would have been found.

It should be pointed out that the commercial channels are operated at a high power level and at a frequency that will give reliable communica-

tion under the prevailing conditions. On the other hand, amateur contacts on this band (and quite often in other bands) are with comparatively low power, and more often than not not are in the "fringe" zone of possible contact. It is to be expected then that small differences in the transmission path would produce a much greater change on amateur transmissions than upon commercial channels.

European observers of American amateur signals, as well as observations from midatlantic ocean reported rapid irregular fading together with mushiness of note caused by high-speed fading during the period at and near totality. Curve B of Fig. 4 shows reception of W2CJM by ON4AU, a distance of about 4000 miles from darkness to a region of 95% totality and crossing the path of totality. A general reduction in signal strength peaking with the eclipse is noted.

Curve C indicates composite results of observations taken by G2JA at sea, 1560 miles east southeast of New York and in a region of about 96% totality on the opposite side of the path of totality from the United States. At this point the eastern station was at 2120 G.C.T. Stations received were at distances of 2000 to 3000 miles down to about 50% totality. This curve shows a regular decrease in signal strength peaking with the visible eclipse. Results toward the end of the period were partially obscured by twilight effects, and this part of the curve is given as a dotted line.

In the United States, W1AZQ, in the path of totality, reported European signals fading out and 6th district coming in at 2000 G.C.T. During totality at 2030 G.C.T., only the 5th district could be heard and with diminished strength. From 2105 to 2145 G.C.T. only 4th, 5th districts and Cuba were audible. At 2200 G.C.T. reception was again near normal with the return of European signals until they disappeared for the night at 2215 G.C.T.

Curve D shows reception of W1HE (99% totality) by W9AOG (65% totality) at a distance of 1230 miles. Signals entirely disappeared for about one hour, the center of this effect lagging about five minutes behind the visible eclipse.

The results, curve E, obtained by W9RS and W9EDE are quite interesting and show that even in the region of 79% totality the reception of a one-watt oscillator over a distance of one mile was considerably reduced.

LONGER WAVES

On the broadcast band reports indicated that at distances less than 100 miles night conditions of mushiness and fading were found during the maximum of the eclipse. At distances of 200 miles near the path of totality, no changes were observed. Reception of broadcast stations from four to five hundred miles distant faded completely or nearly out in various parts of the country, the maximum effect peaking with the time of totality.
WLAFC found no change in the intensity of FYL on 19,000 meters other than the normal daily change.

**QRN**

A great many amateurs reported changes in QRN and were led to the belief that the eclipse had left a high static level. A few reported no QRN for the entire period.

As mentioned earlier, during the period of the eclipse, there were a great many areas of scattered thunderstorms throughout the country, most of which occurred on the afternoon of eclipse day. Analysis of the QRN reports show that without exception those who reported bad QRN were near a local thunderstorm area, and those who reported no QRN were at a considerable distance from one. Of course the greater transmission range during the eclipse also carried the static disturbances over greater distances. So it appears that the eclipse can not be blamed for QRN conditions on August 31st.

**OTHER RESULTS**

Since the eclipse, the results of some other observation parties have become available and should be mentioned briefly in passing.

The Bureau of Standards reported that measurements made near Washington, D. C., showed that the critical frequency for the E region of the Kennelly-Heavyside Layer decreased about 1000 kc. during the eclipse, lagging behind phases of the eclipse by approximately five minutes.

Observations made in Canada under the direction of Drs. Henderson and Rose showed distinct losses in ionization of both reflecting layers E and F regions during the period of the optical eclipse and no indications of a corpuscular eclipse.

Messrs. Kenrick, Mimmo, Pickard, and Wang gave a preliminary report to the Boston Section of the I.R.E. on results of automatic photographic records of echo lag behind ground signals. On 1640 kc. no echoes were observed until ten minutes after totality (2040 G.C.T.), when the E layer appeared at about 110 km. height. This persisted until 2110, when it disappeared and the F layer came in at 250 km. and remained until 2130. No reflections were then observed until 2145 when the E layer returned until 2200, when it vanished and was replaced by the F layer which remained until sunset. On 3942 and 4542 kc. no E layer reflections were observed, but there was an F layer disturbance of double-humped character coinciding with the visible eclipse. Because of its close resemblance to some of the amateur results of reception, the curve showing this disturbance is reproduced in Fig. 5.

And now after complete absence of any indication of a corpuscular eclipse, there appears an article in the public press stating that Dr. E. F. W. Alexanderson of the General Electric, by using a frequency of 8655 kc. between Schenectady, N. Y., and Conway, N. H., had observed almost complete disappearance of signals two hours previous to the optical eclipse, and attributes it to a corpuscular eclipse. Although at this writing complete information on his tests are not available, and full comment must be withheld, it is difficult to accept his conclusions when it is remembered that his tests were conducted in a region supposedly outside the zone of a corpuscular eclipse.

**CONCLUSIONS**

At the outset it was stated that one of the questions which it was hoped to settle by means of radio observations during the eclipse was whether the ionization of the upper atmosphere was caused by ultra-violet radiation from the sun or by neutral particles shot off at a much slower velocity.

Amateur transmission was most certainly effected during the eclipse, the maximum effect in general coinciding with totality of visible eclipse or lagging a few minutes behind it. In all cases conditions approached those of night, the nearness of approach depending upon the extent of the eclipse in the region. The return to normal conditions seemed to be somewhat slower than the onset of the disturbance. On 40 and 80 meters, double humped intensity curves were observed similar in shape to the variation in the F layer height found by the Harvard group of observers.

This would seem to prove definitely that ultra-violet light, or some radiation travelling with the speed of light, is mainly responsible for the
ionization of the upper atmosphere. The findings of scientific observers show that there were changes in the E and F regions of the Kennelly-Heaviside Layer coincident with the optical eclipse.

As regards a corpuscular eclipse, and the acceptance of the opposing theory, very few observations were taken by amateurs which could be used as a basis for a definite conclusion. What observations were made over a sufficient length of time and over the probable path of the corpuscular eclipse failed to show any effect of such an eclipse, if there was one, on transmissions in the amateur bands or on commercial frequencies close to amateur assignments.

On the other hand, if Dr. Alexanderson's results are accepted then it would appear that the effect of the corpuscular eclipse was quite small as compared to the optical eclipse and that the stream of corpuscles or neutral electrons from the sun exert only a small influence on the ionization of the upper atmosphere. So, for the time being, at least, we still have the two theories with us.

Many amateurs expressed a regret that it would be a long time before they could experience the enjoyment of noting the effects of solar eclipses on radio transmission. The results reported here show quite well that it is not necessary to be in the path of totality to observe a "radio eclipse." Wherever the eclipse may be, the ever resourceful amateur can select frequencies and stations upon which he can make satisfactory and convincing observations. Let's continue to make radio studies of coming eclipses.

The Delta Division Convention

When 45% of the delegates reach a convention the night before it begins, it means only one thing — success. That's exactly what happened at the Delta Division Convention held in Pine Bluff, Arkansas, October 15th and 16th, under the auspices of the Tri-State Radio Association. With representatives from every part of the Division, "hamming" was carried through the wee small hours by those early arrivals. Everyone was ready for the morning session, Saturday, when Director Hill opened the convention and turned same over to Ray Arledge, W5SI, the chairman, who immediately started things going. The speakers at the different sessions were: "Bill" Joy, Sales Engineer, National Carbon Co.; Frank M. Davis, University of Arkansas, talking on "Class B Amplifiers" and Nat Scott of Scott Coil & Transformer, who showed some of the apparatus so well known to many amateurs. Radio Inspector DuTrill came from New Orleans and gave examinations. Twenty-two took advantage of the opportunity, and all passed. Several contests were held during the two days and worthwhile prizes won. The Naval Reserve was unusually well represented with Lt.-Commander J. J. Wilkinson in charge, and we can visualize a good unit in that section soon. The Communications Department activities were well covered by Bodker, SCM, Mississippi; Veite of Arkansas and Route Manager Presley. Two trips of interest were made to the Arkansas Power & Light Plant and the airport club house where W5SI is located, and what a location! Then came the Banquet! The guests of honor were Mayor Holderness who gave the freedom of the city to all the delegates; Treasurer A. A. Hebert, A.R.R.L., who spoke on the Madrid developments and Lt.-Commander J. J. Wilkinson, U.S.N.R., with Director Hill acting as toastmaster. Chairman Arledge and W. F. Fortune, President of the Tri-State Radio Association, made the closing speeches. We almost forgot the dance Saturday evening and the YL's who came to the rescue of those terpsichorean hams without partners. All aboard for Memphis in 1939! — A. A. H.

W9FFH reports this gem from a bargain sheet: "These resistances are guaranteed not to develop noise or open circuits in us." No doubt of it!

FIG. 6—THE GRAPHICAL RECORDING OF WIEKL'S 7150-KC. SIGNALS MADE AT CASE SCHOOL SHOWS A TREMENDOUS RISE IN SIGNAL STRENGTH BETWEEN FIRST CONTACT AND TOTALITY, THE RECORDER PEN GOING CLEAR OFF THE SHEET AT TOTALITY.

A few seconds later the signal dropped down to the background level and was inaudible for some 15 minutes. Then it gradually built up and reached a second peak just before the moon's shadow passed away, the pen again going off the sheet, with the second peak lasting somewhat longer than the first. The signals then gradually dropped to normal level. The eclipse was over.

Delta Division Convention

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38 QST for
QRR, 1932
Amateur Emergency Work During the Past Year

By Clinton B. DeSoto*

FOR fourteen years the signal QRR or its equivalent has flashed on amateur waves whenever storm, flood or other emergency disrupted established lines of communication. 1932 saw amateur radio stepping into the breach to link an emergency area with the outer world on two major and a number of minor occasions.

When southwest Texas went grimly to work to relieve distress and restore order in the Guadalupe Valley area struck by flood on July 1st, where nine lives were lost and over one million dollars' property damage done, amateurs of that region were just beginning to relax from their three-day vigil in which they had successfully bridged the total gap in all wire communications, leaping the isolation created by the raging waters.

From the headwaters of the Guadalupe River up in the hill country northeast of San Antonio had come sweeping the most disastrous flood ever to wreak havoc on the peaceful upper Guadalupe Valley. The heavy rains throughout western Texas during the last days of June had suddenly augmented the mountain stream by a 45-foot rise, the highest in history, washing out bridges, sweeping away hundreds of summer resort cottages, inundating great areas, leaving thousands homeless and without food and shelter.

THE LONG WATCH BEGINS

During the succeeding three days W5BSF remained on the air continuously except for late night and early morning hours, when skip conditions prevented local working. Until the wire lines were able to resume service at 6 p.m. on July 4th, Lawson and his assistant operators remained at the key, eating their meals at the operating table when necessary, and maintaining constant contact with Houston, San Antonio and Richmond, Texas.

SEARCHING FOR BODIES IN THE PATH OF THE CALIFORNIA FLOOD

Many unknown itinerants aboard the freight trains were among those buried alive in tombs of rock and sand. Several bodies were found 19 miles from where the wall of water engulfed them.

A total of 111 distress messages were sent and 25 received and delivered, not including notices to the broadcasting stations and several long communications to the press, for whom amateur radio performed an invaluable service in the Texas emergency. Most of the messages were from individuals concerning their safety and property losses. Many of these constituted the Western Union file of telegrams, relayed by amateur radio from W5BSF, and turned over to the wire line at Houston and San Antonio.

Pleas from the chapter commander of the Disabled American Veterans of the World War for department and state aid to the American Legion tubercular camp, Legion, where nearly fifty families of disabled war veterans were driven from their homes, destitute, were accorded prompt action, Governor Sterling ordering tents and bedding from National Guard headquarters to be sent the veterans. This service alone was of enormous importance in the relief work to follow.

*Assistant to the Secretary, A.R.R.L.
Counsellors from the many boys' camps in the flooded region either swam the swollen streams, crossed in canoes or trekked the weary miles over the hills to Kerrville, and had Butt send messages to the outside world that all was well. In practically every instance, according to W5BSF, answers to these messages were received within thirty minutes after they were sent.

While the bulk of the message traffic was with Houston, San Antonio amateurs performed excellent service in delivering press dispatches and radiograms to persons in their locality. Horace E. Biddy, W5MN, and L. J. Stickney, W5OW-WLJ, at Fort Sam Houston, were active for the communication they have learned to expect.

With the wind and rain and ever-present threat of terrible disaster, the feeling preceding an approaching storm is always grave. During the past summer several such storms have passed over and around Florida, and in each instance the Florida 'phones did Herculean work, staying on duty night after night, gathering data on wind velocity, barometer readings, predictions and reports, and maintaining 15-minute schedules hour after hour.

On August 29th, from the first warning of the major storm that began that day, hundreds of dread-filled people gathered at the Lake Worth Radio Club, anxiously awaiting news of the storm, coming through W4AWO. With W4ACZ acting as emergency control station at Orlando, a net covering the entire state was in continuous operation, including W4DU, W4MF, W4WM, W4WS, W4UH, W4BN, W4ANR, W4GJ, W4KM and W4BAM. While W4DU kept the big 'phones of the north from QRMing the band, the remaining stations kept in touch with practically every vital point in Florida. W4BN was completely equipped with emergency power supply if necessity for its use arose, representing the thoroughness with which Florida amateurs prepared for all emergency work they might be called on to do.

A LOST CHINESE

Charlie Wong, cook at a Kasaan (Alaska) fish canery, caused a considerable flurry on the northwest coast last April when he disappeared from his post in the packing plant kitchen. The woe felt by friends and patrons upon being deprived of their customary flapjacks became real alarm when Charlie's skiff was found adrift and empty. K7AAC, of Quadra, Alaska, broadcast an appeal for help, requesting that the U. S. Coast Guard find the cannery chef and return him to his empty-stomached clientele.

The message was picked up by Edward Lloyd, W7AIE, at the Moran Junior College, Bainbridge Island, Washington, and relayed by telephone to Coast Guard headquarters at Seattle. Not long afterwards a damp but happy Charlie was discovered some 20 miles from Kasaan and returned to the canery. Next day's flapjacks were reported as being up to par.

WIRES DOWN IN PENNSYLVANIA

When a heavy snowfall in the mountainous regions of Pennsylvania broke wire lines between many of the principal cities, interrupting communications with consequent detriment to private and business correspondence, Pennsylvania amateurs cooperated with the South Penn Power Co., West Penn Power Co., Western Union and "West Coast Fisheries," George Roger Chute, Editor. A.R.R.L. Communications Department.
other agencies. A. W. McAuly, W8CEO, Oak­­mont; Pennsylvania State College, W8YA, and other stations in Altoona, Harrisburg and Phila­­delphia aided in this work. The Army-Amateur net in this as well as in five other similar instances during the past year did some fine, well organized relaying.

THE CALIFORNIA DISASTER

One of the worst and most tragic storms in the history of California1 began on the night of Sep­­tember 30th, after a day of heavy rainfall, the storm losing its fury in the high Sierras sixty miles southeast of Bakersfield and washing down through the old mountain mining town of Teha­­chapi, through Tehachapi Pass, down Cali­­ente Creek and Canyon—a 45-foot wall of water, accompanied by boulders falling like hail from the many landslides, wiping out six villages, crushing houses like match boxes and killing countless people. Two mon­­ster locomotives and their trailing box cars were handled like toys by the terrific torrent, one engine being buried out of sight under the slit of the creek bed. Two million dollars’ damage resulted, and a path of death twenty miles long became the ghastly aftermath.

Rising to the emergency, Bakersfield ama­­teurs, realizing that all communications lines were down when meagre reports began to trickle in the morning after the disaster, quickly organized their forces. Fred H. Hicks, W6EJU-W6ZZU; George Dryden, W6DQV; Ernest Roux, W6EXO; Joseph R. Meloan, W6CGM-W9BPX and James L. Mattly, W6FJI, composed the emergency amateur radio expedition which, led by the California Highway Patrol, began the trek into the mountain flood area. With their portable equipment stowed away in three cars, they skidded and plunged through the flood waters about Arvin until they reached the mountains, high and by then comparatively dry, the cloudburst

THE CRYSTAL-CONTROLLED PORTABLE USED BY W6CGM IN THE CALIFORNIA FLOOD WORK

Using a dynamotor for portable d.c. supply, this trans­­mitter stood an acid test by giving satisfactory signals with the storage battery so run down that the input was less than 3 watts.

waters having spread over the lower portions of the San Joaquin Valley. Twenty miles of moun­­tain road brought them to the center of the storm area at Keene and Woodford. No sooner did the Bakersfield amateurs arrive than they were greeted by a heavy downpour of rain and the promise of another storm. Hastily they removed their portable ham stations to dry quarters in the large Keene Sanitarium, which lay directly in the path of the disaster but escaped by a stroke of good fortune, the water having passed by its very doors.

Meanwhile, in Bakersfield, Norman McLaugh­­lin at his c.e. W6GEG, the U.S.N.R. Radio Club station W6KE; Frank Cuevas of W6AOA; Cleetus Armistead, W6ENH; Bill Neihaus, W6BRP and Leroy Hicks, W6FKV, arranged a

ONE OF THE LOCOMOTIVES BURIED IN THE SILT OF CALIENTE CREEK BED DURING THE RECENT CALIFORNIA FLOOD

continuous watch for as long as the emergency might demand.

WORK BEGINS

At 2 p.m. the emergency crew dived into the installation of W6CGM’s crystal portable, fighting the twin difficulties of inadequate antenna facilities and poor location, being situated in a canyon encompassed by high ore-laden mountains. It was not until late that evening that skip lifted sufficiently to permit two-way contact with Bakersfield. Schedules were arranged for the next morning, with W6FKV keeping an all night watch at W6KE for the Keene signals in the event of further disaster. By morning signals were better, and real emergency flood traffic was handled. Priceless service was rendered rescue parties, railroad officials and others.

A.c. power being available at Keene that noon, new equipment was brought up from Bakersfield, and with this and a new semi-vertical Hertz, really good signals were being reported in Bakersfield by 5:30 p.m. An army of rescue men, lines­­men, police, news reporters and cameramen were now at the scene of the disaster, while overhead droned the motors of airplanes making photo­­graphic aerial maps for various national news services.

With the coming of dawn, the best report of the entire expedition was received from W6FGE, 130 miles distant, after a bare spot in the antenna

January, 1933 41
had been cleared from a tree, the signals being R7-8 at Baldwin Park, Calif. A few minutes thereafter, W6EGG was again QSO’ed, and notified that communication lines would soon be into Keene. Sole remaining members of the emergency expedition was the isolated duo which then requested that someone be sent to bring them home. While waiting for transportation, the portable equipment was packed, all possible late news secured, wreckage viewed and pictures taken, and the emergency work was ended.

The new mining town of Centreville, in the wilds of British Columbia, is 300 miles from the nearest railway, and there are no means of communication or travel to it except by horseback. When an American miner named Crawford was badly injured by a premature explosion in the mine on July 26th, it looked like certain death for him. Not until the presence among the camp crew of George H. Latham, VE5DZ, was discovered did hope appear, for Latham had with him his portable outfit using a 71A as oscillator. He was able to make immediate contact with VE5FG, RUDY REAR, W6GKB, OPERATING A TYPICAL SET-UP OF FOREST SERVICE RADIO GEAR

Operating on a frequency of 3440 kc., crystal-controlled, these transmitters have call signals beginning with "SP" and ending with a numeral. This equipment had the call SP26.

a distance of some 600 miles, who wired the police at Victoria asking that a doctor be rushed by plane to the injured man. While waiting for the plane, VE5FG gave instructions on caring for the accident victim. Constant contact was maintained between the two stations for 16 hours, while the plane flew from Carcross, Yukon, to Atlin. There the pilot found weather conditions too bad to proceed for several hours, but finally reached the mine and the injured man was taken to Whitehorse, where he recovered.

Ray Reitges, VE4DT, R.M. Alberta; King Cavalsky, VE5AL, S.C.M. British Columbia.

FIGHTING FOREST FIRES

While not strictly an affair of amateurs coping with emergency, the radio work during the big Matilija forest fire in Ventura and Santa Barbara counties, Calif., which began September 7th, is of importance because it is the first big fire where radio has been relied upon entirely for communications, and because the participating operators were all active amateurs especially enlisted for this fire.

The Matilija fire, during which 220,000 acres were burned in five watersheds, was not brought under complete control until September 20th. During nine days of this period, radio communication was maintained between four portable stations in as many camps on the fire line, and from 10 to 30 air-line miles apart. The base station was located at the Ojai ranger station, from which all instructions concerning the fire fighting emanated.

The five amateurs operating the portable stations were Gordon McAdams, W6BFM; Ben Brown, W6BZF (relinquished after three days by Frank Lloyd, W6ENJ); Edward Cain, W6GIE and Harry Williamson, W6CWI. The base station was operated by Rudy Rear, W6GKB. The safety and lives of several hundreds of men were entirely dependent upon the radio communication provided by these amateurs.

The combined transmitter-receivers used 2-volt tubes and were crystal-controlled, with c.w. or voice optional. While the equipment operated highly satisfactorily, it was learned that higher-power transmitters were necessary for use in such large fires because of the adverse conditions created by the blanketing effect of the heavy gasses and smoke, and the terrific static caused by the rushes of cold air against hot.

EMERGENCY APPARATUS CONSIDERATIONS

This experience emphasizes the abnormal difficulties encountered in emergency work, where inadequate facilities for antenna location and transmitter operation and frequent lack of power conspire with unnatural atmospheric conditions to make satisfactory working almost impossible. The California crew, working in their recent flood disaster, were forced to the conclusion that emergency portable equipment must be at least equal to the average home installation, that it must be able to work from a.c. or d.c. with any tubes from '30's to 'lO's and that the antenna must be right and a regular part of the equipment; haphazard emergency antennas are frequently worse than useless. Even a loop will ordinarily work better than the expedient of hopefully tying onto a convenient BCL antenna. Current-fed antennas (the ones we used to call antenna-counterpoise systems) are favored for flexibility and certain radiation.

(Continued on page 48)
Modulating the Screen-Grid R.F. Amplifier*

How It Behaves With Grid, Screen-Grid and Plate Modulation

In Two Parts—Part II

By H. A. Robinson, W3LW**

MODULATION characteristics for screen-grid modulation under a number of conditions are shown in Fig. 7. Here again there is a linear portion the extent of which, and hence the modulating capability, is greatly influenced by the ratio of r.f. excitation to control grid bias voltage, as well as by the tuned circuit loading. The flattening of the characteristic at the lower end, as in the case with grid modulation, indicate the impossibility of securing complete modulation (100%) without excessive distortion.

SCREEN-GRID MODULATION

The oscillograms of Fig. 8 show typical results obtained with this method of modulation. The audio voltage was coupled in at $J_1$ (Fig. 1). Trace 1 shows only a slight degree of distortion in conformity with the modulation characteristic A-2 of Fig. 7 (heavy load) while Trace 2 shows all the distorting effects expected from a characteristic

FIG. 7 — SCREEN-GRID MODULATION CHARACTERISTICS

Here again limited modulation capability prevails, with critical adjustment necessary.

FIG. 8 — OSCILLOGRAMS FOR SCREEN-GRID MODULATION

Trace 1 shows but slight distortion and agrees with A2 of Fig. 7, while Trace 2 shows distorting effects agreeing with B1 of Fig. 7.

* Abridgment of graduate thesis, Moore School of Electrical Engineering, University of Pennsylvania.

** Silver Lake Farm, Willow Grove, Pa.

† Figs. 7, 9, 11, 13 are reprinted by permission from a paper by the same author in Proc. I.R.E., Jan. 1932, pages 131-160, "An Experimental Study of the Tetrode as a Modulated R.F. Amplifier," January, 1933
of the form of B-1 of this figure (lightly loaded tuned circuit). This method of modulation permits a modulation capability of the order of 75% without excessive distortion. This degree of modulation can be secured by a modulating voltage of 50 volts r.m.s. across an equivalent impedance of the order of 50,000 ohms. This method is also rather critical in adjustment and is greatly influenced by all the factors previously mentioned in considering grid modulation.

PLATE MODULATION

When the screen-grid tube is plate modulated in the usual manner there is very serious distortion from secondary emission whenever the plate potential falls near or below the screen potential during the audio cycle. This distortion is particularly pronounced where the screen is maintained at a nearly constant d.c. potential (E_d) with no series resistor in the screen-grid circuit (R_s in Fig. 1 shorted). The typical modulation characteristics of Fig. 9 show the pronounced dip resulting from excessive secondary emission. The improvement of Curve 2 over Curve 1 results from the high output tuned circuit impedance (lightly loaded tank). However, in amateur prac-

TABLE I

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<th>No.</th>
<th>Trace</th>
<th>E_pm (Volts)</th>
<th>E_b (Volts)</th>
<th>-E_b (Volts)</th>
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<th>E_m (Volts)</th>
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<th>% Mod.</th>
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* Screen grid supplied with modulated voltage through R_s, E_pm, r.f. excitation voltage; E_b, plate supply voltage; -E_b, negative control-grid bias; E_c, screen-grid voltage; E_m, modulating signal voltage; E_ea.e., mean (d.c.) voltage on electrode modulated (control grid, screen grid, plate).
condition is clearly apparent in the oscillogram of Fig. 10, Trace 1. Trace 2 shows a decided improvement as expected from Curve 2, though the peculiar humps due to the secondary emission are still noticeable. Because of this distortion and the rather critical adjustments this method of modulation seems to have but little practical value.

The distorting effects of this secondary emission can be greatly reduced by the use of a series resistor \( R_{ss} \) (of Fig. 1) in the screen-grid circuit. At the point of the modulating cycle at which the plate potential falls near the screen potential, the increased screen-grid current flowing through this resistor increases the potential drop and the screen voltage falls. The modulation characteristics obtained by this method show a very great improvement in linearity as evidenced by the typical curves of Fig. 11. The oscillograms of Fig. 12 also show but little distortion even for complete modulation. The series resistor \( R_{ss} \) is not critical and 40,000 to 50,000 ohms seems to be satisfactory with this type of tube. The modulation characteristic is affected by the ratio of excitation to control grid bias voltage (Fig. 11) as well as by the load circuit impedance, thus requiring careful adjustment for best results.

**PLATE AND SCREEN-GGRID MODULATION**

The distortion of the modulation characteristic resulting from secondary emission can be com-

![Fig. 13 - Characteristic for Combined Plate and Screen-Grid Modulation](image)

**FIG. 13 - CHARACTERISTIC FOR COMBINED PLATE AND SCREEN-GRID MODULATION**

The linear region actually extends beyond the highest plate voltage shown, almost to 1000 volts. Complete modulation with maximum output is obtainable with this system.

completely eliminated and the modulation characteristic made practically linear without the critical adjustments characterizing all the previous modulation methods, by introducing the modulating signal in both the screen-grid and plate circuits. Thus, when the plate voltage falls during the modulating cycle, the screen voltage falls in the same proportion. This is accomplished in the schematic diagram of Fig. 1 by throwing Switch 2 to connect the screen-grid return through the resistor \( R_{ss} \) (45,000 ohms) to the high side of the modulation input at jack \( J_2 \).

The modulation characteristics of Fig. 13 indicate how successful this modulation method has been in eliminating distortion. Curve 1 was obtained with a light load on the output tuned circuit, while Curve 2 showed a negligible change when this circuit was loaded. As these curves tend to indicate, the linear region of the modulation characteristics extend to plate voltages higher than those available for measurement. This linear region extends nearly to 1000 volts and oscillograms for complete modulation with the d.c. operating voltage at 500 and a 500-volt peak modulating signal, show a negligible degree of distortion. The presence of a higher harmonic in the modulating signal input in the oscillograms of Fig. 14 and the faithfulness of reproduction in the modulated output are noteworthy.

This method of modulating the screen-grid tube proved to be, by far, the most satisfactory of all those discussed from the standpoint of flexibility, freedom from distortion, ease of adjustment for optimum performance, and maximum power output with complete modulation. Under these conditions the screen-grid tube performs in a manner similar to a perfectly neutralized triode and the r.f. power output, efficiency and audio input for complete modulation are substantially the same as for a modulated triode with the same output load. It is hoped that this modulation system and method of determining the performance of the modulated stage from the r.f. modulation characteristic will find wide-spread application in amateur phone practice.

**MODULATION METHODS AND POWER OUTPUT**

In comparing the various methods of modulation the criterion of r.f. power output should be

(Continued on page 48)
Tunable Hum

Its Cause, Effect and Elimination

By F. S. Dellenbaugh, Jr.*

Rectifiers using gas or vapor, such as the Tungar type and the now prevalent mercury vapor tubes of all kinds, frequently cause parasitic oscillations in the associated circuits. These oscillations usually consist of damped waves of uncertain frequency which can be tuned in at various points on the dial of a receiving set, and which frequently interfere with the tune of the transmitter and crawl out along the power supply wires to make general trouble in the neighborhood.

This tunable hum is frequently confused with straight a.c. ripple in the transmitter note. Since it is caused by the same power supply frequency, it will have the same apparent pitch. It can be readily distinguished, however, by anyone who has once heard it. Too little filter produces a low smooth hum which sounds more like an organ note, while tunable hum will have a raw jagged sound very similar to that of old style spark transmitters and of the electric ignition for oil furnaces.

The First Cause of Tunable Hum

Vapor rectifiers require more voltage to start conduction than to keep the current flowing. In other words, a tube may start on 20 to 25 volts but, as soon as it is started, only about 15 volts drop is required to keep it conducting. Since the rectifier has to operate every half cycle, the sudden change from starting to running voltage drop occurs with twice the supply line frequency. The effect is like negative resistance; and wherever negative resistance is present in a circuit, oscillations are apt to occur. It also can be considered as a sudden release of voltage which is applied to the circuit and causes a small but violent transient surge, which oscillates at various frequencies depending upon the circuit and tube constants.

Fig. 1 shows an exaggerated sketch of the voltage drop across such a rectifier during the conducting half wave. The sudden drop in voltage will be seen at “A.” Fig. 2 shows an oscillogram actually taken of one form of tunable hum. This picture was taken with a cathode ray oscillograph. The plate current of one rectifier tube moved the spot in one direction and the output voltage moved the spot in the other direction. Fig. 3 shows an analysis of how this curve is built up. It is a little difficult to interpret, but it illustrates the parasitic oscillations very well. The whole sweep of the curve horizontally from left to right at (a) to (b) occurs in a very small fraction of a second, since the current passing through the tube rises from zero to some definite value in a small fraction of a cycle. The frequency of the oscillations shown in Fig. 2 is about 50 kc. Other oscillograms of similar nature have been obtained with different circuits, showing such oscillations varying from a few thousand cycles to radio frequency, too high to estimate accurately or photograph.

The Second Cause of Tunable Hum

With some tubes and some circuits the rectifier tube will suddenly stop conducting when current decreases to a very small value. This is known as “shut off,” and the writer knows of several cases.

in large power supplies where defective tubes exaggerated this effect, causing breakdown of highly insulated transformers. In one case enough voltage was produced to jump across an air gap nearly one inch long, which means 15,000 to 20,000 volts. If current is flowing through an inductance, even a very small current, and the rectifier tube suddenly shuts off, the remaining energy in the inductance must be dissipated somewhere. This causes an inductive “kick” in voltage in some part of the circuit and breakdown occurs. In the case just cited there was enough energy present and the tubes were operating so badly that the voltage rose to a destructive point. The same effect may take place in a minor way and small violent transients will occur which oscillate at frequencies, controlled by the circuit constants, which may be in the radio range. This is illustrated by the oscillation from (c) to (d) in Fig. 2.

PREVENTION OF TUNABLE HUM

The best action is to eliminate the hum at the source. A large enough first choke in the filter circuit is one of the first major improvements to eliminate this disturbance. If the first choke is above the critical value the current is handed from tube to tube by the choke action and the tube starting voltage is supplied by energy from the choke rather than by power from the transformer. The choke inductance should swing with current drawn so that it is always greater than the critical inductance.

Some tunable hum may still remain, particularly with bridge type rectifiers. The next step is to make another fundamental attack and introduce buffer condensers as shown in Fig. 4. These condensers act like springs. They are charged up during a rise of voltage and, when the tube breaks down, the charge is released through the tube, supplying the current surge necessary during the sudden drop between starting and running voltage. As a rule fairly small condensers will either completely eliminate or very materially reduce any residual hum. This was the old stunt used with B-eliminators employing gaseous rectifiers of the Raytheon type and for low voltages of 150- to 200-volt condensers of 0.1 µfd. were used. Since the energy stored in a condenser increases with the square of the voltage, every time the voltage is doubled the size of condenser must be increased. This was the old stunt used with B-eliminators employing gaseous rectifiers of the Raytheon type and for low voltages of 150- to 200-volt condensers of 0.1 µfd. were used. Since the energy stored in a condenser increases with the square of the voltage, every time the voltage is doubled the size of condenser can be reduced to one quarter; if the rectified voltage is 1500 to 2000 volts (increased to 10 times), a condenser of about 0.001 µfd. should be satisfactory.

FURTHER CONTROL OF TUNABLE HUM

If an adequate first choke and proper buffer condensers still leave some tunable hum, further steps will prevent it from getting into annoying parts of the circuit. Radio-frequency chokes in

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See Dellenbaugh and Quimby articles on chokes and filters, QST, Feb., March and April, 1932.
each rectifier anode lead will help materially in this case. Because these chokes deal with the tunable hum frequency and not the transmitter frequency, they must be of considerably larger size than those used in the transmitter circuit. (See Fig. 4.)

FIG. 4B — SINGLE-PHASE BRIDGE-TYPE RECTIFIER PROTECTED FOR TUNABLE HUM

The filter input choke and buffer condensers serve the same purpose as in Fig. 4A. The buffer condensers should be connected directly to the rectifier plate at one end. The other end may be connected to any part of the filament circuit, but again short leads directly to tube terminals are preferable.

The r.f. chokes must be installed in each plate lead in the bridge and are not as effective if placed in transformer terminals only. Transformer shields should be provided on all filament transformers and the main power transformer.

A very important feature which cannot readily be adopted by the amateur, but should be furnished by manufacturers of power supply equipment, consists of a shield between the primary and secondary of all transformers operating the rectifier. This shield should have a separate terminal which can be grounded at the best spot to prevent tunable hum being carried back into the supply line and causing interferences to all other radio sets in the neighborhood, as well as to your own.

Modulating the S.G. R.F. Amplifier

(Continued from page 45)

considered as well as modulation capability. Theoretically there is only one limitation affecting every modulation method, in the case of amplitude modulation. This is the well-known relation that for complete modulation the peak modulated r.f. power output rises to four times the unmodulated carrier output. Primarily this maximum power output (modulation peaks) is limited by the type of tube, plate and r.f. excitation voltages employed and is not a characteristic of the modulation method.

In practice, however, in order to operate the modulated r.f. amplifier over the linear portion of the modulation characteristic, the conditions for minimum distortion, a departure from the optimum conditions (from the standpoint of power output) of excitation, bias and plate voltage, becomes necessary with the accompanying reduction in maximum power output. This departure from optimum power conditions is usually greatest in the case of grid modulation methods and least in the case of simultaneous modulation of both screen grid and plate. Because of the very wide variation of output loads, and available excitation in amateur practice, it is practically impossible to predetermine specific limits or the variation in power output resulting with the respective modulation methods.

* The tube rating and power output relationship for the case of a grid-modulated triode amplifier has been described by Leberg, "Making Practical Use of Grid-Bias Modulation," QST, August, 1932. — Forzon.

QRR, 1932

(Continued from page 48)

1715 kc. seems to be the best band, with 3500 kc. regarded as second. We add that 56 mc. would ordinarily have possibilities, but might be found too subject to local terrain conditions. Crystal-control is highly desirable, particularly under bad physical conditions, a single tube and a power crystal being adequate. The old familiar TNT or Hartley will perform workably, however, if the antenna is decently tight and steady, and the power supply not too deplorable. High power is not necessary; efficiency is. This means, to repeat, good, workable antenna systems. With that combination, plus a lot of hard work, a modicum of ability, and a little good luck, successful achievement seems assured.

A New Handbook

We feel like celebrating!

As we write this we are just about completing the job of rewriting and reillustrating the Handbook. For three months or more the Hq. staff has been doing work on parts of it — in as much time as could be spared from other duties. For the past few weeks the pressure has been increasing because we had to have it ready January 1st. Now, with a final flourish of midnight oil and strenuous effort, it's ready for the printer's tender ministrations.

The tenth edition of the Radio Amateur's Handbook is done and — well — with pardonable pride — we think it's pretty hot.

We built new gear, took new pictures, wrote new descriptions, condensed here and expanded there, covered all the many changes which have occurred during 1932, tried to bring everything right up to date from stem to stern.

The "10th Edition" comes pretty near to being a whole new book. It must be that momentous changes took place in Amateur Radio in 1932. At least the new Handbook looks it.
for the
EXPERIMENTER

Detectors with Screen-Grid Feed-Back

Recent QST articles emphasizing the instability of the usual regenerative detector have concentrated attention on doing something to improve matters, particularly in the case of the popular screen-grid detector. Identically the same scheme has been proposed almost simultaneously by three contributors, W2AIF, W8DYY and W5TR. Its essentials are shown in Fig. 1, recognizable as a sort of adaptation of the electron-coupled oscillator as it was first given in "Stabilizing Superhets" April, 1932, QST. The diagrams show how the usual screen-grid regenerative detector, as used in the National SW3, SW5, etc., can be re-wired to use it. Advantages claimed are more stable oscillation, less blocking, reduced background hiss, smoother regeneration control and just as good, if not better, sensitivity. Incidentally, the idea is not unlike the scheme of using the tickler in the screen-grid circuit, as it was described by Howard Cassler in December, 1931, QST. The essential difference is that here the screen is at ground r.f. potential and the cathode is "up in the air," whereas the screen was fed through a choke and the cathode was grounded in the older arrangement. Basically, however, both are the same breed.

Key-Click Preventer

In Fig. 2 is the diagram of a key-thump filter used by C. C. Richelieu, W9ARE, which has proved its effectiveness in a number of different instances. W9ARE has this to say about it:

"The system has been used at W9ARE during the past two years with never anything smaller than a 50-watt tube in the output stage, running with varied inputs of from 100 to 250 watts, and it is the only system that has worked out satisfactorily. I have also given this diagram to numerous hams throughout the Middle West and to the best of my knowledge it has never failed to accomplish its purpose. WSKE at Frankfort, Michigan, is the latest adopter, and reports that he has tried every system ever given in QST or the Handbook during the past three years without results and that this system actually eliminated all clicks and thumps."

"This filter will change the adjustment of one's transmitter slightly if placed at the transmitter proper with lengthy leads run from the transmitter to the operating desk. To eliminate this

FIG. 1 — DETECTOR WITH SCREEN-GRID FEED-BACK

A — the usual screen-grid regenerative detector; B — the revised circuit, with changes shown in heavy lines. Circuit constants are usual, although in B a smaller tickler may be used.

FIG. 2 — KEY-THUMP FILTER WITH NO IRON-CORE CHOKES

RFC — 150 turns of No. 28 d.c.c. on 1 1/2-inch form. C1 — 5µfd. (must be rated to stand full plate voltage). C2 — .006µfd. mica condenser. R1 — 2000-ohm wire-wound variable resistor. R2 — 50,000-ohm variable resistor, any type. R3 — Filament center-tap resistor (may be c.t. of filament transformer).
drawback the filter should be placed on the operating desk right at the key, where it will have an appreciable effect on the transmitter adjustment. Also, the $C_2$ capacity can be increased on certain transmitters with marked improvement — all the way from .006 µfd. up to 1 and even 2 µfd. Considerable arcing at the key contacts will result from the larger condenser, but this arcing will have no effect in a BCL receiver because it is blocked by the r.f. chokes. In some cases the larger type condenser works much better.

**A Novel Class B Modulator**

A Class B modulator using an ordinary power transformer for coupling between the modulator and Class C amplifier is being used successfully by W5ANB. The primary of the transformer is connected in series with the secondary, as shown in Fig. 3, thereby becoming an auto-transformer. This gives about the right impedance match, provided the transformer primary is poled correctly with respect to the secondary. The connections should be reversed when giving the system a trial to see which way gives the better audio power transfer. It is advisable to feed the modulated amplifier through a choke as shown in preference to running the Class C plate current through the coupling transformer because otherwise one side of the transformer will carry all the d.c. for the modulated amplifier and the system is likely to be thrown off balance.

The coupling between the driver stage and the modulator also is of interest because it utilizes transformers originally designed for a different use and offers the opportunity of using a transmission line between the driver and modulator.

**A Neutralizing Kink**

By H. B. Churchill, W2ZC

Generally the greatest trouble experienced in high-power amplifiers after neutralization is from continual breakdown of the neutralizing condenser unless it is rated at twice the plate voltage or so. The following trick was hit upon at W2ZC and saved expensive neutralization condensers for the 500-watt stage and works beautifully.

The neutralizing condenser is connected to an amplifier side of the grid condenser, as shown in Fig. 4, instead of the old method of going directly to the grid. It is often common practice to run the last two stages from the same supply or at approximately the same voltage, and with this method the neutralizing condenser has no d.c. difference in potential across it. With the 852-204-A combination it is possible to use a neutralizing condenser of low breakdown voltage rating. With the old method such a combination required a 6000-volt neutralizing condenser at W2ZC to hold down the voltage.

As applied to smaller transmitters, for instance with a Type '10 feeding a 50-watter, this method is also a great saver. The 50-watter has 1000 volts on its neutralizing lead, while the '10 has perhaps 500 on its plate and the other side of the neutralizing condenser. Both these voltages are positive with respect to a common ground; hence the difference in potential across the neutralizing condenser is 1000-500, or 500 volts. A midget receiving condenser will do now instead of that big double-spaced affair.

Only one further consideration enters, and that can be quickly discounted. The grid coupling condenser is in series with the neutralizing condenser and therefore becomes part of the neutralizing capacity. If the grid condenser is the usual .002 or so, however, there will be very little effect on the setting of the neutralizing condenser (reciprocal sums, with large condenser in one fraction).

**FIG. 3—CLASS B MODULATOR WITH AUTO-TRANSFORMER COUPLING**

- $T_1$ — Transformer designed for coupling a pair of Type 47 tubes to a 15-ohm load.
- $T_2$ — Transformer designed for coupling a pair of Type 45 tubes to a 15-ohm load.
- $T_3$ — Power transformer with center-tapped 1200-volt winding and 110-volt winding.

**FIG. 4—A NEUTRALIZING CIRCUIT WHICH MINIMIZES VOLTAGE BREAKDOWN**

This has been a life-saver at W2ZC. For very high power as much as a 12,000-volt breakdown neutralizing condenser was needed at certain times. Now a very insignificant condenser sits serenely in the final stage and doesn’t turn a hair.
Simple Method of Obtaining Blocking Voltage

BLOCKED-GRID keying is popular among amateurs, as the many ideas along this line published in QST prove. Here is another method of supplying the extra grid-bias voltage required by the system. It is contributed by Andy Hammerschmidt, W8EGZ.

The transformer $T$ in Fig. 5 is a 3:1 audio transformer, 3:1 happening to be the ratio W8EGZ had on hand. Any ratio will be OK if the secondary voltage is high enough to block off the r.f. tube when the key is open. The rectifier is a 201-A with the grid and plate tied together; here again any type of rectifier will serve just as well. Condenser $C$ has a capacity of one µfd., which is enough to keep the output voltage fairly constant. Ripple of supplying the extra grid-bias voltage required is of small consequence since the voltage from the transformer, 3:1 happening to be the ratio W8EGZ had on hand. Any ratio will be OK if the second­

![Fig. 5 - Inexpensive Voltage Supply for Blocked-Grid Keying](image)

Although W8EGZ uses leak bias on his amplifier, the scheme can be used with any kind of bias supply so long as the key can be put in the grid-bias lead.

Announcing — The Fifth International Relay Competition

Worldwide DX — All Hams Invited — To be held March 11-19, 1933 — Contest is for two-way DX QSOs — All parts of the World — with U. S. A./Canada

SELF-ASSIGNED SERIAL NUMBERS

Any amateur station, anywhere, can take part without advance entry. Each operator taking part will assign himself a distinctive three-

numeral group and use this throughout the contest as the first part of each number exchanged. Numbers exchanged will have six figures, the latter three taken from the first half of each number-­combination received. To confirm your first contact, since no numbers will then have been received, the six-figure group sent will consist of the three numbers which identify you in each log, followed by three “naughts.”

AWARDS

Beautiful, new, bronze charms, inscribed with the call signal of the winners and bearing a design symbolic of amateur radio work will be awarded, (1) one in each remotely located country or territory — all hams using the same prefix compete for an award, and (2) in each of 64 A.R.R.L. Sections, mainland U. S. A. and Canada (see page 5, QST).

Since the special charm-awards will be made to the operator of the highest scoring station in each continental area, this puts all operators using the same prefix in competition with each other — and similarly each A.R.R.L. section-boundary circumscribes a competing group. DX-transmission characteristics being the same for all operators in each award-area, the chances of being a winner depend on operating ability and stations are equally fair to all.

SCORING

Both the W/VE station, and the station in the remote locality receive one point when the W or VE serial number is acknowledged by the station in the remote locality. Each operator, similarly, may add two points further when a six-figure number (to U. S. A./Canada) is acknowledged or OKed by a W/VE station.

After all the individual scores have been added together, this sum, in the case of W or VE participants, is to be multiplied by the number of countries or localities (prefixes) worked to give the total score. In the same way, those taking part in other different countries (remote), multiply their total of points by the number of U. S. and Canadian districts they have succeeded in contacting, to give the total score. There are nine U. S. and five Canadian licensing areas making a possible multiplier of fourteen!
And here's a "bird" of a QSY: Not long ago W9DKD tuned up his transmitter on about 3560 kc. in the early part of the evening. Coming back three hours later, he let out a CQ and raised a chap who reported him on 3450 kc., although the transmitter hadn't been touched in the meantime. A clamon from the back yard attracted attention to the antenna, and there, upon investigation, were some fifty blackbirds roosting on sky-wire. After shooting off the birds W9DKD went back to the set and the frequency was back in the band again.

Election Returns — de W1MK
(Continued from page 56)

Amateurs” by your A.R.R.L. Headquarters station W1MK.

Continuous, cumulative, and rapid-fire telegraphic election returns — those who invited friends and families to “sit in” had the thrill of a great evening.

The first such transmission of election returns to all radio amateurs and . . . it was a great evening.

Some statistics:

W1MK frequencies — 3825 and 7002 kc. (500-watt set on each).
Date — November 8th—9th.
Time of transmission — 8 hours and 8 minutes (continuous) following one hour “QST”).
Telegraphic speed — Approximately 22 words per minute.
Election returns via Western Union service, from entire U. S. (excluding Alaska, Nova Scotia, Ontario, Jamaica, B. W. I., Balboa, C. Z., and by the U.S.S. Bushnell, off the west coast of Mexico)

It is impossible to quote from all of several scores of acknowledgments. Some representative comments are indicative of the wide general use and appreciation of this A.R.R.L. service, however:

"Congrats on the manner of handling the returns. 75% of our bulletin board reports were from your transmission. — NY1AA." "Much appreciated service. QSA5 R9 3825. — VE1AP." "Congrats — splendid service. — VE9ST." "Very easy to copy and returns FB until hurricane came our way. — VP2PA." "On mill 7 p.m. until 1.45 a.m. Had figures to check back on which I could not get down from other services. — W1CDX." "Returns copied and successfully bulletinized in Wilko Town Hall with help of another amateur. — W1CDX. " "Very interesting. — W2NV." "Enjoyed the fast service. — W3BKQ. " FB. Looking forward to 1936. HL. — W3BTE. " Congregation at abash. — W4ACB." "Returns copied here 10-8 all evening and still going strong when we left hay 11.50 p.m. C.S.T. — W4PM." "Thanks for FB returns QSA4R7. — W3BN. "Returns 100%. "Good signal 7002 kc. 7 p.m. to 9.30 p.m. P.S.T. Had messenger to take stuff to local newspaper office. Thanks for service. — W6QA." "Much pleased. The figures were much more interesting than the long-winded experting on b/c chains. Thanks for the service. — J. F. Hayes." "QSA3 R5 6.45 to 7.45 p.m. M.S.T. — W7COH." "Like private wire in home. — W5EIE. "Comment by statement men most interesting. 12:45 summary solid. — W7CIL. "Appreciated enjoyable service. — W8DBX." "Had tip wire and half-hourly reports. Dope fm W1MK 1 to 14 hrs. before that over our wire. Announced amateur data via P.A. system with FB credit to amateurs. — W8EVC." "St. Joseph Valley Amateur Radio Club (4 ops) posted bulletin in the window from your service. — W9AB." "Copied solid. — W9PUT." "QSA5 R6. — W9CDE." "Received returns 6 p.m. to midnight. — W9BK. "Sure appreciated. — W9BN. "You scooped the broadcasters on lots of the dope. FB operating. Fine code practise as well as first-hand information! — W9IYA." "75% your dope copied here 7002-R5 3825-R7-9. — W9ACE. "Dope FB, who furnished wrist oil? — W9FUT." "The entire transmission was a success and sure fitted in with our scheme of things on board. Had planned to copy KUP, but when we heard you on 7002 we decided to copy you. Well pde note and steady signal. Started to copy you 5:30 p.m. some plus 8 time. From then until 10 p.m. you were Strength 6, after that Strength 7. We were then in plus-8 time, off Acapulco, Mexico. Stuck to you until 12:30 plus-5 and as we had all dope we needed, knocked off copying. Thanks to you we got the latest and the first. — V. S. Wisniewski, NEFS, U.S.S. Bushnell, en route Balboa from Diego." Also from "Uncle Sam's Last Frontier," Ketchikan, Alaska, "Claim long distance record copying your election returns on 3500 kc. R4 through QRN. 8.15 p.m. 135th meridian time. — R. J. Fox RFQ." "How" the service was conducted will be of possible interest to those who used it. Each man present at W1MK had his hands full every minute from the start at 5 p.m. to the finish at 2:30 a.m. E.S.T., November 9th. Western Union provided an operator to receive all information on the loop run into the station operating room. The A.R.R.L. operators alternated jobs, taking care of (1) necessary editing (2) actual transmission through operation of the tape perforator, and (3) the monitoring of both transmitters constantly to check for any errors, for insertion of the call signal at least once in every 15-minute period, and to correct any necessary adjustments to insure that both transmitters put out full power at all times on the stated frequencies. The monitoring operator also was ready to take up the transmission by hand should anything go wrong with the automatic equipment. Only once was this necessary for a five minute interval, when changing tape reels on the perforator. Also, using a "midget" in the power supply room, the service was checked up before the tests. Only twice was the service compared with broadcasting station reports to check the speed of one service against the other. Believe us, it was a busy evening — a "heat" and endurance run for station equipment, and personnel. We hope you liked the service.

— P. E. H.
## CALLS HEARD

**VE4BQ, John L. Green, 115 Furby St., Winnipeg, Manitoba**

14-mo. band

<table>
<thead>
<tr>
<th>Call Sign</th>
<th>Frequency</th>
<th>Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>VE4BQ</td>
<td>14-mo.</td>
<td></td>
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<tr>
<td></td>
<td>115 Furby St.</td>
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</tbody>
</table>

**W6DB, W. C. Putnam, c/o Shell Pipe Line Corp., Box 637, McCamey, Texas**

7000-kc. band

**1WBO, Malcolm Bruce, 9 North St., Plymouth, Mass.**

14-mo. band

**W3GGF, A. S. Krispinsky, 712 Model Ave., Youngstown, Ohio**

7-mo. band

**WBCO, Joe C. Camay, Texas**

1000-kc. band

**WBCO, Joe C. Camay, Texas**

1112-kc. band

**WBCO, Joe C. Camay, Texas**

14-mo. band

**WBCO, Joe C. Camay, Texas**

7-mo. band

**W3GGF, A. S. Krispinsky, 712 Model Ave., Youngstown, Ohio**

14-mo. band

**W6DLF, Aubrey J. Hopkins, 5138 Hawley Blvd., San Diego, Calif.**

7-mo. band

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**January, 1933**
Devoted to the interests and activities of the
INTERNATIONAL AMATEUR RADIO UNION

President: H. P. Maxim
Vice-President: C. H. Stewart
Secretary: K. B. Warner

Headquarters Society:
The American Radio Relay League, West Hartford, Conn.

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American Radio Relay League
Association E. A. R.
Associations Radiotechniques Italienne
Canadian Section, A.R.R.L.
Deutscher Amateur Sendee-und-Empfangverein
Dansk
Experimenterende Danske Radioamatører
Lwowski Klub Krakowskow
Nederlandsche Vereeniging voor Internationaal Radioamateurisme
New Zealand Association of Radio Transmitters
Norsk Radio Relais-Liga
Radio Society of Great Britain
Rode dos Emissores Portugueses
Reenau Belgis

Conducted by Clinton B. DeSoto

Among the many possibilities of interest brought to us by the approach of the 1933 New Year, is that of witnessing the near approach of the awaited sun-spot minimum, when our predicted radio cycle will reach its first high spot since 1923, the year international amateur radio was inaugurated. We can expect increasingly better DX on the lower frequency bands — unfortunately along with correspondingly increased interference — and more spotty operation on the higher frequencies. The 14-mc. band will, it is anticipated, work miraculously some days, not at all on other days. We will not be able to definitely analyze or predict these minor changes for some time to come, but their observation can be a highly valuable and absorbing phase of amateur activity during the coming year. In general, the intensely interesting period of radio "weather" that we have been closely observing for the past year or two, will grow even more fascinating during 1933.

An innovation in field days is to be attempted by the R.S.G.B. during the week-end of June 10 and 11, 1933, when a National Field Day is to be held. All British districts will place portable stations in operation and points will be scored for contacts with other districts and with foreign stations. Extra points will be counted for QSO's with foreign portable stations. It is hoped that as many European societies as possible will assist in making this the largest field day ever organized. All correspondence in connection with this event should be directed to R.S.G.B. headquarters at 53 Victoria St., London, S. W. 1.

Unreliability seems to have been the keynote of 14-mc. operation during the past summer and autumn. At times, in the various localities, strong signals poured in from all parts of the world. These periods were usually of short duration, however, and were intermingled with spells of fading and days and nights when there were no signals at all. In Europe, during the summer, the good periods were very brief, often not lasting for more than half an hour. The antipodes and Asia were the most inconsistent, although many W QSO's lasted only long enough for an exchange of reports. PAAQQ reports signal strengths of RS as being quite frequent, but for rag-chewing and the Olympic Games traffic-handling going on at that time, the band was unreliable.

WSAYU has analyzed conditions during October as being half bad and half good, the first two weeks being excellent. The last half, on the other hand, he regarded as very poor. A pickup during the first part of November corresponds with observations here in New England, European signals appearing almost every morning in which listening was done.

54 QST for
An announcement from the R.S.G.B. gives the rules for the 1933 B.E.R.U. Contest. Two events are to be staged, one for the Senior Trophy (power unrestricted) and the other for a new Junior Trophy (input 25 watts maximum). A B.E.R.U. receiving contest will also be held at the same time. The Senior contest will take place during the first two week-ends in February, and the Junior contest during the last two week-ends. The receiving contest will continue throughout the four week-ends of the tests.

The 1933 contests will be open to all members of Honorary B.E.R.U. Affiliated Societies, as well as to individual B.E.R.U. members. This arrangement was made by the R.S.G.B. to meet the wishes of certain overseas societies.

In connection with the R.S.G.B.'s 3.5- and 28-mc. tests, which were announced in this department of the December issue, word has just been received that these contests will extend from 1200 G.C.T. Saturday to 2400 G.C.T. Sundays, and not from 0001 G.C.T. Saturdays to 2400 G.C.T. Sundays.

Multiply the struggles of every beginner breaking into the amateur game by a hundred-fold, and you have a fair estimate of the early radio experience of Mg. Hla Aung, Burma's pioneer radio amateur. "I started in the game in about '26," he writes. "Nobody on the air and nobody to work. Listening hams were a rarity. With difficulty I rigged up a 40-meter xmitter using home-made parts, as no suitable equipment could be bought at any price in Burma at that time. Then I found nobody in town or outside owned a short-wave set."

Of necessity, all experiments were abandoned until 1928. In that year, however, "I built up a 20-meter transmitter with receiving apparatus, using 180 volts from batteries on a receiving tube. For a fortnight I called CQ, with no result. Then, one day, the thrill of a lifetime came. I was listening to stations from abroad one evening and envying the great number of amateurs heard calling CQ. I heard one PK station, very loud, calling a long CQ. As he finished, I switched on the weird-looking equipment I called my transmitter, with dignified steadiness of hand, as if I had been in the game for a century and working the antipodes were mere child's play. A moment; then I switched off and listened. The great thrill of my life came — the answering signal 'r r ok ur sigs de etc. etc.' So astonished was I that when I answered him my key turned into a bug, dots becoming dashes and dashes becoming dots. My hand stiffened, paralyzed; I couldn't move it. That night I could not sleep. I had only one watt of power."

Now, as VU2AC, Mg. Hla Aung is a full-fledged amateur, constantly active. He lives at 103 Pagoda Road, Rangoon, Burma, the only native among Burma’s three amateurs.

The annual meeting of the R.S.G.B. is scheduled to be held on December 20th, when Dr. E. H. Reyner, a vice-president, will deliver a lecture.

A real fever of 56-mc. work seems to have enveloped most nations recently, with the unique possibilities of this band being fully appreciated for perhaps the first time. In Great Britain, on September 25th, the first organized 56-mc. field day was held by the four London districts. G6YK, G6CI, G6UT and G2NH were the active stations. Several contacts were established, a full account of the work appearing in recent issues of The T & R Bulletin. The enthusiasm has spread to most other parts of the British Empire, in South Africa, New Zealand, Australia. H. B. Arthur, ZL1AN, made a strong appeal for more New Zealand 56-mc. activity in a recent issue of Break-In, and the result was a large amount of apparatus-building. In Hong Kong, in Shanghai, and in the other internationally known radio communities, five meters is rapidly attaining the status of a major diversion.

In the Netherlands, the Rotterdam section of

January, 1933
the N.V.I.R. has a number of 'phone stations working duplex on sked. A test between ship and shore found contact being maintained until the ship was 5 km. out in the North Sea. The southern districts held a 56-mc. field day with successful QSO's over 10 to 12 km. A number of relay tests and experiments with reflectors are now being conducted.

Attention of amateurs in all parts of the world is invited to the announcement of the Fifth International DX Contest elsewhere in this issue. This year the rules will be somewhat simplified in that no entries whatsoever will be required, and every amateur can take part. Instead of exchanging messages as in previous years, participants will exchange self-assigned serial numbers for identification purposes.

The winning participant in each country will be awarded an especially engraved watch charm, bearing the victor's call signal and a suitable inscription.

Our occasional references in text and picture labels to the types of Philips tubes in use at many foreign amateur stations has led to wonderment on the part of some amateurs, particularly in North and South America, as to exactly what sorts of tubes these type numbers indicate. The following information concerning a few of the more popular Philips transmitting tubes should help to clarify this confusion.

The TC 03/5 corresponds roughly to the American type '15, using plate voltages from 150 to 300, with a maximum plate dissipation of 6 watts. The amplification factor is 6; the plate resistance 2500. Up to 10 watts can be taken out of it as an amplifier, although the rating is 5 watts. The TC 04/10 can be said to correspond with the type '10, permissible plate voltages being 200-500, with a maximum plate dissipation of 10 watts. The amplification factor is 25; the plate resistance 12,500. The power rating is approximately twice that of the TC 03/5. These tubes have two horns on top for the grid and plate connections.

The screen-grid QC 05/15 resembles the type '05. Plate voltages are 400-500; screen voltages 75-125. Maximum plate dissipation is 15 watts. Amplification factor, 225; plate resistance, 160,000. It is a queer looking tube by American standards, the grid terminal being on the top while the plate connection is made near the bottom of the glass envelope. The element construction resembles a group of telescoped square metal boxes. All of these tubes have 4-volt filaments, the last two drawing 1 ampere, the TC 03/5.20 amperes.

In the higher power class we find, corresponding to the '03A, the TC 1/75, which has a 10-volt filament drawing 1.6 amps. Plate voltages from 800 to 1500, maximum plate dissipation 75 watts, amplification factor 25, plate resistance 5000. The highest power triode is the TB 2/250, having the same power rating as the '01A. The 11-volt filament draws 3.18 amps.; plate voltage is 1000-2000; maximum plate dissipation 150 watts.

The 75 watt screen-grid tube, the QB 2/75, resembles the 860 not only in characteristics but in appearance. The maximum plate dissipation, at 2000 plate volts, 300-500 screen, is 75 watts. The filament consumption is 3.25 amps. at 10 volts. The amplification factor is 200, the plate resistance 150,000.

Brief items of gossip from the month's mail: Further with regard to the LOA, etc., calls discussed in our September '32 issue . . . . These stations are British Army stations, not Navy; the latter are nearly all c.c., omit the "rough stuff," and work on 8500 kc., or so says a VS6 correspondent . . . . . . . LOA is actually in VS6, he adds, and "gives us a pain in our respective necks" . . . . . . . Another new African prefix (new so far as we're concerned, at least) reported by WSAYU — UH1AA, in French East Africa . . . . . . . The UH prefix is assigned to Hedjaz, and the low-pitched r.a.c. on 14.3 mc.

(Continued on page 90)
DX—Then and Now

ANYONE who may have lived through the good old days of ham radio prior to the war will verify the excellent receiving conditions that obtained at that time. Delware Valley Radio Association News (Jolly) has a contribution by F. E. Handy, Communications Manager, who may have lived through the good old days of ham radio prior to the war. Mr. Jolly has been associated with radio for many years, and his report is of great interest.

In 1932, with a modern c.w. transmitter at NAX and a regenerative detector and two-stage amplifier at this end, signals are no better, if as good as they were in 1913. We used crystal detectors. Indeed, we used crystal detectors in 1913, and we have been able to hear signals from the old 1 k.w. spark at NAX ten to fifteen feet from the phones. (The wheel came off the non-synchronous rotary once and went through the roof of the shack.)

In 1912 while working for the United Wireless Co. on ships equipped with a double-sider tuner and carbon granule detector, I have copied press from WCC (Chatham, Mass.) on 1800 meters while in South American waters. Try to do it now. With a 1-k.w. spark and this receiver I have exchanged traffic with "NY" the old United Wireless Station at 42 Broadway, N. Y., while cruising in the West Indies, and have played checkers with "HA" (Cape Hatteras) while 500 to 600 miles off shore, in daylight. In 1915 while docked at Jamaica, I have copied press three solid hours from WIB (New York Herald) in spite of tropical QRN — using crystal detector with no amplification.

All the above seems to indicate the changes in propagation conditions that are taking place, at least on the longer wavelengths. I am not trying to intimate that crystal cathode detectors can compete with vacuum tube detectors as described by Professor F. E. Handy, Communications Manager, who may have lived through the good old days of ham radio prior to the war. However, the changes seem to be typical of the conditions that were better in the days we used crystal detectors.

O.R.S. QSO Party

FIVE O.R.S. Parties have been held to date, each more successful than the last. The number of reporting participants has been progressively higher each time, and the scores rolled up have similarly grown larger.

In the October 22-23 QSO Party, W9AUH reported the highest score. He worked 90 Official Relay Stations (of 184 heard by him) in 35 different A.R.R.L. Sections. The winners from the inception of our O.R.S. Parties have been: W8DFE 47 worked in 19 Sections; W9IU 57 worked in 30 Sections; W5BMI 78 worked in 32 Sections; W9AUH 90 worked in 35 Sections.

The eleven highest scoring stations having over 5,000 points are indicated below. Detailed information on the scores of the 229 reporting participants in our October 22-23 O.R.S. Party will appear in the January 1933 Official Relay Station Bulletin to be issued shortly. This is mailed exclusively to A.R.R.L. Official Relay Stations, affiliated radio clubs and field organization officials.

Relay Reliably—Originate Only

Good Traffic

In RECENT operating work I have paid much attention to the way some of the fellows route messages. I have sent messages and tracers to see where they went, and how fast they travelled. Some interesting things were learned. One message for Canada was found 200 miles further from its destination than the starting point, and had been through four Texas cities. Also I had the experience of listening to two stations sitting and trading traffic (without regard to its destination) just to run up their totals. These are typical examples of inexcusable inefficiency in the relaying of message traffic. The few fellows guilty of such practices and irresponsibility ought to consider what they really accomplish by such haphazard work. Real relaying requires some brain work. Any operator who has a degree of real amateur...
spirit will accept responsibility for such traffic as falls his lot to relay. Such an operator will use intelligence in routing messages. They will be placed never their destination, or put in the hands of operators who have schedules which will place the dispatches close to their destination. Our "real" operator, moreover, will try to move his traffic speedily onward, and will never be caught and shamed by being overheard engaging in senseless or corrupt traffic practices.

The good operator also will not originate worthless messages either. Such traffic causes deliveries to fall short of their destination, or get through quickly. Poor, meaningless traffic should be cancelled or ·Treasure Hunt" for portable station W3CHS. An official (W6HM and W6A W). It was resolved that the present overcongested amateur bands" if possible. lt was decided to offer amateurs "Travelers" and to make the necessary construction day next. The transmitter was so well hidden none of the contesteb found it although within 500 or 1,000 feet of the spot several times. At noon the directions to proceed to the basket lunches was transmitted - baseball, swimming and canoeing followed.)

F. 1. CONVENTION

On July 3rd a Philippine Section Convention was held at Calauan, Laguna, and went over with a bang. Hams from the most northerly district as well as the Southern islands were in evidence. Practically every active amateur in the islands was on hand. KAIJR and KAI SL were reelected as regular officials. Greetings were sent mainland A.R.R.L.

The following is a supplement to the list of A.R.R.L. officials (W8HM and W1AW). It was resolved that the present overcongested amateur bands) if possible. It was reported that Japanese stations were unable to QSP, but that the Japanese Consul promised this ruling might be modified soon. KAIAC KAIJR KAIUP KAIISP KAIISL KAIRT KAIJA KAIWR KAILG KAIJR KAIYL KAIJD KAIKI KAIEL KAISS KAIST KAA 50 KAISS KAIJO KAIPE and KAIJR were all well represented at this successful get-together.

Traffic Briefs

W5ANR wants to know how much filter you have when you have six miles of factory-made and four miles of homemade, and then a Rhode Island Red hen lays an egg in your power pack! Yes, it actually happened!

BRASS POUNDERS' LEAGUE

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| W2W4 | 278 | 156 | 434 |
| W8VP | 91 | 169 | 260 |
| W5PJ | 39 | 31 | 70 |
| W8PTV | 41 | 18 | 59 |
| W8BPY | 91 | 67 | 158 |
| W6K | 403 | 166 | 569 |
| W8PBT | 263 | 335 | 598 |
| W9LT | 129 | 105 | 234 |
| W8FX | 56 | 120 | 176 |
| W8FG | 83 | 30 | 113 |
| W3FJ | 91 | 137 | 228 |
| W8DFN | 67 | 41 | 108 |
| W8BNF | 47 | 121 | 168 |
| W8K | 403 | 166 | 569 |
| W9CTT | 150 | 126 | 276 |
| W4J | 45 | 168 | 213 |
| W8MK | 123 | 148 | 271 |
| W2X | 9 | 31 | 40 |

O.B.S.

The following is a supplement to the list of A.R.R.L. officials (W8HM and W1AW). It was resolved that the present overcongested amateur bands) if possible. It was reported that Japanese stations were unable to QSP, but that the Japanese Consul promised this ruling might be modified soon. KAIAC KAIJR KAIUP KAIISP KAIISL KAIRT KAIJA KAIWR KAILG KAIJR KAIYL KAIJD KAIKI KAIEL KAISS KAIST KAA 50 KAISS KAIJO KAIPE and KAIJR were all well represented at this successful get-together.

Traffic Briefs

W5ANR wants to know how much filter you have when you have six miles of factory-made and four miles of homemade, and then a Rhode Island Red hen lays an egg in your power pack! Yes, it actually happened!
Traffic Briefs

Sparks, published by J. B. Sanders, W6CDQ (Editor, Glen Talbutt, W6AUL; Assoc. Ed. and Advr. Mgr., Roy Taylor, W6JF) is by and for Fifth District hams. It is printed weekly on 10 whole pages of ham dope in the August number — a fine example of amateur journalistic enterprise, and only 50 cents a year. Activities are looking up, down in the Fifth, and sparks will work to add "pep" and ham excitement in West Gulf and Delta divisions. Dedicated to Fifth District hams Sparks is in a position to give special attention to the interests and peculiarities to that locality.

The Bluefield Amateur Radio Club (West Va.) was sponsored by a hamfest with some 50 of the fraternity in attendance on Sunday, August 7th. The meeting opened with a luncheon at the West Virginia hotel. Guests were welcomed by Lawrence M. Dunnam, W8EIK (ex-ZY1, 1951), the club President. Speakers were Capt. J. A. Hammond, Signal Corps Reserve, U.S.A.; Lt. Howard C. Welling, S. Minn. signals whether they are answering my CQ or calling CQ S, (:j.M.C. Reserve, and J. Frank Key, W3ZA, who discussed antenna systems. Luncheon period doings were broadcast over WHIS and trips to the local airport and ham stations were arranged. A number of the gang remained over until Monday, at which time examinations were conducted by F. M. Kratokvil, Federal Radio Commission Inspector of the Detroit office. The Bluefield Amateur Radio Club is holding weekly meetings. There are 18 members at present. Plans to dedicate to Fifth District hams Sparks is in a position to give special attention to the interests and peculiarities to that locality.

Some operators with bad signals wouldn't get 81% of their calls answered as some hams seem to think they do. Wouldn't this be a sure way to clear up the situation? If other hams wouldn't work them, the operators with poor signals would be forced to clean up their notes. . . . W6LDL

Directional CQs bring results: Having ordered radio parts from a New York firm and wishing to find out if the order had been sent W6APM called "CQ N.Y.C." Turning on the receiver, and without even touching the dial, he heard a "W2" answering the call. This "W2" was just a few blocks from the firm from which W6APM had ordered the parts! . . . Another example of positive directional CQs is told by W6CVR. He gave W6CAP a message for the Naval Academy at Annapolis, Md. W6CAP called "CQ East," and was answered by NEDF. W6CAP inquired, "QSP Annapolis Naval Acad?" and NEDF replied, "'H Annapolis, Mk." Thus the message was put right to its destination. . . . Still another example of QSOing the spot wanted is related by W3EWF. With a message for W6EYJ he tuned around looking for a good traffic station to QSP. Having no likely station he sent out a "CQ"—imagine his surprise when he was answered by W6EYJ! Not only did W6EYJ clear his message but W6EYJ had traffic for two members of W3EWF's local club . . . W4CP, Rocky Mount, N. C., tells of his successful use of the directional CQ. A southern Missouri, N.C. station was not working W6CKO, W9EQG asked W6CKO to QSP, took the traffic from W4ACM and QSped to W6CKO.

Relative Traffic Standings

(October—November)

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<th>Messages Per Station (25%)</th>
<th>Stations Reporting Traffic (25%)</th>
<th>Gain or Loss (Traffic Spread) (35%)</th>
<th>Traffic Total (25%)</th>
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The ten highest sections

S. C. M.

Michigan 47.5          Ohio 45.5     Missouri 45.5
Los Angeles 45        Colorado 45      Washington, D.C. 45.5
Northern California 45  Florida 40       Maine 40
Cincinnati 40           St. Louis 40     Minnesota 40

The "Michigan" again "turns the trick" and MICHIGAN holds the Banner for the second consecutive month. Next in the same Ohio, Dayton and Los Angeles, A. A., for the fifth consecutive month and another "all time high" in number of stations reporting traffic with 196 traffic reports! Michigan is also well over the 100 mark with 130 stations reporting traffic. The "M" is a very fine show of support for QST's "traffic" section. A gain of 179 over the same month last year. Y36 takes the third place in traffic reports, and the National Traffic Total is almost 5000 sets above the previous records.

January, 1933 59
**Code Practice**

We announce the addition of the following transmissions to the list of "1715-kc. Stations Sending Code Practice" on page 30, December QST — W8CFE, Oakland, Calif., 1039-kc., Tuesdays and Fridays, 8:00 p.m. P.S.T.; W8RBP, Oshawa, Ontario, 1903-kc., daily, 7:00-8:30 p.m. C.S.T.; W8FCH, Appleton, Wisc., 1900-kc., daily, 7:00-8:00 p.m. C.S.T.; W8UO, Aurora, Ill., 1945-kc., daily, 8:00-6:45 p.m. C.S.T. W8CFE offers a subscription to "code learners" in the middle west; Station 1SAC, Manhattan, Kansas, broadcasts code lessons on 580-kc. for one hour each Saturday, 12:30-1:30 p.m. C.S.T.

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**WIMK Schedule**

Effective January 1, 1933 the following schedule will be used at WIMK for the transmission of "Official and Special Broadcasts" to A.R.R.L. members:

- **Sunday**: 8:30 p.m. E.S.T. 3825 & 7150-kc.
- **Monday**: 8:30 p.m. 3825 & 7150-kc.
- **Tuesday**: 8:30 p.m. 3825 & 7150-kc.
- **Wednesday**: 8:30 p.m. 3825 & 7150-kc.
- **Thursday**: 8:30 p.m. 3825 & 7150-kc.
- **Friday**: 8:30 p.m. 3825 & 7150-kc.

The transmissions at the times listed are at approximately 13 words per minute, and make good code practice for more advanced beginners. Try it sometime.

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**ATLANTIC DIVISION**

**SOUTHERN NEW JERSEY**—SCM, Gedney M. Riger, W3QL — W3ZJ was afflicted with acute appendicitis. W3ARV has moved to Moorestown. W3APN was QRL election. New o.c. rig for W3ZJ. W3ACJ will be on with new MOPA. W3BEX is out for ORS. W3BiD hooked a V.K. W3BEI reports two off frequency. W3BMY was in Sweepstakes. W3AEJ has nine schedules. Walch for W3ATJ's W8FCH offers a subscription to "code learners" in the middle west; Station 1SAC, Manhattan, Kansas, broadcasts code lessons on 580-kc. for one hour each Saturday, 12:30-1:30 p.m. C.S.T.

Traffic:

**WESTERN PENNSYLVANIA**—SCM, C. H. Grossarth, W8CFE. "Sked trouble," says W8FKU. W8DYF reports on the 16th. Get the habit. W8HGG is looking for morning schedules. W8ELZ is for more advanced beginners. Try it sometime.

W8VY has nine schedules. Watch for W3ATJ's W8FCH offers a subscription to "code learners" in the middle west; Station 1SAC, Manhattan, Kansas, broadcasts code lessons on 580-kc. for one hour each Saturday, 12:30-1:30 p.m. C.S.T.

Traffic:

**MARYLAND-DELWARE-DISTRICT OF COLUMBIA** — SCM, Harry Gimbler, W3NY — W3ARAK, E. L. Hudson, RM. W3BWT, W. E. Darce, Chief RM. The Washington Radio Club had 70 present at their Hamfest, Nov. 12th. The Delmarva Amateur Radio Club was organized Oct. 18th; W3QCS, Pres.; W3WJD, Vice-Pres.; W8KDS, Secy.; Marion Blades, Treas. Ted Smith delivered a talk on "Velocity Microphones" at the Nov. 18th meeting of the Institute of Radio Conference. Special credit is due W3ZD for his schedule with EAR96. W3HI is on 56-mo. 'phone. W3ELZ is out for ORS. W3BBD hooked a VK. W8DLV reports for the Greensburg gang, W8BVM, W3HJR, W3HXS and W3VWD. W8DDU is for more advanced beginners. Try it sometime.

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Traffic:

**WASHINGTON, D. C.** — SCM, Gedney Riger, W3QL. "Sked trouble," says W8FKU. W8DYF reports on the 16th. Get the habit. W8HGG is looking for morning schedules. W8ELZ is for more advanced beginners. Try it sometime.
Western New York — SCM, Don Farrell, W8DSP-GV, turns in a fine BPL total. W8FPM is a new O.O. W8DXW was QRL Sweepstakes. W8HUI is now located in Norwich. W8AGS has a new Zepp, W8BUI has been rebuilding. W8CJJ is using '40s for doubler and buffer. W8DBJ reports 50-mc. tests being conducted by the Gloversville Junior High School. Radio has become a troop of Boy Scouts. W8DHH is using car. Thanks to W8AJ. W8BFG's unorthodox receiver works swell. W8DMF handled some important traffic. W8AWX is QRL school. W8CWT reports new hams in Penn Yan. W8BMH, W8BFV, W8DJI and W8DME are building new bandstreaks. W8FYT has portable W8ZZOS. W8BEX is using new o.c. job. W8CDB has done some fine 56-mc. work. W8DLA has all his transmitters going. W8ELW has borrowed his 50-watters. W8FQQ and W8KKG qualify for ORS. A.A.R.S. schedules keep W8AXL XYL. CQs are now handled by W8ELW XYL. QSOs with the other. Hurrah for Glasgow, W8KBV and W8DFI report with traffic. W8FPM is working much DX on 14 mc. We wonder what W8FZL has in his shack besides radio equipment. W8EI of "one-tuner" fame is on at Bowling Green. W8HUI has the phone bug. W8ASU is getting good reports on new Class B. W8JPA has first-places operator's license. W8DSP is all puffed up about his new ticket. W8KWO at Oshkosh and W8KZC at Winchester are new stations. W8JHU forsook radio for triclonometry. W8JPI is carrying on in his place. This month's rag-chewing honors go to W8GJJ. W8CDA is forever rebuilding. Landlord remodeling basements keeps W8FZV from pounding the airwaves. "No time for radio, going back to school this year," says W8AJ. SCM extracts report from W8ETD by using his official appointment, report regularly on the 16th each month. Starting Jan. 1, 1933, there will be a general cleaning out of all dead-wood in the Section. If you are interested in keeping your official appointment, report regularly on the 16th of each month XYL.

Traffic: W8FDPY 551 DBX 458 DII 231 AGS 120 EUY 64 C4J 43 BDK 40 CMH 27 DFK 24 BPG 18 DME 18 AXW 18 GWT 14 BFF 14 GWE 15 AXU 9 DFP 8 EKF 5 AED 3 OWW 97 DFW 18 P00 1232 DPH 443 90 BPL 10 BHF 1 GNS 59 DLA 27 DMJ 22 2Y 2 CLP 16 GPF 16 BCL 13 EWE 15 FFF 4 AKX 2 G7M 93 GPS 16 GPN 16 ERO 19 GWY 8.

Central Division

Kentucky — SCM, Carl J. Pfumm, W9GXX — HOT-ZIGGITY! Traffic increases over 300% this month. W9AUII leads state; makes BPL. W9ZBIZ-W9BJI is moving to Owensboro Dec. W9CBD is off to a good start. W9YQQ and W9KGK qualify for ORS. A.A.R.S. schedules keep W9AXL XYL. CQs are now handled by W9AXL XYL. QSOs with the other. Hurrah for Glasgow, W9KBV and W9DFI report with traffic. W9FPM is working much DX on 14 mc. We wonder what W9FZL has in his shack besides radio equipment. W9EI of "one-tuner" fame is on at Bowling Green. W8HUI has the phone bug. W8ASU is getting good reports on new Class B. W8JPA has first-places operator's license. W8DSPW is all puffed up about his new ticket. W8KWH at Oshkosh and W8KZC at Winchester are new stations. W8JHU forsook radio for triclonometry. W8JPI is carrying on in his place. This month's rag-chewing honors go to W8GJJ. W8CDA is forever rebuilding. Landlord remodeling basements keeps W8FZV from pounding the airwaves. "No time for radio, going back to school this year," says W8AJ. SCM extracts report from W8ETD by using his official appointment, report regularly on the 16th each month. Starting Jan. 1, 1933, there will be a general cleaning out of all dead-wood in the Section. If you are interested in keeping your official appointment, report regularly on the 16th of each month XYL.

Traffic: W8AUIH 412 DBX 210 OX 174 CIM 136 FQQ 107 HAX 70 BAN 90 CNE 50 BAJ 49 BAZ 48 JYO 44 ERH 43 EQQ 40 FJJ 32 JPM 27 FZL 21 E 30 ELL 14 ETD 13 FJI 10 C1 9 EYW 5 IFM 5 IPU 5 GJZ 5 KGI 5 CDA 2.

Indiana — SCM, A.L. Braun, W9TE — W9ABW has a receiver with new tubes. W8ABW worked a Q5. W8AET makes BPL. W8AKU is having trouble with his dynatron. W9XZBZ-W9BRZ is seeing more amateurs are F8. B8ADL has electron controlled osc. W8DML has his new 56 mc. W8BCC reports traffic picking up. W8BKH has new temp. oven. W8CKB made a fine showing in the S.S. W8CDA is going strong. W8CDW is QRL PA. W8CDA says local club going strong. W8CDW spends most of his time handling traffic. W8LLU cracked his crystal. W8ESU is big shot in A.A.R.S. W8EFD did FB in ORS QSO Party. W8EEO is doing FB traffic work. W8EUF and W8OLO report for W8EEO. W8EUX has trouble getting out. W8FQQ ops at W9ERO. W8KFK is coming on with a new o.c. rig. W8FYY wants to get in A.A.R.S. W8FSP has a 175-mc. phone. W8FUT sent up big in S.S. W8FXY is QRL work. W8DML and W8DFI are rebuilding. W8FZL is building a dynatron. W8GCP with ad. 211. W8FFP says his ant. is no good. W8HUII has new Zepp. W8HUII is new ORS. W8HUU has the phone bug. W8HUII has his hat in the ring for ORS. W8HUII wants ORS. W8HUII says someone stole his call. W8JSM is getting to be a real traffic hub. W8HUII took 'phone exam. W8JKK says S.S. is FB. W8KSP's receiver went haywire. W8SRS spends 70% of his time on the air with traffic. W8TBE worked a K4. W8VZB makes BPL. W8WUL is tuning up. W8WUL at Evansville. W8AOM makes crystals oscillate. W8ABW wants ORS. W8JQF is in crystal. W8M2Z and W8KXY are new in Richmond. W8YUW is new in Ft. Wayne. W8HJFQ and W8QWE are building new o.c. rig. W9AM1 works plenty DX. W8EUX cut out a pair of "10s. W8DML is
having trouble with c.o. rig. W9QGH has QSY to 3.5 mc. W9HUF is experimenting with new receiver tubes.

Traffic: W9FTU 1001 YB 661 ESU 305 AET 229 CKB 129 C9G 121 TB 120 DHJ 93 JKX 92 HML 60 EJJ 53 HUO 48 FTX 47 EPT 41 HXK 33 EEO 32 BKJ 32 JHY 29 EX 28 AXJ 19 H9Q 16 FIX 15 IOW75262 JSM 14 AXH 12 AKJ 10 CHA 8 HU5 8 FSP 4 G3G 4 HSF 2 AEB 2.

ILLINOIS - SCM, F. J. Hinda, W9APP -- RM N. F. Section Ed Wilson W9DDE -- XM N. W. Section E. A. has submitted these reports, greatly helping up the good work. W9FFQ has a neat rack and panel job. W9KRI is rebuilding. W9JKQ changed QRA. W9DSS has a new MG. W9JLJN has 45s PP. W9ZCB has an MOPA. W9GRI is run by W9HUX in Racine. W9IQQ is a sock in that town. W9BTQ is building a 211E PP-MOPA. W9KSB is a newcomer. W9DX is doing nicely with his sound truck. W9UQK says, "When bigger and better trades are made -- W9XH will make them," W9PD is doing 211E. W9GID is working VK. W9DIN is going to fix up receiver. W9UWY says, "All the time W9FDN has is 24 hours a day." W9AIZ’s position is back on the Coast. W9IYY blew his 211E. W9HOK is up with the leaders. W9DLA sends first report. W9FX has received trouble reports. W9DHM says the Burlington Radio Club had a shocking Hallowe’en Party with the aid of a spark coil. W9KHD is rebuilt. A new bug at W9HAV. W9FQH was QSO Martinique. W9ABA has worked VK, ZL and ZH. W9AEC is a new 50-watt crystal. W9CJE works VK and ZL. W9HMB has PP-MOPA. W9SG is the new call of W9IJA. W9FRA is building a new 50-watt crystal. W9JCE works VK and ZL. W9HMB says, "All the time W9FDN has is 24 hours a day." W9AIZ’s request is for a new bug.

Traffic picking up at W9CZL. W9FGD is trying for a Commercial Broadcast ticket. The Triple R net is in full swing -- so says W9BTT. W9CKW is a new man at Aurora. W9CQK says contents are lots of fun. The portable at W9AVB is now o.c. W9EWN says skip plays hob with traffic. W9DZC cracked crystal, blew filter condenser and made 10 turn blue. Twin 7-pound babies were born at W9CZX. W9DX is going to join the A.A.R.S. W9JW says "All the time W9FDN has is 24 hours a day." W9AIZ’s request is for a new bug.

W9BQD has QSY to 3.5 mo. W9HOR is on 3.5 mo. W9HKL is rebuilding. W9DRO and W9AZN donated some money for "QRZ." W9IFL is putting in a pair of '10s. W9AHJ and W9BXZ have new rigs.

Station. W9EYX is building a crystal transmitter. W9EHD is trying to get ORS appointment. W9A VG is trying to get some interest in ham radio. W9AVG says what's become of W9BSS. W9GTD and W9KIQ are building transmitters. W9HG likes 7 mc. W9JCW is getting good results. W9KXR is a new ham. W9DZJ is waiting for his crystal to work right. W9FSS and W9EYX have been getting DX. W9QZ is a new ham. W9FFQ has a neat rack and panel job. W9GKI is trying to get W9KLR’s license. W9GKI has a new call of W9IJA. W9FRA is building a new 50-watt crystal. W9JCE works VK and ZL. W9HMB says, "All the time W9FDN has is 24 hours a day." W9AIZ’s request is for a new bug.
sored a real hamfest at the West Side Y.M.C.A. in Cleve­
rebuilding. WSEDY has worked 175 stations since Sept.
JO minutes. WSEXI fellows. District No. 6: RM W8BBH. Second report from ORS. A real report comes in from Windy, W8GZ, for work and near Shelby, on a visit to W8PO, Nov. 13th. W8UW ia using portable W9ZZBZ. The Lakewood Radio Club apon­
building up the district. W9BW.T is now at Ironton, Ohio, RM W8EEQ has a new rig about finished. Firat report since
district. No. 4: RM W8EEQ. W8DTW radio•
be on much. W8VP makes the BPL both ways. District
No. 8: RM W8CGS. W8BKC
WlMK, W9FHV, W9FUT, W8CGS, W8DLG. District
No. 7: RM WSVP. BCL radio service work at W8C.KX. W8DFR. Give him your cooperation. W8HPH handled

January, 1933 63
394 BMG 386 BGY 325 BMZ 294 CEU 256 BMZ 231 CEU 164 EGI
7 BRS-GMB-GQC-EZM-ERX-BIU 6 FIO-CPY 5 AAF-EBB
FRF-.AJL-FQD-HHQ-WR-FGW-HPH-GSP 4 CFM :1
148 AYO RQQ 15 IBM 14 BBP 13 VL 12 CEX 10 IJH-CWR 9
HOT 21 FXB-FQE-DLX 20 FQF 19 JO-DA 16 BIK-BUH-HPL consistently. W9BKK's second consecutive month in
FBC 5 KPW 4 EGF 2 EEM 1 CSI 53 HK 424 EVI 20 DQT
DYR 6 CAT 3 BEP 2 DUR 2. WBCE 75 DAB 59 HXB 42
YX 12 GDJ 4.

NORTHEAST DIVISION

Traffic: W9DGS 449 EVQ 289 HJC 247 EGI 121 DYA 118 IGH 107 TK 96 IHS 60 34 CFL 23 JVF 23 SFF 17
GB 6 ENM 6 DXY 5 ZJH 6.

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GB 6 ENM 6 DXY 5 ZJH 6.
still works them. W5AVY will be on soon. W5KG reports traffic. W5PFR is on phone. W5WF hits the Sweepstakes full force. We want more traffic. Don't forget to report on the 16th of every month.

Traffic: W2BFL 5 HR 12 YW 12 BYQ 10 APA 18 BYX 26 BZK 13 AIF 68 AMR 61 AIF 16 CO 61 CO 18 EJK 10 EKM 10 EKM 8 EJF 3.

ARKANSAS—SCM, Henry E. Velte, W5ABI—W5FX has left the state. W5ABL gets out well. W5AJ and W5GR report by radio. W5BUX is rebuilding. W5CR reports. W5IQ hands in a nice traffic total. W5BXW is located at Fayetteville. W5W is working three bands. W5BZU sends first traffic report. W5BGM was on during Sweepstakes. W5BRI says, "Nearly sober for month. Hi." W5ANR sends first traffic report. W5BSG was on during Sweepstakes. Our best wishes, W2DQD; will be looking for call on W2OP. W2BER is revamping to MOPA. W2DMH is force. We want more traffic. Don't forget to report on the Sweepstakes. W2DQF is QRL working.

Traffic: W2BZZ 531 BJA 372 LU 205 CQH 185 UL 147 ACD 90 ENY 83 BJP 77 ANV 77 DQD 77 DTV 76 BVY 72 ATM 71 DRO 74 BXX 90 DFC 23 ORS 15 CTA 74 BBL 14 ACY 12 10 BRR 9 DMI 7 QY 3 CJS 2 ENC 52 DJ 55 CFU 14.

NORTHERN NEW JERSEY—SCM, Walter A. Cobb, W2CO—For the fifth successive month this Section doubled its traffic total! Chief credit for our standing goes again to W2DIU. Runner up is our RM, W2BPY. A good third is W2TP, W2DPU is getting out FB on 14 mo. W2CUI doubled his traffic total in the ORS Party. W2AMR is experimenting. The Newark Amateur Radio Association helped W2EFR and W2EMM get their licenses. W2CIZ keeps portable W2ZZW working on 3.5 mo. The need of a '10 keeps W2CIM from putting his rig on 14 mo. W2BGW gets a schedule with W2CIV. W2CIV is Cleveland. W2DQF is in Mobile again. W2AIF has hopes of making BPL. W2DMG wants schedules in all directions. W2CDP, Ex-2BGG with spark in 1921, reports. W2WR threatens to get on the air as actively as he was ten years ago! W2AFIAT spends 99 percent of his time swapping fables with Aussies. The Union County Amateur Radio Assn. is holding regular meetings; W2DZS is engaging in lining up technical speakers for the bunch. W2LJ is a newcomer in Matawan. In the same town, W2EUK is holding the fort. Another old time of 1921 vintage comes to life in the person of W2BYJ. All messages going through W2BXM are handled on schedules. The world's record for proximity of stations is held jointly by W2CIC and W2CTV, the two transmitters being located exactly 5 feet 7 inches apart. W2CQ is on W2QD. W2WY is being remodelled for higher power. W2RH is striving for maximum coverage with minimum watts. W2TR is using the same MO he used in spark days. A new 14-mo. 'phone rig engages the attention of W2BUX. W2VBW has been brushing up on his Morse. W2CTU got his crystal rig on the air. How to get rid of chirps has W2CWL guessing. W2EKM helped W2EFC rebuild; W2DEE visited along the New Jersey line, W2EKM, W2EPX, W2ENP, Ed Felch and the SCM conducted an all band transmitter. W2LB keeps Navy schedules. W2COR reports 56-mc. work. W2AIFAT, W2DR reported to the second floor. W2ALD QSOs West Coast on 3.5 mo. W2HC reports making 56-mc. tests from an Army plane with W2RZ and W2WY.

Traffic: W2BPY 529 TP 256 CJX 92 AIF 68 AMR 61 AIF 16 CO 61 CO 18 EJK 10 EKM 10 EKM 8 EJF 3.

NEW YORK CITY AND LONG ISLAND—SCM, M. J. Grainger, W2AUS—The great work done by RMs, W2AZV, W2AZM and W2CWF results in the biggest month heard often. W2QY is coaching the boys to get that pigskin over the mark. W2CJS is trying TNT. W2BZS is inactive. W2DQF is using '24 Electron coupled OAC, '40 Buffer, '10 final Amp. W2ENC erected 70-ft. mast. W2DGU is heard with a new transmitter. W2BLA was nominated for SARA Pres. W2BZK is on 20 mo. W2WY is in New Rochelle. W2DJ hits the Sweepstakes. W2CQF is QRL working.

Traffic: W2BZZ 531 BJA 372 LU 205 CQH 185 UL 147 ACD 90 ENY 83 BJP 77 ANV 77 DQD 77 DTV 76 BVY 72 ATM 71 DRO 74 BXX 90 DFC 23 ORS 15 CTA 74 BBL 14 ACY 12 10 BRR 9 DMI 7 QY 3 CJS 2 ENC 52 DJ 55 CFU 14.

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Traffic: W2BPY 529 TP 256 CJX 92 AIF 68 AMR 61 AIF 16 CO 61 CO 18 EJK 10 EKM 10 EKM 8 EJF 3.
call with raw a.c. W2BGO now has five transmitters. W2FF schedules Jamaica, B.W.I. W2APV reports another schedule. W2BRR has new schedules. W2COI has a new transmitter. W2BDR, at college in Iowa, talks to his OM at home via W9JL and W2COI. W2AGL is rebuilding traffic. W2BUD becomes eligible for ORS. W2DQK handled church bazaar traffic. W2DCF is a new reporter. W2BWW has a new power supply. W2BQL is planning schedules for President Hoover. W2AIQ is recruiting for A.A.R.S. W2COI has five transmitters. W2FF daily schedules. W2COI reports. W2BDR, at college in Iowa, for President Hoover. W2AIQ is recruiting for A.A.R.S. on talks to his OM at home via W9JL and W2COI. W2AGL reports blown tubes. W2CJ reports poor traffic. W2BST reports success on 3.5 me. W2BWD wants to see W2APV. W2CBB has new pentode receiver. W2CYX reports poor schedules. W2APV has a note for B.W.I. W2CBB has new pentode receiver. W2CYX 3 DBA 1 BWL 2 BST 10 LR 41 CFH 15 AQN 31. W2DQK has a high total. W2CUH reports four handled church bazaar traffic. W2DCF is a new reporter. W2BRB is now located at Bellmore. W2CHK spent some moved to Queens. W2API is active in Astoria. W2AUS is a dog. W9GXV reports new call in Hiawatha, amateur working most stations Sunday afternoons for the gang. W9IEW promises big things. ORS Party has been resumed. It is being held on Sunday afternoon. W9IOL is Ex-NNCAB Ex-post. W9KLD until the Lincoln gang. W9KLD is trying to line up the bunch in Omaha. W9EEF is starting in the traffic game. W9GTM is rebuilding. W9EOL will soon be on. W9FFB is getting some trouble with QRM. W9BDF is facing DX trouble. W9FFD is third place. W2BQL is planning schedules. W2COI is planning schedules. W2BDR is at college in Iowa. W2AGL is rebuilding traffic. W2BDR, at college in Iowa, talks to his OM at home via W9JL and W2COI. W2AGL reports blown tubes. W2CJ reports traffic. W2BST reports success on 3.5 me. W2BWD wants to see W2APV. W2CBB has new pentode receiver. W2CYX 3 DBA 1 BWL 2 BST 10 LR 41 CFH 15 AQN 31.
Getting better. W9DHN reports some talk of organizing a stakes contestant. W9FEH-CJR is QRL court. W9DUM.JLE-EWT-KLJ-KJK 2 ENK-JPC-COH-DUM-KNH-22 HCP 21 DVV 21 ,JPT 20 RR 18 EHS 17 JYC 17 FYU-8500 kc. WlCJO is building new receiver. WlAXL is keeping busy, WlGTS 6 li'YM 5 BGE-FAL-FKF-HUI-GIH-UC 4 ZZ-ANG

Club: Five members of the club attended a meeting in St. Louis preparing for the BIG MIDWEST DIVISION contest. W9IN left for California with W9ZZCA for winter. W9FVM-CON paid a visit from Arkansas U. DON'T FORGET THE CONTEST!

New England Division

Traffic: W1DIJ report. W9FVM-CON sent in resignation as ORS. W9BFS is working "swell" W9FSU is asking for sky hooks for his portable W1FHI. W1BEU showed the gang at the Waterville Hamfest how to tune a transmitter. W1DAW will send in first report. Miss Eva R. Perkins is working on another electron coupled oscillator for his portable. W1BPN has come back to radio, his first love. W1CIZ reports the "Paper City Dial Twisters" have "amalgamated." W1BSJ is designing an electron coupled oscillator for his portable. W1BFN has come back to radio, his first love. W1CVF is Chicopee's only ham.

January, 1933

67
Taft won in ten moves. W1BH was busy in the S.S. W1QV is arranging schedules with ZL and EAR. W1CTI wants to sell cheap. W1APW paid a visit to W1CBA. W1BEF is getting out on the air. W1ERU spends part of his time on 1.75 mo. W1DBU, W1CVD, W1DCI, W1BMP, W1ASP, W1AJB, W1CTO, W1HQ, W1ESD, W1CUH, W1DF, W1UZ, W1CDS is trying some test schedules. W1TD is getting out DX on 7 mo. W1AHC has his shack to keep schedules. Following report traffic: W1AUK reports by radio. W1APZ was laid up in the S.S. W1QV is arranging schedules with ZL and EAR. W1CTI wants to sell cheap. W1APW paid a visit to W1CBA. W1BEF is getting out on the air. W1ERU spends part of his time on 1.75 mo. W1DBU, W1CVD, W1DCI, W1BMP, W1ASP, W1AJB, W1CTO, W1HQ, W1ESD, W1CUH, W1DF, W1UZ, W1CDS is trying some test schedules. W1TD is getting out DX on 7 mo. W1AHC has his shack to keep schedules. Following report traffic: W1AUK reports by radio. W1APZ was laid up in the S.S. W1QV is arranging schedules with ZL and EAR. W1CTI wants to sell cheap. W1APW paid a visit to W1CBA. W1BEF is getting out on the air. W1ERU spends part of his time on 1.75 mo. W1DBU, W1CVD, W1DCI, W1BMP, W1ASP, W1AJB, W1CTO, W1HQ, W1ESD, W1CUH, W1DF, W1UZ, W1CDS is trying some test schedules. W1TD is getting out DX on 7 mo. W1AHC has his shack to keep schedules. Following report traffic: W1AUK reports by radio. W1APZ was laid up in the S.S. W1QV is arranging schedules with ZL and EAR. W1CTI wants to sell cheap. W1APW paid a visit to W1CBA. W1BEF is getting out on the air. W1ERU spends part of his time on 1.75 mo. W1DBU, W1CVD, W1DCI, W1BMP, W1ASP, W1AJB, W1CTO, W1HQ, W1ESD, W1CUH, W1DF, W1UZ, W1CDS is trying some test schedules. W1TD is getting out DX on 7 mo. W1AHC has his shack to keep schedules. Following report traffic: W1AUK reports by radio. W1APZ was laid up in the S.S. W1QV is arranging schedules with ZL and EAR. W1CTI wants to sell cheap. W1APW paid a visit to W1CBA. W1BEF is getting out on the air. W1ERU spends part of his time on 1.75 mo. W1DBU, W1CVD, W1DCI, W1BMP, W1ASP, W1AJB, W1CTO, W1HQ, W1ESD, W1CUH, W1DF, W1UZ, W1CDS is trying some test schedules. W1TD is getting out DX on 7 mo. W1AHC has his shack to keep schedules. Following report traffic: W1AUK reports by radio. W1APZ was laid up in the S.S. W1QV is arranging schedules with ZL and EAR. W1CTI wants to sell cheap. W1APW paid a visit to W1CBA. W1BEF is getting out on the air.
over the antennas-clippings in his back yard. W7AZW is Navy op at NPF. W7ATC is c.o. W7CQU wants pictures of his shack. W7BDA is F.G.R. at W7BDO and W7BQV is W7BPV's antenna. W7BMA, W7BOO and W7AYV, of Astoria, visited the SCM. W7AYJ is looking for traffic with tears in her eyes. W7AJX is re-papering the shack. W7C0C has a single "45. W7ASEK worked a W in Virginia with 25 volts on a 25. W7C2Z and W7A2Z are still going out. W7HD is new ORS. W7ED delivered 11 from K7FF. W7FE reports. W7WR says skip is tough. W7AFE is QRL Weather Bureau. W7WL handles important eastern traffic. W7AEM reports the following. W7BEM is active. W7BAD, W7AYV, W7C7L, W7BLR wants a job. W7ALD was an F3 on the Amplifier. W7AIQ wants to be an ORS. W7BOH worked a "J" and XU1U. W7SY is quite a rag-chewer. W7BOA keeps plugging along. W7AJX has plenty of schedules. W7ALM was active in S.S. W7RLC is going 1.75-mc. 'phone. W7AXK worked England and Belgium. W7AWI is QRL post-office. W7BTH got some filter. W7PK says all the YLs want to marry him. W7AJM reports that the junior op, age 25 yrs., has to be locked out of the shack. W7BPA and W76TF are both c.o. W7AFP has F6 signal. W7BSXU is from Forest Service. W7BYC has phosphor bronze antenna. W7BTS is rebuilding. W7AMQ is moving. W7ABZ finds that neighbor's super-het makes an F3 monster. W7C5N at Port Angeles is now in its new club rooms, Room 401, Imperial Hotel, and W7WD and W7AMQ are on G.T. in Kitsap County. W7BWI is at W7FJ's place. W7S5K at Seattle has trouble with R.F. W7LD and W7ABU use e.o. oscillators. W7AHJ turned in a nice total. W7BZX has installed a commercial S.S. W7B6B is a W7AEG member. W7CBA keeps plugging along. W7AXJ has plenty of space and plenty of eyes. W7BTS is rebuilding. W7AMQ is moving.

K7HA, and W7A WI. W7TFZ worked a "J" and XU1U. W7BYB, W7BOO, and W7CQV are new ORS. W7AVV is active. W7CIK reports health improving. W7AGP has antenna tied to a church steeple. Did we hear a "kick" from W7BYF and W7CHH off the air. W7WY is A.A.R.S. W7HS relayed a message, originating in Spain, reached its destination in less than forty minutes! W7ADR should be on air soon using portable W7UU at Seattle. Mr. and Mrs. Wallace are ugging the new 300-watt rig at W7AYO. RM.

WASHINGTON — SCM, John P. Gruble, W7RT — Congratulations to W7NR for making BPL and leading Section. W7NR was active in S.S. W7VO schedules K7FF, K7EA, and W7AHE. W7TTS tried grinding a crystal. Lack of space is antenna problem for W7ACF. W7BCN is using tourmaline crystal on 14 and 7 mc. W7AVM completed a new shop at Aberdeen. W7SL will use W7AG when new receiver is ready. W7ASW is c.o. on 7120 kc. Illness kept W7CHH off the air. W7FY is A.A.R.S. W7H5L relayed a message from East Coast to California, with result that the message, originating in Spain, reached its California destination in less than forty minutes! W7ADJ should be on air by now. W7BCC turns in a nice total. Most of W7Ps' traffic is having to go to W7CQV for QSLing e.o. W7CQV is using c.o. portable equipment for communication with his trapping cabin. W7BNW is handling traffic in great style. W7BMY reports receiving conditions rotten at his shack. K7ATM got back on the air after a month's trip to Pacific Side of the Alaskan islands. VE650X was a visitor at K7PQ. K7BQ7's license expired on him. K7HVM is on the air. W7DAF turns in a nice total. K7BQAQ is active at Port Angeles. K7AFT is ORS applicant. W7KV Broke his leg in basketball game. W7CCN is on the air. A three stage 50-watt transmitter at W7BCB. K7CKK is using W7CSS at Seattle. W7WBG, Ferndale, is member VCR, Seattle's YL operator. Miss Norma Jenner, is getting RS-HD reports from Tokyo, using e.o. portable, W7BKB depends on portable equipment for communication when in mountains. W7BUW is to use 50 mc. 'phone soon. Following stations help Yakima's traffic activities: W7ATU, W7AYC, W7BUX, W7BYB, W7DUQ, W7BWB, W7COK, and W7CMQ. W7BDA declares K7G6V quits W7BCR. K7DAF got a call,

PACIFIC DIVISION

NEVADA — SCM, Koston L. Ramsey, W6EAD — W6API is high man again. W6BOU has a second op now, Charles B. Newcombe, Jr., who just got his ticket. W6FMS is now an ORS. The University of Nevada W6XAR had a station in operation on Homecoming Day. W6AXX reports traffic. W6F0U is rebuilding receiver. W6EAD is building a 50-mc. receiver. W6CSP lost all his licensees in moving. W6BHR is QRL school. W6GO is going back on air. W6ATN is heard occasionally. W6AAR is working good DX. W6FME is on with a 52. W6F2F is a new transmitter. W6ATP is at the Air Force Academy.


January, 1933 69
Traffic: K6EQG 213 AUJ 47 EDH 42 ACW 16 CRT 14 COG 6.

EAST BAY — SCM, S. C. Houston, W6ZM — Alreda C. E. Cron, J. H. MacLafferty, W6JN, W6NAC contributed to the section this month. W6JN says that Trunk "F" and RM work keep him plenty busy. W6ZM pointed out a few Drury Show invitations while arranging for the show booth. W6BYF is a leader of a few of the show messages. W6ABF has a daily schedule with W6DDE at Salt Lake City. W6AAC reports in two years. W6YMA reports in two years. W6BAM reports a few of the shows. W6AYB sent the reports in two years. W6CBF announces that he will send W6CSV and W6AC reports. W6HH, W6CZQ and W6NB are new good reports. W6CDA is home from the hospital. W6DKJ handled a few of the show messages. W6AF has held open home oil the night of Nov. 10th; ops were W6ZM-W6AKB-W6TT-W6ALH and W6AMN assisted at the show. W6DUB is looking for DX. W6YM sends a good report. W6CDA is home from the hospital. W6CZQ and W6NB are new good reports. W6ABF is a new ORS. W6ORS sent in his first report in two years. W6BF reports that he will send beginners code practice every Tuesday and Friday at 8:00 p.m. on 1369 kc. W6AH1 (Ex-W7EKG) is on the air with c.q. W6CQP is building new receiver; no supply. W6AFQ has been QRL work. Contra Costa County: W6EAJ discovered that 3.5 mc. is FB for traffic. W6AAE says W6FQ is back in control. W6FQ and W6GMB have worked W6HCA with a fine QRM. The Hammond Memorial Bug was presented to W6CDA at the last Hamfest. A new contest is on from Oct. 15th to Apr. 15th to see who will get it for the next six months. Send in reports not later than the 16th.

Traffic: W6NAC 492 RJ 233 ZM 200 GMX 142 AF 134 AAC 114 YJ 98 NB 83 AQ 60 DUB 49 EJA 37 YM 14 CDA 11 DKX 10 CAN 9 CSV 5 HH 4 CIZ 4 QZG 3 DRS 9 AAT 1.

SANTA CLARA VALLEY — SCM, Bruce Stone, W6AMM — To all my knowledge, this is the best report ever received in the SCV Section. Congratulations on a wonderful report! W6FQY turned in the highest total—his first report, too! W6BYF ran him close. W6DKJ is an old-time amateur with a fine IQ. W6HHH, a fine Tran-Pacific total, is the only one to make the BPL. W6YQ has a daily schedule with W6FOO. W6AMM's total seems to have suffered this month. W6EFN has a good total in spite of college work. W6BMW reports QRN hindering 85 traffic. W6YLJ carries three schedules. W6BBB sent the results of the St. Marys vs. U.C.L.A. football game to W6CMU. W6DKJ reports sending P. I. schedule. W6CDA finished the seventh round with W6ABF time on the air. W6BRW is hard at it again, working P. I. schedule. W6CIS, our SCM, is continuing P. I. schedule. W6BMC is handling a few of the show messages. W6AFQ has held open home oil the night of Nov. 10th; ops were W6ZM-W6AKB-W6TT-W6ALH and W6AMN assisted at the show. W6DUB is looking for DX. W6YM sends a report. W6CDA is home from the hospital. W6CZQ and W6NB are new good reports. W6ABF is a new ORS. W6ORS sent in his first report in two years. W6BF reports that he will send beginners code practice every Tuesday and Friday at 8:00 p.m. on 1369 kc. W6AH1 (Ex-W7EKG) is on the air with c.q. W6CQP is building new receiver; no supply. W6AFQ has been QRL work. Contra Costa County: W6EAJ discovered that 3.5 mc. is FB for traffic. W6AAE says W6FQ is back in control. W6FQ and W6GMB have worked W6HCA with a fine QRM. The Hammond Memorial Bug was presented to W6CDA at the last Hamfest. A new contest is on from Oct. 15th to Apr. 15th to see who will get it for the next six months. Send in reports not later than the 16th.

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former. W6COH expects to attend technical school in Texas. W6DRX has moved to a better location. W6AAAM is very blue lately 'cause the R.I. told him he had waited too long before renewal of his prise call, held since 1921.

Traffic: W&BIP 293 EXH 196 AOA 110 DZN 73 AME 68 W6DRX has moved to a better location. W6CFN has moved to a better location. W6CFN has moved to a better location.

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Sacramento, will be very pleased to receive your traffic and

Traffic: W6UM gets out well with an '01A with 180 volts. W6UM schedules Danville. W3EAI has low power 1.75-mc. 'phone. W6GAC gets out well with an '01A with 180 volts. W6UM schedules Danville. W3EAI has low power 1.75-mc. 'phone.

Traffic: W6GAC gets out well with an '01A with 180 volts. W6UM schedules Danville. W3EAI has low power 1.75-mc. 'phone.
Western Division

W4FBN 17 W2ARK 12 W2DFY 9 AVY 8 W7BXS 5 ACQ 7 W9KRV 4 W7SJR

Lo-oco Division

SCM, Artie Dave, W9BJN—W9ESA is on the air, again today. Our Director W9AAB has been on again during the last and shore back. W9BTO will be on soon with new outfit. W9COK reports for the W9COK, W9WAC, and W9WDQ. W9QX. W9KQY is kicking out. W9FJD is in effect. In use. W9GKZ has the record for not completing QSOs. "G" phone, W9KRV is times. Greeley: W9EDM is QRL college and KFKA. W9FQJ are awaiting the R.I. Leadville: W9GEG built a new recall; same for Earl Leonard. Woodman: W9JNV makes the BPL. FBI Colorado Springs: W9EYN assists KOA in a

W8FRN 17 W7ARK 12 W8DFY 9 AVY 6 W7BXS 5 AVW 6 W7BXS 5

stakes. Ovid: W9JGF, W9ZZAR is going to be back in W9GQX. W9KKY is kicking out. W9JFD is active in ACQ 5 W6DTB 4 W7CJR 2. W9JQN V lost his tag. W9DNP is QRL KVOR. W9JCQ has W9ESA is on the work Duplex 'phone. W9JQN V is remote control. W9FXQ out FB. W9HOU has a file telephone pole to support his ant. expects to be on 'phone soon. W9GL is Prof. at North W9FQK-W9HPR is on 3.5 me. W9IGO moved to Willing­

W9BTO will be on soon with new outfit. W9CKO reports will be on 1.75 mo. W9ATM is on some. W9ACV is kicking for some time. W9HON has a 250-watter. W9CSR is QRL college. W9CWX is heard now and then. W9CNL and Bramwell passed his ops license exam. W9EJW is on 7 me. W9FHX is pushing W9HQT, Bill Groves and Melvin Collier are QRL KLZ. W9QZ is QRL KFXF. W9HPY has built new receiver. W9FYY and W9HRI are QRL school. W9FYK, W9BYC- W9BCL of Cheyenne, Wyo., paid the Dever hams a visit. W9IA V is building MOPA. Bill

The Florida R.I.'s office is now in Miami. W4KB went through the exam with flying colors. W5ZZR is in our midst. W4AIL-W4VCZB AGRAGB, and W4QZD is portable. W4UW-W4NO is at WCO for the W4CMS-W4ZQZ exam. W4ASV-W4ZZW moved his station downstairs. W4VR is rebuilding. W4AUI is on 14,000 kc. W4ML is selling out. W4AQI-W4PD in is the movie business. W4AXP is pounding some more work. W9FJF does a great job. Ex-W4ADV is applying for W4MXZ's call. W4AQA is active. W4QI is getting all set. W4AV has a new transmitter. W4WOB is quiet. W4BMI worked all districts on 6500 kc. W4ACB let his portable expire. W4QR is busy with 'phone business. W4AQA is keeping the U.S.N.R. going. W4SM does likewise with the W9X net. W4AVB is going for exams. W4ZZL in Annapolis keeps his schedule with the gang. W4BDA replaced his '48s with '10x. W4KB continues to knock them out. W4QI has moved to W4QJ. W4ZAO wants to work Minnesota. W4QK is rebuilding. W4GP has the U.S.N.R. unit going. W5BC and Talla­

rafite for next month.

Traffic: W4BGA 46 MS 37 KB 24 AP 2 AQY 21 ACB 14.

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Traffic: W4AUW 494 QZQ 248 BVC 50 BPJ 30 AAX 30 ZM 3 B1T 1 ZU 1.

Traffic: W4AFL 995 QST 146 BVR 30 AAX 30 ZM 3 B1T 1 ZU 1.

Traffic: W4AMQ is off the air. W4BDY and W4AMV are also off the air. W4TK is again active. W4VS kept the old 'phone busy. W4AFY is semi-active. W4AAG will operate at W4GS. W4ANY is trafficfing. W4QG is working ON7MC. W4BN is building a c.o. outfit. W4BS is a new 3-mc. 'phone. W4BNI is using an.condenser mike. W4BVC wants some traffic schedules. Santa Fe: W5CGJ is getting out well. Las Cruces: W5AGP is on 3.9-mc. 'phone. W5AUW's YF is getting on well with the code; W5ZZQ is being used. Clovis: W5BVC wants some schedules. W5ALB is now operating the high seas. W4BNB has the BPL in a big way; he can QSP to Panama, Alaska, Philippines, Hawaii, Guam and Shanghai. W5AM has portable W5BTI. W5VL has all schedules. W5ALM keeps SYL luck. WSPF has a special delivery mail. W5AVM is waiting for the fa<1uer to arrive. W5BUB is going crystal. W5AFS says nil reports. W5AEC is QRL YL. W5GZ is working DX. W5CRT is doing well on 3.5, 7 and 14 mc. W5OJ works 3 schedules. W5AYW is building MOPA. 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Please report your traffic, OMs.

Traffic: W4AUW 494 QZQ 248 BVC 50 BPJ 30 AAX 30 ZM 3 B1T 1 ZU 1.

Traffic: W4AFL 995 QST 146 BVR 30 AAX 30 ZM 3 B1T 1 ZU 1.
ONTARIO DIVISION

ONTARIO — SCM, H. W. Bishop, VE3HB — Please note the SCM's new QRA on page 5. VE3CB leads the traffic score. VE3AD is close behind. VE3GT also makes the BNL Division list. VE3LM is working DX. VE3OE, VE3FO, and VE3MY are new. VE3IB will keep schedules on any band. VE9AL schedules VE3OJ. VE3DC is raising new antenna. VE3IA is gusting with Modulators. VE3WM getting good result. VE3DD is following its success. VE3GL has a cracked crystal. VE3JS is going to work on 1.75-mo. 'phone. VE3QB is QRL teaching school. VE3BU is on with new rig. VE3KM is very active. VE3OF has an FB station. VE3IOJ is a new man. VE3RM is an operator at CKOC. VE3SP is on 3636 kc. The new Amateur Club in Windsor. VE3GL is busy building a new antenna. VE3H is on with new rig. VE3IU is interested in traffic. VE3KM is very active. VE3OF has a FB station. VE3IOJ is a new man. VE3RM is an operator at CKOC. VE3SP is on 3636 kc. The new Amateur Club in Windsor. VE3GL is busy building a new antenna.

Traffic Briefs

Traffic: VE3QP 885 5G 541 WX 269 HI 71 JI 70 DW 70 GX 42 HB 34 GL 27 LA 24 JH 25 BJ 17 WB 15 9AL 10 OM 9 LS 7 QS 3 HP 3 1A 105 AD 704 SA 1.

QUEBEC DIVISION

QUEBEC — Acting SCM, John C. Stadler, VE2AP — VE2BB keeps the lead in traffic. VE2BT operates the Army station 2C1C. The following are on with crystal: VE2GQ, VE2GQ, VE2GQ, VE2GQ, VE2GQ, VE2GQ. VE2CA is getting across the pond with his 14-m. phone. The Northern Electric gang comprises: VE2ED, VE2EX, VE2FX, VE2QX, VE2H; all anxious to work hams of the Western Electric. VE2YQ sticks to 3.5 mc. VE25C has moved back to old QRA. VE2DB is on 7 mc. VE2GH roped his brother to the call of VE2FR. VE2AA awaits the R.I. to get on 'phone. VE2E5K reports considerable activity in the St. Maurice Valley district. VE2AH does his bit on 7 mc. Welcome to VE2EE, VE2FF, VE2DW wants to meet somebody on 1.7 mc. VE2CM is holding its '04A Class "B." VE2AP was taken for a spin by VE2BM with usual results. 'Phone stations are doing well in the Quebec region. Boys! Don't blush unsee and waste your sweetness in the desert air; let's know about your activities.


VANALTA DIVISION

ALBERTA — SCM, C. H. Harris, VE4HM — VE4BD is getting out well. VE4BI visited Edmonton. VE4BV handled some traffic. VE4BZ is busy hunting bugs. VE4DQ is waiting for a $50-watt. VE4DR and VE4DB are active. VE4F is on 3.5 mc. VE4E9 is on 7 mc. VE4EG is on 3.5 mc. VE4FH has new receiver. VE4FR's crystal transmitter VE4GH is short-waved. VE4EG is piling up score in local contest. VE4EO is getting good reports from De Forest H tube. VE4EW is on 3.5 mc. VE4EY has new receiver. VE4FR's crystal transmitter VE4GH is short-waved. VE4EG is piling up score in local contest. VE4EO is getting good reports from De Forest H tube. VE4EW is on 3.5 mc. VE4EY has new receiver. VE4FR's crystal transmitter VE4GH is short-waved. VE4EG is piling up score in local contest. VE4EO is getting good reports from De Forest H tube. VE4EW is on 3.5 mc. VE4EY has new receiver. VE4FR's crystal transmitter VE4GH is short-waved. VE4EG is piling up score in local contest. VE4EO is getting good reports from De Forest H tube. VE4EW is on 3.5 mc. VE4EY has new receiver.

Traffic: VE4BB 73 GR 67 HE 37 AU 28 EL 26 JH 20 AO 20 AT 15 DI 14 CV 12 GN 6 CB 6 AZ 6 BF 5 LI 4 AM 3 QO 2 FF 7 IQ 4 HS 4X 1E 69.

Traffic Briefs

Which amateur band yields the most QSL'as? W9CWD decided to investigate this question. For four months he sent a QSL to each new station worked on the 3.5-, 7- and 14-ma. bands. The results tabulated for each band show:

Traffic: VE4BQ 48 BB. 94 DR 82 EJ 77 BD 70 DQ 60 KI 59 DR 14 GX 11 KI 10. VE4BD returns with the results back: 3.5 mc. sent 44, received 37, 60% return; 7 mc. sent 21, received 17, 81% return; 14 mc. sent 97, received 70, 72% return. The total for all bands was 166 sent, 114 received, 68% return. The 7 mc. bands are the best "QSLero" as per SCM's results.
W. R. Robertson
40 21st St., Hermosa Beach, Calif.

Editor, QST:

Most of us no doubt read of the recent destruction of the freighter Nevada when she ran aground in the North Pacific, carrying to their deaths thirty-nine out of her crew of forty-two men, and of the heroic part played by her radio operator when he locked himself in the shack in order to repair the damaged transmitter and renew his SOS. But there were only a few of us who knew that W. R. "Russ" Robertson was W6BXS, and as enthusiastic an amateur as any.

We who knew him will always remember his sacrifice and feel proud to be called amateurs, for he more than fulfilled the "Amateur's Code" when he answered that last call.

— Charles D. Perrine, Jr., W6CUH

"The Copper Watch"

1428 S. Norton Ave., Los Angeles, Calif.

Editor, QST:

When the original NAA Gang arrived at what was to be the world-renowned station a little later, they found themselves some nine miles southwest of Washington, near the Arlington National Cemetery. Our nearest interurban jumping-off station had been called St. Johns, from a small Negro settlement just to the south of our station grounds; we promptly changed its name to "St. Radio"!

A three-phase 6600-volt 60-cycle power line was installed between our station and the nearest power house of the Potomac Electric Co., in the southern part of the city; three fine, husky strands of copper, about nine miles long.

Upon installing our main power transformers (local substation) in our basement, we called up the Potomac Electric and asked them to turn on the juice. The answer was "Right away." When, after waiting about 5 minutes, there were still no signs of life, we called up again only to be told they had cut in our line. That was odd! Upon investigation it developed that our three 9-mile long strings of copper had disappeared to within a few poles from St. Radio station; apparently someone who knew did themselves well at our expense.

There was an idea at first of having a "copper watch" patrol the line when re-strung, but the prompt application of 6600-volt a.c. rendered this unnecessary, and we finally had power after all.

Then we proceeded to place our ground net work.

This consisted of a belt of 5 or 6 parts of old trolley wire around the foundation walls of the building buried in a trench about 6 feet in depth. From this radiated a closely-spaced network of No. 12 bare copper wire, each ray being crossed by a series of concentric wires, each cross being spliced and soldered, the whole being buried in shallow trenches. The system had much the appearance of the conventional spider-web with the buildings at the center. Beside each of the foundation pedestals of our three towers we interred a 36-inch square plate of copper, which was tied into the nearest part of the ground net.

All in all, we used about 35,000 feet of wire; and, as it took some few weeks to accomplish this work, our dusky neighbors from St. Radio (thrift folk) had ample opportunity to observe our work. They apparently thought it a shameful waste of good copper so promptly undertook to salvage as much as possible, greatly to the detriment of NAA.

As their praiseworthy efforts were discovered very shortly, we (the Old Gang) mounted guard over our precious copper, patrolling the grounds from 4:00 p.m. to 8:00 a.m. with .45 automatics strapped to our hips.

This "copper watch" was continued for some time after the grading contractor had completed covering up the trench system and seeded the surface to lawn.


Once a Ham —

W9OP, Chicago

Editor, QST:

They all come back, don't they? I mean the old-timers who roared away with the old spark sets and who frowned on the little squeaky tube sets when they first came out. Those anemic tubes sounded too much like undernourished ducklings for your correspondent, so he deserted the old ham game for the wide-open sea. But an amateur who is one at heart can't stay away. So yours truly announces his return joyously. I used to be old spark 9UE in those glorious days of the 5-Kw.
LEEDS says:
It Pays to Watch Our Bargains

The biggest B C L development in years is the Lynch "No Stat" matched impedance, shielded lead in antenna system. Now you can eliminate man made static from your own and your neighbors B C L set at a reasonable cost. Incidentally "No Stat" systems will help cure B C L qrm troubles and gives your neighbors finer reception than ever. One antenna coupling transformer, one receiver matching transformer and a 50 foot shielded lead in, only $2.95

Complete with 100 foot shielded lead in, only $3.75

**SERVICE MEN AND DEALERS**

Here are two real bargain numbers. Only a few of each so order quickly JEWELL 562 Test Oscillator. A self modulated calibrated oscillator covering 550-1500 kc. - 125-185 kc. - 175-450 kc. Complete with 220 tube and batteries. List price $47.50 Special only $19.50

**JEWELL 533**
Counter tube seller, complete with adapters to standard 19 width, 45" high, 1.1 8 readily adapted to test all 4-5-6 and 7-prong tubes. List price $12.50

**LEEDS dust proof holders**

X cut Crystals 160-80 M. bands .1 of 1% accuracy $4.25

**Leeds General Radio holder.**

De Luxe model $1.45

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**General Radio Xtal holder.**

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*This is the same as No. 563. except without a cover*

There is a KENYON TRANSFORMER for every amateur need. For example — tube to universal line, universal line to grid, universal line to universal transformer line, each.

And the new double purpose 4 stage Class B 46 amplifier kit for use as a modulation system or public address amplifier, as described in January Radio News. Complete kit less tubes, only $3.30

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Band Spread MONITOR

furnished complete — DeForest 430 tube, A and B batteries and 200-600-2000 kc. coils. 50 division spread on 20 meters — 35 divisions on 40 meters and 70 divisions on 80 meters. Unconditionally guaranteed. No. 398 Gold Bug Automatic Transmitting Key $12.50

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List, Simple in construction, correct mechanically, tough electrical, rugged and durable 3/16" contacts, complete with cord and plug. Brand new in original cartons. While they last, No. 10025 Extra heavy 3/16" contact.

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Ideal for portable transmitters. Extra Special $1.95

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Cat. No. 316 Electron Coupled Oscillator and Buffer Amplifier. A basic unit that provides that characteristic crystal tone without a crystal and still allows change of frequency — Employs one type 24A oscillator and one type 59 amplifier — Can be used as buffer amplifier or doubler — Will deliver sufficient power to excite push pull 210's.

Cat. No. 315 Crystal Oscillator and Amplifier. This basic unit is designed to assure absolute frequency stability — Crystal oscillator employs type 47 tube — Amplifier uses a type 59 — Can be used as buffer or doubler — Delivers ample output to excite push pull 210's — Provides for plug-in crystal — Crystal and holder not included.

These oscillator-amplifier units are furnished on standard 19" panels, finished in black crystal lacquer. Single meter provided with plug reads plate current of each tube. Completely assembled, wired and tested.

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For maximum precision of operation, this NATIONAL type N Dial is being used more and more by amateurs and experimenters in receiving and transmitting equipment, frequency meters, etc. Engraved flush-vernier gives exact readings to 1/10 dial division. Insulated flexible hub-coupler assures permanent accuracy by taking all strain off dial itself, and at the same time insulates exposed metal parts of dial from the shaft. The original and matchless NATIONAL Velvet-Vernier Mechanism is used, of course, but with materially increased driving power, so that drive-slip is practically impossible. (National Co. Inc. makes a complete line of dials of all types. Protected by U. S. Patent Nos. 1,744,675, 1,653,875, 1,656,532, 1,713,146. Other patents pending.)

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This special condenser is designed for use in amateur frequency meter and monitor circuits. Adapted for use in High-C circuits, thus avoiding changes in calibration which would otherwise arise from differences in tube characteristics, temperature, etc. Spreads 160 and 80 meter bands over 80 divisions with 100 division dial. Min. cap. 40 mmf., max. cap. 75 mmf.

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QST Helps Out

4002 Fir St., East Chicago, Ind.

Editor, QST:

Some time ago QST ran a stray about some of my equipment that was stolen on August 6, 1932. I want to thank QST and the Editor for putting that stray in, because without it I would never have located the stuff. I will tell you how it happened.

About three weeks after the stray appeared in QST I received a letter from W9ANY saying that he had traded a 40-meter crystal for some fifty-watters to a fellow in this town. He had read in QST about my hard luck, so he asked me to describe the tubes. I did, and they corresponded to my description. He told me the name of the fellow that made the trade and I had him arrested. This chap confessed that he did the job, and he was faced with a three- to ten-year sentence. He returned the junk and I had the police let him off this time, but made it clear to him that if there is any more dirty work of that type I won't have any sympathy for him. He is just a young fellow and I imagine he learned his lesson.

So you see that QST should really get credit, as well as Mr. Kelley, of Kansas City, who was so kind as to let me know about the junk. I want to thank you again as an A.R.R.L. member.

— Andrew A. Janiga, Jr., W9HPQ
The COLLINS 30W

has won enthusiastic users throughout the world. Amateurs everywhere have put the 30W through the gruelling test of popular use—and it has proved itself a winner.

There are good reasons for its success:
Correct design—Use of only the very best materials—A DX range equal to that of larger transmitters—And a price so attractive that it is no longer an economy to build your own transmitter from composite parts.

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SPECIFICATIONS:

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"HOW CAN I BECOME A RADIO AMATEUR?"

Does your answer come easily, freely, briefly?
No blame to you if it doesn’t—amateur radio is a complex and diversified pursuit, and it cannot be considered in a word.

The easiest way to answer that question is to suggest that your inquirer secure a copy of the League’s special beginner’s booklet. It is by far the best answer you could possibly give him, too, for the 32 pages of the new second edition of “How to become a Radio Amateur” outline the entire field of amateur radio, make learning the code easy, and tell how to build a simple station, with clear illustrations and easily followed building instructions—and there’s concise dope on getting licenses and operating properly, too. In short, it answers the question—thoroughly, yet simply. An inexpensive introduction to amateur radio and preliminary to the Handbook. The price is 25c, postpaid. No stamps, please.

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In the Hills

Editor, QST:

Much has been said in past issues of QST regarding the five-meter tests performed so ably by those very active “Back East” hams. The time is not so far in the past that similar thrills, “portablely” speaking, were obtained by reception in the now more or less routine 7000-kc. band. How many amateurs have taken good receivers with them on their vacation jaunts into the hills? Wouldn’t you like to have a location like that at home — no locals, no power leaks and other forms of “ham misery”? A spot where VK and ZL is local?

Just such a spot did we pick for our vacation. About seventy-five miles northeast of Seattle, at the foot of Mount Whitehorse and on the north fork of the Stillaguamish River is located W7BC, portable of W7BB. The shack is a three-room cabin, overlooking the river and about as pretty a spot as can be found in the Northwest. Fishing abounds in the river and various kinds of “upland” birds are in abundance. An amateur license and a hunting and fishing license, with a full larder — and there’s your ideal vacation.

The receiver was installed, without misgivings, and we’re off. At 1:00 p.m. local time, the first station logged was W3CXL, with an R8 signal that rattled the ‘phones. The next — W8DFH, equally loud. In just exactly thirty-nine minutes, every district in the U. S. and all districts in Canada with the exception of the first were heard. At 6:30 p.m. K6AJA was pounding in R9 and at 9:00 p.m. ZL1AA, the first foreigner heard, was R7. At 11:00 p.m. in came OM2TG, with an R9 signal. From 11:00 p.m. to 2:00 a.m., sixty-one VK and ZL stations were logged. G5ML and SM6UA were heard, R5, at 7:00 p.m. At 6:00 a.m. VK6WR was logged R9. ACSNA, XU1U and VS6AG were R8 at the same time. Shortly after ZS2A was logged R6. Signals from KAIHR, KA1CM, KA1LG and KA3AA pounded in, R8, until 8:30 a.m. P.S.T.

One peculiar skip effect was noticed. Three stations in Spokane, roughly two hundred miles distant, were logged between 7:00 p.m. and 3:00 a.m. with sufficient volume to block the receiver. These stations apparently were not at all affected by the usual skip distance. Japanese hams and commercials started coming through at 10:00 a.m. with the W6’s a source of constant QRM. A number of Europeans could be heard in the background.

915 N. 13th Ave., Seattle, Wash.
PROUD OF IT?

Are you proud that you are an amateur — proud of your A.K.R.L. membership? Then proclaim it! Let the hams who meet you on the street, in the radio store, or traveling, know it. Wear your A.R.R.L. emblem!

The distinctive League emblem comes in four different forms. Its use by members is endorsed and encouraged by the League. Every member should endeavor to display the insignia of his organization in every possible way.

The Personal Emblem, in extra-heavy rolled gold and black enamel, just $1.00, is recognized as the sign of a good amateur. Wear your emblem, and feel proud of having taken your rightful place in the radio fraternity. Either style, $1.00, postpaid.

The Automobile Emblem, heavily enameled in yellow and black on sheet metal, will gain you friends. On the road, traveling, it identifies you as a real amateur. 5 x 2 1/2", holes top and bottom, 50c each, postpaid.

The Emblem Cut, a mounted printing electrotype, the same size as the personal emblem, is for use by members on amateur printed matter, letterheads, cards, etc. $1.00 each, postpaid.

The "Jumbo" Emblem, an attention-getter for the shack wall or that 100-footer, is a big yellow-and-black affair 19 x 8 1/4", same style as the Automobile Emblem. $1.25 each, postpaid.

American Radio Relay League
West Hartford, Connecticut

GULF RADIO SCHOOL
Radiotelegraphy
Radiotelephony
Radio Servicing
SECOND PORT
U. S. A. 
NEW ORLEANS, LA.

LOW RANGE FUSES
- Littelfuse for Instrument; Amps: 1/100, 1/32, 1/16, 1/8, 1/4, 3/8, 1/2, 1—10c ea. For milliammeters, ham rectifiers, etc. Use 1/8 for radio B circuits. High Voltage.
- Littelfuse 1000, 5000, 10,000 volt ranges in 1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1 1/4, 2 amas. Renewable. Price 35c to $1.25 ea.

LITTELFUSE LABS.
1722 Wilson Ave., Chicago

AMATEURS West of Rocky Mountains
We can supply all parts for the new circuits.
Send for your catalog of nationally advertised transmitting and receiving parts at lowest prices.

RADIO SUPPLY CO.
H. A. Demarest, President
912-914 So. Broadway
Los Angeles, California
(W9FBI located in building)

WHISTLING IN THE DARK

How many times have you sat in the dark, softly whistling "Goodbye Forever" while you gazed ruefully at your big '04-A which had glowed for the last time? Or perhaps it was your fifty watter or even your prized 210. In any case, it meant TIME and MONEY before the old transmitter would be perking again. Nine chances out of ten, the poor thing had not served 10% of its normal life—just a mistake in plate voltage—a slight error in neutralization and — POP!

The Sentinel Magnetic Overload Circuit Breaker
abolishes the danger of these and other errors, makes your transmitter fool-proof and insures 100% normal tube life.

Tripping range 50 to 400 m.a. Handles all amateur tubes and loads. Back of panel mounting. 5 1/2" x 3 1/2" x 2". Shipping weight 3 lbs. Breakers for higher powers on order. SEND FOR CIRCULAR A. Cash with order or C.O.D. only $5.85 plus postage.

ORDER ONE TODAY AND SAVE THOSE EXTRA DOLLARS
DON H. MIX & CO.
BOX 403
BRISTOL, CONN.
## BARGAINS

**WESTON METERS (In Original Cartons)**

**MODEL 267**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.C. Voltmeters (Rect. type)</td>
<td>0-15v, 0-30v, 0-250v each</td>
<td>$5.00</td>
</tr>
<tr>
<td>D.C. Voltmeters</td>
<td>0-15, 0-25, 0-100, 0-150v each</td>
<td>$0.00</td>
</tr>
<tr>
<td>D.C. Milliammeters</td>
<td>0-10, 25, 50, 100, 500 each</td>
<td>$5.00</td>
</tr>
<tr>
<td>D.C. Milliammeters</td>
<td>0-1, (1000 ohms per volt) each</td>
<td>$5.00</td>
</tr>
<tr>
<td>A.C. Voltmeters</td>
<td>0-100v (Rect. type)</td>
<td>$5.00</td>
</tr>
<tr>
<td>D.C. Voltmeters</td>
<td>0-10, 20, 50, 100v each</td>
<td>$5.00</td>
</tr>
<tr>
<td>D.C. Voltmeters</td>
<td>0-1, 2, 5, 7.5, 15, each</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

**TYPE 301 WESTON METERS**

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.C. Voltmeters</td>
<td>0-10, 100, 150, each</td>
<td>$4.00</td>
</tr>
<tr>
<td>D.C. Milliammeters</td>
<td>0-5, 10, 25, 100v</td>
<td>$4.00</td>
</tr>
<tr>
<td>D.C. Ammeters</td>
<td>0-1, 10</td>
<td>$4.00</td>
</tr>
<tr>
<td>D.C. Milliammeters</td>
<td>0-1, (1000 ohms per volt) each</td>
<td>$5.00</td>
</tr>
<tr>
<td>A.C. Voltmeters</td>
<td>0-150v (Rect. type)</td>
<td>$6.00</td>
</tr>
<tr>
<td>A.C.-D.C. Universal</td>
<td>All purpose A.C. &amp; D.C. volts</td>
<td>$5.00</td>
</tr>
<tr>
<td>Wire wound resistors</td>
<td>1% acc. for above, each</td>
<td>$8.00</td>
</tr>
<tr>
<td>Medel No. 425 Thermo-Amms</td>
<td>0-1, 2, 5, 10, 15, 20</td>
<td>$8.00</td>
</tr>
</tbody>
</table>

**NOTE: WE REPAIR ALL MAKES OF METERS REASONABLY**

Send for list of AMERTRAN, J. & A., CARDWELL, DIAFOUR, DUCHE, FARA-DON parts. Many others at LOW PRICES

### RELAY RACKS (ASK for Blue Print)

- Bakelite and Steel panels (any size) $8.00
- Crystal: 1" square Calib. 1% 80 or 160 Mtrs. . . . . 2.50
- 100 Watt CW Trans. Comp. with power supply . 400.00

Write for Prices on other Equipment

Universal Wireless Sales Company
412 N. Leavitt Street
Chicago, Illinois

Phone: SEELEY 1264

---

## PASSING THE EXAM

**is more important than merely taking it**

Make sure you do not flunk out; be prepared for any question you may be asked. Typical questions, and their answers, are given in the new reprint of QST's popular articles on "Passing the Government Examination for Amateur Operator's License." Originally these articles appeared in the January and February, 1930 issues; so popular were they that the entire back copy supply of these issues was exhausted within a year. Re-written, they were again published in October and November, 1931, as reprints prepared for distribution. This supply has again been exhausted, and now — Revised in terms of latest amateur practice, with complete information on the new amateur regulations, a new reprint of the "Passing" articles is ready for distribution. In convenient, economical pamphlet form, you can find the answer to every exam question in it. 20c per copy postpaid. No stamps, please.

**The American Radio Relay League**

West Hartford, Connecticut

---

but extremely loud signals and poor notes made it impossible to get their calls. Roughly, there were at least fifty W6 and W9 signals with sufficient strength to block the receiver.

This letter is not meant to start a general movement of all hams for the hills, but what a relief after the crowded city with its various sources of QRM. Even in this location, with the nearest ham, "radiously" speaking, fifteen hundred to a thousand miles away, considerable interference was experienced from broad and rough signals. Let it be noted that the improperly tuned d.c. signal caused as much, if not more QRM than the r.a.c. signal. Several so-called d.c. signals were heard to bawl-out an r.a.c. signal that was just 100% better than this "1932 d.c. pest." Of all the signals logged, only about fifty percent actually complied with the regulations of our government. And what a "swell feeling" to hear a real operator after listening to the "t r r ok ge om tks for the vy fb call" variety. After a few turns over the 40-meter band it is quite apparent that a little more space in QST on decent operating procedure would be far from wasted. Not only would the good operator benefit, but the "lid" would find the fun of his QSO's doubled and the number of them increased. Give it a little thought, then see what results you obtain.

— Edwin R. Stevens, W7BB-BC

## ELECTION NOTICE

To All A.R.R.L. Members Residing in the PACIFIC DIVISION:

1. You are hereby notified that Clair Foster has resigned as A.R.R.L. Director from the Pacific Division. You are also notified that a special election for A.R.R.L. Director is about to be held in the Pacific Division to fill the remainder of the 1932-1933 term left vacant by this resignation. Your attention is invited to Section 1 of Article IV of the constitution, providing for the government of A.R.R.L. affairs by a Board of Directors; Section 2 of Article IV defining their eligibility; and By-Laws 10 to 19 providing for their nomination and election. Copy of the Constitution and By-Laws will be mailed any member upon request.

2. The election will take place during the period between January 15 and March 1, 1933, on ballots which will be mailed from Headquarters in the first week of that period. The ballots will list the names of all eligible candidates nominated for the position by A.R.R.L. Pacific Division members.

3. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members of the Pacific Division have the right to nominate any member of the League in that division as a candidate for director therefrom. The following nominating form is suggested:

---

Dite che l'avete visto nel QST — Ciò vi identifica ed aiuta QST
NEW INSULATORS FOR PLUG-IN COILS—STAND-OFF—LEAD-IN

General Radio has designed a new series of jumbo heavy-duty insulators for amateur and experimental use. Heavily moulded of brown glazed porcelain, 2¾ inches high, 2¼ inches diameter at base, 1 3/16 inches top diameter, thick corrugated walls. Supplied with three mounting screws and lead washers. Ideal for use in the amateur's shack, for transmitter, antenna lead-in, high-voltage wiring, switches, inductance supports, etc.

THREE TYPES

Jack-Top Stand-Off — (upper illustration) top hole ½-inch diameter — fitted with new G.R. heavy-current Type 674 Jack — ideal support for any plug-in transmitter coil — complete with jack — Type 627 — 60 cents.

Plain-Top Stand-Off — top hole ½-inch diameter — for general stand-off use — antenna lead-in support — lightning or transfer switch mounting — any place in the amateur station where high-voltage insulation with great mechanical strength is desired — Type 628 — 30 cents.

Lead-In Assembly — (illustrated at lower right) complete lead-in unit — two Type 628 Insulators — 15-inch length of ¼-inch threaded nickel brass rod — with brass and lead washers, nuts, mounting screws — Type 629 — 90 cents.

Sent post paid to any point in the U. S. or Canada if cash accompanies order. Address: General Radio Company, 30 State Street, Cambridge, Massachusetts, or our San Francisco Branch at 274 Brannan Street.

G E N E R A L  R A D I O C O.

R A D I O S C H O O L

YOUNG MEN wanted to train as radio operators, we prepare for U. S. Govt. license, send for 40-page catalog, established 1899. Oldest, largest and best equipped school in N. E. 170 Lic. graduates in 2 yrs. Investigate.

MASS. RADIO SCHOOL, 18 Boylston St., BOSTON

Bigger Values at Still Lower Prices!
EVERY ITEM FULLY GUARANTEED

210, 281, 250 type tubes—triple tested $ .89
LeCo model 606 M.V. Rectifiers $ 2.25
Made Home Microphone, with switch and 15 ft. lead $ 1.65
Stellite 40 Hy. cased Filter Chokes $ .25
Bread new tubes—a months unconditional guarantee-types 46—$ .69; 65—$ .59; 75 or 85—each $ .75; $ 5—$ .75; 82M—$ 2.69; 80—$ 1.45; 45—$ .58; 35—$ .49
871 M.V. Rectifier—new—6 months guarantee $ 1.39
Pilferance transformers: 2½ V. at 12 amp. c.t. and 5 V. at 2 amp. c.t. $ 1.50
2½ V. at 12 A. c.t. 2½ V. at 3 A. c.t. and 5 V. at 2 A. $ 1.65
Rubber Covered Lead-in copper wire—50 ft. $ .25
Lacquered Flex. Copper Filament Wire, heavy insulated—coils—25 ft. $ .25
Peerless Pr. Transf. 2½ and 5 volt c.t. windings 325 volts plate, unboxed $ 1.49
U. S. Radio Cased Pr. Transf. 2½ and 5 volt c.t. windings, 180 v. plate $ 1.49
Echophone Pr. Transf. 2½ and 5 v. c.t. fins, 325 v. plate, semi-cased $ 1.49
Matelie Filter Chokes $ 1.19
Majestic Filter Chokes $ 1.99
Majestic Plate and 50 Pfa. Trans. $ 1.25
Majestic P. F. Output Trans. $ 1.19
Genuine Victor Filter Chokes—30 Hy. 150 M.A. 200 ohms $ .35
Victor "ARC" Pr. Transf. 6-226, 1-227, 2-45'1 and 1-80 $ 1.35
Victor P. F. Inset and Output Trans. models R-32, R-52, RB-65 and RG-15 $ .69
Victor Audible for above models $ .39
Victer Power Amplifiers 1-225, 1-280, 2-245 P. F. $ 7.90
Write for prices on all Nationally advertised radio parts.
20% deposit on all C.O.D. orders. Postage extra.
2½% bonus allowed on all orders above $5.00
This is a REAL "Ham" outfit fellows—Shoot all your orders to us, and watch your savings grow.

MAURICE SCHWARTZ & SON

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

78 NATIONS ASK

and only ONE Answer...

...the BLUE tube

ARCTURUS BLUE

ARCTURUS RADIO TUBE CO.
NEWARK N. J.

MAURICE SCHWARTZ & SON

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

85
Highly polished 1" x 1 1/8" blanks guaranteed oscillators. Approximately 4000 to 2000 kc., $2.50; approximately 1500 to 450 kc., $2.00; ground to frequency 1 part in a thousand in amateur bands, $5.50 postpaid.

LA GRAYCE CO.
150 Post Street
SAN FRANCISCO, CALIFORNIA

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

Gentlemen:

We, the undersigned members of the A.R.R.L. residing in the Pacific Division, hereby nominate

[signature]

as a candidate for director from this division for the remainder of the 1932-1933 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 commercial radio connections. His complete 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 January 15, 1933. There is no limit on the number of petitions that may be filed, but no member shall append his signature to more than one such petition.

4. This election is the constitutional opportunity for members to put the man of their choice in office as the representative of their division. They are urged to take the initiative and file nominating petitions immediately.

For the Executive Committee:

A. L. BUDLONG, Acting Secretary.
West Hartford, Conn., November 12, 1932.

New Frequency Meter-Monitor

THE combined frequency meter and monitor for the amateur bands shown in the accompanying photograph has just been placed on the market by the General Radio Company. Conforming to general amateur practice, the meter covers the 1715- to 2000-kc. band and delivers usable harmonics through the 56-megacycle band. The circuit is a Colpitts with electron coupling and full voltage stabilization, the latter being obtained by means of a voltage divider. It is stated that the working accuracy of the meter will be better than $\frac{1}{2}$ of 1%.

The tuning dial is a 6-inch 300-division friction-drive machine-engraved type, supplied with a magnifying glass which makes it possible to read to one part in 1500. The panel is 1/4-inch aluminum, crackle-finished and engraved. The walnut cabinet is lined with sheet copper. The meter comes equipped with a 24-A tube but without filament and plate voltage sources. It is intended to be operated with a 90-volt plate supply.
Vacuum Tube Relay

Relay type CXB-51 is an ultra-sensitive unit designed for direct current in the coil circuit and either direct or alternating current in the contact circuit. It has single pole double throw contacts, making one circuit when the coil is energized and another circuit when the coil is de-energized. The coil has a resistance of 10,000 ohms, and it will safely carry currents up to 18 milliamperes. Adjustments are provided that will cause the relay to operate on any desired current value down to less than one milliampere. This unit is particularly adapted to operation in the plate circuit of small vacuum tubes. Contacts are rated at 2 amperes at 110 volts AC.

Size 2 ¼" long x 2 ¼" wide x 2 ¼" long.

Dunco Relay, Type CXB-51 Your Cost, $5.00

Some of Our Regular Bargains

- Lamb Single Signal Super kit of parts only ............................................ $65.00
- I. F. and Audio channel kit only ..................................................... $47.00
- National SW3 complete with coils ................................................... $32.34
- New Cardwell band spread condenser type 518 ........................................ $2.70
- Mercury thermo-regulator for ovens 50°C ........................................... $4.00
- Western Union Telegraph keys tungsten contacts .................................. $95
- Genuine Western Electric Navy head sets (radio) .................................. $2.50
- Aerovox 5000 volt .002 mica condenser ............................................... $1.07

Send for New 1933 Catalog. Just off the Press

M. & H. SPORTING GOODS CO. 
512 MARKET STREET PHILADELPHIA

1882 FIFTY YEARS 1932

"The best Transformer money can buy"

In 3 to 7 months we train you to secure government license. Course consists of Wireless Code, Radiophone, Microphone-Studio Technique, Television, Service, Police, and Aeronautical Radio. We are authorized to teach Radio Corporation of America Inst., Inc., texts. Return coupon for details.

Name ...................................................
Street or Box ...........................................
City and State ...........................................

PORT ARTHUR COLLEGE
PORT ARTHUR, TEXAS
SINGLE SIGNAL RECEIVERS
The Latest and Finest Development in Amateur Radio
Built to order. Complete in one unit, including ucutz crystal
filter, 2-stage I.F. amplifier and power
radio stage. With 4
speckled tubes $8.75.
Special heavy duty powersupply unit $35.

Custom built radio equipment, to QST or your own specifications
HENDRICKS & HARVEY
408 Main St.
Hartford, Conn.

CRYSTALS
Cut from the Finest Quality Brazilian Quartz
UNCONDITIONALLY GUARANTEED
All Calibrations made with General Radio
Frequency Standard and Checked with
Bureau of Standards Transmissions and
U. S. Naval Observatory Time Signals.

New Reduced Prices — Finer Accuracy of Calibration
80 and 160 METER BANDS, "X" or "Y" cut, our calibrations
guaranteed accurate to .001%.
Approximate frequency specified by you...
50
10 or 5 Kc. of frequency specified by you...
7.50
40 METER BAND, "X" cut, random frequencies
within the band...
8.00
40 METER BAND, "Y" cut, within 1% of pre-
specified frequencies...
10.00
178 Kc. STENOPOD CRYSTALS...
4.50
BROADCAST CRYSTALS — With Holder...
42.00

For full details, see our new catalog.

PREMIER CRYSTAL LABORATORIES, INC.
53 Park Row
New York City

QST Oscillating
Crystals
"SUPERIOR BY COMPARISON"
SINCE 1925

COMMERCIAL AND BROADCAST STATIONS
We are at your service to supply you with HIGH GRADE
CRYSTALS for POWER USE, said crystals ground to an
ACCURACY of BETTER than .03% fully mounted in our
Standard Holder, TWO DAY DELIVERIES. Prices as
follows:

FREQUENCY RANGE
100 to 1500 Kilo-cycles...
1501 to 3000 Kilo-cycles...
3001 to 4000 Kilo-cycles...
4001 to 6000 Kilo-cycles...

Special Prices Quoted for Quantities of Ten (10) or more Crystals

AMATEUR BAND CRYSTALS
Prices for grinding crystals in the Amateur Bands below
are for a crystal ground to within 10 Kilo-cycles of your
specified frequency unmounted. Mounted in our Standard
Holder $5.00 additional. Frequency calibration of the
crystals are BETTER than .1% immediate delivery.
1715 to 2000 Kilo-cycles, $12.00 each. Two for $20.00
3500 to 4000 Kilo-cycles, $15.00 each. Two for $25.00

LOW FREQUENCY CRYSTALS
Low frequency crystals available to as low as 13,000
CYCLES. Prices upon receipt of specifications.

SCIENTIFIC RADIO SERVICE
"The Crystal Specialists"
124 Jackson Ave. University Park, Hyattsville, Md.

Each meter is calibrated against the General
Radio primary frequency standard at points 25
kilocycles apart in the 1715-ke. band, the cali-
BRITATION being recorded on a chart on top of the

Financial Statement

BY ORDER of the Board of Directors the following statement of the income and expenses of the American Radio Relay League, Inc., for the third quarter of 1932 is published for the information of the membership.

A. L. BUDLONG, Acting Secretary

STATEMENT OF REVENUE AND EXPENSES FOR THE THREE MONTHS ENDED SEPTEMBER 30, 1932

<table>
<thead>
<tr>
<th>Revenue</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising sales, QST</td>
<td>$10,231.27</td>
<td></td>
</tr>
<tr>
<td>Newsdealer sales, QST</td>
<td>10,690.29</td>
<td></td>
</tr>
<tr>
<td>Handbook sales</td>
<td>3,717.92</td>
<td></td>
</tr>
<tr>
<td>Beginners booklet sales</td>
<td>320.65</td>
<td></td>
</tr>
<tr>
<td>Membership dues</td>
<td>9,451.73</td>
<td></td>
</tr>
<tr>
<td>Membership supplies sales</td>
<td>1,442.20</td>
<td></td>
</tr>
<tr>
<td>Interest earned</td>
<td>705.08</td>
<td></td>
</tr>
<tr>
<td>Cash discounts earned</td>
<td>131.86</td>
<td></td>
</tr>
<tr>
<td>Bad debt recovered</td>
<td>213.78</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>$37,494.86</strong></td>
<td></td>
</tr>
</tbody>
</table>

| Deduct: | | |
| Returns and allowances | $ 4,129.37 | |
| Cash discounts on sales | 192.88 | |
| Exchange and collection charges | 26.96 | |
| | **$ 4,309.00** | |
| Less reduction of provision for QST newsstand returns | 24.34 | |
| | **4,284.66** | |

| Net revenue | **$33,210.20** | |

<table>
<thead>
<tr>
<th>Expenses</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication expenses, QST</td>
<td>$10,655.76</td>
<td></td>
</tr>
<tr>
<td>Publication expenses, Handbook..</td>
<td>1,068.02</td>
<td></td>
</tr>
<tr>
<td>Publication expenses, Booklet...</td>
<td>278.20</td>
<td></td>
</tr>
<tr>
<td>Membership supplies expenses</td>
<td>727.02</td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td>17,364.15</td>
<td></td>
</tr>
<tr>
<td>QST forwarding expenses</td>
<td>688.46</td>
<td></td>
</tr>
<tr>
<td>Telephone and telegraph</td>
<td>364.30</td>
<td></td>
</tr>
<tr>
<td>Postage</td>
<td>1,604.81</td>
<td></td>
</tr>
<tr>
<td>Office supplies and general expenses</td>
<td>1,560.33</td>
<td></td>
</tr>
<tr>
<td>Rent, light and heat</td>
<td>1,030.07</td>
<td></td>
</tr>
<tr>
<td>Travelling expenses</td>
<td>1,277.14</td>
<td></td>
</tr>
<tr>
<td>Provision for depreciation</td>
<td>291.81</td>
<td></td>
</tr>
<tr>
<td>Communications Department field expenses</td>
<td>125.15</td>
<td></td>
</tr>
<tr>
<td>Headquarters station expenses</td>
<td>72.31</td>
<td></td>
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<tr>
<td>Bad debt charged off</td>
<td>119.45</td>
<td></td>
</tr>
<tr>
<td>Federal tax on checks drawn</td>
<td>4.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>$38,364.57</strong></td>
<td></td>
</tr>
<tr>
<td>Total expenses</td>
<td><strong>$38,364.57</strong></td>
<td></td>
</tr>
<tr>
<td>Net loss from operations</td>
<td>$ 5,154.37</td>
<td></td>
</tr>
</tbody>
</table>

Information Service Rules

PROMPT handling of inquiries concerning
amateur equipment and problems will be
greatly facilitated if the following rules are ob-
U
do you want to be a High Speed, Expert Operator write CANDLER for free Advice

GET YOUR SPEED where the Champions got theirs

CANDLER Scientific Method, High Speed Telegraphing

3 Times World Champion Operator Candler Trained
"By applying Candler System methods I won the Radio Telegraphic Championship of the World 3 consecutive years at 50, 55 1/10 and 56 1/2 wpm.


Join C. S. Code Guild. Regular Daily Practice Schedules on Short Waves. - Get Details

WALTER H. CANDLER
World's Only Code Specialist, Instructs You Personally.

Candler System Co., Dept. 51
6343 South Kedzie Ave. Chicago, Illinois

THE ELECTION IS OVER!

Are you ready for PROSPERITY?

Have you made use of your spare time? Do you know the basic PRINCIPLES of Radio?

You will want RAMSEY'S RADIO BOOKS

EXPERIMENTAL RADIO
(255 pages, 168 figures, 128 experiments.) By R. R. Ramsey, Prof. of Physics, Ind. Univ. The experimenters' manual: Measurements, Tests, Calibrations, with ordinary radio and physical apparatus. "Measure and know." FUNDAMENTALS OF RADIO
(372 pages, 402 figures.) Modern radio explained with a minimum of mathematics. "You find it in Ramsey's." Experimental, $2.75. Fundamentals, $3.50 postpaid.

RAMSEY PUBLISHING CO.
Bloomington, Indiana

Aluminum Box Shields

Genuine "ALCOA" stock, silverdip finish. 5 x 9 x 6. $1.75 10 x 6 x 7. $2.95

ANY SIZE TO ORDER

Do not compare prices! We are pioneers in this field. Our silver-dip finish is washable; does not show finger prints and we do not sell zinc under fancy-alloy names to fool you!

W2FZ

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New BLILEY crystal holders are designed to meet the demand for higher quality and lower prices. Made of molded bakelite - neat, light, compact. Greater crystal efficiency - moisture-proof chromium electrodes. Plugs into standard tube socket. Takes crystal up to 1 1/4". List, $1.50.

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CODE machines, tapes and complete instruction for beginners or advanced students—both codes—for sale or rent, rental. Potential may apply on purchase of new equipment. Special offer to Amateurs. Extra tapes for all machines. Instructograph, Deply, C. 512 Lakeside Place, Chicago, Ill.

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ON approval—almost new, standard W.E. watercooled tube. 5 KW, type 228A, used only 70 hours, $50; Morrill mfd. 1500 working condenser, $5; Tobo mfd. surgeproof 1200 volt condenser, $4; GE mercury are, $5; New 211E, $4; Raytheon Kino lamp, $3; National precision "X" dial, $3; Weston Bakelite 0-3 ac. volts, $4; 0-300 ac. volts, $4.50; type 280, 0-500 volt dc., $4.50; WIXD, 1751 Main Ave., Cleveland, Ohio.

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We specialize in rush service matching transformers for public address work. Our class B transformers for 80 cents $1.00. For 200's $1.50. For 204A's $9.50. 30H 300 m. a. Chokes $4.00. 815 m. a. $3.75. All prices are postpaid. First grade material thoroughly guaranteed. Write for details. We can match or rebuild any make of transformer. Write for free price list. Universal Coil Company, W9EY, 305 33rd St. Sacramento, Calif.

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92

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50¢, straight with copy in following address form only:

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

W1AKW-WIKP Clyde J. Holdson “ch.”

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W1AL J. J. Lamb “im.”

W1DIP Geo. Grammer “hp.”

WEB K. B. Warner “ken.”

WIES A. A. Hebert “ah.”

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Dubilier brand means all types—mica, paper, oil-filled, oil-impregnated, ultra-short-wave, and now, compact electrolytics here shown. Infinitely superior workmanship and materials. Two-year service guarantee. Lowest prices.

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I hereby apply for membership in the American Radio Relay League, and enclose $2.50 ($3.00 outside of the United States and its Possessions, and Canada) in payment of one year's dues, $1.25 of which is for a subscription to QST for the same period. Please begin my subscription with the .......... issue. Mail my Certificate of Membership and send QST to the following name and address.

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

Thanks
My transmitter is a 75 Watt crystal controlled, and uses two type T-183 Cardwell Transmitting Condensers, one in the buffer stage and...

In the C.W. key pounders contest held recently...my signal was rated the most consistent and high quality signal in the 3500 Kc. band in the 9th district...

Cecil W. Chisholm
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"NO SMOKE WITHOUT FIRE!"

"High quality" and "consistent" signals require high quality and consistent condensers. W9BRA might have attained the same degree of success with other than CARDWELL condensers but with the odds always in favor of the best equipment, why use anything else?

For many years CARDWELL condensers have more than held their own against countless "improved" designs and "world beating" innovations. CARDWELLS are better because they are fundamentally right and fundamentals, somehow, manage to remain essential factors not subject to change at the will of any designer.

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Note how consistently and successfully the CARDWELL construction design—the Standard of Comparison for more than a decade—is employed in condensers for harnessing tremendous potentials or for tuning the smallest receiver or transmitter.

Big condensers for high powered transmitters. Smaller ones in infinite variety for every tube and purpose. See the CARDWELL Midway Featherweight, made for both transmitting, and receiving, and particularly useful for aircraft and portable equipment and neutralizing purposes. Only a handful, all aluminum and featherlight—but a man's condenser that will hold its own anywhere. Send for literature.

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GC-100—Same construction as GC-30—a new higher powered job for use with 20-9 or 211 in the output stage. Completely assembled.

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A real advantage for continuous monitoring. Again Jerry must say this IS SOME job. Has back of panel vernier dial insulated 2 black crystallized nickel cabinet with hinged cover, complete with three in coils for 20, 40 and 80 meters, all batteries and tube, wired and tested. Complete kit...

FIVE METER RECEIVER—A REAL receiver, built in same cabinet as the Eagle, with two German silver dial plates and fine action vernier dial. The quality of this set is above any offered—Jerry invites comparison—custom made construction—a fine job. Uses 2-275's and 2-238's. Employs QST super regenerative circuit. Completely assembled...

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This Receiver was designed for the discriminating buyer desiring of purchasing the finest short wave receiver of its kind, and should not be compared with any of the "junk piles" selling at anywheres near the price of the "EAGLE".

The "EAGLE" is guaranteed to give you the satisfactory performance you would naturally expect from apparatus produced by JERRY GROSS.

Economical to operate. Employs new 2 volt tubes which can be operated from two dry cells on the filament for extended periods of time.

Also the "EAGLE" is the ideal amateur receiver incorporating such features as full band spread, etc., it is not limited to this purpose alone, but is also an unusually efficient short wave broadcast or police alarm receiver. While full dial coverage on each band can be had, the "EAGLE" may be adjusted to cover continuous range from approximately 15 to 200 meters. This is very easily done by controlling the tank condenser which is operated from the front of the panel.

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SCREEN GRID 232 R.F. and screen grid detector offering highest possible gain and most efficient regeneration.

PENTODE POWER AUDIO—233 gives more audio gain than obtained from two ordinary transformer coupled stages. Will operate speaker on most stations.

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RANGE—15 to 200 meters—4 plug-in coils are supplied with each receiver.

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West Hartford, Connecticut
The Big News in Amateur Radio

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