we want you to buy a handbook. you need it. for over four years we've been talking up the handbook and we've sold over 120,000 copies of it all over the world. that's because it's good. it sells itself. everybody who sees it must have one. through twelve printings, constantly revised, it has presented the most modern information in the world for radio amateurs. nothing can compare with it, for it is written for amateurs by practical amateurs who know their stuff, the headquarters staff of the a.r.r.l. the apparatus chapters answer every question. suppose it's receivers you're interested in: here are various band-spreading schemes, a simple two-tube d.c. receiver, a three-tube a.c. one, a fine four-tube peaked receiver, a superhet converter, or is it transmitters?: a single control low-powered baby, a 210 hartley, 852's in push-pull, 210's in m.o.p.a., crystal rigs with sundry doublers, and high-power amplifiers. antennas? all of them, hertz and marconi, end-feed, center-feed, sliding-feed, voltage and current feed. power supply? one for every rig and purse. radio-phone? you bet: world's hottest dope on 100% modulation and tube combinations, speech amplifiers and modulators for every ham power. whole chapter on keying and trouble shooting, then there are chapters on what amateur radio is all about, how it works, how radio works . . . explained so you can understand it, too . . . how to operate, how to handle messages. a complete treatment of operating procedure by famed communications manager handy, original handbook author. yes, all of this sounds like a five-dollar book. it would be if it were produced in ordinary fashion but the handbook isn't. it's printed "qst" format and gets the 187,654 words and 200-odd illustrations of a big textbook down to a price all can afford. no wonder it is the most helpful publication ever made available for anyone interested in amateur radio. price? a modest one dollar in heavy red-and-gold paper covers, anywhere in the world. or if you're fussy, stiff buckram binding for two dollars, postpaid. as we said at the beginning, you can't get along without this peerless guide in all amateur activity. order your copy today! eighth edition.

American Radio Relay League
West Hartford Connecticut, U. S. A.
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CARDWELL MID-WAY CONDENSERS

are light, compact, strong—shockproof and shakeproof, because tension keeps them tight. Expensively constructed, like fine machinery, with watch-like precision—but costing you no more. Made in the following sizes:

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<tr>
<th>Type</th>
<th>Depth Behind</th>
<th>Max. Cap.</th>
<th>Min. Weight</th>
<th>Price</th>
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<tr>
<td>401-B</td>
<td>2-9/16”</td>
<td>28</td>
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<td>407-B</td>
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<td>505</td>
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*Transmitting

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<td>413-B</td>
<td>3-9/16”</td>
<td>200</td>
<td>14 oz.</td>
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*Rotor and Stator plates of Transmitting Condensers have edges well-rounded and are highly polished over all.

Many other condensers, receiving and transmitting, for high voltages and low are included in the CARDWELL line. Ask for literature.

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83 PROSPECT STREET, BROOKLYN, N. Y.
"THE STANDARD OF COMPARISON"
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Kenneth B. Warner (Secretary, A.R.R.L.) Editor-in-Chief and Business Manager; Ross A. Hull, Associate Editor; James J. Lamb, Technical Editor; George Grammer, Assistant Technical Editor; Clark C. Rodimon, Managing Editor; David H. Houghton, Circulation Manager; G. Donald Meserve, Advertising Manager; Ursula M. Chamberlain, Assistant Advertising Manager.

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A limited number of electrolytic condensers are being offered to amateurs at special prices. These condensers are electrically and mechanically perfect in every respect. The amateur is being given this opportunity because of our wish to cooperate in the excellent work of amateur research, and to assist in developing new markets for our products. Two types are available, viz: the famous Sprague single 8 MFD upright electrolytic at 75c each, and the combination 16-8 MFD upright electrolytic at $1.25. These may be placed in series parallel arrangement to fit any filter need from the power supply for the low power c.w. transmitter or speech amplifier to that for the largest transmitter. In most cases a single section filter is ample to give you that pure d.c. note or hum-free 'phone. The number of condensers required to give a modulation hum of less than 0.5% are tabulated below.

<table>
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<tr>
<th>Peak Volts at Rectifier (Max.)</th>
<th>Single Section Filter (1 choke)</th>
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SPRAGUE SPECIALTIES COMPANY
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*Officials appointed to act until the permanent members of the Section choose permanent SCM's by nomination and election.*
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.

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ID you ever stop to think what you get for your two dollars and a half dues in the A.R.R.L.? Here is a figure which represents the ordinary annual subscription price to a magazine which sells for a quarter on the stands, yet it is the sum total paid as dues by the League member and represents not only his subscription price to QST but his entire payment of dues for the year.

In addition to receiving the magazine which we all love and cherish, the member receives the benefit of countless activities which our union in a League makes possible. First the costs of our very system of government are met by the League, including the travel expense necessary to bring the Directors together for their annual two-day meetings. Then there is the Communications Department, planning our operating activity with a view to bringing to each of us a great deal more enjoyment from the pursuit of amateur radio than would be our lot as unorganized individuals, arranging tests, improving procedure, maintaining W1MK. There is the constant participation of the League down through the years in every matter that affects amateur rights in legislation or regulation — internationally, nationally, municipally — involving endless travel and endless days of work by numerous representatives. There's the free technical information service for members, with its many thousands of letters of advice and suggestion every year; the administration of League conventions and much headquarters travel to visit them and our affiliated clubs; national newspaper publicity for amateur radio; such varied special things as sending Godley to Scotland, Mix to the Arctic, and running a technical development program. And, on top of it all, providing a headquarters where there will be somebody to worry about the whole course of amateur radio, keep a watchful eye on trends, and do something about them.

It costs a great deal of money to maintain these activities. The membership dues do not near support them. It cost $167,482 to run the League last year. The dues paid by members amounted to $42,595, just about one-fourth of the cost. The remainder — and here is an important point — was made up by revenues derived from outside sources, such as advertising, newsstand distribution, the sale of radio literature. If members really paid for the things the League gives them, the dues would be nearly four times what they are — say ten dollars a year, the average amount in the national engineering societies. Enterprise in permissible outside activities brings down the amount that the member must contribute to a quarter of what it otherwise would be. It is much like the occasionally-encountered tax-free town, where the municipality owns the utilities or an oil-well and derives enough revenue therefrom to lower taxes materially.

Don't think lightly of your League because its dues are low. Be proud of it, instead, for you get an awful lot for your money. Moreover, when you pay dues you become part owner of a membership corporation whose surplus, if liquidated and pro-rated amongst the members, would bring you a dividend check for nearly two years' dues. League membership, any way you look at it, is a good investment.

K. B. W.
Warner Goes to Copenhagen

K. B. WARNER, Secretary of the A.R.R.L., and editor of QST, has again been named by the Department of State as a member of a United States delegation to a meeting of the International Technical Consulting Committee on Radio Communications (C.C.I.R.), which this year meets at Copenhagen, Denmark, from May 27th to June 8th. It will be remembered that he had a similar appointment as technical adviser on the delegation to the first meeting of the C.C.I.R. at The Hague, in 1929. The organization rules of the C.C.I.R. provide for participation by governments and commercial companies but not for other classes of radio, such as amateurs. Mr. Warner's appointment to the delegation is this government's method of insuring amateur representation. The delegation sailed on the America on May 13th and will return late in June.

The C.C.I.R. is advisory in its functions, confines itself to technical matters, cannot change amateur frequency assignments, power, etc.

In This Issue

It so happens that most of the technical matter this month is the product of Headquarters' personnel. Quite a large slice of it is devoted to the description of circuits and equipment for the ultra-high frequencies — which, we need hardly say, is getting to be "hot stuff" in these days. The amateur is not by any means alone in finding that the waves below 10 meters have a wide (even though not DX) field of usefulness. Indications point to the probability of a future ultra-high frequency spectrum swarming with telephone communication system, television transmitters and broadcast stations.

James Lamb, whose article faces us at the moment, has had this ultra-high frequency work as his chief side interest during the last few weeks. As a result, the laboratory has been even more than ordinarily crowded with oscillators of every description and the associate modulation and power supply equipment. Though thoroughly practical 56 me. phone communication has been demonstrated in this work it is not suggested that the apparatus employed is necessarily the "last word." There is a great deal more on the hook than could possibly be presented in a couple of QST stories. Hull's spare time activity has been chiefly in the realm of reception on 56 me. His receiver, described in this issue, is representative of the type of equipment which is almost certain to find wide application. From the present viewpoint it would seem that super-regeneration is to accomplish for the high frequency television receiver just about all that we could wish. He is working now with a companion transmitter to the super-regenerative receiver — occupying a "can" of the same size. His plans are complete for some inter-plane tests with this equipment.

George Grammer, though having his hand in the ultra-high frequency business, has been more interested in the problems of crystal control for those enormously low frequencies below 14,000 kc. He has been working toward the simplification of preliminary amplifier equipment and the improvement of efficiency in doublers. The unit detailed in his story is the beginning of an experimental transmitter for the lab., which is to end up with four Type '32's in push-pull parallel.

On the hook, and held over for the early future there is some juicy technical stuff. In "What Is This Thing Called Decibel — An Amateur View of the Transmission Unit," James McLaughlin and James Lamh conspire to make the Decibel something utterly simple and unbelievably useful in amateur work. Then there is "The Mechanics of Modulation," by Paul Hunteinger; "An Inexpensive Constant Temperature Crystal Oven," by Louis Lauman: "Sine-Tracking the Superheterodyne," by F. I. Anderson; "Break-In Operation and Interference Elimination," by Robert Foreman. Aside from other similar material there is, of course, more to come from our Laboratory, with the ultra-high frequencies as the very probable subject matter.

Strays

In 1934, when radio conditions reach the peak, we'll have to have WAP (Worked All Planets) certificates, as ham radio will be a wow at that time! — W2CQX

A novel way of changing your note from d.c. to r.f.c. is to set up the transmitter on the sleeping porch. As the weather changes so does the note — in fact, the electrolytic condensers may freeze to the extent that transporting them to the kitchen range may be necessary before the old d.c. returns. — W9CRT

We note the formation of two institutions for the study of radio law. Announcement comes from the Air Law Institute of Northwestern University School of Law at Chicago, Illinois, of the establishment of the Journal of Radio Law, which will be published quarterly commencing April 1, 1931. The Journal will have service features concerned with pending regulation by the Federal Radio Commission, radio legislation and decisions, and international developments.

The New York University School of Law has also announced the formation of the American Academy of Air Law, the purpose of which will be to conduct and encourage research into aeronautical and radio law, and to continue the publication of the Air Law Review which, since January, 1930, has been devoted to the consideration of legal problems, both of aviation and radio.

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On the hook, and held over for the early future there is some juicy technical stuff. In "What Is This Thing Called Decibel — An Amateur View of the Transmission Unit," James McLaughlin and James Lamb conspire to make the Decibel something utterly simple and unbelievably useful in amateur work. Then there is "The Mechanics of Modulation," by Paul Hunteinger; "An Inexpensive Constant Temperature Crystal Oven," by Louis Lauman: "Sine-Tracking the Superheterodyne," by F. I. Anderson; "Break-In Operation and Interference Elimination," by Robert Foreman. Aside from other similar material there is, of course, more to come from our Laboratory, with the ultra-high frequencies as the very probable subject matter.

— W2CQX

A novel way of changing your note from d.c. to r.f.c. is to set up the transmitter on the sleeping porch. As the weather changes so does the note — in fact, the electrolytic condensers may freeze to the extent that transporting them to the kitchen range may be necessary before the old d.c. returns. — W9CRT

We note the formation of two institutions for the study of radio law. Announcement comes from the Air Law Institute of Northwestern University School of Law at Chicago, Illinois, of the establishment of the Journal of Radio Law, which will be published quarterly commencing April 1, 1931. The Journal will have service features concerned with pending regulation by the Federal Radio Commission, radio legislation and decisions, and international developments.

The New York University School of Law has also announced the formation of the American Academy of Air Law, the purpose of which will be to conduct and encourage research into aeronautical and radio law, and to continue the publication of the Air Law Review which, since January, 1930, has been devoted to the consideration of legal problems, both of aviation and radio.

The legal problems related to amateur communication in both organizations will come under the control of the General Counsel of the League, Paul M. Segal, Esq., of Washington, D. C.

On the Journal of Radio Law Mr. Segal is a member of the Editorial Advisory Board, and in charge of the department relating to the general trend of radio regulation.

In the Academy of Air Law Mr. Segal is a member of the Advisory Board on Radio and author of an article, "The Regulation of Amateur Radio Communication," which appeared in the April, 1931, issue of the Air Law Review.
Developments in Ultra-High Frequency Oscillators

By James J. Lamb, Technical Editor

Within the last year there has been a revival of interest in the frequencies lying in the region above 30 mc. (10 meters) and frequencies above 50 mc. have become particularly attractive. This has been brought about to a considerable extent by a continually growing awareness of the utility of these frequencies for restricted communication purposes, to which they are peculiarly fitted, and furthered by the somewhat spectacular communication stunts that recently have been given wide publicity in the public press. To the amateur way of thinking, and in the opinion of others as well, the limited range of ultra-high frequency signals has been taken as a decided handicap to their practical usefulness, most probably because it had become almost traditional that the higher the frequency the better the DX — until early experiments with frequencies above about 30 mc. began to show that there was something sour about this idea and that the frequencies in this region were not so good for DX, not even as good as the frequencies below 1500 kc. (wave-lengths above 200 meters). And we decided forthwith that being no good for DX they were no good at all.

But now there is a new trend of opinion. What was once considered a paralyzing liability is being found an attractive asset. The limited range of these frequencies makes them peculiarly fitted for short-haul point-to-point services and even for restricted general broadcasting where it is advantageous to have effective coverage in the immediate area and keep the signals from being effective outside this area. This suggests short over-water or over-land jumps in telegraph and telephone circuits; local broadcasting for sound and television entertainment; municipal police radio which does not cause interference to police services in towns a hundred miles or more distant; and amateur phone and c.w. communication for those activities which do not require and are handicapped by the use of DX frequencies, and which are exactly satisfied by the peculiar properties of ultra-high frequencies such as we have available in the 56-mc. band. What activities, you ask? Why, working across town; rag-chewing with the local gang on Sunday morning; furnishing communication for community events such as air-race meets and regattas; to say nothing of the pure fun that the experimenters can have exploring the country in a car equipped with a receiver like the one that Ross Hull describes elsewhere in this issue and getting the same kick that we get out of the unexpected things that 56-mc. signals can do. And this brings us to the how of it, particularly to what we have learned from some recent experiments with ultra-high frequency oscillators and simple transmitters.

Types of Oscillators

Although the region of frequencies with which we are dealing is usually considered as a whole and is generally described as "ultra-high" or "quasi-optical" (the latter because the waves in some respects seem to behave like those of light) it is necessary to divide them into two classes when it comes to the consideration of their generation and reception. Frequencies below about 200 or 300 megacycles (wave-lengths above 1.5 or 1 meter) can be obtained in a practicable manner by vacuum tube oscillators of the usual regenerative variety, utilizing circuits such as the Armstrong, Colpitts, Hartley, and their modifications. The skeletonized appearing affair illustrated is a push-pull Armstrong (t.g.t.p.) oscillator that was used to investigate the high-frequency limits of regenerative type of oscillators using commercial tubes. With the VT-14 or CG-1162 tubes shown, oscillations sufficiently stable to be measured with Lecher wires were obtained at 214 mc. (144 cm.). Since the tubes have metal...
bases and were mounted in standard UX sockets. This limit is surprisingly high. Type '10 tubes were made to oscillate reliably at 180 me. (160 cm.) with the grid circuit jumper across the grid terminals of the sockets. The schematic circuit of the oscillator is given in Fig. 1. Tuning is like that of any t.g.t.p. oscillator, the short-circuiting links being moved along the parallel wires to tune the grid and plate circuits. Not more than 300 volts should be used on the plates of Type '10 or similar tubes because of the danger of breakdown in the stem. This is explained in detail further on in this article.

The upper frequency limit for regenerative type oscillators using triodes is somewhere in the region of 300 mc. The absolute limit is reached where the velocity of the electrons and the path that they take in transit within the tube itself becomes the controlling factor — inter-electrode capacities alone do not set the limit, as is sometimes thought — and the grid and plate circuit phase relationship upon which the regenerative oscillation depends is no longer effective. Therefore, for very short wavelengths a different type of oscillation must be used. A type of oscillation is necessary which does not depend on the usual regenerative principle but which is based on a radically different theory. Fortunately oscillations of this different kind can be obtained and their development has reached a stage where they can be handled in a practical way. Frankly, we do not know a great deal about them and at the time of this writing have not had the opportunity of making a thorough first-hand acquaintance with their peculiarities. We are at it, however, and for the benefit of those whose appetites may be whetted like ours have become we shall pass on a sketch of what information we have been able to collect. Obviously, these "electron" oscillations are especially promising for practical work in the amateur 75-cm. band. Incidentally, oscillators of this type were used in the recent stunt of communicating across the English Channel between Dover and Calais on a wavelength of about 20 cm.

Since the primary concern of this article is developments in regenerative oscillators for the lower quasi-optical frequencies, particularly the 50-mc. band, the present treatment of "electron" type oscillators necessarily must be condensed.

**ELECTRON OSCILLATIONS**

As suggested above, this oscillation is not a function of regenerative action by merit of electrostatic or electromagnetic coupling between the grid and plate circuits of a vacuum tube but is a result of actual oscillation of the electrons between the electrodes of the tube. The phenomenon is universally known as the Barkhausen or Barkhausen-Kurz effect, for its discoverers; and practical arrangements for obtaining the oscillations with three-element tubes are known as Barkhausen-Kurz and Gill-Morrell. Barkhausen-Kurz (B-K) and Gill-Morrell (G-M) oscillators are quite similar in circuit arrangement, taking

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**FIG. 1 — REGENERATIVE PUSH-PULL OSCILLATOR FOR WAVELENGTHS DOWN TO 1.4 METERS**

The grid and plate circuits are tuned by sliding the "jumpers" along the parallel wires. $R_1$ is a grid-leak having a resistance of 20,000 ohms or more.

**FIG. 2 — AN ILLUSTRATION OF THE ELECTRON OSCILLATION GIVING THE BARKHAUSEN EFFECT**

The electrons actually oscillate about the positive grid, describing orbits between the electron emitting cathode and the negative plate.
the form shown in Fig. 1. The filament is heated in quite normal fashion but the grid is highly positive with respect to the filament and the plate is at zero potential or slightly negative. In operation the electrons emitted by the filament are attracted to the highly positive grid and acquire a pretty good velocity in the process. In fact some of them acquire such a high velocity that they travel on toward the plate and would continue to that destination were they not met with discouragement. The unfriendly negative potential on the plate does the discouraging and they swing about, take the return path to the positive grid, pass through it again, and once more join the procession of electrons leaving the filament. (Fig. 2.) In the true Barkhausen oscillation, the orbit that these electrons describe and the velocity with which they do it determine the frequency independently of the constants of the external circuit. The length of the path is of course dependent on the spacing between the electrodes and the velocity is affected by the positive grid potential. This has been stated by Barkhausen and Kurz in the form of an approximate equation:

\[
\text{Wavelength} = \frac{1000 \, d_s}{\sqrt{E_g}} \, \text{cm.}
\]

where \(d_s\) is the distance between the electrodes in cm. and the grid voltage is \(E_g\), when the filament and plate are both at zero potential. In this relation plane electrodes and equal spacings are assumed and the effect of space charge (which is likely to be considerable at low grid voltages) is not taken into account.

**FIG. 3 — THE ESSENTIALS OF THE BARKHAUSEN-KURZ AND GILL-MORRELL OSCILLATOR CIRCUITS**

The grid of the triode is connected to the positive of \(B_3\) and the plate to the negative of \(B_2\). \(B_3\) is the filament heating battery. Either B-K or G-M oscillation may be obtained by tuning of the circuit, accomplished by adjusting the “bridge” along the parallel wires.

**BARKHAUSEN-KURZ; GILL-MORRELL OSCILLATORS**

Experiments with tubes having cylindrical electrodes and a tuned circuit between plate and grid, as in Fig. 3, have shown this to be the most satisfactory arrangement for the production of useful power although the oscillation does not seem always to be of the strictly Barkhausen variety because the tuned circuit can take control of the frequency of oscillation. This leads us to the Gill-Morrell oscillator which is identical in arrangement to the B-K set-up but which behaves in a decidedly different manner. The frequency of oscillation becomes practically independent of the electrode voltages and is governed by the constants of the oscillatory circuit. This seems a little confusing but as explained by Hollmann it is possible to obtain a transition from B-K to G-M oscillation with the same set-up simply by changing the operating conditions, as by moving the short-circuiting link along the parallel wires. These oscillations are of the electron variety but (quoting from Hollmann) are due to the alternating potentials induced in the oscillation circuit and superimposed on the d.c. potentials of the electrodes. An alternating field of the frequency of the oscillations is thus superposed upon the stationary retarding field and results in an electron movement differing from the pure Barkhausen-Kurz oscillations.” Oscillations of the G-M variety generally have the greater intensity and occur at a higher frequency than the B-K oscillations for the same electrode potentials. Using special tubes which had the oscillatory circuit within the glass envelope, Hollmann reports obtaining pure B-K oscillations of 21.4-cm. wavelength and states that, “accordingly, with a proper tuning system Gill-Morrell oscillations down to 15 cm. might be obtained with safety.”

Incidentally, it seems to be possible to obtain both types of oscillation simultaneously although the “maxima of the Gill and Morrell oscillations mask the far weaker Barkhausen-Kurz oscillations” at these points, according to Hollmann.

Tubes have cylindrical elements with the plate, grid, and filament coaxial (Fig. 4) seem to be the most satisfactory. Japanese experimenters have found Type ‘99 tubes suitable and it is known that the old war-time VT-14 or CG-1162 tubes

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also work. It has been found also that the modern heater Type '27 is suitable 3 and the '37 might also be useful since it has this type of construction. Anyone happening to have some of the old "French" tubes, smuggled back after the War, might find them satisfactory.

Fig. 5 shows a suggested transmitter arrangement after Uda, 4 the Japanese experimenter. Two or more tubes in parallel have been used successfully by him to obtain greater output, with the additional tube capacities showing negligible effects. The grid voltage appears to be important in determining the frequency for B-K oscillations (the higher the voltage the higher the frequency), and in determining the intensity of oscillation at a frequency set by the tuning of the parallel wires for G-M oscillations. Usual values of grid current seem to be 20 to 30 ma. for a grid voltage of about 180 and a negative plate voltage of 30 volts or less. The plate current may be a fraction of a milliampere when the circuit is oscillating, maximum plate current indicating maximum intensity of oscillation, an abrupt change in this current indicating that things have started to happen. Warning: Do not switch off the grid voltage and leave the filament on with the plate circuit closed. If the plate voltage is zero or but slightly negative the usual filament-plate electron current may damage the low-range plate milliammeter.

The parallel-wire tuning system should be "low-loss" and if supported by insulators they should be of good dielectric material, such as paraffined wood, glazed porcelain, etc. Copper or brass rods or tubing would do for the conductors. For a frequency of 400 mc. (75-cm. band) a length of about 20 inches (about 50 cm.) should be sufficient. The bridge (condensers and r.f. meter) should be adjustable along the parallel wires for tuning. The preliminary tuning up and playing with the rig should be done with no radiating system, of course, the r.f. meter and plate meter being watched for indications of oscillation. The r.f. current indicated by A1 is not likely to be very great, perhaps not more than 100 ma. But then one might be lucky and get enough to burn out a meter. (If you are that lucky it should be worth a good meter.) The wavelength can be measured with a Lecher wire system like that of Fig. 6 or one of the new General Radio 50- to 100-cm. wavemeters can be used. 4 When things are going properly, modulation will be in order. Either the simple modulation scheme shown in Fig. 5 might be used or a speech amplifier can be cut in, the microphone transformer T being replaced by an ordinary A.F.T. coupled to the output of the speech amplifier. After this much progress has been made, experimenting with the radiating system consisting of the two quarter-wave rods can follow.

THE RECEIVER

The schematic circuit of a receiver that has been found to be suitable for picking up the signals is shown in Fig. 7. This arrangement is also after Uda, 4 the specifications given under the diagram being taken from his I.R.E. paper describing communication by radiotelephony and telegraphy using a similar receiver and a transmitter after the diagram of Fig. 5. Using a direc-

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1 These tubes are now obsolete but a few are still available from the "salvage" stores. They are of the 5-watt type and have a 7.5-volt tungsten filament surrounded by a cylindrical grid and a small cylindrical plate.
tive transmitting antenna of the Yagi type\(^1\) and a similar receiving antenna, phone communication over a distance of 10 kilometers (6.2 miles) and telegraph communication over a distance of 30 kilometers (18.6 miles) have been successful, according to the above mentioned paper.

The receiver is almost identical with the transmitter except that a potentiometer has been added to control the grid voltage and a variable condenser has been inserted in the bridge of the tuned circuit. Tuning over a wavelength range of from 40 to 80 cm. has been accomplished with a single receiver by adjustment of these two controls. In operation the receiver has an apparent regenerative effect and Uda's description of its action might lead one to suspect a form of superregeneration as well. Because of the relatively poor frequency stability of both transmitters and receivers of the electron type, only modulated signals are practicable. Beat note c.w. reception is out of the question.

This sketchy outline should enable the competent experimenter to get an idea of the fundamentals of B-K and G-M transmitters and receivers. More complete information for the practical amateur will be published in QST as it becomes available. In the meantime, it is suggested that the Proc. I.R.E. references given in the footnotes be studied and it is urged that reports on practical results be sent in to QST. But we must leave this fascinating phase of ultra-high frequency activity for the present and get back to the more familiar but no less interesting frequencies below 300 megacycles.

**REGENERATIVE OSCILLATORS**

Pages and pages in QST as well as in other publications have been devoted to descriptions of 5-meter oscillators utilizing every circuit known to the game; so it must be that our contribution to the fund of information is made with a frank acknowledgement that what we have to report is not in any sense something revolutionary or actually new but is more properly modification, with some improvement in performance, of self controlled regenerative transmitters for frequencies in the lower quasi-optical region. We have borrowed generously of the information made available in years past by such pioneers as Kruse, Phelps, Reinartz, Hoffman, West, Douglas, Santangeli, Long, and a host of others. Space does not permit individual division of credit for the various ideas that we have made use of but those familiar with amateur pioneering in the ultra-high frequencies will recognize the features identified with their sponsors.

As it has been said often enough, almost any transmitter circuit will operate at a frequency of 50-mc. or even higher and it is true that almost all of them have been made to oscillate more or less satisfactorily in the 50-mc. region at least. But it cannot be denied that some arrangements do the job more satisfactorily than others, some more dependably than others, and a few with better dependability and frequency stability than the rest. Now the qualifications of dependability and frequency stability are generally coincidental, in our experience, and the arrangement having the best possible frequency stability is the one we are after.

But why worry about frequency stability in the 50-mc. band? Because there isn't any QRM problem there as yet should not anything that works at all be good enough? Far from it. The best obtainable stability at any frequency is none too good. And this is particularly so at the ultra-high frequencies. Without it there can never be any hope of beat-note c.w. reception or of the highest quality phone transmission. And although there may be no genuine QRM problem on the ultra-high frequencies at present, it is coming as surely as this summer's QRN. True, it may never be anything more than purely local in character; but it certainly can be more troublesome with fewer signals to cause it, because frequency stability is largely a matter of percentages. Although a signal may wabble around but 1 part in 35,000 at 3500 kc. (100 cycles) and sound like "pure d.c.," the same proportionate wabble at 56 mc. would be 1600 cycles, taking up 16 times as much space and sounding like "hash." It is acknowledged that it has not been possible with the oscillators described here to obtain a carrier so perfectly stable as to sound like crystal control; but even when using a.c. filament supply and filtered r.a.c. plate power it has been possible to obtain something sounding like "near d.c." and having a degree of stability good enough for beat-note reception with a rigid radiating system and a reasonably stable heterodyne in the

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\(^1\) Yagi, "Beam Transmission of Ultra-Short Waves," Proc. I.R.E., June, 1928. This paper describes a type of antenna using "directors" and also describes Barkhausen oscillators of the magnetron type in which a diode (tetrode) tube is operated in a strong magnetic field.
receiver. On voice and modulated c.w. the carrier is completely free of objectionable hum (although the frequency modulation cannot be other than plentiful) and the quality is comparable with that obtained with a 3500-ke. crystal-controlled transmitter utilizing the same modulating equipment.

But this cannot be considered the ultimate limit in frequency stability at these frequencies, good though it may seem, because it is still liable to those influences which threaten the performance of any self-excited transmitter coupled to a relatively unstable antenna system and modulated for phone or telegraph transmission. The good qualities possessed by oscillator-amplifier type transmitters are just as essential for these frequencies as for the lower frequencies and there is no reason why they cannot be made entirely practicable. Amateur transmitters of the crystal-controlled type have already proved their worth at 50 mc. and indications are that crystal control will be the standard in commercial designs.

PRELIMINARY 56-MC. EXPERIMENTS

In the course of investigating various oscillators practically all of the "standard" circuits were given a trial. It soon became obvious that to obtain a reasonable degree of efficiency and frequency stability there were some circuits having inherent features that gave them an unquestionable superiority to the rest. It was found immediately that a push-pull arrangement with a high-C tank was more suitable than a single-ended one, high-C or low-C, checking the results of experiments on oscillators for lower frequencies previously described in QST. Over, it was found that circuits requiring magnetic coupling between the grid and plate circuits were not so satisfactory as those using capacitive coupling because the tangle up and crossing of grid and plate leads to magnetically coupled coils not only made construction and adjustment a nightmare but also because the stray capacitive and inductive couplings incidental to such circuits made for poor efficiency, a rough carrier, difficult adjustment, and virtually wrecked the frequency stability. Told manipulation and futuristic arrangement of the components very probably could reduce these objections but since they were found to be straightened out easily by simpler and more straightforward methods, the long way around was not deemed worth the trial.

MORE STABLE OSCILLATORS

The first marked improvement in performance as judged by reliability, frequency stability, and efficiency, resulted with the circuit shown in Fig. 8. Although this is not a strictly capacitive feed-back arrangement (the two halves of the tank circuit could be considered as magnetically coupled to each other with each half acting alternately as the grid coil for one tube and the plate coil for the other) it does eliminate separate grid and plate coils with the objectionable features mentioned above. The plan of the set was identical with that of the low-power outfit shown in the photograph except that the grid condensers were used instead of the grid coil shown in the illustration. This circuit exhibited two objectionable features, however. One was that the grid condensers were somewhat critical as to capacity, making it advisable to have them adjustable, and the other was that the tying of all the tube capacities to the one tuned circuit had the effect of reducing the amount of lumped tuning capacity that could be used for a given frequency.

Since to realize the utmost from the high-C feature it is unquestionably necessary to minimize the tube capacity affecting the tuned circuit and maximize the lumped tuning capacity as much as reasonably possible, this circuit was rejected in favor of that shown in Fig. 9. This will be recognized as the increasingly popular "TNT" arrangement sponsored by Director Woodruff and used in several lower-frequency transmitters that have been described in QST. The plate circuit is relatively high-C, tuned by the condenser $C_1$, and the grid circuit is "fixed-tune" consisting of the inductance $L_1$ in parallel with the tube input capacities only; and these are in series. The feed-back is solely through the interelectrode plate-grid coupling within the tubes and, once the grid coil has been adjusted, is of optimum value for satisfactory oscillation over a frequency range well in excess of that necessary to cover the 50-mc. band.

The plate tank circuit is completely symmetrical, the inductance being tapped at the center for

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d.c. plate feed and the tuning condenser being of the double-stator type. This type of tank condenser contributes several commendable features, as has been pointed out in a previous article describing a higher powered transmitter.3 The rotor is completely “cold” at both r.f. and d.c. potentials and may be grounded. Hand capacity affecting the frequency is practically nil when the dial is touched during tuning adjustments and the transmitter can be set to heat with an oscillating monitor or receiver. Moreover, the bearings of the condenser are not in the r.f. tank circuit and the liability of high-resistance plate current at maximum capacity setting plates in each section. Net maximum capacity in series) about 40 µµfd.

FIG. 9—THE FINALLY ADOPTED CIRCUIT

It is a push-pull Armstrong with fixed grid coil — better known as the T.N.T. circuit. 

$L_1$ — Single turn of ¹/₄-inch copper tubing, 4 inches in diameter, mounted on stator terminals of tank condenser. 

$L_2$ — 4 turns No. 14 enameled antenna wire, 1” in diameter, and about 2” in length. Turns are squeezed together or separated until set oscillates with minimum plate current at maximum capacity setting of plate tank condenser.

$C_1$ — Cardwell tapered-plate condenser, 2 sections, 3 plates in each section. Net maximum capacity (sections in series) about 40 µµfd. For modulated transmission spacing between rotor and stator plates should be increased slightly, to raise breakdown voltage rating, and small fixed capacity connected in parallel.

RFC — 18 turns of No. 24 d.c.c. on ¹/₄-inch wooden dowel, 1/16-inch spacing between turns.

$R_1$ — 10,000-ohm non-inductive grid-leak, 25-1.vatt size or larger.

with an oscillating monitor or receiver. Moreover, the bearings of the condenser are not in the r.f. tank circuit and the liability of high-resistance contacts at these points is completely eliminated. Further, grounding the rotor makes it possible to by-pass the even harmonics directly to the “neutral” side of the circuit without the necessity for a by-pass from the tank inductance center-tap.

It will be noticed that there are no filament by-pass condensers in this oscillator and that both grid and plate blocking condensers have been omitted. The evil effects of resonant filament circuits and inductive condensers (pointed out in a previous article describing a transmitter of this type) 4 made it advisable to omit them and the performance of the transmitter completely justifies their omission.

The rig shown has shunt connections through r.f. chokes for the grid bias but the alternative series connection shown in Fig. 10 could be used instead. The reason for using the shunt bias connection in this particular set is that the grid chokes were in place when the circuit was changed from that shown in Fig. 8 and since the chokes seemed to be completely effective they were allowed to remain. Their use of course eliminates the necessity for a center tap on the grid coil and also makes the preliminary adjustment of the grid coil less bothersome. Incidentally, it has been agreeably surprising to find the r.f. chokes used in this 50-mc. equipment so completely effective. Although the choke specifications given here may not be satisfactory for every set, there is no doubt that r.f. chokes can be made to “do their stuff” at these frequencies. The r.f. choke in the positive plate lead is not intended so much for stopping r.f. of the fundamental frequency as for stopping the even harmonics which exist in this part of the circuit. The same would apply to the choke in series with the leak in the series bias-feed arrangement of Fig. 10.

In laying out and wiring the set there are a few precautions that should be observed. Since there is a “neutral field” along a line passing between the tubes from the grid to plate end of the assembly as laid out in this oscillator, the zero r.f. potential leads between the condenser rotor and leak and to the sources of supply should be kept in this neutral area as much as possible. This applies particularly to the filament leads. They should be connected to the midpoints of the busses between the filament terminals and brought out at the grid end of the assembly. The use of a twisted pair for these leads is also advisable. It is obvious that any r.f. picked up in an unbalanced filament circuit will be modulated by the alternating filament current and probably affect the quality and frequency stability of the carrier.

A test comparison of a.c. and d.c. filament supply showed that the output of this oscillator was not in any way affected by a.c. filament supply.

SUITABLE TUBES

Although this set is designed particularly for Type '10 tubes having thoriated filaments, other tubes having suitable characteristics could be used with but slight modifications in the circuit constants. Type '27 tubes might be used in a lower powered set with the usual filament and cathode connections, for instance, or Type '01-A or '12-A tubes might be used in a set intended for battery operation. In any case, the plate voltage should be kept well below the values that are

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customary at the lower frequencies, for it must be remembered that the strain on the tube insulation is much greater at the ultra-high frequencies and that the limit on what a tube can handle becomes not what it can dissipate on the plate but what the dielectric breakdown in its stem may be. As an interesting instance of this, we were successful in puncturing the stem of a pot '10 at 70 mc. (this set goes up there with the tank condenser near minimum) by the simple process of raising the plate voltage from 350 to 550 volts and letting the oscillator run unloaded for about 10 minutes. And the plate was stone black when a warning sigh (it was literally that) called our attention to the fact that something had happened. Oscillation ceased immediately, of course, and the filament stayed lighted for about a minute after the plate power had been switched off. Then it collapsed. The tube had simply sprung a leak through a break in the seal caused by failure of the glass as a result of dielectric breakdown. This sort of failure is most likely to occur when the oscillator is running without an antenna or other load coupled to its output and is particularly pernicious in low-C circuits, especially those of the single-ended type. When tube capacities become large in relation to the capacity shunting them the proportion of the tank current through the tube becomes greater and hence the dielectric heating of the tube increases — another reason for high-C push-pull circuits in regenerative oscillators at the ultra-high frequencies. Incidentally, tubes having oxide coated filaments are likely to give some trouble. Tests on a few sample Type '45's indicated that their grids had a leaning towards becoming emitters of electrons and wanted to go positive after a few minutes' operation. This was at a plate voltage of 350, however, and might not be serious if the plate voltage were considerably lower. Tubes having straight tungsten or thoriated tungsten filaments are preferable for oscillators operating at plate voltages over 300. Commercially available tubes of the medium and high-impedance types appear to have the most desirable characteristics and those having inter-electrode capacities no greater than those of the Type '10 are to be favored. Screen-grid tubes are not very well suited to oscillator use although they have possibilities as power amplifiers in oscillator-amplifier transmitters.

Type '52 tubes were used in the hurriedly assembled experimental set that was built up to get an idea of the relative merits of high and low power at 50 mc. and needless to say that they showed their intended qualifications for ultra-high frequency work. This set is shown in an illustration and its schematic circuit is given in Fig. 11. Everything in the set is visible on top of the baseboard so no further detailed description should be necessary. The arrangement of the parts is based on the same principles as were explained in connection with the low-power rig.

**Finding the Band**

Although the 50-mc. band is a good many kilocycles removed from the other amateur bands, it is still in harmonic relation to the rest and this facilitates locating the transmitter tuning within the band limits. In the preliminary cut-and-try period of getting the set to oscillate properly somewhere near the "5-meter" region, an absorption or reaction type wavemeter or frequency meter is handy. Not many commercial models come with a 50-mc. coil and calibration (the General Radio Type 558-P is one that does) and it is improbable that many amateur-built wavemeters are calibrated for this band. In using an absorption type meter to make an approximate check on the frequency it should be coupled to the transmitter tank circuit just enough to cause a slight kick in the plate milliammeter reading at resonance — and no closer. A wavemeter "resonance indicating" lamp (neon or filament type) cannot be trusted for even approximate frequency measurement except with a high-power oscillator because the coupling necessary to light the lamp is too great. A sensitive thermo-couple or equivalent indicating device may not be so bad. In any case the absorption type method of direct measurement can be no more than roughly approximate — it is no

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**Diagram**

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FIG. 11 — CIRCUIT OF THE HIGH-POWER TRANSMITTER

L₂ — 4/5 turn of 1/4-inch copper tubing, 3" diameter, ends flattened and drilled for mounting on porcelain wall-type insulators.
L₁ — 11 turns of No. 14 enameled antenna wire, 1-inch diameter, about 1/8-inch spacing between turns. Supported by lug soldered to center turn and screwed to top of 5/8-inch wooden dowel which is 8 inches high.
ς₂ — Antenna coupling coil, 3-inch inside diameter, pivoted on machine screws through brass angles mounted on wall-type insulators.
ς₁ — Remodeled National Type TM 450 transmitting condenser. Split into 2 sections each having 9 rotor and 9 stator plates.
RF.C. — Same as in Fig. 9. R₁ — 20,000-ohm non-inductive grid leak, 100-watt type. Higher resistance may be used.
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better at 56 mc. than it is at the lower amateur frequencies — and a heterodyne meter like the dynatron, calibrated for the lower-frequency amateur bands, is far more accurate and dependable. In addition, the process of getting 56-mc. calibrations from it is much simpler than the long jump in kilocycles would lead one to believe. Here is the way to do it:

Put the receiver on the 14-mc. band and tune it to a frequency between 14,000 and 15,000 kc. by beating the detector oscillation against the proper harmonic of the frequency meter, say the fourth harmonic of a 3500-kc. dynatron. The detector should be oscillating vigorously with the regeneration control pushed almost to the point where squealing starts, assuming that you have one of those squealing detectors. This will make the detector generate plentiful harmonics, especially the fourth which we are going to use.

Now start up the 56-mc. oscillator and tune the tank circuit carefully, starting from maximum capacity and going up in frequency. Do this slowly and listen for signs of a fairly loud signal in the phones or speaker, disregarding any weaker ones. When you find it, tune the oscillator "right on the nose" and make a record of the dial setting. If everything is according to Hoyle this should be near the maximum capacity setting of the tank condenser (for a duplicate of the low-power set that has been described), probably between "90" and "100" for 56,000 kc., and you are beating the fundamental frequency of the 56-mc. oscillator against the fourth harmonic of the receiver. Of course it is possible that the oscillator frequency, might be some harmonic other than the fourth of the oscillating detector, or that a harmonic of the oscillator might be beating with a harmonic of the receiver. The first possibility might be probable but the second is very remote providing the oscillator setting chosen was that for the loudest signal. The harmonics of the transmitter will be so weak in comparison to the fundamental that there is little danger of making this mistake.

Now there are several ways to check whether the oscillator frequency is the fourth or some other harmonic of the receiver, the most direct being to go looking for the ones on either side of it. Using coils that cover a little more than just the amateur bands, the receiver can be tuned to a frequency whose fifth harmonic is the same as the fourth of the one in the 14-mc. band (this would be 11,200 kc. for 56,000 kc., the fourth harmonic of 14,000 kc.) or to a frequency whose third harmonic coincides with the fourth of the 14-mc. band frequency (this would be 18,000 kc. for 56,000 kc.). It happens that the 3500-kc. band frequency meter can be used to spot the 11,200- and 18,000-kc. points on the receiver, too. Without splitting kilocycles, 11,200 kc. is the third harmonic of 3733 kc. and 18,000 kc. is the fifth harmonic of 3733 kc. Here is an opportunity to get some work out of those loafing odd harmonics of ham-band frequency meters. If the oscillator setting is right the signal should be found at both of these "straddle" points. Another method is to tune the receiver to the 7000-kc. band, exactly to the frequency which is half that of the 14-mc. setting, and find the 56-mc. signal beating against the eighth harmonic of the strongly oscillating detector. We have used both of these methods and have found them to work to a "T." All this may look like a cross-word puzzle or one of those "if 3 men can dig a ditch in 2 days" problems, but don't let that scare you. The step-by-step doing of the thing is a straightforward and interesting procedure despite the confusing appearance and dullness it may seem to have as reading material. Give it a trial and get a liberal education in higher frequency measurement!

ANTENNA SYSTEMS AND COMMUNICATION TESTS

After all this conglomeration of detail had been collected, it would seem to be high time that some practical use was made of it. We reached the same state of mind and the completion of Ross Hull's super-regen receiver, which he describes in this issue, started activities with a bang. Although a casual visitor might have jumped to the conclusion that Ross, George Grammer, Clark Rodimon, and one Jim Lamb were become but so many candidates for the State Hospital (a Connecticut institution that harbors people who get that way) there still remained a modicum of rhyme and reason to the program. The low-power transmitter was rigged and made ready for the modulated transmission necessary for reception with the super-regenerative receiver, by adding to it the Handbook speech amplifier and modulator.
designed to handle a pair of Type '10 Class-C amplifiers. This unit has two stages of speech amplification using Type '27 tubes and swinging the grids of a pair of paralleled Type '50's serving as modulators. The plate voltage on the '50's was 500 and this was dropped to 325 by the time the 70-ma. plate current to the Type '10's got through the 2500-ohm plate dropping resistor connected between the modulator plates and the "plus high voltage" terminal on the 56-mc. oscillator. Of course this arrangement represented quite a come-down for the modulator unit since it was originally designed and used to work into nothing less than a genuine Class-C r.f. power amplifier having at least one buffer stage between it and the oscillator. But 56-mc. development needs a little further exploration before oscillator-amplifier phone technique teaches the practical status it has attained in the 3500- and 14,000-ke. phone bands, so that modulation of an oscillator (and 100% modulation at that) was excusable in this case. Beit said, however, that this equipment never has and never will be used to modulate an oscillator at any lower frequency! That would be inexcusable.

With the "inside plant" equipment thoroughly checked and ready for business, the next necessity was a radiating system. A number of antenna designs to test various theories had been prepared in previous stages of the ultra-high frequency program (the work is following a planned course that started last fall, by the way) and one of the basic classifications in these designs is that of high-angle versus low-angle radiators. A second classification is that of horizontal versus vertical polarization. Now it happened that a 28-mc. band was completely out and going ahead or backing up a few feet brought the signal back to R9 level. Clearly there were nodes and loops of field intensity as we traveled along. Something was causing violent interference patterns in the field. Continued cruising in different directions and at distances up to .5 miles or so from the transmitter showed that this phenomenon was the general rule. The complex characteristics of the radiating system were suspected immediately so back we went to make what appeared to be the necessary corrections.

The second antenna system is that shown in Fig. 13-A. This theoretically provides low-angle radiation and vertical polarization. The current...
distribution and direction of flow at a particular instant are shown in Fig. 13-B. The two half-wave antennas are excited in phase with the result that the radiation is concentrated in a plane at right angles to the axis of the wires. Since the antennas are both vertical, one above the other, the polarization of the waves also is vertical. When this system had been completed and tuned to resonance with the transmitter, a second field trip was made over the same route as the first one. Except for a few exceptions, the standing waves had almost disappeared and the average signal level was considerably higher than with the hybrid antenna system. This was according to expectations and checked with the theory. The "standing waves" still remaining cropped up over but short stretches and might be attributed to "accidental" phase shifts in the vicinity of the transmitting or receiving antenna as a result of re-radiation from conductors such as smoke-stack guys, power and telephone lines, lightning rods, BCL antennas, wire fences, and perhaps even rocks and trees. We hope to be able to run down some of the possible causes of these interference patterns in future experiments to that end but our expectations of isolating them are none too sanguine. The average of a number of observations should be valuable in finding out something about this interference pattern business and it is suggested that other experimenters observe and record for QST conditions where these "standing wave" effects are encountered.

In subsequent tests, particularly the 35-mile northward run described by Ross Hull, reflector antennas were added on the south side of the non-directional system of Fig. 13, as shown in Fig. 14. It has not been possible to make anything like a comprehensive comparison between the performance with this antenna and the non-directive system at the time of this writing, because of lack of time, but test runs have indicated that there is a marked reduction in radiation toward the south and perhaps a slight gain towards the north. An accurate indication of the gain would require more precise methods than the aural measurements used in these preliminary tests.

A hurried comparison of the relative merits of high and low power, made by substituting the oscillator using the Type '52 tubes for the low-power set, modulated by an 849, indicated that there was a slight increase in the average signal strength with the increased power but that the increase was not proportional to the relative cost of the two outfits. It is probable, however, that the higher power would be effective in pushing useful signals into spots that are just out of range with the lower power. Power ratio in itself is not a true index of relative usefulness anyway, as pointed out in the "decibel" article in a forthcoming issue.

In the later tests made with the two transmitters, it was found that a continuous tone of constant amplitude was more useful than voice modulation in gauging the performance of the signals and an audio-frequency dynatron oscillator using a '24 tube was substituted for the microphone. This modification made sudden fluctuations in signal strength more noticeable when the test car was in motion.

FUTURE DEVELOPMENTS

The sketchy investigation of the performance of 50-mc. signals made so far does not warrant anything like conclusive predictions as to what may be expected under any and all, or even "average," conditions. It is obvious that the useful range is considerably in excess of what might be called "sight" range, for instance, and solid obstructions in the path of the signals show erratic capabilities for stopping them. The signals are often found in the most unexpected places and then again are lost entirely in spots where good reception would appear likely. How the signals get over and around such apparently insurmountable obstructions as high hills and show up in the valley on the other side without the assistance of reflection or refraction in the atmosphere is just one of the things that intrigues us.
Amateurs can do a lot towards the solution of such puzzles by making careful records of what their investigations show and by sending written reports on their findings to A.R.R.L. headquarters for "averaging" and making the information available to the rest of the gang. Until we know more about the behavior of these ultra-high frequencies in our own bailiwicks, it is safe to say that their probable behavior over long distances cannot be intelligently forecast. If it ever should be possible to obtain reliable DX communication at 56-mc, the way to do it is most likely to be discovered after we have reached a thorough understanding of the behavior of the signals in the immediate vicinity of the transmitter.

The New England Division Convention

WITH fair weather conducive to good fellows getting together this year's New England Division Convention, held at the Hotel Bradford, Boston, Mass., on April 24th and 25th, under the auspices of the Eastern Massachusetts Amateur Radio Association, was most successful. A large registration and a programme replete with interesting events made a perfect setting for the official opening Friday afternoon by G. W. Bailey, W1KH, the General Chairman. Almost immediately the stunts committee got busy and saw to it that everyone would have a chance to participate. The first event being the Code Speed contest and one of the finest demonstration of perfect copying by an amateur was made by Frank S. Huddy, W1HI, who won the first prize. For a respite F. E. Handy, Communications Manager, A.R.R.L., gave a good talk and then throwing the meeting into forum everyone had a chance to give expression to pertinent matters. The Navy was well represented at the afternoon meeting by Lieut. R. G. McCool, U.S.N., and the naval reserve men as well as others interested in the work. While this was going on, the Army was represented by Major J. C. Platt, Jr., who supervises the First Corps Area Army-Amateur Net, in another session.

The first evening was filled with events and there were no lag in anything — the Fall River Club and the Blackstone Valley Club participating in the Inter-Club Contests; the event being won by the latter club whose orchestra was well worth hearing. During a short intermission, Frank Huddy showed his versatility by giving a very interesting talk on a remote control system which he has developed. The individual stunt contest was won by Dr. J. A. Stewart, W1SK. "Woody" Darrow has not lost his imagination and won the first liar's prize. And then came a very novel stunt — the sending of the alphabet in continental code on a large wooden key with one's foot; the prize winner Hisamoto, K80LJ, sent perfect code. The evening closed with a skit by the S.N.E. Amateur Radio League of Providence. If reports are true plenty of "hamfesting" was enjoyed until the wee small hours. This did not deter the delegates from assembling early the next morning for trips to the East Boston Airport; Navy Yard, Charlestown; General Radio Company, Cambridge; and Massachusetts Institute of Technology under the able guidance of Hayward, Quinlan, Battison and Elser.

Saturday afternoon the small ballroom on the 15th Floor was crowded and the expectancy of those present was fully justified in the talks given by Prof. E. I. Bowles of M.I.T., Mr. Allan D. MacLeod of Champion Radio Works, Mr. L. S. Fox, National Carbon Co., television demonstration by Mr. Reginald Sherman, WB1BDJ, and last but not least "Woody" Darrow gave an illustrated lecture based on his Milkatron, which, for humor, could not be improved on.

To complete the two full days came the banquet with its good food and fine music by Signor Pietro Mordelia and Mr. Davis Lynch, organist. For the first time in the history of New England Division Convention our worthy President, Hiram Percy Maxim, was unable to be present owing to an operation he underwent some few weeks ago, but we had the pleasure of hearing his voice over long distance and loud speakers through the ingenuity of the phone fellows, and his words of greeting were well received. The principal speeches of the evening were made by A. A. Hebert, A.R.R.L. Treasurer, and Fieldman, who reviewed the year's activities and the preparations being made for the Madrid International Conference in 1932; Capt. J. B. Gay, U.S.N., who dwelt on the days when Uncle Sam's ships were without radio as compared with to-day. Major J. C. Platt, Jr., U.S.A., F. E. Handy of A.R.R.L. made some remarks and Supervisor of Radio Kolster brought forcibly to those present what may be expected from the radio division in future for off frequency operation.

Some twenty-seven manufacturers generously donated prizes which were distributed to winners of events and the sincere appreciation of the convention delegates is extended to all who contributed.

Three cheers to Bailey, Weeks, Hannah, Cooley and the other committee members for their efforts in making this convention a success. PROVIDENCE next year.

— A. A. H.
"Five Meter" Receiver Progress
Describing a Successful Super-Regenerative Receiver for the Ultra-High Frequencies
By Ross A. Hull, Associate Editor

AGREAT many notions have had to be modified since the time when amateurs first took an interest in "five-meters." Chief of these is the original idea that, because "20-meters" was a whole lot better than the longer waves for distance work, the five-meter band should be better still. This apparently erroneous presumption led to disappointment when the uselessness of the band for DX work was indicated; and this disappointment, in turn, so thoroughly anesthetized amateur interest in the work that it is only now being revived after two years of dormancy.

As we see it now, it seems that experiment on the frequencies between 56 and 60 megacycles can be just as absorbing as that on any other band if only one's DX ambitions are not allowed to mask the real issue. The band, it appears, is useful exclusively for short-haul work. As such, it represents territory of peculiar and undoubted worth.

The local ultra-high frequency revival (if we may call it that) started out some few months ago when James Lamb cooked up some new equipment and began experiment with it in the laboratory. So successful was it and so intriguing its possibilities that before long all of us were steamed up to the point where only an active interest in the work would appease our appetite. As will probably be reported in Lamb's article, his laboratory work was concerned with the development of simple, practical equipment which would be free from the "craziness" which seems to have been considered characteristic of all 56-mc. apparatus. It was only after the successful attainment of this objective that communication was attempted, during the last two days, outside the laboratory.

The receiver illustrated on these pages was used in the communication tests. It is a hybrid with circuit details borrowed from several of the scores of five-meter receivers which have been described in QST since 1926. It has quite high sensitivity, freedom from microphonic noises and a simplicity and effectiveness of adjustment which has made it unnecessary to touch the tuning of the set during an eighty-mile observation trip in an automobile. The reasons for the success of the set lie chiefly in the use of super-regeneration and the new indirectly heated 6-volt "automobile" tubes. Without super-regeneration the set would be insensitive and extremely difficult to tune. Without the indirectly heated tubes it would be noisy when operated in a moving car. These things we know from sad experience.

Since super-regeneration plays such an important part in this set and since it has had so little treatment since the original QST articles of 1922, it might be well to outline the principle on which it operates. We all know that the sensitivity of a regenerative receiver increases very rapidly as the point of oscillation is approached, but that the point of oscillation constitutes the limit to which this amplification may be carried in the usual receiver. In the super-regenerative sys-
The application of an auxiliary super-audible frequency voltage on the grid or plate of the regenerative tube allows relatively terrific regeneration without the paralyzing self-oscillation which would ordinarily occur. In this particular version of the system, the regenerative detector is “plate modulated” by the long-wave oscillator and the detector plate voltage is therefore swinging back and forth at the frequency of that oscillator. On the positive peaks the voltage is of an order which would ordinarily make the detector oscillate violently. Such oscillation has no time to develop, however, before the plate voltage swings down on the next half-cycle of the auxiliary oscillator. Strictly speaking, an oscillation may develop during the positive half cycles but its amplitude is of such a low order as to be of little consequence. Operated in this condition, a regenerative detector may provide amplification many million times greater than that of the simple regenerative detector operated just below oscillation.

The super-regenerative receiver as originally described by Armstrong in 1922 appears at that time to have been considered a “flop” for amateur work (or any other work for that matter). The low ratio between the frequency of the received signals (on 200 meters) and any possible super-audible frequency limited the amplification of the system and caused it to be wretchedly difficult to handle. Since that time the arrangement has been used successfully for reception on the higher frequency amateur bands where the ratio between the received and auxiliary oscillator frequencies is much higher; but it is on the 56 mc. band where super-regeneration really comes into its own. On that band, the possible amplification is very great indeed. All the dizzy squeaks and general irregularities of operation disappear and we are provided with an extremely sensitive receiver, much simpler and more positive in its control than any conceivable autodyne set of the usual type. With the one tuning knob and a regeneration control, the receiver behaves just as if it were an ordinary rig on the 1715-ke. band. As we have said, it has been tuned to a signal just below the point of oscillation and has remained in that condition during an 80-mile ride over more or less rough back-roads. But enough, enough — on super-regeneration at least.

The other important feature of a 56-mc. receiver (perhaps it should have received first mention) is the tuning circuit: For this, almost any amateur could eull from his repertory a half-dozen possible schemes. Probably they would all work but it is certain that some of them would be quite unsuited. On the frequencies with which we are concerned it is obvious that the total amount of inductance in the circuit, even with a low order of capacity, is to be very limited. The leads within the tube itself added to the connecting links to the coil and tuning condenser are likely to represent quite an appreciable proportion of the total inductance necessary. Then, we have the capacity between these leads and between the elements of the tube. It is also to be of great importance in limiting the possible inductance in the coil itself. A preliminary experiment (or computation if you like) soon shows that if we are to connect the tuning condenser across the coil itself the inductance of the coil will have to be kept very low if we are to reach 60 mc. (the high-frequency end of the band). With a tuning condenser having a low minimum capacity and a low capacity range, the scheme could be used with satisfaction — and has — but there are much more interesting possibilities in that group of tuning circuits in which the tuning condenser is in series with the coil and the capacity between the two elements of the tube to which the tuned circuit is connected. By using this scheme, a much lower minimum capacity is obtained and the coil can be made considerably larger than in the parallel-tuned circuits. This, perhaps, is made clearer in Fig. 1. At “A” is shown the usual parallel-tuned circuit with the grid-filament capacity of the tube in parallel with the condenser $C_1$. At “C” is the series tuned circuit in which, as “D” shows, the grid-filament capacity is in series. Carried into the realm of push-pull we see that at “E” and “F” the tuning condenser and coils could be in series with the two tube capacities also in series, so permitting an even greater increase in the tuning inductance. The push-pull feature could be applied to the shunt tuned system with similar advantage. However, we can hardly digress to discuss all the possible schemes. There are scores of them, all probably having some particular worthwhile characteristic.

The first circuit tried in our bread-board layout was that shown in Fig. 1 at “C.” The 56-mc. band could be covered satisfactorily with a practical amount of inductance but with the usual

![FIG. 1 — SOME POSSIBLE TUNING CIRCUITS for the 56 mc. receiver. That shown at "F" is incorporated in the receiver described.](image-url)
tickler arrangements we found it very difficult to obtain a similar degree of regeneration across the band without frequent adjustment of the regeneration control. This weakness was not to be tolerated and we detoured, therefore, to see what offered elsewhere. A version of the Hartley used in a 1927 model receiver, described in QST by Frank C. Jones, looked promising and it had

found a vigorous oscillator in one of the small transmitters. Actually it is the old series or split Hartley of transmitter fame without any shunt condenser across the coil. It oscillated persistently all across the 56-mc. band at the first kick. And for no other reason than that it operated well, we decided to make use of it. It is shown at "G" in Fig. 1. Admittedly, both sides of the tuning condenser were above ground, but experiment soon showed that no troublesome hand capacity effect would be noticed if a metal panel were used with a short insulating coupling between the condenser and dial. A split stator tuning condenser would have constituted a more direct solution to the hand-capacity problem but it would not have been an equally convenient or inexpensive one.

The one disadvantage of such a series-tuned circuit is that the tuning curve is much steeper at the lower end of the scale (where the capacity of the tuning condenser may be of a similar order to that of the tube capacity) than it is at the upper end of the scale. This problem was covered by the very simple though certainly crude process of adjusting the circuit so that the 56- to 60-mc. band occupied about 50 degrees of the dial near its upper end.

To allow a precise placement of the band on the main tuning dial without the necessity of fiddling with coils the condenser $C_s$ was found a convenience. It is a 15 µµfd. Cardwell "Balanced" fitted with the locking device featured on that particular condenser. It is not an essential fitment but it certainly is a useful one. It is, of course, so mounted as to be insulated from the metal base. $C_t$ is the usual antenna coupling condenser. It consists of two aluminum plates $\frac{3}{4}$ in. by $\frac{1}{2}$ in. spaced about $\frac{1}{6}$ in. and fitted to the grid terminal of the detector tube socket.

Much experiment on the bread-board with other circuit details resulted in the final arrangement shown in Fig. 2. Let us review it.

The upper tube is the detector — Type '37 of the new series of indirectly heated 6-volt battery type tubes. Its own private circuit corresponds to that of "F" in Fig. 1 — a series-tuned series-feed Hartley. $L_t$ and $L_a$, the two sections of the inductance each have 7 turns $\frac{3}{8}$" inside diameter. (We visualized the enormous voltages building up across such a high-L circuit!) The main tuning condenser $C_t$ is of 105 µµfd. maximum capacity and for it one of the new Cardwell Type 404B was used. $R_1$ is the grid-leak used to complete the grid circuit and to maintain the grid at a satisfactory operating voltage. In the plate circuit of this tube we have the usual radio frequency choke, the primary of the audio transformer (with a large by-pass condenser) and the regeneration control resistor $R_q$. This, of course, is by-passed, the condenser being large enough to keep the resistor quiet in operation.

The low-frequency auxiliary oscillator comprises the tube at the left of the diagram, the inductances $L_a$, $L_s$ and the associated condensers. Examination of the wiring will show that this oscillator unit is connected to the detector unit in just the same way as a modulator would be connected to a modulated amplifier for plate modulation — $L_a$ being the equivalent of the speech choke. The tube used for this oscillator is the same (Type '37) as the detector. A Type '36 screen-grid tube was tried in this position (a variable screen voltage being used to control the amplitude of oscillation) but no advantage was indicated. Maximum sensitivity was obtained with the oscillator pumping its hardest.

The circuit of the Type '38 pentode audio amplifier tube is quite conventional. Bias is obtained, as in the oscillator, with a resistor in the plate return to the cathode. A resistor $R_4$ across the secondary of the audio transformer serves to eliminate any tendency towards "fringe howl." The main idea in the planning of the circuit was to eliminate as many variable elements as possible, to make the set operative from just a single 45-volt "B" battery, and to make the whole thing absolutely "sure-fire" in operation.

The make-up of the final set is shown in the two photographs. Its main-frame is composed of an aluminum panel 5 in. by 7 in. attached to a base 5 in. by 8 in. with two Benjamin brackets. These brackets allow a space 2 inches high under the base in which the components of auxiliary oscillator and the audio amplifier are housed.

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The upper surface of the base is reserved for the tuning circuit of the detector and the three tubes.

In the plan view of the set, the detector can be seen at the rear center of the base. It sits in a General Radio Isolantite UY type socket. A bakelite socket would, of course, serve the purpose. On the left rear corner of the base is the "band-setting" condenser Cz. Once adjusted to give the desired band-coverage it is left untouched. The condenser in the center of the base obviously is the main tuning condenser C1. Since both stator and rotor are above ground potential it is not mounted to the base with the usual metal brackets. Instead, it is mounted to two small pieces of bakelite (one in front, one in back) which in turn are attached to the base with metal angles. The rear piece of bakelite (measuring 2½ in. by 2 in.) is fitted with four GR sockets and serves as a mounting for the coils. The coils, to be seen between the tuning condenser and detector tube, are wound with 16 gauge enamelled or bare wire on a ½ in. diameter wooden dowel and, with the dowel removed, are soldered to lugs on GR plugs. The leads are spaced approximately the diameter of the wire. The leads between the two center GR sockets and the two terminals of the tuning condenser are made as direct as possible, while the leads from the two outer sockets are shot straight down to the grid and plate terminals of the detector tube socket.

Sitting transversely under the tuning condenser is the one radio frequency choke in the set. It has 85 turns of 30 gauge d.s.c. wire wound on a ½ in. diameter hard rubber rod. The turns are spaced about two diameters. Obviously, wooden dowel of some similar diameter would be suitable in place of the hard rubber. On the right side of the tuning condenser is the grid leak, connected directly between the frame of the condenser and the frame of the set. Connections to this frame are, as usual, shown as "grounds" on the diagram. The tubes sitting right up against the panel are pentode output tube (right) and auxiliary oscillator (left). The insulating coupling on the tuning condenser shaft can be seen immediately between them.

On the front panel is the National Velvet Vernier dial (once again used because of its beautifully smooth action) and below it, the knob of the regeneration control resistor.

Turning the set over on its back or looking at second photograph shows at once that the remaining apparatus has been bunched up in the sub-

FIG. 2—THE COMPLETE CIRCUIT OF THE super-regenerative receiver. The tubes are indicated in the same relative position as they are mounted in the set.

C1 — 105 µfd. Cardwell Type 404B variable condenser.
C2 — Antenna coupling condenser — see text.
C3 — .005 µfd. fixed condenser.
C4 — .004 µfd. fixed condenser.
C5 — .03 µfd. fixed condenser.
C6 — .03 µfd. fixed condenser.
C7 — .03 µfd. fixed condenser.
C8 — .03 µfd. fixed condenser.
C9 — .002 µfd. fixed condenser.
C10 — .004 µfd. fixed condenser.
C11 — .001 µfd. fixed condenser.
R1 — 5 megohm gridleak.
R2 — 50,000 ohm Frost No. 2890 variable resistor.
R3 — 2,000 ohm carbon type fixed resistors.
R4 — 130,000 ohm carbon type resistor (or gridleak type).
L1, L2 — Each seven turns of 16 gauge wire ½ in. inside diameter with turns spaced the diameter of wire.
L3, L4 — see text.

"Grounds" indicated on the diagram represent connections to the metal chassis of the set.

THE UNDER-SIDE OF THE RECEIVER SHOWING the low frequency portion of the set. The placement of these components and of their wiring is not of any great importance.

QST for
base cavity in a very haphazard manner. This, of course, is quite permissible because of the low frequencies on which it all operates. In this illustration, the panel is at the top. On it can be seen the resistor $R_8$, mounted on a piece of bakelite to insulate it from the panel. In the left corner is the unit containing the auxiliary oscillator coils $L_3$ and $L_4$. These coils are wound in a double-slotted former made up from three 1½ in. diameter cardboard discs and two ½ in. lengths sawn from a piece of ½ in. diameter wooden dowel. A hole is drilled through the centers of the discs and the two pieces of dowel. The five units are then held together with a small brass machine screw which also serves to mount them to a piece of bakelite attached to the side bracket. The slots in this former are wound with 1200 turns of 36 gauge enamelled and silk covered wire for $L_4$ and 750 turns of the same wire for $L_3$. The winding was done as irregularly as possible with the former mounted in a twist-drill. It is naturally important that these coils be so connected that the tube will oscillate. This means that if the two sections are wound in the same direction the start of the first winding will go to the plate of the grid. The capacity $C_4$ across the grid coil is of .0025 µfd.

Other components visible in this illustration are the audio transformer in the right corner, the phone jack just above it and the condenser $C_8$ above that again. In no case is the location of these sub-base units of any particular importance. Terminals for battery supply are fitted on a bakelite strip mounted to the Benjamin brackets, while the remaining resistors and condensers are hicheted into place at any convenient spot.

The wiring of these components is done with flexible “Braidite.” For all wiring above the panel, however, 16 gauge enamelled wire is used.

For a preliminary test of the receiver any ordinary amateur antenna might well be used. Should the builder have our luck, the thing will operate first pop. In control, and in the sound of the thing, it will be quite similar to the usual detector-audio high frequency set except that passing automobiles and electrical machinery in operation will produce an unusually heavy “racket.” Signals from a near-by 56-mc. transmitter are likely to be extremely loud if our experience is any criterion. With a six-foot antenna and in a moving automobile we have been able to operate a speaker with voice signals from a low-powered transmitter at distances up to a dozen miles—and this without any critical adjustment of regeneration. Should it be planned to operate the set in a car (for observation purposes) it will be necessary to do something to avoid interference from the ignition system. We fitted the usual BCL type “ignition interference suppressors” with the secret fear that they would fail. Surprisingly, they were completely successful. Interference from our own car was then no greater than that from other un-suppressed cars at distances of three or four hundred yards.

First tests were made in the car listening to the small transmitter described in James Lamb’s article. A General Radio attenuation unit was used on the set to check approximate signal strength and comparisons were made within a few miles of the office of the signal audibility with various antennas and a reflector. Unexpectedly strong and surprisingly reliable signals soon led us farther afield and during the next 48 hours we made trips around the Connecticut hills and into Massachusetts totalling 350 miles. Time did not permit anything approaching a complete examination of the signal to the limits of its range nor does space allow a complete story of the observations made. However, a summary of the first results may be of interest.

(a) Very little difference was noted in the strength of signals from the low powered (20 watts oscillator input) and the higher powered transmitter (200 watts input).

(b) Excellent speech quality was obtained even though no attempt was made either to filter the transmitter supply to the usual degree or to avoid frequency modulation.

(c) At occasional locations a form of distortion, similar in effect to that of “selective fading” on the broadcast band, was noted. It did not interfere with the intelligibility of speech, however.

(d) With the car in motion at certain locations the signals would sweep from $R_5$ to $R_2$ and back to $R_8$ every few yards. Under these conditions, a reading of the maximum signal strength with the car stationary could be made only after the position of the car had been adjusted to within a few feet. This effect is discussed in detail in James Lamb’s article.

(e) $R_5$ voice signals could be heard around the town and at distances up to 12 or 15 miles along Connecticut River valley (where no high ranges of hills intervened); With the receiver close under the lee of the Avon range—about seven miles to the west—signals were usually of a very low audibility. Out beyond the range, however, signals returned, within a mile or so,
League Again Demands Enforcement

STUDYING the control of out-of-band operation by careless or irresponsible amateurs, which continues to be embarrassing to the craft generally, the Board of Directors of the League at its recent annual meeting unanimously voted to renew its request of the Department of Commerce that the latter comply with the law by suspending the operator’s licenses of amateurs consistently operating out of band. Accordingly the following letter has been written to the Secretary of Commerce:

AMERICAN RADIO RELAY LEAGUE

West Hartford, Conn.,
May 6, 1931

Dear Sir:

The Board of Directors of the American Radio Relay League was in session in Hartford on May 1st and 2nd in their regular annual meeting. As in the case of the meeting a year ago, the Board gave much consideration to the problem of confining amateur operation to the authorized bands of frequency. A small minority of amateur stations continues to operate outside of the bands authorized for amateurs, despite numerous technical aids now easily available. There is a widespread feeling amongst the great majority of amateurs who are law-abiding that amateur activity should not be permitted to suffer from the careless or wanton acts of a minority. Complaints of interference from amateur operation outside of the authorized bands have been made by other services during the past year, but it is the view of our Board of Directors that the Department of Commerce has not yet exerted a proper effort in the enforcement of regulations. It is the opinion of our Board that the well-being of amateur radio requires a stricter observance of the frequency regulations.

Accordingly I am instructed by the unanimous vote of my Board to advise you that the American Radio Relay League again requests the Secretary of Commerce to comply with Section 5 (D) of the Radio Act of 1927 as amended, by immediately putting into effect the policy of suspending the operator’s licenses of all persons consistently violating the regulations of the Federal Radio Commission by operating outside the frequency bands prescribed for amateurs.

This office will be pleased to be of any assistance that it can in the carrying out of this policy.

Respectfully yours,

K. B. WARNER
Secretary and General Manager

Every thinking amateur must realize that this is a vital problem to all of us. It is to be solved by each amateur giving individual attention to his own transmitting activity. Certainly it is highly desirable for every amateur transmission to be within an authorized amateur band. There is no reason why you, the reader of these lines, should get into trouble on this score. Plenty of splendid aids exist to make it easy for you to play the game squarely. In particular, see QST for October, 1930, page 9, for data on the assembly of an inexpensive and easily built dynatron frequency meter; and see any QST for information on the scheduled transmission of weekly standard-frequency signals by the stations of the A.R.R.L. Standard Frequency System, which will enable you to calibrate and maintain your frequency meter with a high degree of accuracy.

In addition to these aids there are many powerful commercial and government stations operating adjacent to our bands, whose known frequencies serve as “markers” and are of great aid in calibrating and in staying within the bands. For instance, it is self-evident that an amateur “outside” of one of these markers is outside the band. Not exact, not always reliable, they nevertheless mark the bands in a first approximation which makes it easy to be “inside”—and safe. Many such lists have been published in QST. The most useful ones are here repeated:

<table>
<thead>
<tr>
<th>In vicinity of,</th>
<th>Good markers, kc.</th>
<th>Also useful, kc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3500</td>
<td>None</td>
<td>Night airways phones, 3484.</td>
</tr>
<tr>
<td>4000</td>
<td>NAA, 4015</td>
<td>Naval Reserve, 4045.</td>
</tr>
<tr>
<td>7000</td>
<td>WLM, 6990</td>
<td>WEO, 6957.5</td>
</tr>
<tr>
<td></td>
<td>RXC, 6985</td>
<td>WJP, 6940</td>
</tr>
<tr>
<td>7300</td>
<td>WIZ, 6965</td>
<td></td>
</tr>
<tr>
<td>14,000</td>
<td>KWT, 13960</td>
<td></td>
</tr>
<tr>
<td>14,400</td>
<td>GBW, 14440</td>
<td>WQL, 14815</td>
</tr>
<tr>
<td></td>
<td>WNC, 14470</td>
<td></td>
</tr>
</tbody>
</table>

W5CT wonders if the “voice call for dynamic speaker” advertised in one of the magazines recently is “Hello CQ.”

W1B KD recalls memories of low-power records of former years by telling us that he worked a station 250 miles away with an input of .06 watts to a pair of 201-A’s. This figures out to be about 4000 miles per watt.

W7CT immerses his 210 in an oil bath to keep the frequency of his transmitter from creeping. The tube is mounted upside down in a can of light oil, and the drift is considerably reduced. If the filament is kept lighted there is no drift at all.

The proposed RMA color code for the identification of the range of resistors has been worked into a neat little chart by the International Resistance Company, Philadelphia, Pa. By means of three dials the resistance range represented by the combinations of colors may be easily determined. It is a useful gadget for the service man. A limited quantity is available for distribution, and one may be obtained by writing to the address above.
THE Board of Directors of the American Radio Relay League assembled in Hartford for its regular annual meeting on the first day of May. Most of the Directors had come in a day or two early to inspect the headquarters offices, the headquarters station, and to observe the carrying-on of League business at West Hartford. On Friday the 1st the meeting opened at the Hartford Club in Hartford, with every League official in attendance. There was President Maxim, Vice-President Stewart, Canadian General Manager Reid, and every last one of the Division Directors. There were the remaining headquarters officers and also General Counsel Segal and Assistant Secretary Budlong. For two days the meeting lasted, the Directors deserting their conference table only for the meals which were served in an adjacent room. All of the Directors had made studies of League conditions in their home areas before coming to the meeting, and so for two days every aspect of League welfare was thoroughly canvassed and policies made and instructions given to the headquarters for another year.

It is our purpose in this account to give a bird's-eye view of the meeting and to report briefly all of the things done by the Board.

After the opening roll-call and the approval of the minutes of the previous meeting, each of the five officers of the League read an annual report in which he informed the Board on the status of that portion of League work which has been in his hands, and made recommendations for the study of the Board at this meeting. These reports, and the report of the General Counsel, were then accepted and all of the recommendations therein listed for examination by the meeting.

The Board then examined the actions of the Executive Committee since the last meeting of the Board, in its constitutional duty of carrying-on for the Board between the meetings of the latter, and ratified and confirmed all of its actions. Proceeding then to examine some of its own actions which had been taken by mail during the preceding year, the Board ratified its own votes appropriating funds for representation at the C.C.I.R. meeting this summer, for a reconsideration of its plans for the government of 'phone operations, for adjusting the salary of the Communications Manager, and for a Madrid frequency-band policy.

The ratifying of the Board's policy for frequency bands to be asked for at Madrid occurred only after a thorough examination of the subject from every angle, as many Directors had requests from their members that the League undertake to secure a widening of the bands at the Madrid conference. After receiving confidential information regarding the plans for Madrid, the Board voted without dissenting voice to confirm its previous decision to seek at Madrid the existing amateur frequency bands. It must be apparent that there is more to the matter than can be mentioned in these lines in QST; it must suffice here to say that the Board, after the most careful consideration of the matter, was unanimous in confirming its previous decisions.

After making an appropriation for the expenses of this meeting of the Board, the reports of Directors were heard. Each Director in turn reported in detail on the status of amateur activities in his territory and the sentiments of members on all important issues and expressed his views on what ought to be done on these ques-

AT THE CONFERENCE TABLE IMMEDIATELY AFTER BREAKFAST: DIRECTORS AND OFFICIALS OF THE LEAGUE PAUSE BEFORE STARTING THE SECOND DAY'S SESSION

We see, left to right: F. M. Corlett, W. T. Gravely, Treasurer A. A. Hebert, K. W. Weinigarten, A. H. Babcock, L. G. Windom, Alex. Reid, A. L. Walsh, Paul M. Segal (General Counsel), President Maxim, Secretary Warner, Assistant Secretary Budlong, Vice President C. H. Stewart, E. C. Woodruff, H. F. Dubbs, B. J. Andrews, H. W. Kerr, M. M. Hill, Communications Manager Handy, Cy. L. Barker. Unavoidably absent at the moment of taking the photograph was Director Best.
The Board then buckled down to an examination of radiotelephony, a knotty problem which had been discussed for many hours at each Board meeting the last several years. Again the question was examined this year for over two hours by the whole Board and then a committee was appointed with the duty of studying the question further and bringing in a proposal. Late that night, after the Board had adjourned for the day, the committee went into session and after burning much midnight oil, brought in a plan the next day, as will be discussed hereinafter.

The Board then considered further plans for the important Madrid conference. Thankful that our A.R.R.L. in past years has accumulated a surplus available for such extraordinary needs, the Board authorized the Executive Committee to appropriate up to $10,000 to cover the expenses of A.R.R.L. representatives to Madrid in 1932 and named Messrs. Warner and Segal as two of its representatives to attend that conference, to which additional representation may subsequently be added. Some rather neat strategic plans which have been proposed were examined, but because the Madrid meeting has now been postponed to the fall of 1932 instead of the spring, with the Board again meeting before then, final consideration was postponed until more information is available. A project for certain international publicity was examined but abandoned.

Again the Board gave lengthy consideration to the embarrassment which amateur radio as a whole is suffering from the out-of-band operations of some amateurs. After thoroughly canvassing the subject the Board voted to renew its demand of the Department of Commerce that it enforce the regulations by suspending the operator's licenses of amateurs consistently violating regulations by operating outside the amateur bands. This question is further discussed in another article in this issue.

The possibility of changes in the domestic radio law of this country were then looked into rather thoroughly and the expressions of the Board secured for the guidance of the headquarters officers. By this time it was 10:00 p.m. and the Board had had a hard day, so it adjourned until the following morning — all except the 'phone committee, which thereupon went in to session at the Hotel Bond, to work until all hours.

The following morning the Board had its picture taken and then went to work again. The first question this day was on making certain amendments to By-Laws. These were not of great importance, being rather minor matters. The rules governing the election of the Canadian General Manager were changed to conform with the practice of choosing United States Directors, a change which had been overlooked a couple of years ago when the United States regulations were changed; the headquarters location was specified as West Hartford, to accommodate the recent move to new offices; a West Hartford bank was named as one of the official depositories of the League; written annual reports from Directors were provided for; and the regular order of business at Board meetings was amended to conform with present practice.

We are reminded to suggest here that more members of the League familiarize themselves with our Constitution and By-Laws. Copies of these, revised to date, are always available at headquarters, and will be sent at any time without charge to any member who will write for them.

Then the special committee on telephone allocations reported and again the old 'phone question was discussed pro and con for a long while, with countless suggestions considered. Finally the proposal of the committee was accepted and approved, the headquarters instructed to endeavor to secure its adoption at Washington; and at the same time the Board instructed the headquarters to do everything possible to encourage c.w. operation in the range 1715 to 1875 ke. The radiotelephone program adopted by the Board deserves an expanded explanation; a further discussion of it will be found at the end of this report.

The Board reviewed its amendment of By-Law 4 a year ago but made no further changes. It examined the practice of Army stations in the Philippine Islands in reimbursing American amateurs for money paid out on telephoning and telegraphing rush messages, and voted to request these stations to make such repayments only on itemized bills showing actual disbursements for expenses, so as to avoid any suspicion of compensation for amateur activity.

The Board did nothing about changing any Division boundaries but instructed the Executive Committee to study the question further. A second operator for W1MK was authorized, if it can be afforded. The participation of headquarters personnel in League contests was authorized but with the understanding that they are not eligible to receive prizes or certificates. The stations of the A.R.R.L. Standard Frequency System were whole-heartedly thanked for their cooperation. The matter of "High Power Holiday" coming up for discussion, the Board considered that matter to have been purely one of discussion among amateurs relating to individual station operation and having no connection with regulation or any possible limitation of power imposed by the authorities, the Board recognizing that federal power limitations will remain at one kilowatt.

It was then 2:31 of the afternoon of the second day, and the Board had completed its program. At this hour adjournment occurred. At best, this brief account gives only the high lights of the meeting and cannot hope to give the reader any
adequate impression of the many things which were discussed, of the comprehensive preparation which the Directors had made for the meeting, and of the really-exhaustive fashion in which every angle of all of these problems was gone into. Perhaps the reader can visualize for himself that twenty-one well-informed officials of amateur radio, sitting around a table for two days and each speaking of his personal knowledge, were able to bring to bear upon our problems a very considerable measure of thoughtfulness, intelligence and devotion.

THE BOARD’S PHONE PLAN

The 'phone problem in amateur radio is in many respects like national prohibition; in essence it is probably impossible of solution. While realizing that, the Board’s plan endeavored to take account of the necessity for providing more space for 'phone, more space for c.w., of avoiding interference with other services, of encouraging greater use of the 1715-ke. band by both 'phone and c.w., yet avoiding interference with broadcast listeners, of providing somewhat more strict regulations for phone operation but in such manner as to avoid injustice to any amateur. The Board was confronted by the need of 'phone amateurs for more space in the 80-meter band, the opposing demand of a multitude of c.w. operators that 'phone be driven completely out of this band, and the desire of everyone, particularly the 'phone operators themselves, that the operators of 'phones in the congested portions of the spectrum he obliged to show some special technical qualifications so that the assignment would be big enough to be useful for those who ought to have the right to use it. Here is the Board’s plan, which endeavors to make the best possible arrangement of these requirements:

The 80-meter 'phone sub-band in this plan is moved from the low-frequency end to the high-frequency end of the band — from 3900 to 4000 kilocycles. Examining the illustration, it will be seen that if the existing 'phone privilege at 3500 kilocycles were expanded to cover 100 kilocycles, as was desired, it would then occupy all that portion of the 80-meter band which is harmonically related to the 14-megacycle band and deprive c.w. stations of any opportunity to work in the 80-meter band on the same crystal with 14,250 kilocycles. It is part of this latter plan that the required special qualifications will not be considered as possessed by the holders of temporary operator's certificates. The general plan is that in order to operate 'phone in the 80-meter and 20-meter bands, the operator must have held an operator's license or certificate for at least one year; must now possess himself of a regular license, and not a certificate; and must now pass some form of a special amateur examination upon matters relating to amateur radiotelephone technique and thus disclose the possession of some small special knowledge of telephony-in addition to his previously demonstrated knowledge of c.w.

Perhaps a better idea of the Board’s 'phone plan is to be obtained from an examination of the accompanying illustration. First it is to be noted that the 1715-2000-ke. band is cut in two, and the portions from 1875 to 2000 ke. made available for 'phone. This is the half of the band the farthest removed from broadcast listeners, which is a good thing. It has five times the width of the existing 80-meter 'phone privilege and so possesses ample width. It is confined to half of the band width not only because of the probability of broadcast interference from operation at the low frequency end of the band but because of the growing appreciation of the need that c.w. will have for some of these frequencies in a short while — see our February editorial. This region from 1875 to 2000 ke. (and the entire 5-meter band as well will be open to every amateur, without the necessity of showing any special technical qualifications. This is an extremely useful frequency range, splendid for 'phone work, and the Board hopes that more 'phones will take advantage of it.

THE DIRECTORS AND OFFICIALS AGAIN FACE THE CAMERA ON THE STEPS OF THE HARTFORD CLUB AT THE CLOSE OF THE MEETING

July, 1931
which they might desire to double twice into the 20-meter band. This was one reason why this band had to be moved. Another was that it ought to embrace the range of frequencies in harmonic relation to the ‘phone frequencies in the 160-meter band, so that ‘phone stations might have the opportunity to use a crystal between 1950 and 2000 kilocycles and thus work in either of two ‘phone bands at will. It is also to be remembered that we have had a serious QRM situation with a delicate commercial ‘phone service adjacent to the 3500 kc. end of our band and of two ‘phone bands at will. It is also to be pointed out that no amateur as yet has the right to operate ‘phone between 3900 and 4000 kilocycles. These matters are still under negotiation at Washington and it is impossible at this writing to say when they will become effective. Nor can it be prophesied in advance just what the arrangements will be for showing the special qualifications necessary for operating in the 80-meter and 20-meter bands. Complete information will be broadcast and published in QST as soon as it is available.

Considering the limited use of the 20-meter band by ‘phone and the extent to which these stations have not confined themselves to the portion of the band assigned for ‘phone, it is part of the Board’s plan to narrow the 20-meter ‘phone privilege to embrace only the central quarter of the band, from 14,150 to 14,250 kc. Both this band and the 3900–4000 kc.-band are then to be made available only to amateurs who have served a year’s apprenticeship as demonstrated by having held some kind of an operator’s license for that length of time, who now possess a regular license and not a certificate, and who furthermore show that they know a little something about what they are doing. This has been one of the chief requests of the ‘phone people — that c.w. men just “fooling around” with loop modulation and beginners who know nothing of the importance of frequency stability and the niceties of modulation methods be denied the right to operate in their most useful and congested band. It is not intended to make the requirement for this so difficult that only a physicist can qualify but at the same time to keep out the beginner and the absolute tyro, and confine the privilege to those who can demonstrate a normal amateur knowledge of the technique of ‘phone, the evils of frequency modulation and how to overcome them, the importance of amplitude modulation and how to secure it, etc.

The Board’s plan above outlined is not yet in effect. It is important to note that no amateur as yet has the right to operate ‘phone between 3900 and 4000 kilocycles. These matters are still under negotiation at Washington and it is impossible at this writing to say when they will become effective. Nor can it be prophesied in advance just what the arrangements will be for showing the special qualifications necessary for operating in the 80-meter and 20-meter bands. Complete information will be broadcast and published in QST as soon as it is available.

In the meantime, all of the old regulations continue to apply. It is expected that any change in regulations will occur only with about four months advance notice, to give ample time to every operator to qualify if he has the necessary ability, and to make the necessary small changes in his equipment.

Incidentally, it is to be noted that the proposed changes in frequency are in the right direction — crystals can be ground a few molecules and antennas can be clipped a few inches much easier than vice versa. It is also to be pointed out that the Board’s plan does not contemplate any exclusive ‘phone bands, as the fundamental rights of all amateur stations to all of the bands must not be violated. The ‘phones need have no worry on this score, however, because amateur practice has amply demonstrated that a non-exclusive ‘phone band soon assumes the aspects of an exclusive assignment because of the difficulty which c.w. stations have in working through the ‘phones.

Nobody can claim that this is a perfect solution of the ‘phone problem. It admittedly isn’t. It won’t satisfy everybody. But at the same time, it must be said that it is the best possible solution to-day, and that it has been arrived at sincerely and only after the most exhaustive sort of study. It does have the practical effect of giving both ‘phones and c.w. stations more space and it provides the bulk of the ‘phone amateurs with what they wanted. Realizing that few things are perfect in this world, may we not now hope that this program will be accepted by c.w. and ‘phone men alike and embraced as at least the temporary (Continued on page 98)
Inexpensive Crystal Control
A Three-Band Low-Power Transmitter

By George Grammer, Assistant Technical Editor.

Although the desirability of crystal control for transmitters is almost universally admitted, its actual application is not nearly so universal. Many of us, while perhaps agreeing that the signal put out by a crystal transmitter is as nearly ideal as anything we have, still stick to outfits with more flexibility in changing frequency and fewer complications in design and operation; some insist that the cost of tubes and parts for a crystal-controlled transmitter that can cover three bands is too great. Although it is true that a crystal-controlled transmitter is likely to cost more than a self-excited outfit of equivalent power, the gain in frequency stability and power amplifier tube efficiency more than makes up the difference. As has been pointed out in a previous article,1 an amplifier properly excited can always be expected to give more power output for a given plate input than a self-excited oscillator, because it is possible to use a better $L-C$ ratio in the tank circuit and because the amplifier does not have to supply its own grid losses. Besides these material gains, there is the pride of ownership—difficult to appraise in terms of cash. A crystal note is in a class by itself—the sort of thing that causes its owner to feel right at home in the most select ham company.

The obstacle for the amateur who wants to crystal-control a Type '10 tube or two in his transmitter usually is the expense involved. But crystal control for the low-power transmitter need not cost such a lot. A Type '10 tube does not require a tremendous amount of excitation to work efficiently, and therefore the tubes preceding the output amplifier may work at rather low voltages. This in turn means that low-priced receiving parts; midget tuning condensers, receiver-type mica fixed condensers, wire-wound coils instead of copper tubing—all may be used without danger of breakdown. Furthermore, the tubes in the “exciter” stages, the oscillator and doublers, may just as well be receiving tubes. True, the crystal itself will cost something, and a mounting will have to be made or purchased, but excellent crystals are available from numerous sources at figures that seem like ten-cent store prices compared with the amounts paid for them in the early days of crystal control.

All of which simply means that no great outlay of money is necessary if a Type '10 tube is to be crystal-controlled. Once the crystal itself is acquired the other equipment can be accumulated without causing the present financial depression to become noticeably worse.

It is the purpose in this story to point out one of several possible ways in which receiving tubes may be utilized to excite a Type '10 amplifier for operation on three bands. Many other schemes and tube combinations no doubt will suggest themselves to the experimenter.

**Using Receiving Tubes**

Several experiments over quite a period of time have indicated that if a tube is to give anything like the output it is capable of producing as a self-excited oscillator, it must be excited by a

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1 “More Power with Better Frequency Stability,” p. 27, February, 1931, QST.
in a transmitter with only a $7\frac{1}{2}$-watt tube at the output end. For this reason it was thought desirable to try some of the many varieties of receiving tubes for the oscillator and doubler stages to see whether or not it was possible to get sufficient excitation to run the last tube. For the type of transmitter we had in mind the '27 for the oscillator and the '24 for the doublers seemed to be the most suitable, because indirectly-heated cathodes require no filament by-pass condensers and because several people who know something about tubes had assured us that the cathodes would stand a 10- or 15-milliampere heating. A rough measurement of the power output on the different bands showed that the amplifier would deliver between 10 and 15 watts to the antenna on 14,000 kc. and 20 to 30 watts on 7000 and 3500 kc. Increasing the voltage on the oscillator and doublers helps to step up the power a great deal; with 300 volts on the doublers there is ample excitation for the amplifier. The tubes have been operated at this voltage without causing the plate to show any change of color. On 14,000 kc., owing to the impossibility of getting as high \( L-C \) ratios at this frequency as at the lower frequencies, and because the efficiency of any type of amplifier begins to drop off considerably at frequencies of this order, the performance was not quite so good. It was possible, however, to run the input up to about 35 watts before the amplifier showed signs of heating. A rough measurement of the power output on the different bands showed that the amplifier would deliver between 10 and 15 watts to the antenna on 14,000 kc. and 20 to 30 watts on 7000 and 3500 kc. Increasing the voltage on the oscillator and doublers helps to step up the power a great deal; with 300 volts on the doublers there is ample excitation for the amplifier. The tubes have been operated at this voltage without showing any tendency to break down, but probably it would not be advisable to exceed this figure. The Type '27 tubes will often show gas if the voltage is increased beyond 200.

An experimental layout was accordingly built up and at 250 volts the '24's were found to work nicely as doublers. It was found that with 150 volts on the '27 oscillator and 250 volts on a '24 used either as a straight-through amplifier for 3500 kc. or as a doubler for 7000 kc., it was possible to put as much as 50 watts on the plate of a Type '10 neutralized amplifier and work the tube at an efficiency high enough to allow it to run continuously without causing the plate to show any change of color. On 14,000 kc., owing to the impossibility of getting as high \( L-C \) ratios at this frequency as at the lower frequencies, and because the efficiency of any type of amplifier begins to drop off considerably at frequencies of this order, the performance was not quite so good. It was possible, however, to run the input up to about 35 watts before the amplifier showed signs of heating. A rough measurement of the power output on the different bands showed that the amplifier would deliver between 10 and 15 watts to the antenna on 14,000 kc. and 20 to 30 watts on 7000 and 3500 kc. Increasing the voltage on the oscillator and doublers helps to step up the power a great deal; with 300 volts on the doublers there is ample excitation for the amplifier. The tubes have been operated at this voltage without showing any tendency to break down, but probably it would not be advisable to exceed this figure. The Type '27 tubes will often show gas if the voltage is increased beyond 200.

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A PRACTICAL TRANSMITTER

Following these experiments a breadboard transmitter was built up for operation on all three bands. This outfit is shown in the accompanying photographs, and a wiring diagram appears in Fig. 1. As the diagram shows, the circuit is the conventional crystal layout with capacity coupling between stages. The plates of all tubes are series-fed, which relieves the plate chokes from carrying much of a burden. Capacity coupling to the grids of the tubes makes it necessary to bring the d.c. grid returns back through an r.f. choke, and these chokes must be good or a large part of the excitation is likely to leak off through them. Pie-wound chokes (the ones on the set in the photograph are Silver-Marshall Type 277's) seemed to work best in the grid circuits. The others are straight cylindrical chokes of the usual type. A 10,000-ohm resistor is placed in series with the grid returns of the doublers and the amplifier to further aid in blocking out the r.f.

All tubes are series-fed, which relieves the plate current. Although it is possible to get the transmitter working without the aid of any meters at all, a plate milliammeter at least will prove an invaluable aid in tuning as well as a safeguard for the tubes in that it will show whether or not they are drawing excessive plate current.

The layout of parts shown in the photograph provides short leads between stages and yet allows the tuned circuits to be sufficiently separated to minimize stray coupling between them. To this end the inductances for the first three tubes have been mounted so that their fields will not interlock. The tuning control for the oscillator is at the right of the right-hand panel on the front of the breadboard (this board measured 10 by 27 inches), while the 7000-ke. doubler stage is mounted at the rear of the board and slightly to the left of the oscillator. The tuning condenser for this stage is mounted on a small square of bakelite set perpendicular to the rear edge of the board. This control need not be touched after having been adjusted once for a given crystal, because this stage always works on the 700-ke. band. National Type SE-100 condensers are used in the oscillator and doubler stages. The crystal mounting plugs into the jacks on the small strip of bakelite mounted alongside the panel which holds the tuning condenser for the 7000-ke. stage. The two bakelite panels at the front of the baseboard are each 3½ by 12 inches.

The third tube is used as a straight amplifier for 3500 kc., as a doubler for 7000 kc. (or as a straight 7000-ke. amplifier following the first doubler), or a 14,000-ke. doubler. The inductance for this stage is therefore made plug-in, and since the neutralizing coil for the amplifier is part of this inductance a three-plug mounting must be used. The plate milliammeter for the first three stages is mounted between the tuning condensers for the first and third tubes; a bakelite strip on which three jacks are mounted is placed below the meter on the bottom side of the breadboard. The small condenser at the left of the panel, a Cardwell double-spaced "Balancet," is the neutralizing condenser for the Type '10 amplifier.

The fact that the control grid connections for the '24's are on top of the tubes makes it an easy matter to change bands. Referring to Fig. 1, it will be seen that the plate of the '27 oscillator is connected to one side of the coupling condenser $C_7$, and that the other side of $C_7$ is connected to $R_{FC'}$, the grid choke for the following stage. The connection between $C_7$ and the grid of the following tube is made by a piece of flexible wire about six inches long which terminates in a screen-grid clip. The connection between the plate of the first '24 doubler, coupling condenser $C_9$, and the grid of the second '24 is made similarly. The two Type '24 tubes are placed on the baseboard so that the flexible lead from $C_7$ can be attached to the grid cap of either tube; it is therefore possible to cut out the first '24 entirely, simply by removing the grid clip from that tube and placing it on the second '24. The flexible lead from $C_9$ is left floating when this is done.

By this process $R_{FC'}$ becomes the grid choke for the second '24 tube. The stages are connected up in this way when the set is to be used on 3500 kc., in which case the 7000-ke. stage is unnecessary. This connection also may be used on 7000 kc., when the '24 actually in use (the second '24 from the right in Fig. 1) works as a doubler. An alternative connection for 7000 kc. would be to connect $C_7$ to the grid of the first '24, which is tuned permanently to 7000 kc., and connect $C_9$ to the grid of the second '24. In this case the second '24 is being used as an additional amplifier. This will generally give more excitation for the final amplifier than the first arrangement, but there is a possibility that there will be enough stray coupling between the two stages to cause them to self-oscillate. This may be checked readily in a monitor by listening with the crystal oscillator off. If there is no tendency towards self-oscillation it is just as well to take advantage of the additional amplification.

On 14,000 kc. the three tubes work in regular order; the oscillator on 3500, first doubler on 7000 and second doubler on 14,000.

The view of the underside of the baseboard shows how the various chokes and by-pass condensers are placed. Although the available space...
is small every effort has been made to prevent coupling between stages by mounting the chokes at right angles to each other. The two by-pass condensers for the screen-grounds of the '24's have been mounted so that the leads from the tube sockets come directly down through the board to them, making extremely short connections.

Binding posts for the various plate, filament and bias supplies are mounted on bakelite strips at the rear of the baseboard. They are identified in the photograph.

THE OUTPUT AMPLIFIER

The amplifier occupies the left-hand side of the baseboard, and to prevent feedback has been moved as far away as possible from the small tubes. The panel holds the amplifier plate milliammeter, plate tank condenser, antenna condenser and antenna ammeter. The amplifier tank inductance is made plug-in, as is also the antenna coil. The latter coil plugs into a bakelite strip which is pivoted at one end so that the coupling between the two inductances can be varied. The tuning condensers are the new Cardwell Midway type, a 250-µfd. receiving condenser being used for the antenna and a 100-µfd. transmitting model for the amplifier tank. Condensers with ordinary receiver spacing between plates often spark over when used in a low-C tank circuit, even though the plate voltage is only of the order of 500 volts.

Although the axes of the amplifier tank coil and that of the preceding '24 tube are parallel, the amplifier has shown no tendency to oscillate when properly neutralized. If the amplifier should oscillate in spite of apparent neutralization, a baffle shield, simply a grounded sheet of aluminum mounted vertically between the two stages, should fix things up.

A series connection for the antenna coil and condenser is shown in the diagram. The type of antenna in use will determine the exact form of connections to be used, and the choice of antenna circuit will have to be left to the individual constructor.

The amplifier tank coils are wound on 2½-inch bakelite tubing. No. 14 enamelled wire is used for the 7000- and 14,000-kc. coils, while the 3500-kc. coil is wound with the same wire as is used for the other coils in the set; No. 18 d.c.e. As the tank circuit has comparatively little tuning capacity the circulating current is small, so there is no particular heating because of the small conductor.

POWER SUPPLIES

It is advisable to use two power supplies to operate the transmitter, one capable of delivering 250 to 300 volts at about 60 milliamperes for the oscillator and doublers, and the other to furnish about 550 volts at 60 to 70 milliamperes for the Type '10 amplifier. Offhand it would seem that one power supply should be sufficient for the whole outfit, but practically it does not work out so well. With most power supplies ordinarily used with Type '10 tubes the voltage drops to a rather low value when the current drain becomes high; we have in mind one in particular which used a 550-volt transformer and the conventional brute-force filter, the voltage output of which was about 450 volts at 100 milliamperes. As the total drain in this case would be in the vicinity of 120 to 130 milliamperes, at which the voltage was in the vicinity of 400, the amplifier did not have much to work with. A greater objection, however, is that as the amplifier is keyed the voltages on the other tubes fluctuate between wide limits. For example, the voltage dividers or series resistors might be adjusted with the amplifier plate circuit closed so that the actual voltage on the doublers is 250; with the amplifier load off, however, the voltage could easily rise to 350 or 400, which is not desirable.

For these reasons it is better to use a separate power pack for the first three tubes. Such a pack can be built quite inexpensively from replacement parts used in broadcast receivers, and is well worth the small additional investment.

A voltage divider, R5, is connected across the 250-volt power supply in this transmitter to provide reduced plate voltage for the oscillator tube and screen voltage for the '24's. The unit shown in the photograph is a Pilot No. 960 resistor. A similar divider can be made up by connecting three resistors of the proper values in series. The part between the positive side and the oscil-
ator tap should be approximately 4000 ohms; between the oscillator tap and the screen grid tap 3600 ohms; and between the screen grid tap and the negative side, 5000 ohms. Differences of 10% in these values will make no practical difference.

**TUNING**

After the transmitter is wired and the connections have been checked, the filament, plate, and bias supplies should be connected to the proper binding posts. For the time being the amplifier plate supply should not be connected. The crystal should be plugged in and the grid clips left off the '24 tubes until the oscillator is in operation. The bias on the '24's should be about 45 volts at the beginning, and the same battery may be used for all tubes.

The plug for the milliammeter $A_1$ should be placed in the oscillator jack and the plate current noted. This current will be in the neighborhood of 20 milliamperes if the tube is not oscillating. Slowly vary $C_1$ until there is a dip in the plate current, which indicates that the tube has begun oscillation, and set the condenser at a point slightly above the minimum plate current reading, which will be, ordinarily, about six or eight milliamperes. A loop of wire connected to a flashlight lamp may be coupled to the oscillator inductance and the brightness of the lamp will give some indication of the strength of oscillation.

The 3500-kc. coil for the '24 amplifier, $L_9$, should next be plugged in the coil socket and the clip from $C_3$ placed on the grid cap of the second '24. The first '24 is not used on this band. Connecting the amplifier to the oscillator probably will cause the oscillator tuning to change, so that $C_1$ should be adjusted again until the plate current is at a minimum. Then put the milliammeter plug in $J_1$ and vary $C_1$ until the plate current on the '24 shows a dip, and again set the condenser for minimum plate current, which will be about eight or ten milliamperes, probably. The tuning lamp will be useful for checking this stage also, and should light up fairly brightly.

Neutralization of the Type '10 amplifier is the next step. As the process of neutralization has been covered very thoroughly in *QST* we need not go into it here except to say that during the operation the grid circuit of the amplifier should be closed; that is, if the key is in the center-tap

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condensers are moved through resonance should be smooth; a sharp change in plate current at any point usually indicates that one or both of the amplifiers is breaking into oscillation of its own. Such oscillations can be picked out easily with the monitor, and if present must be eliminated by shielding between stages. A baffle shield between the final amplifier and the preceding stages should be sufficient.

As has been mentioned previously, there are two ways in which the set may be tuned on 7000 kc. The simpler method is to connect C7 through the grid clip lead to the grid of the second '24 tube, plugging the 7000-kc. La coil in the coil socket. The tuning is done in the same way as before; that is, C3 is adjusted for minimum plate current with the milliammeter plug in J3, and the final amplifier is neutralized and tuned in exactly the same fashion as on 3500 kc., except that the proper coils will be used, of course.

The alternative method is to connect C7 to the grid of the first '24 and C6 the grid of the second '24. The first tube then becomes the 7000-ke. doubler and the second an additional 7000-ke. amplifier. In this case the plug is first placed in J2 and C6 is adjusted for minimum plate current, which will be about 10 or 12 milliamperes. The plug is next placed in J3 and C3 is adjusted similarly. Again the amplifier tuning is the same. It may be advisable to increase the bias on the second '24 in this case, as the plate current on the tube is likely to be higher. This bias, connected to the post marked C2, may be approximately 90 volts.

When using this method of connection the amplifier should be carefully checked for signs of self-oscillation, because there are three tubes on the rather high frequency of 7000 kc. If it is impossible to prevent oscillation the first doubler should be omitted and only the second '24 used.

On 14,000 kc. all the tubes are in the circuit, and since each of the '24's is working on a different frequency, there is little likelihood of oscillation on this band. It is advisable to use 90 volts bias on the second '24 in this case, because the plate current may run quite high. The tuning process is the same as before; that is, each tuning condenser is adjusted for minimum plate current on the tube associated with it. The tuning lamp will be helpful in locating the bands, but should not be left near any of the inductances when final adjustments are made because it is likely to shift the tuning. As a rule the amplifier plate current will run between 25 and 35 milliamperes with the antenna disconnected on this band, and it will not be possible to load the tube beyond 60 or 70 ma., because of the lower efficiency at this frequency.

The specifications for the coils may require some modification in different layouts. As a general rule it is best to use as much inductance and as little capacity as possible in each stage to get the greatest output. It is an easy matter to add or subtract a turn or two in case it is impossible to make one of the stages tune properly. The coil specifications under Fig. 1 will form a good starting point, and in fact may be found to work out without any change.

It should be possible for the chap who already has a self-excited Type '10 outfit to control it by this method at comparatively small cost. With judicious buying the cost of the extra tubes, parts and power supply should not exceed $25 exclusive of the cost of the crystal and mounting. In many cases surplus receiver parts, such as are found in quantities in most amateur stations, will be available and may be used. For only one or two bands an even simpler layout can be used; for instance if the transmitter is to be used only on 3500 and 7000 kc. one of the doubler stages may be omitted. The transmitter as illustrated also will make a good exciter unit for larger tubes, and as such does not represent waste equipment if higher power is to be installed later, as might be the case if self-excited circuits were considered.

3500-KE. PHONE

A transmitter of this type is well suited to low-power 3500-ke. phone work. If used exclusively for 3500-ke. phone only three r.f. tubes are needed, a '27 oscillator, a '24 as a buffer amplifier, and the Type '10 as the modulated amplifier. In such a transmitter it is advisable to have plenty of physical separation between stages, and shielding of the buffer and oscillator stages is also recommended. These precautions will aid in preventing any energy in the amplifier stage from leaking back into the crystal oscillator and will thus improve the frequency stability of the transmitter. A modulator unit which will work well with this outfit is described on page 14 of the September, 1929, issue of QST, and in the chapter on "Radiotelephony" in the Seventh and Eighth Editions of the Handbook.

The A.R.R.L. Board Meets

(Continued from page 30)

end to our squabbles on this question? We are entering now a most difficult time in our life as one group of radio amateurs, and in the months which are coming upon us we must stand solidly together.

Strays

W9IN finds that rubber nipples (stripped from the junior op's bottle) make good rain protectors for porcelain tube lead-in insulators. The bottle end of the nipple is slipped over the tube and the antenna wire goes through the hole that's intended to pass the milk.

36 QST for
BIGGER AND BETTER" is indeed appropriate to describe the Second All-Section Sweepstakes Contest, but it can never describe the keen enthusiasm of the participants and the pleasure and benefits they derived from the two weeks of "the most interesting operating they ever experienced."

From all quarters the "1931 Sweepstakes" has been acclaimed the "biggest contest of recent years; national or international" so far as national participation and interest is concerned! "Never had so much fun in all my life." "It was the most interesting two weeks that I have ever spent at the key." "The greatest contest that the A.R.R.L. ever sponsored." "I believe it is the most fascinating contest you conduct." "One of the most pleasant experiences that I have had in a long time." "I believe the benefits derived by the participants in a contest of this kind are manifold." "I enjoyed the contest very much, making more contacts and handling more messages than in any previous two weeks during the many years I have had a station." We could quote page after page of comments similar to the above, but the reader can judge for himself the attitude of the participants towards the "Sweepstakes." It "went over big."

The rules of the contest? They appeared in full in the February issue of QST. Anyone not already familiar with the requirements should dig out his copy and become acquainted with full particulars. It was a contest between individual stations, and was open to all amateurs in the sixty-eight A.R.R.L. sections throughout the United States and Canada, and including Hawaii, Alaska, the Philippines, Porto Rico, Cuba, etc. A station in any given section was competing only with all other stations within that section. Certificates were awarded only to the highest scoring station in each section. Even though there was no prize for having the highest score throughout all the sections, it proved a great deal of sport to strive to attain the leading total. The system of scoring was, briefly: A count of one point for each message transmitted, making a total of two points for each QSO, if a message had been transmitted and received successfully. One message only could be exchanged each way with any one station, but exchanges could be made with as many stations as possible. Messages had to be transmitted in complete form with city of origin, station of origin, number, date, address, text and signature, the text being of no less than ten words (plain language count). Messages that did not comply with this rule were designated incomplete, and likewise the QSO on which they were exchanged was eliminated from the contest. If, therefore, a bona-fide exchange had been made, each QSO counted two points. That was only the beginning of the scoring! The total score made by exchanging messages was multiplied by the number of sections with which exchanges had been made. A possible multiplier of 68. As new sections were added scores doubled, trebled, quadrupled; there was no stopping them.

Such scores have never before been heard of in any contest. The sum total of all scores is 885,541. With 276 stations listed on the score sheet this makes an average score of approximately 3208 per station!! 31 stations have scores over 10,000! Two are above 25,000 and two above 30,000!! Enough of that. Who are the high scorers? And who are the certificate winners?

W8CHC pounded away with vigor and determination, and came out in first place with the astounding total of 32,940!! He exchanged messages with 10,5 stations in 54 sections. If you don't think that is getting about the greatest possible efficiency out of a one-man station, try it sometime! Congratulations, W8CHC! The four operators at W5WF "did themselves proud" and came in second with another eye-opening score — 32,016! And to W5WF goes the honor of making successful exchanges with the greatest number of sections — 68, all but ten of the possible sixty-eight. The third highest and the station working the second greatest number of sections is W7AAT, a station with one operator that did most out-
standing work. 265 exchanges with 55 sections brought W7AAT the score of 29,150—nothing to be snickered at!

The Illinois Section leads all sections and the three ops at W9DGZ, backed by splendid team work in reporting scores throughout the Section, had no small part in putting her at the top. Exchanges with 235 stations in 54 sections gave W9DGZ fourth place—25,380. VE3GT is fifth high with 19,872, and is also the leading Canadian participant by many thousands of points.

The operators of all certificate-winning stations should feel mighty proud of their accomplishments! The work of the five stations mentioned above, shows competition "fast and furious."

Eleven stations made successful exchanges with 50 or more A.R.R.L. Sections during the two weeks of the contest and are entitled to special mention because of such creditable work. They are here listed in order of number of sections: W5WF 58, W7AAT 55, WSCHC 54, W9DGZ 54, W6BIF 53, W6AQJ 53, W8BGY 51, W8BMA 51, W9ECZ 51, W3AMP 50, W9CPM 50. This shows mighty nice work, and the operators may well throw out their chests!

As a matter of record and for the information of all concerned we are listing below stations having scores above 10,000.

STATIONS WITH SCORES ABOVE 10,000
W8CHC, 32940 W2CUQ, 15364 WBEN, 11880
W5WF, 32016 W9ECZ, 14592 W9CPM, 11800
W7AAT, 29150 W9BMA, 14992 WSJJ, 11992
W9DGZ, 29150 W2CEX, 14598 W1AVL, 11430
V3EGT, 19872 W6YU, 14076 W9IDDB, 11180
W4GQ, 17484 W3AMP, 13600 W4GX, 11070
W6BIF, 16642 W9AXA, 13344 W8CBM, 10020
W8BGY, 16320 W7ACX, 12684 W8AM, 10722
W8AQJ, 16112 WD9DS, 12672 W9EZK, 10584
W4MM, 15908 W2BUE, 12382 W5BBQ, 10464
W3GS, 11988

That certainly is some list. It will be noticed that all United States and one Canadian district are represented in the above list. While the work of the 31 stations listed deserves worlds of praise and admiration we must not lose sight of the fact that this was not a contest for national high place. It was a competition between stations within each A.R.R.L. Section. Any given station within a Section was competing only with all other stations in his section. Certificates of merit were to be awarded to the leading station of each Section. A study of the scores at the end of this article will show 64 sections listed. Certificates have been awarded to the highest scoring station in 62 of these territories. No stations in the other sections submitted scores in accordance with the contest rules so no awards can be made.

A word as to the checking of logs and disqualification of those who failed to observe the rules might not be amiss at this point in our story. The usual variety of entries came in. Some were works of art and gladdened the hearts of the judges. Others were just the opposite, being nothing more than a conglomeration of messages and a pencil-scribbled log sheet jammed into an envelope. We were glad to get them all. Very, very few logs were found to check letter-perfect. Many scores were reduced considerably by the checking committee. Rule No. 4 (February QST) of the contest stated that all messages must be composed and transmitted in the proper form with city of origin, station of origin, number, date, address, text (at least ten words, plain language count), and signature, and that unless they were so composed and transmitted the award committee would disregard such communications as "insufficient evidence of satisfactory two-way communication." Therefore, out of fairness to those who complied with the rules, any message lacking any of these essential parts was designated incomplete and the QSO on which it was exchanged was eliminated from the contest. In a few cases violations of Rule No. 4 cut scores in half! The greatest fault seemed to be carelessness of participants in preparing the copies of messages handled. It is better to submit original copies of messages handled than to try to re-copy them as that was found to be when most errors occurred.

Several stations not taking part in the contest sent in copies of messages handled to be checked and counted to help the stations they worked.
They have been given a score, and although they are not eligible for certificate awards, their scores will count for their respective sections. Such stations will be found marked with an asterisk in the list of scores. A number of stations submitted logs for consideration, but failed to give all the information required in the rules, such as time messages were received and sent. Of course these stations are ineligible for certificates, but in cases where the messages submitted were complete in every detail they have been given a score to count for their sections. They are marked with two asterisks. The following stations sent in messages to help out participants, but the messages were incomplete so scores cannot count for their sections: W1CSR, W1MO, W1QS, W1UZ, W2AW, W2APZ, W2BEB, W2BKL, W2CZZ, W3IC, W6CBO, W6ZS, W7AFS, W8CMV, W9AMI and CMSYB. Three stations, W1BU, W9BBL and W9FNJ, submitted logs, but since their messages were incomplete, or insufficient information was given, they could not be considered for scores. Logs from W3AWV and K7ANQ were received late, so these stations were eliminated.

Again this year, as was the case with the 1930 Sweepstakes, low power stations were able to run up sizeable scores. W6CTP, certificate-winner in the San Diego section, used only a type '71A throughout the contest and came out with a total of 7878. W8APQ placed third in Western Pennsylvania with his score of 4410, and he used only a type '01A with 230 volts on the plate on 3.5 and 7 mc, and a '12A on 14 mc! W9DZK used two '71s with 200 volts. W5BMI had a lot of fun with a '45 with 250 volts on the plate.

The 7000-kc. band was very popular during the Sweepstakes. Approximately 22% of all participants worked on 7000 kc. only. 23% divided their time between 3500, 7000 and 14,000 kc. 17% used 7000 and 14,000, 16% did their work on 3500 and 7000. 15% honored 3500 kc. only. Only 4% stuck to the 14,000-kc. band entirely. 2% chose the 3500-14,000 combination. And 1% used 3500-7000-17.50. A bit of 'phone work was done during the contest, mostly on the 14,000-kc. band.

Just a few side lights which may be of interest — VE2AC received 97 QSL cards as a result of the Sweepstakes! WSBPT, XYL, and W9GJX, YL both submitted scores. W1OS and W8CNO, XYLs, were worked by several contestants. W9DBB's shack and everything in it including Sweepstakes files were destroyed by fire shortly after the contest. He submitted an affidavit swearing to his score, so his two weeks' labors did not go for naught. W1AVL worked one fellow who didn't know what QST was! And worse still, he worked another chap who, when asked to exchange messages, replied that he "had to take his wife for a ride..." and that at 2 a.m.!! It just isn't being done. W9ECI bet WIRV a pair of burned-out '81s against a 1924 call book that he would have the highest total. W1RV now has two tubes to throw away.

In conclusion we repeat the assertion made at the start of this article — "The 1931 Sweepstakes was the biggest contest of recent years, national or international, so far as national participation and interest is concerned!" It is estimated that well over one thousand stations took part and, although not all reported for full credit, we know they enjoyed the radio work and contacts with good operators as fully as those whose expressions we have quoted here. As a measure of the fact that we have a live organization throughout, we may say that stations were active in each of the 68 A.R.R.L. Sections during the two weeks. This included stations in Alaska, Hawaii, Cuba, Porto Rico, the Philippines, Newfoundland, the Yukon and other remote points. That the contest was enjoyable is questioned by no one. It was also beneficial from the standpoint that it gave much practice and instruction in correct operating procedure. W9BVI writes, "I was an absolute beginner when I entered the contest; in fact I handled my first message on my third QSO. This taught me the proper message handling procedure." Many other operators were likewise benefited. W3AMP says, "A host of new friends was made, our spirit and interest in ham radio raised, and operation improved." All in all, "it was a peach of a contest." W3FJ sums it up well when he says, "It has proven a convincing illustration of the courtesy, cooperation and efficiency of the American amateur."

The list of scores follows. Stations are listed under their respective sections in order of their scores. The number of sections worked by each station is also listed. Whenever a station is known to have had more than one operator, the number of operators is shown in brackets with the call. Sections are listed according to their totals, the three highest being Illinois, Western New York and Western Pennsylvania. A summary showing the total scores for each Division and the leading Section in each Division is given at the end of the list of scores. How did your Section and Division come out?
## Results of the 1939 "Sweepstakes" Contest

**Section Station** | **Number of Sections** | **Score** | **Number Station** | **Score**
--- | --- | --- | --- | ---
Illinois | W9DGZ (2) | 54 | 25580 |  
W9ECZ | 51 | 14902 |  
W9ERZ | 42 | 10584 |  
W9CUD | 34 | 4964 |  
W9AFN | 22 | 4608 |  
W9ERU | 30 | 3000 |  
W9COB | 22 | 1320 |  
W9DGK | 12 | 480 |  
W9DWA | 13 | 468 |  
W9EN | 11 | 418 |  
W9FUL | 12 | 336 |  
W9CNY | 7 | 126 |  
W9A11Q | 6 | 72 |  
W9A1A | 3 | 30 |  
W9Q1* | 3 | 24 |  
W9BH1W* | 1 | 4 |  
W9ATTY* | 1 | 2 |  
W9C1FPQ* | 1 | 2 |  
W9ADN* | 1 | 2 |  
  | 46712 |  
  | 48532 |  
W9AXA | 48 | 13344 |  
W9BEN | 45 | 11880 |  
W9C1Y | 35 | 7210 |  
W9ADG | 40 | 6800 |  
W9DUB | 27 | 5070 |  
W9BFG | 20 | 1760 |  
W9DSP | 19 | 1292 |  
W9AKC | 11 | 506 |  
W9BCON* | 5 | 70 |  
  |  
W9CHA | 54 | 23240 |  
W9DNO | 38 | 5746 |  
W9A1PQ | 35 | 4410 |  
W9AXD | 19 | 2052 |  
W9DLG | 20 | 1440 |  
W9ASE | 17 | 816 |  
W9AJU | 11 | 264 |  
  | 47658 |  
W9AQl | 53 | 16112 |  
W9AM | 48 | 10752 |  
W9C1XW (2) | 33 | 9608 |  
W9SN | 35 | 6110 |  
W9BGF | 30 | 2220 |  
W9IP | 20 | 1360 |  
W9STJ | 18 | 960 |  
W9AOA | 9 | 396 |  
W9C1Z | 10 | 340 |  
W9E8A | 7 | 112 |  
W9BBO | 5 | 50 |  
W9DZI* | 3 | 18 |  
  | 43238 |  
  |  
W9GS | 44 | 11968 |  
W9EY | 30 | 7020 |  
W9FX | 27 | 5508 |  
W9JR | 40 | 5280 |  
W9AIZ | 31 | 4525 |  
W9C1W0 | 21 | 2478 |  
W9NF | 17 | 1550 |  
W9DHT | 17 | 986 |  
W9A1H** | 10 | 280 |  
W9MG | 8 | 192 |  
W9CF | 7 | 126 |  
W9HH* | 7 | 126 |  
  |  
W3MG | 6 | 120 |  
W3RES | 1 | 2 |  
N. New Jersey | W2GEX (3) | 49 | 14308 |  
W2BUE | 41 | 12382 |  
W2C1W | 28 | 7676 |  
W2AI | 24 | 3108 |  
W2HWH | 20 | 1120 |  
W2BPY | 13 | 728 |  
W2CFY | 9 | 630 |  
W2AG0 | 5 | 60 |  
W2AFB* | 2 | 2 |  
  | 40974 |  
Louisiana | W5WF (4) | 58 | 32016 |  
W5YW | 32 | 4928 |  
  | 36944 |  
Florida | W4GJ (3) | 47 | 17484 |  
W4MM (2) | 47 | 15698 |  
W4AKH | 21 | 2268 |  
  | 35450 |  
Washington | W71N | 42 | 8004 |  
W7DF | 41 | 7988 |  
W7TRT | 19 | 4674 |  
W7FA | 29 | 4002 |  
W7VN | 27 | 2214 |  
W7AT | 24 | 2016 |  
W7KEF | 19 | 1046 |  
W7TK | 18 | 858 |  
W7WU | 9 | 612 |  
  | 31194 |  
Ontario | VESGT | 48 | 19672 |  
VESBE | 28 | 4524 |  
VESZ | 23 | 3404 |  
VESRF* | 25 | 2400 |  
VESA1D | 9 | 198 |  
  | 30208 |  
Michigan | W8GGY (2) | 51 | 16320 |  
W8MV (2) | 27 | 4014 |  
W8DRL | 22 | 2420 |  
W8GJX | 24 | 2112 |  
W8PP | 19 | 2014 |  
W8OOG | 19 | 1178 |  
W8CFB | 12 | 504 |  
W8SH | 15 | 492 |  
W8BMG | 7 | 496 |  
W8DM | 5 | 50 |  
W8BPT | 3 | 42 |  
W8GW* | 4 | 32 |  
WSTJ* | 3 | 18 |  
W8A1F* | 1 | 2 |  
  | 30234 |  
Los Angeles | W6AQ1 | 53 | 16112 |  
W6AM | 48 | 10752 |  
W6C1XW (2) | 33 | 9608 |  
W6SN | 35 | 6110 |  
W6BGF | 30 | 2220 |  
W6IP | 20 | 1360 |  
W6STJ | 18 | 960 |  
W6G8A | 9 | 396 |  
W6C1Z | 10 | 340 |  
W6E8A | 7 | 112 |  
W6BBO | 5 | 50 |  
W6DZI* | 3 | 18 |  
  | 43238 |  
  |  
S. New Jersey | W3AMF | 50 | 13600 |  
W3SK | 42 | 11592 |  
W3UT | 31 | 4030 |  
W3BUSF | 12 | 456 |  
W3JL** | 8 | 224 |  
  | 29902 |  
E. Penna. | W9GS | 44 | 11968 |  
W9EY | 30 | 7020 |  
W9FX | 27 | 5508 |  
W9JR | 40 | 5280 |  
W9AIZ | 31 | 4525 |  
W9C1W0 | 21 | 2478 |  
W9NF | 17 | 1550 |  
W9DHT | 17 | 986 |  
W9A1H** | 10 | 280 |  
W9MG | 8 | 192 |  
W9CF | 7 | 126 |  
  | 22302 |  
Missouri | W9BMA | 51 | 14888 |  
W9C1U | 34 | 4094 |  
W9E1C1 | 17 | 1020 |  
W9CJB | 18 | 900 |  
W9DXJ** | 12 | 696 |  
W9EPF* | 4 | 32 |  
W9DGN | 2 | 2 |  
  | 29150 |  
F. Mass. | W1RV | 38 | 9880 |  
W1BX | 28 | 5712 |  

**Notes:**
- The entries are arranged in descending order of score within each section.
- Scores are rounded to the nearest integer.
- The contest was a nationwide event with participants from various states.
<table>
<thead>
<tr>
<th>Section</th>
<th>Station</th>
<th>Number of Sections</th>
<th>Score</th>
<th>Score</th>
<th>Section</th>
<th>Station</th>
<th>Number of Sections</th>
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<td>Score</td>
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<td>W9DCL</td>
<td>North Dakota</td>
<td>44</td>
<td>12672</td>
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<td>W9DCL</td>
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<td>W9FPM</td>
<td>W9FJR</td>
<td>So. Minnesota</td>
<td>50</td>
<td>11600</td>
<td>W9FPM</td>
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<td>70</td>
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<td>W4RO</td>
<td>Tennessee</td>
<td>41</td>
<td>11070</td>
<td>W4OJX</td>
<td>W4RO</td>
<td>Tennessee</td>
<td>41</td>
<td>11070</td>
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<td>W4RO</td>
<td>W4OJX</td>
<td>12</td>
<td>408</td>
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Connecticut

W12Y (4) 35 7138
W1CDS 21 2684
W1CLH 26 2444
W1LAFB 24 2238
W1MK 24 1652
W1BVW 16 1120
W1UE 16 636
W1BDI 13 468
W1DF 11 392
W1APJ 11 322
W1AVB 8 240
W1AQC* 8 192
W1GJD** 8 144
W1CFI 5 80
W1QV 3 18
W1BNB* 1 2
W1BNF* 1 2

19844

Ohio

W8CBM 39 10020
W8BZB** 35 6850
W8CZC 8 238
W8CSG 9 160
W8CSS 8 160
W8DID 8 108
W8BMA* 2 5
W8CY* 1 2
W8BY* 1 2

17996

Wisconsin

W9FAW 43 9718
W9EYH 31 4030
W9CER 30 2820
W9BRR 16 792
W9ABM 10 200
W9PHU 7 112

17772

Virginia

W3HY 39 6162
W3EJ 30 2940
W3AEW 31 2856
W3ARU 16 864
W3CFL 16 672

16924

Arkansas

W5ASG 36 4824
W5BMI 20 1000

5824

Arizona

W6RIF 53 16642
W6BIP 7 112

16754

East Bay

W6BPC 33 5808

5508

Oregon

W7ACH 42 12684
W7AEB 21 5486
W7LK 13 468
W7AME 5 100
W7ACT* 1 2

16740

Saskatchewan

W4CV 35 5920

5920

N. Y. C.-L. I. W2CUQ 46 15364
W2ABP 9 254
W2BQK 28 884
W2ADB* 1 2

15684

W1CLN* 2 8

5208

New Hampshire W1AYL 45 14430
W1UP 22 2420
W1CAF 20 1160

15010

Idaho

W7KA 32 4288
W7AKZ 6 306

4684

Santa Clara V. W6YU 46 14706
W6DBB 11 616
W6DCP 6 168

14860

Mississippi

W5RUI 33 4488
W5HNW 5 70
W5MC* 1 2

4560

July, 1931
Section | Station | Number of Sections | Score | Section Score
--- | --- | --- | --- | ---
Quebec | VE2AC | 35 | 4550 | 4550
Oklahoma | W6OJ | 22 | 2112 | 2112
 | W8AMC | 22 | 1408 | 1408
 | W5BOE | 16 | 806 | 806
Iowa | W9DBW (2) | 31 | 3100 | 4416
 | W9AHP | 6 | 130 | 130
 | W9EOP | 7 | 182 | 182
San Joaquin | W6EFP | 22 | 1656 | 3402
 | W6CLP | 20 | 1300 | 3010
Manitoba | VE4IC | 27 | 2484 | 
E. New York | W2CBR | 19 | 1672 | 2484
 | W2BIA | 13 | 702 | 702
 | W2FN* | 4 | 40 | 40
 | W3CC | 2 | 8 | 8
No. Minnesota | W9DQQ** | 21 | 1218 | 2286
 | W9CZ | 15 | 900 | 900
 | W9BVI | 7 | 198 | 198
Kentucky | W9DQQ | 21 | 1806 | 
 | W9CNE | 13 | 456 | 456
Maine | W1EF | 19 | 1538 | 2078
 | W1ANH | 13 | 520 | 520
Nebraska | W9DTX | 22 | 1540 | 
 | W9DZK | 10 | 900 | 900
Md.-Del.-D.C. | W3A00 | 18 | 1290 | 
 | W3OZ | 11 | 330 | 330
 | W3AF* | 2 | 8 | 8
Sacramento V. | W6CGJ | 17 | 1508 | 1508
South Dakota | W9DKL | 19 | 988 | 1012
 | W9FLI | 3 | 24 | 24
Brit. Columbia | VE5AW | 14 | 784 | 875
 | VE5EC | 4 | 64 | 64
 | VE5AM | 3 | 27 | 27
New Mexico | W5AHI | 12 | 528 | 814
 | W5BQE | 11 | 286 | 286
Utah-Wyo. | W6DPJ | 16 | 640 | 640
Nevada | W6CDZ | 13 | 624 | 
 | W6UC* | 2 | 8 | 8
Hawaii | K6ALM | 10 | 420 | 428
 | K6CCS* | 2 | 8 | 8
Rhode Island | W1BUX | 10 | 220 | 310
 | W1DW | 6 | 72 | 72
 | W1AAD* | 3 | 18 | 18
Ga.-S. C.-etc. | W4SS | 9 | 198 | 260
 | W4RM | 5 | 60 | 
 | W4WD | 1 | 2 | 

So. Texas W5TD* | 4 | 32 | 32
Maritime V83* | 1 | 2 | 2

**Sweepstakes Standing by Divisions**

Atlantic led by Western New York (48532) .......... 167842
Central led by Illinois (66712) .......... 146306
Pacific led by Los Angeles (43238) .......... 103362
Northwestern led by Washington (31194) .......... 81788
New England led by Eastern Massachusetts (20716) .......... 63168
Delta led by Louisiana (26944) .......... 58806
Hudson led by Northern New Jersey (40074) .......... 58180
Southwestern led by Florida (35460) .......... 41346
Midwest led by Missouri (22922) .......... 39272
Roanoke led by Virginia (16924) .......... 35766
Ontario .......... 30298
Dakota led by North Dakota (12816) .......... 28024
West Gulf led by Northern Texas (11783) .......... 16440
Rocky Mountain led by Colorado (7078) .......... 8318
Prairie led by Saskatchewan (5300) .......... 7374
Quebec .......... 4550
Vanalla led by British Columbia (878) .......... 875
Maritime led by Newfoundland (3) .......... 2

Total Scores .......... 885541

"Five Meter" Receiver Progress

(Continued from page 86)

often to Rs. From then on, the signals were heard continuously up to approximately 35 miles. This was obviously not the DX limit, however.

(f) The poorest signals usually were heard when the receiver was close under the "shadow" of an intervening hill. The presence of such hills at more than a mile or so from the receiver did not, appear to have much influence on signal strength. This was obviously not the DX limit, however.

Quite the best signals at any appreciable distance from the transmitter were heard on the far side of an intervening hill. The presence of such hills when the receiver was close under the "shadow" of an intervening hill. The presence of such hills at more than a mile or so from the receiver did not, appear to have much influence on signal strength. Quite the best signals at any appreciable distance from the transmitter were heard on the far side of a large lake just across the Massachusetts border. In this case, the approach to the receiver was across a mile or two of water.

The chief deduction arrived at from these short receiving tests, as far as amateur work is concerned, is that in the 56-mc. band we really have a valuable piece of territory for short-haul phone work. It is at once obvious that a small 56 mc. transmitter and receiver, auxiliary to the usual amateur equipment, could be of great value in around-the-town and inter-town communication. Because of the limited range, interference is not likely to be a real problem (for the present at any rate) while contacts, short-haul though they may be, have a better chance of being 100 per cent reliable day and night than on any other band.

This story is just a starter. Our results, obviously, are incomplete. But there is more — much more, we hope — to come.

Strays

The "grasshopper" fuses used in telephone exchanges are excellent for protecting mercury-vapor rectifier tubes. They are rated at about 1 or 1.3 amperes.

— W9DOE

42 QST for
A survey of the reports received from users of the A.R.R.L. Standard Frequency Transmissions since the three-station network got going full blast last winter brings out some decidedly interesting and illuminating facts. Some of them are surprising and gratifying; and some of them are not so surprising and not at all gratifying. Let's look at the bright side first.

The reports have come from practically every nook and corner of the world, some of them from places where reception of the signals would hardly be expected. Many European countries, including the U.S.S.R. (Russia), South Africa, Australia, New Zealand, and the Malay States are represented. Amateurs in the British Isles have been having good luck with W1XP's transmissions on all three bands while other foreign reports indicate the best results with the 7- and 14-mc. transmissions of W1XP and W6XK. One striking feature is the apparent consistency with which W1XP's Schedule BB, transmitted on 7 mc. at 2100 G.C.T. (4:00 p.m., E.S.T.) is being received by Australian amateurs. This is breakfast time for the VK's and the signals seem to go the long way around, eastward from our Atlantic coast. It is suggested that more of the gang "down under" look for this transmission and report on its reception.

And now for the darker side. The situation in the U. S. A. is not altogether encouraging. While there has been a steady increase in the number of reports received from all over the United States and Canada, especially in the number of "first timers" requesting reporting blanks, there still seems to be an amazing lethargy afflicting large numbers of American hams. Some localities apparently have more than their share of these frequency-unconscious individuals; and it is no coincidence that these same localities from which the fewest proportionate S.F. reports come are the very ones in which a disproportionate share of the off-frequency signals originate. A comparison of the S.F. survey figures with the Communication Department's files of band-jumpers shows this conclusively. Stations that report regularly on the S.F. transmissions are not found listed in the off-frequency reports.

What can be done about it? The three Standard Frequency Stations are doing everything they can, transmitting accurate calibration signals for everyone that will use them — doing it month in and month out with no recompense for their services but the gratitude of organized radio and the written thanks of a relatively few individual hams; the League's field representatives are doing their darndest by every possible way to get the whole gang to stay in the bands and make use of the means provided to do it; QST is continually publishing the S.F. schedules and information on practical and simple frequency meters that leave no excuse for any station being without adequate frequency measuring equipment. What more can be done? Dr. R. H. Baker, W5BTL, gave us an idea in his letter published in May QST, and we are going to try it.

FREQUENCY MEASUREMENT CONTEST

Some time during October there is going to be a frequency measurement contest. Complete details have not been worked out at this time, but here are the essentials:

Every amateur having a frequency meter will be eligible. Every contestant will have a chance to win one of the Certificates of Accuracy that will be issued to those who measure the official contest signals within the prescribed reasonable degree of accuracy. You will need a good frequency meter, such as the dynatron type that has been described in several QST articles and in the Radio Amateur's Handbook (7th and 8th Editions); and you will have to have it accurately calibrated. Now is the time to get started. Build the frequency meter. Become an expert at frequency measurement by constant practice. Use as many standard frequency transmissions as possible.

Here are the schedules for July and August. It won't be too early if you start on them.

DATES OF TRANSMISSION

| July 3, Friday | A | W1XP |
| July 10, Friday | B | W9XAN |
| July 11, Saturday | BB | W1XP |
| July 12, Sunday | A | W9XAN |
| July 17, Friday | BX | W6XK |
| July 19, Sunday | C | W9XAN |
| July 24, Friday | BB | W6XK |
| July 26, Sunday | B | W1XP |
| July 31, Friday | A | W9XAN |
| | B | W6XK |

July, 1931 43
Aug. 7, Friday  
BB: W6XK  
B: W9XAN
Aug. 8, Saturday  
B: W6XK  
A: W9XAN
Aug. 9, Sunday  
G: W9XAN
Aug. 14, Friday  
BB: W6XK  
B: W9XAN
Aug. 16, Sunday  
C: W9XAN  
B: W6XK
Aug. 21, Friday  
C: W6XK
Aug. 23, Sunday  
C: W9XAN  
B: W6XK
Aug. 28, Friday  
C: W9XAN  
B: W6XK

STANDARD FREQUENCY SCHEDULES

**Friday Evenings**

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<tr>
<th>Time (p.m.)</th>
<th>Schedule and Frequency</th>
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<tbody>
<tr>
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<td>BB 3500</td>
</tr>
<tr>
<td>8:08</td>
<td>B 7000</td>
</tr>
<tr>
<td>8:16</td>
<td>A 7100</td>
</tr>
<tr>
<td>8:24</td>
<td>BB 7200</td>
</tr>
<tr>
<td>8:32</td>
<td>B 7300</td>
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<tr>
<td>8:40</td>
<td>C 8000</td>
</tr>
<tr>
<td>8:48</td>
<td>D 4000</td>
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**Saturday Morning**

<table>
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<tr>
<th>Time (a.m.)</th>
<th>Schedule and Frequency</th>
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<tr>
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<td>7100</td>
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<td>4:16</td>
<td>7200</td>
</tr>
<tr>
<td>4:24</td>
<td>7300</td>
</tr>
</tbody>
</table>

The time specified in the schedules is local standard time at the transmitting station. W1XP uses Eastern Standard Time, W9XAN, Central Standard Time, and W6XK, Pacific Standard Time. Schedule BB transmitted by W1XP is intended particularly for European amateurs and starts at 2100 G.C.T. Schedule BX is transmitted especially for amateurs in Oceania and the Far East. It is transmitted starting at 1200 G.C.T. by W6XK. Reports on these special schedules are particularly desired, not only from overseas hams but from those in the Americas.

Although the frequencies of the transmitting stations are not guaranteed as to accuracy, every effort is made to keep to within 0.01% of the announced frequencies. The frequency standards are calibrated against the National Frequency Standard. Frequent checks on the transmissions are made by laboratories equipped with accurate frequency standards and the transmissions are also checked by the U. S. Department of Commerce monitoring stations.

**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 frequency by call letters and statement of frequency. Characteristic letter of W1XP is "G," of W9XAN is "D," and of W6XK is "F."
- 1 minute — Statement of frequency in kilocycles and announcement of next frequency.
- 2 minutes — Time allowed to change to next frequency.

**THE TRANSMITTING STATIONS**

W1XP: Massachusetts Institute of Technology, Round Hill Research, South Dartmouth, Mass., Howard A. Chinn in charge.


W6XK: Don Lee Broadcasting System, Los Angeles, Calif., Harold Peery in charge.

**REPORTS**

Handy blanks for recording and reporting the transmissions can be had for the asking. Just drop a card or send a message to Hq. asking for s.f. report blanks and they will be sent postpaid. When you receive a transmission be sure to send in a report addressed to the A.R.R.L. Standard Frequency System, QST, West Hartford, Conn. After a record of the report has been made at this office it will be forwarded to the proper transmitting station.

**5000-KC. SIGNALS FROM WWV**

Calibration signals will be transmitted on the single frequency of 5000 kc., accurate to within 1 part in a million, by the Bureau of Standards station, WWV, between 2:00 and 4:00 p.m. and between 10:00 p.m. and 12:00 midnight on each of the following Tuesdays: July 14th, 21st, and 28th; Aug. 11th, 18th, and 25th. Schedules of additional multi-frequency transmissions from this station will appear in August QST. Reports on WWV signals may be forwarded via A.R.R.L., West Hartford, Conn.

**Strays**

When building a receiver with r.f. amplifiers a milliammeter inserted in the plate circuit of the r.f. tube will help locate troubles. If the amplifier oscillates or if there is any interlocking between stages the meter will dip as the tuning controls are varied. The effect of any adjustments can be gauged immediately.

---

W1AJW ran into a curious trouble with his receiver. Movement of people in certain parts of the room or a change in the position of the operator would cause the tuning of the set to vary, and at the same time set up all kinds of racket. Grounding a hot air pipe running along the cellar ceiling cured it.
A Newly Developed Group of Tubes Which Shows Promise for Amateur Receivers

By George Grammer, Assistant Technical Editor

This has been a great year for the tube crop. So many new types have blossomed forth during the past few months that it’s beginning to be a job to remember the numbers of even a small portion of them. Add three more to the list; the 236, 237 and 238. These are RCA designations; as usual, we may expect that other manufacturers will retain the last two figures and put their own “first figures” on them, so that the general types will have to be known as the Types ’36, ’37 and ’38.

This latest group of tubes has some features which are new to the American market. They are the first indirectly heated cathode tubes made in this country for d.c. operation. Intended primarily for automobile sets, they are ruggedly constructed and look as though they should be non-microphonic. The loud-speaker tube, the 238, is a pentode, and is about the only audio power output tube with cylindrical elements, and incidentally is the only power tube for either a.c. or d.c. heating which has an indirectly heated cathode. Last, but perhaps not least, in meeting the need for a group of tubes suitable for automobile radio sets the demand for good tubes for 110-volt d.c. receivers has also been satisfied.

As might be expected from the present status of receiver design, the new group of tubes comprises a screen-grid amplifier, a general-purpose tube for detection, amplification, or oscillation, and an audio power output tube. These are known as the 236, 237 and 238, respectively. The general appearance of the tubes is shown in the photograph; they resemble the older types except that the envelope is noticeably smaller than is the Type ’27, ’28, etc. The bases are the small UY type. Pin connections for the 236 and 237 are the same as the ’24 and ’27. The pin connections of the 238 pentode correspond to those of the ’24, the space-charge grid taking the place of the screen-grid. The control-grid is brought out to the cap on top of the tube.

The heaters are designed to operate from a six-volt storage battery without a rheostat. The cathodes have been constructed so the emission is ample for satisfactory operation of the tubes over the entire range of battery voltage from full charge to normal discharge. Practically this means that the heater voltage may be anything between 5.5 and 8.5 volts without noticeable effect on the operation of the tubes. The heater current is only three-tenths of an ampere, little more than the current taken by a Type ’01-A tube; consequently the battery discharge rate is not unduly high. The heaters are of the “straight-through” type — a single filament concentrically located in the cathode sleeve — and since no provision has been made for hum cancellation the tubes are not particularly suitable for a.c. heater operation.

Tentative ratings and characteristics of the tubes are shown in the following tables. Some of the similar types of tubes are also shown for purposes of comparison.

### Screen-Grid Tubes

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<tr>
<th>Type ’36</th>
<th>Type ’37</th>
<th>Type ’38</th>
<th>Type ’39</th>
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<tr>
<td>Heater voltage</td>
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<td>2.0</td>
<td>2.5</td>
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<tr>
<td>Heater current</td>
<td>0.3</td>
<td>0.06</td>
<td>1.75</td>
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<tr>
<td>Plate voltage</td>
<td>135</td>
<td>135</td>
<td>180</td>
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<tr>
<td>Plate current</td>
<td>0.3</td>
<td>1.75</td>
<td>0.25</td>
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<tr>
<td>Grid bias</td>
<td>-1.5</td>
<td>-3.0</td>
<td>-3.0</td>
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<tr>
<td>Amplitude factor</td>
<td>275</td>
<td>550</td>
<td>400</td>
</tr>
<tr>
<td>Mutual conductance</td>
<td>1100</td>
<td>505</td>
<td>1000</td>
</tr>
<tr>
<td>Grid-plate</td>
<td>0.01</td>
<td>0.25</td>
<td>0.01</td>
</tr>
<tr>
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<tr>
<td>Output</td>
<td>9</td>
<td>11.4</td>
<td>10.0</td>
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</table>

### General Purpose Tubes

<table>
<thead>
<tr>
<th>Type ’37</th>
<th>Type ’38</th>
<th>Type ’01-A</th>
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</thead>
<tbody>
<tr>
<td>Heater voltage</td>
<td>6.3</td>
<td>2.5 (a.c.)</td>
</tr>
<tr>
<td>Heater current</td>
<td>0.3</td>
<td>1.75</td>
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<tr>
<td>Plate voltage</td>
<td>135</td>
<td>180</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-9.0</td>
<td>-9.0</td>
</tr>
<tr>
<td>Plate current</td>
<td>-4.5</td>
<td>4.5</td>
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<tr>
<td>Plate resistance</td>
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<td>Amplitude factor</td>
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<td>9</td>
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<tr>
<td>Mutual conductance</td>
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<td>1000</td>
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<tr>
<td>Optimum load resistance</td>
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<td>No data</td>
</tr>
<tr>
<td>Undistorted power output</td>
<td>74 mw</td>
<td>80 mw</td>
</tr>
<tr>
<td>Approx. inter-electrode capacitances, µµfd.</td>
<td>4.0</td>
<td>3.2</td>
</tr>
</tbody>
</table>

### Tentative ratings and characteristics of the Type ’38 Pentode

<table>
<thead>
<tr>
<th>Type ’38 Pentode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage</td>
</tr>
<tr>
<td>Heater current</td>
</tr>
<tr>
<td>Plate voltage</td>
</tr>
<tr>
<td>Grid bias</td>
</tr>
<tr>
<td>Plate current</td>
</tr>
<tr>
<td>Screen current</td>
</tr>
<tr>
<td>Plate resistance</td>
</tr>
<tr>
<td>Amplitude factor</td>
</tr>
<tr>
<td>Mutual conductance</td>
</tr>
<tr>
<td>Load resistance</td>
</tr>
<tr>
<td>Undistorted power output</td>
</tr>
</tbody>
</table>

* Filament-type directly-heated cathode.
* 135 volts given here for comparison. Maximum recommended voltage is 180.

July, 1931
From the tables already given the 236 appears to be the "best" of the screen-grid tubes, having the highest mutual conductance and the lowest plate resistance. It certainly appears to be far better than the Types '22 and '32. The Types '37 and '27 are very nearly alike in essential characteristics, with the '27 perhaps a shade better. It is reasonable to expect about equal performance from the two tubes in amateur receivers. The '01-A, now rapidly dropping out of the radio picture, is not quite up to either of the other two.

There is no other audio output tube which can be directly compared with the 238. The undistorted power output is about the same as that of the '71-A at 135 volts, but this output is secured with a much smaller grid swing and with considerably greater economy of plate power than with the '71-A. The 238 will produce about the same volume as the '71-A at 135 volts, but no doubt could be reduced to a negligible amount with care in laying out the circuit. No attempt was made to secure the proper plate load for either tube, the phones simply being inserted in the plate circuits as is done in most amateur receivers. The '38 showed a just barely perceptible increase in signal strength over the '27, however, so that there is no particular reason for thinking that it will replace the latter tube in amateur receivers. Although for a given signal the '38 will give somewhat more than twice as much power output as the '27, it takes a healthy increase in power to make a noticeable increase in signal strength. There was a quite marked increase in the background noise with the pentode in this test due, no doubt, to its tendency to produce high-harmonic distortion.

The new tubes undoubtedly should find application in amateur receivers, especially those employing a six-volt storage battery for filament heating. The characteristics of the tubes are superior to those of tubes commonly used in storage-battery sets, and it is possible that there may be a noticeable gain as the result of changing over.

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 first quarter of 1931 is published for the information of the membership.

K. B. Warner, Secretary.

STATEMENT OF REVENUE AND EXPENSES FOR THE THREE MONTHS ENDED MARCH 31, 1931

<table>
<thead>
<tr>
<th>Revenue</th>
<th>$15,706.88</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising sales, QST</td>
<td>12,397.02</td>
</tr>
<tr>
<td>Newsdealer sales</td>
<td>2,024.55</td>
</tr>
<tr>
<td>Handbook sales</td>
<td>10,350.67</td>
</tr>
<tr>
<td>Advertising sales, Handbook</td>
<td>425.00</td>
</tr>
<tr>
<td>Membership dues</td>
<td>13,222.13</td>
</tr>
<tr>
<td>Emblems</td>
<td>48.98</td>
</tr>
<tr>
<td>Miscellaneous sales, net</td>
<td>2,818.02</td>
</tr>
<tr>
<td>Interest earned</td>
<td>1,216.62</td>
</tr>
<tr>
<td>Cash discounts earned</td>
<td>386.62</td>
</tr>
<tr>
<td>Profit, sale of equipment</td>
<td>142.50</td>
</tr>
<tr>
<td>Deduct:</td>
<td>$6,609.91</td>
</tr>
<tr>
<td>Returns and allowances</td>
<td>3,319.18</td>
</tr>
<tr>
<td>Provision for wage and return</td>
<td>1,123.92</td>
</tr>
<tr>
<td>Cash discount on sales</td>
<td>381.70</td>
</tr>
<tr>
<td>Exchange and collection charges</td>
<td>40.16</td>
</tr>
<tr>
<td>Net revenue</td>
<td>$85,151.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expenses</th>
<th>$14,230.48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication expenses, QST</td>
<td>3,590.41</td>
</tr>
<tr>
<td>Publication expenses, Booklet</td>
<td>1,082.23</td>
</tr>
<tr>
<td>Salaries</td>
<td>19,063.59</td>
</tr>
<tr>
<td>Forwarding expenses</td>
<td>3,152.22</td>
</tr>
<tr>
<td>Telephone, telegraph and postage</td>
<td>2,812.33</td>
</tr>
<tr>
<td>Office supplies and general expenses</td>
<td>3,496.50</td>
</tr>
<tr>
<td>Rent, light and heat</td>
<td>1,143.71</td>
</tr>
<tr>
<td>Traveling expenses</td>
<td>609.59</td>
</tr>
<tr>
<td>Depreciation on furniture and equipment</td>
<td>277.75</td>
</tr>
<tr>
<td>Bad debts charged off</td>
<td>6.50</td>
</tr>
<tr>
<td>Communications Department field expenses</td>
<td>74.92</td>
</tr>
<tr>
<td>Headquarters Station expenses</td>
<td>110.37</td>
</tr>
<tr>
<td>Total expenses</td>
<td>47,043.90</td>
</tr>
<tr>
<td>Net gain from operations</td>
<td>$5,107.35</td>
</tr>
</tbody>
</table>

Strays

New song dedicated to ham operators, with apologies to Rudy Vallee: “Ninety-nine out of a hundred wouldn’t be missed. How about you?”

—W9FO
Help Wanted

Here's an extract from a letter from W2WD that looks like a good suggestion:

"Why not have a symposium arranged from the solicited answers of amateurs on the general subject of increasing the ratio between signal strength and background noises — and the perennial question of eliminating static, or at least of reducing it to some extent?"

At this time of the year there's certainly plenty of background to be reduced, and anything new along these lines will be welcome material for the "X" Section. Some of the stunts that have proved to be effective are doublet receiving antennas, peaked audio amplifiers, limiting devices such as audio amplifiers working at low plate voltage, "volume control" tubes adjusted for filament or plate saturation, etc. But there's still lots of room for improvement.

Some of you experimenters should have ideas along different lines which look as though they might work out. How about giving them a whirl and giving us the dope if they show possibilities? Even a small improvement is worth while.

Improving Power Supply Regulation

The keying scheme shown in Fig. 1 is used by W9CHA, Ben J. Biederwolf, Evansville, Indiana, to eliminate the voltage rise encountered with most rectifier-filter systems when the load is thrown on and off with keying. A back-contact relay is required, but this need offer no difficulty because W9CHA made one which works very satisfactorily from an old telegraph sounder.

The variable resistor $R$ is adjusted so that the same current flows through it as is taken by the tubes when the transmitter is adjusted for normal operation. This resistor must therefore be capable of dissipated the same amount of power as is used on the tubes — possibly 50 or 60 watts with a pair of '10's. The advantage of this system over the more common bleeder resistor is that no power is being wasted in the resistor when the key is closed; furthermore the voltage on the tubes cannot vary at all — as it will with most bleeder resistors — if the relay contacts are ad-

FIG. 1

FIG. 2

Improving Power Supply Regulation

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condenser the antenna tank is tuned to obtain the highest current with the feeder off; then the feeder is connected and the point where the largest difference is found is the proper adjustment for maximum radiation. Finally, using the monitor, slightly detune to clear up the note.

— L. S. Fox, W2AHB

Three-Phase Self-Rectification

In the January Experimenters' Section there was published a circuit suggested by W2ZC, Harold Churchill, Little Silver, N. J., for using self-rectification on a power amplifier following a crystal-controlled oscillator or preceding buffer amplifier, the plates of which were fed d.c., the object being to save expense of high-voltage rectifiers and filters. Here is another letter from W2ZC describing an extension of the idea:

"Since publication of the back-to-back crystal amplifier circuit in January QST I have been flooded with numerous requests for dope, information and the saving possibilities of this circuit. It might be of interest to the gang to try out a new type of this amplifier, rather tricky in its performance.

"Three-phase supplies are quite frequently available to hams who do not take advantage of them. Here is a back-to-back crystal amplifier similar to the Army system but perfected into a three-phase set-up using either three Type '52's or three Type '10's (see Fig. 3). The note is almost pure d.c. — a suggestion of violin in the background. The power output is somewhat more than that obtainable from a single tube and the note really sounds great.

"Am sure some of the gang interested in self-rectified amplifiers would like to try this three-phase job. It's electrically very pretty and sure works FB."

Three single-phase transformers or one three-phase transformer will be required. The star connection of the secondaries is necessary to provide a negative return for the tubes, but the primaries may be connected either delta or star.

Key Thump Filters

Several readers of the "X" Section have written in recently to suggest key-thump filters in which the choke has been split in two sections, one on each side of the key, instead of a single choke. One of these, due to W7AAAT, O. W. Viers, Red Lodge, Montana, is shown in Fig. 4. The values of the various chokes and condensers are shown under the diagram. Not everyone may have the particular chokes shown but no doubt other small iron-core inductances could be substituted with equal success. Probably a single variable resistor could be substituted for $R_1$ and $R_2$. W7AAAT has used this arrangement successfully with several different types of transmitters. Sparkling at the key contacts is completely eliminated, and there is no trace of thump in nearby broadcast receivers.

The hook-up in Fig. 5 is used by both W2BLU and WSBOO with excellent results. The values used at each station vary somewhat, showing that there is nothing particularly critical about the circuit. W2BLU keys in the filament center-tap, and both $L_1$ and $L_2$ are double chokes taken from a Philco power-pack. The condenser $C$ is 2 µfd. or more, and the resistor $R$ is anything that works. A variable resistor of 500 ohms or so should be O.K. In WSBOO's outfit $L_1$ is a 5-henry choke and $L_2$ is 30 henrys. Condenser $C$ is 1 µfd. and $R$ is 50 ohms.
Homemade 50-Watt Sockets

Figs. 6 and 7 show two ways of making inexpensive sockets for 50-watt tubes. Fig. 6 was suggested by P. W. Moor, W3BER, who writes as follows concerning it:

"While collecting parts to add a 50-watt amplifier to my transmitter à la February QST it became evident that a socket for the 50-watt tube would be required. A dollar or two was saved by using about one foot of \( \frac{3}{4} \)" copper tubing and eight brass machine screws and nuts for binding posts. A piece of bakelite and about an hour's work were then all that were required to make what appears to be an entirely adequate socket. Procedure is as follows:

1. Cut four pieces of tubing each 3" long.
2. Place in vise with about 1" extending beyond jaws and flatten the remaining two inches of tubing.
3. Bend tubing at right angles at end of flat part.
4. Cut slot in round portion with hack saw.
5. Place on prongs of tube and then mark position of flat portion on bakelite base.
6. Drill and countersink two holes for each prong.
7. Adjust tension on prongs by pinching slotted end of tubing with pliers.

"With reasonable care a very neat socket resembling one of well-known manufacture can be made."

The socket shown in Fig. 7 is perhaps even less trouble to make. E. C. Lockwood, WSDUF, originated this one. A square piece of insulating material such as formica or bakelite, four battery clips, four \( \frac{1}{4} \)" x \( \frac{3}{8} \)" brass angles and four binding posts are the parts required. The diagram explains very clearly how the parts are assembled. A small square of formica bolted to the center of the base prevents sagging of the clips when the tube is in place.

A similar socket for larger tubes such as the 212-D can be made by using larger clips and larger dimensions.

Self-Neutralization

An interesting circuit for self-neutralization of a power amplifier when two tubes are used in a "back-to-back" self-rectified system is brought to our attention by Russell Dunaja, W3BBF, who writes:

"While looking over the January issue of QST I noticed in the Experimenters' Section a dia-
gram of an a.c. full-wave self-rectified power amplifier which was neutralized by means of a neutralizing condenser.

"I wish to inform you that in a self-rectified amplifier the neutralizing condenser is not necessary as the circuit can be made self-neutralizing. In the self-rectified set only one tube works at a time (on the positive half of the cycle, the other tube being inactive) and the inactive tube may be used as a neutralizing capacity for the active one.

"Figs. 8 and 9 show two diagrams of a full-wave self-rectified self-neutralized power amplifier.

"These circuits are used by the U.S. Lighthouse Service in their 200-watt M.O.P.A. transmitters on 300 to 500 kc."

---

### Finding the Expeditions

(Help Contact These Stations, Report Their Signals to A.R.R.L. for QST Mention)

<table>
<thead>
<tr>
<th>Station</th>
<th>Frequency (kc.)</th>
<th>Call Signal</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submarine Nautilus</td>
<td>5555, 6620, 8290, 8450, 11,110, 13,240, 16,660.</td>
<td>WSEA</td>
<td>Wilkins-Ellsworth Transantarctic Submarine Expedition. R. E. Meyers, ex-W3AJZ, Operator. Schedules KUP at 6:00 p.m. and 9:00 p.m. P.S.T., WRII even hours, shifting to higher frequencies as day advances.</td>
</tr>
<tr>
<td>Motor Car Station</td>
<td>8600, 8240. (500 watt)</td>
<td>FPCF</td>
<td>Haardt Trans-Asia Expedition. Personnel of 35 traveling in wilds of Asia (Pamir region) for 18 months. Now in Afghanistan.</td>
</tr>
<tr>
<td>'Plane NC146M</td>
<td>7- and 14-mc. amateur bands.</td>
<td>KHFQJ</td>
<td>Sikorsky Pan American Airways plane with expedition inland from Sao Paulo, Brazil. May use PY call in amateur bands.</td>
</tr>
<tr>
<td>Yacht Mopelia</td>
<td>6670.</td>
<td>DAIY</td>
<td>Count von Luckner on summer cruise. J. Pascal, W2CEV, Operator.</td>
</tr>
<tr>
<td>Peru Observatory</td>
<td>. . .</td>
<td>OA4U</td>
<td>Carnegie Institute, Dept. of Terrestrial Magnetism station. S. L. Seaton, W3BWL, Operator.</td>
</tr>
</tbody>
</table>
W3CXM is of unusual interest to amateurs, and particularly those amateurs participating in Army-Amateur activities, because the station is A-A Control Station for the entire country. The station is located about seven miles from Washington, D. C., and is the personal property of Capt. Norman L. Baldwin, Signal Corps. It was built by him and is installed in his home. "BN" is the only operator, repairman, etc.

The transmitter, a close-up of which is shown in one of the photographs, is semi-portable, being built to receive plug-in leads carrying plate supply, filament supply and "C" bias leads. It is built in an aluminum box 20 by 12 by 8 inches. The box has a removable back and is ventilated by holes drilled along the upper sides. A Type '10 crystal oscillator tube is used to excite a pair of VT-4-B (UV-211) tubes in parallel used as neutralized amplifiers. A 3950-ke. crystal is used, and the amplifiers work on the same frequency. A wiring diagram of the set is shown in Fig. 1.

The plate inductance for the amplifiers is mounted on top of the case to minimize absorption losses and to prevent the amplifier from reacting on the oscillator. The photograph of the transmitter alone shows an antenna coupling coil in place, but this coil is normally unused since the antenna is a single-wire feed affair.

The keying system used at W3CXM is unusual in some respects. Ordinary blocked-grid keying forms the chief part of the system, the bias on the amplifiers being adjusted to completely cut off plate current when the key is open, and part of the bias being shorted out when the key is closed. However, it was found that this method alone allowed a noticeable back-wave to get through when the key was open, so a 10,000-ohm resistor was placed in series with the plate voltage lead to the oscillator tube so that the oscillator just about operates when the key is open. When the key is closed an auxiliary relay shortcircuits this resistor. This scheme has effected a satisfactory reduction of the back-wave.

The plate supply for the set is furnished by a 1500-volt motor-generator, the output of which is filtered by a 15-henry choke and 8 μfd. of capacity. Keying relays, filament transformers, fuses, bias batteries, etc., are placed under the operating table with cabled leads plugging into each end of the transmitter proper.

The receiver shown in the station photograph has been replaced by a National SW-5 a.c. receiver. A seven-turn loop fifteen inches in diameter is used as the receiving antenna.

On Army-Amateur drill nights W3CXM acts as Army Net Control Station on the 3500-ke. band and works schedules with the corps area net control stations from coast to coast from 7.30 p.m. to 4.30 a.m. The station has been well up in the Brass Pounders' League every month since it was put into

July, 1931
operation and needs no introduction to Army Amateurs.

A CLOSE-UP OF THE TRANSMITTER

The set is completely shielded except for the amplifier tank coil and antenna coupling apparatus. The amplifier tank coil is not used normally, however, because the antenna is a single-wire fed Hertz coupled to the plate coil through a small condenser.

Captain Baldwin has had a set on the air off and on since 1906. He operated 5Y1I in the old 200-meter spark days, and later signed NU8DKX and W2CXL. He expects to have W3CXM going regularly for the next three years.

The Hudson Division Convention

The weather was fine, the committee was on the job and the attendance good, all of which was conducive to making the Sixth Annual Hudson Division Convention held at the Hotel Pennsylvania, New York City, May 8th and 9th, successful.

At 7:00 p.m., Friday, Dave Talley was in the small ballroom, with two assistants, surrounded by a crowd of delegates all anxious to register, and when some time later Director Walsh formally opened the convention with words of greetings every seat in the room was taken. The first speaker of the evening, after Director Walsh, had given a very complete report of the annual meeting of the Board of Directors, was Mr. S. R. Riccobono, one of the engineers of the Pacent Electric Company, who talked interestingly on the latest development of his company on home-recording apparatus and demonstrated its operation.

A. A. Hebert, fieldman, spoke on legislative matters confronting the radio amateurs to-day, and also covered the communications department's activities. Mr. L. S. Fox, an old-time amateur, and now on the engineering staff of the National Carbon Co., lectured on the new Eveready Air Cell, and present indications are that this cell should be useful in amateur stations for a number of purposes. To break up the evening the star chairman of the contest committee, C. E. Sargeant, got busy, and before you knew it everybody had pieces of paper answering questions and drawing circuits, putting to use the intelligence most radio bugs are supposed to have; anyway, it was after midnight before the meeting closed and allowed some of the visitors to spend the rest of the night at some "ham" shack.

Saturday afternoon found many new faces present and ready to listen to Ross A. Hull, Associate Editor, QST, who gave a bully good talk on a pentode short-wave receiver and answered numerous questions—believe it or not, the "gang" knows how to ask questions. After listening and sitting down for more than an hour, Sargeant again came to rescue of the restless and started that old-time stunt of "liars," and the poor judges had their hands full deciding who were the two best liars. The most interesting talk of the convention from a technical standpoint was given by Mr. S. Young White, of Lothian-White Laboratories, who covered very fully the early developments of sound recording from a commercial standpoint, bringing these developments to date, demonstrating perfect reproductions as well. The meeting was thrown into an open forum so as to give every one a chance to ask more questions, ending a very pleasant and instructive afternoon.

As in the past, the Banquet is always the big event of all Hudson Division conventions, and again Frank Frimmerman showed his gastronomic knowledge by having a menu that proved most satisfactory to all the guests. The entertainment features during the banquet were of the best and Ed. Berlin's Society Orchestra furnished good music for dancing. That good entertainer, Eddie Green (W2AKM) and Co., of R-K-O Vaudeville, presented a good comedy sketch. The principal speakers of the evening were introduced by Toastmaster Walsh and consisted of Col. J. B. Allison, U. S. Army; C. Peterson, Byrd's Antarctic Expedition; Dr. L. J. Dunn, former director; George Droste, former president, Second District Executive Radio Council, and A. A. Hebert, representing A.R.R.L.

Before general dancing started the distribution of prizes took place with Bronx Radio Club winning first prize for the largest attendance; the liars' contest won by W2ADX; the "kinks" by W2BWF; "technical answers" by W2BAM—"foolish answers" by W2ASS. The youngest ham of the convention (12 years old), W3ARN, and the only YL licensed op. present was W2WP. After the numerous prizes were given a general expression of appreciation was voiced to all the (Continued on page 76)
F.R.C. Revokes Amateur Station License

ON April 11, 1931, agents of the Department of Justice, with U. S. Radio Inspector Dutrauil went to the home of Charles Andres, Jr., 2748 Gladola St., New Orleans, La., and arrested Charles Andres, Jr., and seized the radio transmitter he was using as evidence. Mr. Andres, Jr., at the time held amateur radio station license W5NE which license was subsequently revoked on May 7, 1931, by the Federal Radio Commission as provided for in Section 14 of the Radio Act of 1927 and in accord with the Commission’s practices and procedures.

It was admitted by Andres that (1) he used an unauthorized call, (2) used frequencies not in the amateur band, (3) kept no log of his transmission.

What’s Ahead

By Frank K. Tiffany

In January QST (page IV) we invited contributions on every phase of amateur, communication activity. New ideas and viewpoints, criticisms of and remedies for conditions, hints on DX, suggestions concerning radio clubs, operating practices, suggestions on interference elimination, exceptional, two-way communication work, covering emergencies, athletic games and trips, timely attention to operating practices, commentary on the place of radio-telephony, experimenting or development work in present-day amateur radio, data on low-power possibilities, 1750-kc. 28-56 mc. operation, etc., all are needed. There is plenty of romance and real accomplishment in amateur work. Read this contribution and the one presented last month. Then give us some real operating stories or the benefit of your views on different subjects.

In addition to publication of the best articles in QST, the author whose article appears to have greatest value of those received for consideration, has his choice of (1) a copy of The Radio Amateur’s Handbook bound in leather cloth, (2) six pads of messages, or (3) six of the new type A.R.R.L. log books. Our offer is good throughout 1931. The article presented herewith is the prize-winning article for this month.

Army Air Corps Maneuvers

THE Communications Department.

F. E. Handy, Communications Manager

E. L. Battey, Asst. Coms. Manager

THE Communications Department.

F. E. Handy, Communications Manager

E. L. Battey, Asst. Coms. Manager

THE Communications Department.

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THE Communications Department.
They've had money behind them, and public necessity. First it was the wave lengths above 200 meters they wanted — then they learned they could use the higher frequencies, and the amateur again was picked up, his suit was recut, and he was down with seams bursting and trousers binding, reminding him unpleasantly of the days when he had more room to play in. Such pains cause a good deal of mental activity — and it's a good thing they do.

To-day the Federal Radio Commission assures amateurs that it continues to help them in staking out claims of amateur stations to be of public interest and necessity." By virtue of their non-commercial status, of their desire as citizens, to make use of radio, we have the right to occupy the bands we do.

But the objection also has been well brought to a number of broadcasting interests who chose to suggest otherwise, that it does not consider the use of a frequency by any station to give that station property rights on that wave. The same is true, it would seem, of any radio group, commercial or otherwise. Just how long our amateur status is going to make us safe on our present bands is a question to be treated with considerable respect.

How are we to get a more secure grip on our frequencies? Simple enough.

Broadcasting stations, as a class, aren't likely to lose any of the channels they now occupy. Because they are doing an undeniable service to the public, and because they have real economic reasons for occupying them — pressure - influence — behind them, they're more apt to invade regions of the other they've not yet used.

The commercials won't lose, either. They have traffic, important traffic, vital to business, which must be handled. And government services, even more in scope and in frequency requirements, probably will be the first served.

That leaves the amateur. If he continues predominantly to be of the "play-boy" type — dawdles with the tuning controls at all hours of the day and night, spends his time entirely in seeking DX, splatters the ether with careless notes, wanders aimlessly as of yore — his play-house is going to fall on him. If he doesn't have time to handle traffic, to experiment and aid in finding the things which make radio grow, in learning something which will be of definite, concrete assistance to himself and the nation in time of need, then he won't continue to be of "public interest and necessity."

Get into the experimenting game, fellows. Handle traffic. Sign up with the Army Amateur Net. Enlist in the U.S.N.R. Help those nets to function so the amateur bands will be useful for training purposes for the Army and Navy (in the usual manner) instead of amateur communication — so valuable that those federal services won't let the commercials and the broadcasting stations gobble them up, interest yourself in worthwhile expedition work in addition to full participation in those other unessential activities we have mentioned.

It won't take a lot of your time. Both the Army Net and the Volunteer Communications Reserve offer worthwhile experience in radio operating procedure and in radio discipline. The A.A. operator and the U.S.N.R. radioman accomplish more things per minute on the air than any other short-wave artist except the ORST commercial or service man. You learn how to get things done systematically, that's all.

There'll be plenty of time to do the things you did before. You'll work just as many foreigners as you did, and get just as many precious QSL's — or fail to get them, as the case may be. He's been spending his time giving the world a serious and concentrated effort to make retention of the amateur bands, worked by amateur stations, a matter of public concern.

Radio pioneering will go on. The Experimenters' Section will suggest more than ever the solutions you need so much. The ultra-short waves will be probed and opened wide. The ultra-short waves will be probed and opened wide.

A summer contest for Nebraska amateur radio operators has been announced by the Cornhusker Amateur Radio Association of Lincoln. Any Nebraska amateur, whether a member of the association or not, is eligible. The competition will last from July 15th to September 15th. The aim is to boost activity throughout Nebraska. Scoring will be as follows: Completeness of log, 10 points; traffic count (A.R.R.L. practice), 35 points; number of Nebraska stations worked, 25 points; number of Nebraska schedules kept, 20 points; quality of signal, 15 points. The contest is open to both 'phone and c.w. stations. Any one interested should notify Bill Bamer, Secretary of the Cornhusker Amateur Radio Association, Y.M.C.A., Lincoln, Nebraska.

W4PBO worked FX, an oil expedition on the Orinoco River, South America, on May 14th, and took a bunch of traffic from them. Several other amateurs are reporting contacts with this station. Further details would be appreciated.

MORE RE: 3500-ko. DX

More and more reports are being received on 3500-ko. DX. The band is surely coming into its own. A report from W5AL says: "Worked K6DF at 0330, 3.5 mc., 5:00 to 6:00 a.m., C.S.T., on March 8th, using a code oscillator 01A's with 450 volts on plates." W7AAT also worked K6DF, with reports of QSL's R5 at both ends. W71E, W7ALO, W7UN and others have worked New Zealand on 3.5 mc. W8DUG heard ZL2BE at 0145 E.S.T., March 1st. W2DV has been getting his share of the 3.5 mc. DX — on January 3rd he worked GWY and on January 29th he snagged PAOQQ. W7DSP reports that he heard ZL2BE at 9:20 p.m., B.S.T., March 29th, both stations operating on about 3810 kc. Watch that 3.5-mc. band, fellows!

The first message known to have been handled from Porto Rico on 28 mc. was received from K4BPF by W2IN. W2JN reports hearing K4BPF's c.c. signals very consistently on 28 mc. between 1000 and 2000 GMT, the strength sometimes being R9. K4BPF hears a number of 28-mc. signals from the states, mentioning W8BTC and W8QL in particular.

W6ACV reports a QSO with K QEG, the schooner Northern Light, which left San Francisco on April 2nd bound for the South Sea Islands and Australia. Bill Crabbe, W6ESW, is the operator on KQEG and will be glad to work amateurs whenever possible. Watch for KQEG on 8330 kc. Other authorized frequencies are 5555, 13240 and 16600 kc. but the first-mentioned (8330) is used mostly.

A course in code instruction by radio is being broadcast from station WRVA, Richmond, Va. The first lesson went on the air on February 7th. The first complete word in this lesson is "CAB" and W3AW was present in the studio at the time of the broadcast. These code lessons are put on by W3AAM and W3ZU. Newcomers might find the broadcasts helpful.

W6AXM, Sacramento, Calif., maintains daily schedules with KAI NF and ACHFM, and advises that any messages not received by mail can be sent direct to the East coast. These code lessons are put on by W3AJ and W3ZU. Newcomers might find the broadcasts helpful.

Say, fellow. If you haven't got a call of your own, "lay off that other guy's designation!" Too many complaints are being received of the illegal use of calls. Let's call a halt.
Official Broadcasting Stations

(Changes and Additions)

(Standard Local Time)

W5AUW (3700 kc.) Mon., Wed., Fri., 8:00 p.m.

W5IDM (7100 kc.) Daily, 12:30 p.m.

W6AEQ (7150 kc.) Tues. and Thurs., 8:30 p.m.

W6CRF (3507 kc.) (phone) Mon., Thurs., 8:00 p.m.

W6DMZ (3511 kc., used) (phone) Tues., Fri., Sun., 8:00 p.m.

W6CRB (2375 kc., and 3522 kc., available)

W5CRA (14620 kc.) Wed., Sat., 6:00 p.m.

W9FFY (5675 kc.) Mon., Wed., Sat., 8:30 p.m.

Traffic Summaries

(April-May)

Pacific led by Sacramento Valley . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ..
DIVISIONAL REPORTS

ATLANTIC DISTRICT

SOUTHERN NEW JERSEY - SCM, Robert Adams, 3rd, W38M — M. E. Gregory, W3JJJ, our new Route Manager, kept a schedule with Manila. W3BBD reported QSL’s and is active. W3VX was QRL on South Jersey Radio Club’s hamfest. The Atlantic Radio Club in Atlantic City has forty members. W3ACX reports good work on phone and CW. W3ATL and W3ARN have trouble. W3BN is located in the area of the Absecon Light House. W3RUP is on phone, W3GBT has two 50-watters in push-pull. W3ANX has a dinning car for his shack. W3LT has antenna trouble. W3APV bought QRL on South Jersey Radio Club’s hamfest. The Atlantic Official Observer. W3NK is installing crystal. W3VX is W3ADC is QRL at DuPonts. Keep up the fine showing of having excellent meetings. W3SM had nice total due to sympathy, Doc. W3BEI is jogging many amateurs off-frequency. W3TH uses a sideswipe. W3UT is active in the Naval Reserve traffic. W3ASG lost his mother. Our sympathy to all.

COLUMBIA - SCM, Forrest Calhoun, W313BW ---- W3CXL controls his station. W3NY handles a bunch of traffic. W3AFF is now doing AARS work. W3BGV is about ready to go with a 50-watt. W3ZK built a new AC receiver, W3FU is trying 1000-ke. phone, W3BBW is changing things around some. W3ED is busy with exams. Delaware: W3HC is still holding his own in traffic. W3AJE says DX is plentiful. District of Columbia: W3BBW has his usual high total. W3BAT is going to move. W3SBLW is leaving, June 6, for Peru, to set up the Magisteri Observatory station OA4U. Listen for him, fellows. W3CAE hasn’t had much time for traffic. W3CDQ is changing her handling. W3ARK wants his ORS scheduled for the summer.


WESTERN PENNSYLVANIA - SCM, R. M. Lloyd, W3DME - W3CUG maintains his place as high man. W3WAV is looking for long results. Duesy was hit by a truck while returning from the Directors’ meeting. W3SCUG is worried about his mast; four of its guys have broken during recent wind storms. W3AGO is re-modeling his station. W3AQ is going on "band" from the place. W3CWO says there will be no change in his set this season. W3AVY has a new 14-mc. transmitter. W3DGW is house-cleaning! W3ARC is chasing DX. W3AIE has QRM from BCL’s; a telephone line running from a BOL receiver to another BCL’s house modulates AFE’s receiver! W3GU is planning a new transmitter on 7 mc., accurate within one cycle! W3CBH has applied for an ORS certificate. W3CRA is building a new shack. W3CWX, an old-timer, reports. W3PA is planning a new 7-mc. job. W3WAV thinks he’s had enough. W3E has another new MOPA. W3CIP is increasing his power. W3CFR has a new oscillator-doubler panel and a new PA under construction. A ‘52 is going to be installed at W3DUT.


WESTERN NEW YORK - SCM, J. R. Blumenauer, W3CCX, is still around. W3P is in the BPL. W3CZW is giving us a nice report. W3CM gives us a nice report. W3CWW is going visiting in Virginia. Get some traffic. W3FFV, W3SDT applies for way. W3BLH is strong for beam transmission. W3BJI is using an MOPA. W3BH ran up big total on 3500 ‘phone. W3DSS reports W3RVO is new member in Onesida. W3DSP is AFX 25, W3AROW is in Rochester, W3CEZ and W3ACY are on ‘phone. W3AGU gets out well. W8SU is going on ‘phone. W3DFN is using a collapsible antenna. W3BOX is the only “old-timer” on W3DX’s list. W3DFN has his Army gang going full blast. How about a contest between Army and Navy gangs for traffic totals? W3DES has a real total. W3DCX sure gets the DX on 7000, W8AQJ is on 3.5 again. Our most successful ‘phone line is in W3AFM. W3AQJ is on 1750 again. W3QB is QRL in the OW’s garden. W3DJA is returning to W1ASV for the summer. A new convert to crystal control — W8BIP. W3AOU plays checker with W3EKM every evening. W3DME is doing some BCL work in Auburn State Prison. Six new ones in Syracuse: W8EGY, W3CWH, W3FP, W8AQE, W3EEL. W8BYD knows how to keep Jamestown working. W3BIF is QRL — the YLs. The J.A.R.U. has a big hamfest this month — a regular young convention.


CENTRAL DIVISION

KENTUCKY - SCM, J. B. Wathen, III, W0BAZ - The Kentucky Derby, the yearly turf classic, has been run. Our own race for Water’s 625 Trophy will finish with the June reports. W3LAR makes a final push and lands in the BPL. W9BBW has been appointed RM for Eastern Kentucky; W9AZY, Western. W9OX is acting A.A. NC for remainder of drills. W9QT is taking rest per doctor’s orders. W3AQV complains of ORS, W9HAG having trouble. W9HAG has an irregular schedule with WSEA. No news from W9EDQ. W9LH doesn’t like radio in hot weather. W9AZY has joined Nat. Guard. Summer slump is starting at W9BDW. W8ACS was appointed Unit Commander of all N.R. W9AIL, W9HAG, and W9DUM are in small units. Watching the “ponies” keeps traffic low at W9ARI. W8EYW averages a message per each hour’s operation. W9DCA raised his antenna and increased results. W3CFW has a crystal “phone now. W3DQG reports conditions of 7 mc. and 14 mc. Now that his license is back, W9QT is making some good DX on 7 mc. W3DQG is in trouble with his transmitter. W3CJEE shifted to 14 mc. W3CMI gives us a nice report. W3DGG is going visiting in Virginia. Get some traffic. W3F2F, W3SDT applies for
the "phone OBS appointment. W9FQQ is back from Purdue. Ex-AH, now at WFTW, will open up in Hopkinsville with a nice outfit. W9BNE wants to know how he has to get here. W9GZK is building a pull-pusher receiver. W9GUV gets out fine with two "4's. W9GXX and W9GVL are new stations in Rockford. W9GWL used to be W9HQ. W9ERU has added three "2 to the 75-meter box on the house. W9EUU is now using "10s. W9QXO is a new station. The transmitter and receiver QRM at W9GAI has caused a lot of worry lately. The Federal Radio Commission has gobbled another heart with the call of W9GZK in Chicago. W9CNYY calls to his friends on the street a few blocks away using a portable public address system. HL W9GV got a card from AUIAI in Siberia reporting him QSA9GS. W9GTP is building up an MOPA phone. W9GPI is a new ham in Chicago. W9AFN has a new 20-watt 'phone. W9BYL is building a new power supply. W9CYT is moving. W9FAU is a new traffic man. W9EAO has a new Dee. QST tube AC receiver. W9LA is doing nicely on 3600. W9ATS will soon be an ORS.


MICHIGAN — SCM, Ralph J. Stephenson, WSDMS — Another big hamfest for Michigan, this time at Grand Rapids. About 85 attended, including W9BDJ, the Indians SCM. Congratulations, fellows, on a very successful party. W9FDP is resigning as Western Michigan RM. Sorry to see "Rums" QRT. W8BMG will be able to keep the gang over there busy W8BKT, W8GJX, W8CWWK and W8BQ all report good DX. At last, W9DJV has been bitten so badly in first place in traffic totals, W8PP taking the honors with W8BMG running a close second. W8MV takes good care of the A.R.R.L. net for American Legion here. W8SDX is moving into Detroit for the summer. W8DXY has changed QRA to a farm near Pontiac. W8DJQ is leaving for New York. W9EIK dropped us another of his newsy letters. W9CE is building bird houses in his spare time. W9COI is a newcomer among the Michigan niners. W9DLY, W9BPB and W9HK were visitors at W9GJX's. W8DMD took his crystal into producing a good report. W8WO has been experimenting with 14-m. 'phone. W8DFE opted to slow up on 14-m. this contest work. W8BKM is the chief op. W8BND is building a push-pull receiver. W9GS is a new ham in Chicago. W9AFN has a new 50-watt 'phone. W9BYL is building a new power supply. W9CYT is moving. W9FAU is a new traffic man. W9EAO has a new Dee. QST tube AC receiver. W9LA is doing nicely on 3600. W9ATS will soon be an ORS.

WSOQ, WSBFC, WSDMX, WSEHD, WSEBT, WSKP

send in good reports. W6BDH is on 3700 kc. W6CUL is organizing phones for traffic work. W6CWR is housecleaning a lot of old things. This month, W6BCG made an exchange with W6BAC. W6C5X must carry on. W8AXV will be on soon with 250 watts. Some good portable work is being done by W6CSS. The SCM was glad to meet the following ORs when in W6CWI's shack: W8AN, W8JD, and W8JF. Congratulate our new ORs, W8ARW, W8ATV burnt his hands with acid. W6C5GS has regular schedule with SCM. W6DCJ writes a letter. W8US is off for air for summer cruises. "Popped '66," says W8DJK. "there will have W6SMK club tea next month." W6BMX delivered message for Hawaiian party in Cleveland. W6C5G continues his good traffic work. "YL and study," says W8CY. W8KEW is a new OR in Lakewood. The reports from W6BNC are better every month. W6BTP has a 14-mc. set going. W8SEEQ handled some traffic for Western Union. Look out for that new '82 at W6CCX. W8AND is not cont'd, U.S.R., at Toledo. Look for W6CCX at Camp Perry for two weeks starting August 3. W6BBR has a new '52. W8DU has been on vacation at W6DZG and W8D5G. W8BNM is now on 3700 kc. W8RN never misses on his report. "Hurray, we got our corn planted," says W8CK. W8BAH is pulling for four Banners in a row. W8WP reports a new club, Cambridge Amateur Radio Operators. W8U8 is a new private OR. W8P5 and W8D6V are new reporters. W8UDU will be off for air awhile. Nothing new, but a lot of QRN reports W8AND. To make matters worse, W8C5T notes better results after replacing his splices with a brand-new skywire. W8EAB and the W8BEL ops attended the Ames Convention with the SCM. W8FMK nukes his MOPA between patients. W8FFY reports the Luverne hams attended Sioux Falls Radio Club annual picnic. W8H6Z has a dynatron frequency meter. W8K3T is kicking out fairly well. An inconsiderate tornado smashed W8BKK's beautiful 80-footer. W8D6P has been hamfesting in St. Louis and Dubuque. W8BBX has an AC SW5. W8CRQ is rebuilding his 'phone. W8FMF would like to see some hams this summer. W8BG sked the Heron Lake and Jackson gangs, W8GTO is a new one at Blue Earth.


NORTHERN MINNESOTA - SCM, Ray Weihe, W8CTW - New Clubs are at St. Paul, Altikin High School and at Payneville. The gang at Payneville have a Naval Reserve Unit call of Q50, under W8JSG. W8C5S handles some traffic for Western Union. The BPL, W8B6H adds fine local for the QST. W8AAE is leaving section till fall. W8E6K is getting portable license. W8DQ0 reports a burn wrist. W9F4Q is looking for traffic. W8BIL has a steady dance band job. W8B1V works plenty DX with its '52. The SCM has been on the sick list. W8BVU is rebuilding receivers. W8FNF has hard time getting MOPA parking. W8EGU has Extra First-Class Amateur ticket. W8GKM will be gone for the summer.


NORTH DAKOTA - SCM, Guy L. Oettinger, W8BYF - W8DQS ranks first again. W8CRF is off the air temporarily. W8ZYA will be on more from now on. Two schedules are kept by W8EGJ. W8BFW had QRM from college. W8DM is getting ready to close up for the summer.


DELTA DIVISION

MISSISSIPPI - SCM, William G. Becker, W5AYZ - W5AWP has a new big 'phone on 3500 kc. W5AYZ is planning a 14,000-kc. crystal-controlled 'phone. W5BKL has trouble getting out with his haywire antenna. W5BNW and W5BXB are graduating from high school. W5BCF was heard in Russia on 7000 kc. W5BHI will probably operate under a "9" call during the summer, as his QRA will be St. Louis, Mo. W5VJ finally succeeded in working a "6." The Jackson Amateur Radio Assn., located in the penthouse of the new 22-story Tower Building in Jackson, has several out-of-town visitors lately, including W5HY and W5BBT.


TENNESSEE - SCM, James B. Witten, W4SP - W4BGM is new RM for East Tenn. W4DRK is a new crystal rig. W4AAD put up a new antenna. W4CW has a commercial ticket. W4RO says European signals are FB on 14 mc. in early afternoon.


ARKANSAS - SCM, Henry E. Velte, W5ABI - OUR STATION this month is W5BMI. W5Q4 made the BPL. W5HN has a portable license with call W5BHH. W5BOP was heard in Russia on 7000 kc. W5W7T is getting out with W8SBG. W5ERS plans a number of changes during summer. W5SI reported by radio. W5LV has four schedules. W5BIB is building a new "phone rig. W8J5R is new station.

LOUISIANA — SCM, Frank Wasse, Jr., W5WF — W5YW advertised for traffic during the State High School Award Day ceremonies at Baton Rouge. W5WHJ, a 2000-watt amplifier to his receiver, W5ACY is still keeping his AA schedules. We never hear W5JRA any more. W5BPN has a new TTT. W5AJJ is new fellow for Shreveport. W5AIB is going to work some OXV yet. W5VT is portable call of W5WUG. W5WUG has sent in an application for a new call. W5WUG, W5KC, W5NJ and several others. There will be lots of room for some good ORS stations after this month I think!!


HUDSON DIVISION

EASTERN NEW YORK — SCM, H. J. Rosenthal, W2UQ — At a recent meeting of the Mid-Hudson Radio Club at Poughkeepsie, plans were made to start an active Naval Reserve Unit in that Section. W2LU had the pleasure of entertaining W1KR. W2BJA reports Army Amateur net moving traffic quickly. W2CBB is moving from Rye to New York City. W2ACD is one of the main active Naval Reserve Unit in that Section. W2LU had the reports Schenectady Amateur Radio Assn. had three higher power transmitter. W2CGO keeps schedules with business be heard with the call W2ZZK. W2AYK is planning a pleasure July, W2AYK 23, W2CGO 18, W2ACB 17, W2UL 14, W2CBB 10. W5WG, W5KC, W5NT and several others. There will be schedules. W2AYK has the pleasure of first VK QSO. W2AZP handed a fine report. W2ACB, our new seener from the 7th dist, is moving again. W2CLX will welcome all the schedules he can get.


MIDWEST DIVISION

NEBRASKA — SCM, S. C. Wallace, W9FAM — W9FAY leads the ORS this month. W9FAM received a new portable call of W9FZQ, W9FAM is going to work some DX yet. W9FAM is still punching away. W9EHW, W9BHI and W9GDH have the rebuilding fever. W9BQG says hard time to QSO the SCM. W9DTH is trying his luck on 14,000 kc. W9BGT is sending in some equipment. W9BGG is looking for traffic. W9BYY is QRL with flowers, garden and office. W2JFZ had some observations of YL operators and thinks it would help the sex to get into radio. W2GMT joined the U.S.N.R. W2CDQ worked Jack J5CC. W2AIP burned out some equipment. W2CBB is looking for traffic. W9BYX is QRL with flowers, garden and office. W2BJB had the pleasure of his first VK QSO. W2AZP handed a fine report. W2ACB, our new seener from the 7th dist, is moving again. W2CLX will welcome all the schedules he can get.


NEW ENGLAND DIVISION

CONNECTICUT — SCM, Fred A. Ellis, Jr., W1CTI — W1BPC is a new man at So. Glastonbury. W1BFU is in high school. W1BPC is a new man at So. Glastonbury. W1BFU is on 1750-kc. 'phone. W9HL has a schedule with the RM. W9GHI is graduating from high school. W9BHU wants traffic on 3000-kc. 'phone. Spring fever took a look of W9FXY's time. W9ERR will be on the air at his home station, W9GCP, during vacation. W9EWS is on 3500 kc. with 'a lot.'


NEW ENGLAND DIVISION

CONNECTICUT — SCM, Fred A. Ellis, Jr., W1CTI — W1BPC is a new man at So. Glastonbury. W1BFU is in high school. W1BPC is a new man at So. Glastonbury. W1BFU is on 1750-kc. 'phone. W9HL has a schedule with the RM. W9GHI is graduating from high school. W9BHU wants traffic on 3500-kc. 'phone. Spring fever took a look of W9FXY's time. W9ERR will be on the air at his home station, W9GCP, during vacation. W9EWS is on 3500 kc. with 'a lot.'

ORS. W1A VB will be ORS when this is read. W1BVW is one of the quiet gang — no news on his form one. W1HQ is working real DX on 14050 kc. W1BGP is reaching out on 3.5 mc. W1ES schedules W2WP. W1BHM is on 14 mc. W1HFXT schedules W1BDC and W1BTFT. W1FAX was QSO W6AF on 3.5. W1ADIJ, Vice-Press, of Conn. Brass Founders Assn., hands in his first report. W1FL got his report in on time this month. W1BBBU schedules W1CDS. W1BW, will be available for a couple of months. W1AIFB gets all the Hartford traffic. W1TD will be all set for a new antenna soon. W1ASP will try 3073 kc. as soon as he can revamp his outfit. W1AMG has been very QRL. W1BNB keeps busy in the garden. W1DMWM rebuilt his transmitter. W1AFP has been transferred to Waterbury. W1ABUW handles his traffic on 'phone. W1OA8, W1AOW and W1ACQ paid a visit to the SCM, but no one was home. W1AZG schedules W1ZGA. W1AMG has been quite QRL. W1BFS is having trouble with 3.5 mc. W1QV has on 3.5 mo. W1E is holding meetings every Thursday evening at the club house and W1ACQ paid a visit to the SCM, but no one was home. W1AHF reports traffic very poor. W1ASX has been appointed OBS and will send out the OBS by office. W1BEU reports traffic on 3.5 mc. W1BNL, who has been operating at W1CAB, will shortly be on from his own station. The following ORS failed to report this month: W1KY, W1BUX, W1AEZ, W1IAK, W1D and W1BE. W1FCQ reports W1GDX new ham, W1CIT. W1ITW reports following guests at his home: W1BD, W1AOA, W1AQX and W1BVW, W1WZ and W1AXN. W1STW has much doing. W1AXN reports working his station from camp at Lake Iroquois under Portable license; call letters same. W1AOA is QRL, school. W1IT so QRL thinks he will have to resign SCM job.


MAINE — SCM, G. C. Brown, W1AQI — W1ATF reports by radio. W1ACW has worked five continents and sixteen countries. W1BJZ reports W1AMQ has been QRL. W1BWX has been ORS 3, 14 mc. W1BME reports an old timer, Harris Day, coming back on the air. W1BFA recently read an article in a New England newspaper which asked the following questions: "Where are stations WQSA4, WQ8A5, WQSY and W1B IX? W1BRG is a new ham in North Charlestown. W1BII was a recent visitor at the SCM's. W1BII is waiting for a new 75-watter. W1AWA has been getting good reports. W1BCA haa been getting good reports. W1AATZ, a NON-ORS, never fails to report every month. W1BII is still busy. W1BII has been working on 14, 7 aud 1.4 mo. W1AGI and W1MG are going strong on 14 mo. W1AKY has been appointed OBS and will shortly be on from his own station. The following ORS failed to report this month: W1KY, W1BUX, W1AEZ, W1IAK, W1D and W1BE. W1FCQ reports W1GDX new ham, W1CIT. W1ITW reports following guests at his home: W1BD, W1AOA, W1AQX and W1BVW, W1WZ and W1AXN. W1STW has much doing. W1AXN reports working his station from camp at Lake Iroquois under Portable license; call letters same. W1AOA is QRL, school. W1IT so QRL thinks he will have to resign SCM job.


RHODE ISLAND — SCM, N. H. Miller, W1AWE — W1GV makes the BPL. W1BUX is a new ham. W1CAB is working some in the west coast easily on 'phone. W1AOA reports traffic very poor. W1ASX has been appointed OBS and will send out the OBS by office. W1BEU reports traffic on 3.5 mc. W1BNL, who has been operating at W1CAB, will shortly be on from his own station. The following ORS failed to report this month: W1KY, W1BUX, W1AEZ, W1IAK, W1D and W1BE. W1FCQ reports W1GDX new ham, W1CIT. W1ITW reports following guests at his home: W1BD, W1AOA, W1AQX and W1BVW, W1WZ and W1AXN. W1STW has much doing. W1AXN reports working his station from camp at Lake Iroquois under Portable license; call letters same. W1AOA is QRL, school. W1IT so QRL thinks he will have to resign SCM job.


NORTHEASTERN DIVISION

I DAILO — SCM, Oscar E. Johnson, W7AKZ — W7KQ will increase power to 100 watts. W7RAU and W7RBE report for the first time. W7ACD will transmit tests on 20 mc. during July, August and September. W7ACP is president of the Idaho Amateur Radio League, a new organisation. W7QD worked ZS5X on 14 mc. 'phone! W7AUR is on after a long vacation. W7ALW is still busy. W7AO is having troubles with antennas. W7AFH has a new monitor. W7ATF has a new monitor. Extra First-Class ticket. W7AKZ finds conditions rotten.

Traffic: W7AT 18, W7AFT 10, W7ACD 9, W7BUX 1, W7KZ 10.

ONTARIO — SCM, Dr. O. W. Ziera, W7AAT — W7HLP likes to chew the rag. W7ASO was in Denver a few weeks ago. W7CCU is a new OBS. W7ARH is rebuilding. W7AMX, a NON-ORS, never fails to report every month ON TIME! W7BCA has been getting good reports. W7AOL is waiting for a new 75-watter. W7ATF is the chairman of the Anaconda gang. W7AUF keeps schedules west. W7ATF has been doing some reconstructing.

W7QI takes the lead this month. W7QI sends most of his time working. W7AVM has a new MOPA. W7AGL-81 is still active at W7AGL. K6BX is looking east. W7AW is not on vacation at sea. W6EMA has new sepp. W6AJM is in QRL. W6BCL sets. W6EOL will have new outfit. W6QY has new shack. W6DNW is heard after midnight. W6CTR got promoted in Police Department. W6AGI puts out more sepp tickets that those. W6CVA, W6DNL is building portable. W6BF is building crystal outfit. W6AEH has schedule with Hawaii.

Traffic: W6EPP 12, W6OEP 11, W6CTP 9, W6AEF 9, W6AKB 8. W6PVW, W6AFW.

SACRAMENTO VALLEY — SCM, Paul S. Farrelle, W6AXM — W6EIC is a new OBS. W6DEW is building a dynastron. W6EOG doesn't like Schnell's idea of low power. W6QT has crystal going PB. W6EQ is building 14-mc. 'phone. W6EDY has an 'FB' phone on 3.5 mcs. W6EMK is going for the YTL. W6DKN, W6CMA, W6ADN, W6AIE and W6BIE are new men in this Section. W6DVF is still using low power. W6ORM is back on after a long absence. W6A and W6PF are thinking about joining U.S.N.R. W6EVS is building crystal. W6CR and W6GF, two old-timers, are back again. W6UW is getting the fever. Am sending OHS tickets to W6TM, W6AIM, W6BSQ.

SAN JOAQUIN VALLEY — SCM, E. J. Beall, W6BVY — Thanks, Gang, for the FB reports sent in this month. W6AOA leads in traffic with a splendid total. Welcome, Kern County, into the San Joaquin Valley Section. W6DQV connected with G6BY. W6BBS is a YL op at Wasco. W6BEL is still building down the Alaskan schedules. W7RT is busy raising subscriptions for the Oscillator. W6APP helps to keep Tacoma on the air. W7WW and W7AVN are busy with Navy Net work. W7AQ has moved to new and larger quarters.

ANITA LAY — SCM, J. Walter Frates, W6CZP — W6RAB covered himself with glory again this month with one of the highest totals ever handed in by one man in the three and a half years that the present SCM has been in office. W6ALX came in second with his usual fine, consistent work. During the past month he had the aid of old W6IP, who contacted P.I., Guam, China, and a few way points. W6CGM says his annual power leak is working again. W6DY is seen hovering over the shack at W6A WY. W6VO is back and is in line for ORS. W6UM is getting the fever. Sacramento buildings. W6EAG is building MOPA. W6JB is in line for ORS. W6EMX is going for the YLs. W6DKH, W6CMA, W6ADS, two old-timers, are back again. W6 UM is getting the fever. Pacific Division.

TRAFFIC:

PACIFIC DIVISION

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PHILIPPINES — Acting SCM, John R. Schults, KAIJR — This report was received at W7ALM by radio from KAIJR and mailed to HQs. KAIJR is using crystal equipment to transmit operating on 15 meters. KAIJR requests KAIIS to send all available works. KAIIS reports completion of his crystal transmitter. KAIIC reports QRM from KAI2A. KAIIS is newly married. KAIIS worked Army planes on maneuver. KAIER has returned from Bolo. KAIERA is busy building a new home. KAIIS reports W2LF will be on 15 and 7 meters. KAIJR is busy making a new ‘phone rig.

Traffic: KAIJR 543, KAIIS 204. OM/BB 198, KB1JR 149.

ROANOKE DIVISION

WEST VIRGINIA — Acting SCM, D. B. Morris, W3JM — W8OK has highest total of month. ‘The Mountainstate Brass Foundry,’ W3JS, reports W3JHK, W3EES, W8BOK has visions of two ‘65s on 14 meters. W8SR is selling out. W8HD is our ‘old reliable’ when it comes to schedules. W8HJL was heard in Russia on 14 meters. The West Virginia Amateur Radio Assn. held their monthly meeting in Morgantown, May 3rd; a record crowd was on hand. All meetings from now on will be held at Fairmont, West Va., on the first Sunday of each month. All the gang is invited to attend. W8SFB has been operating on 12 meters on 14 meters. W8AGT is busy building a new home. W8SDO is installing 500-watt crystal-controlled job for 3500 kc. W8JLJ has QRM on 14 meters. The West Virginia Amateur Radio Assn. is holding convenient meetings from now on. W8WJH is off the air. W8HJL is on irregularly. W8HJH has transmitter on 7000 kc. W8HAD is back on air. W8JLJ is working on CW. W8BOK is working overtime on ‘phone. W8EJF reports trees surrounding his antenna system keep him off the air now. W8AGI is doing good work.


VIRGINIA — SCM, J. F. Wohlford, W3CA, W3FJ will have 100 watts at National Guard camp this summer. W3AAJ attended the Danville hamfest. W3AMB won the Virginia QSO Contest. W3CFL took the hamfest at Danville and won a type 49. W3HL is on irregularly. W3HJH has transmitter on 7000 kc. W3HAD is back on air. W8JLE is working on CW. W8BOK is working overtime on ‘phone. W8EJF reports trees surrounding his antenna system keep him off the air now. W8AGI is doing good work.


NORTHERN VIRGINIA — SCM, H. L. Carence, W4DWH — Winston-Salem has the most active radio club we know of. W4AHP has completed a four-stage crystal rig. W4APZ is a new ham. W4QG needs a little more power. W4JIR has his receiver trouble ironed out. W4ABT visited W4EC and W4PF. W4ATC will be off the air for the summer. W4AIS is working to complete the station. W4FHY leaves us for the summer.


TRAFFIC

ROCKY MOUNTAIN DIVISION

UTAH-WYOMING — SCM, C. R. Miller, W6DP1 — The U. A. R. C elected the following officers for the coming year: W6DWT, President; W6DFL, Vice-President; and W6WFX, Secretary-Treasurer. W7AWZ has been changing DX. W6DAM is looking for traffic. W7HX reports business on the hum. W7AAH is too busy to pound brass. W6DPO pushed through a few. W6BTX will be away this summer. W6DAM is in the Army Net. W6DFL conducts and W4QZ have been very quiet. W4AZ has moved to Arizona. W4ALJ has wrecked his MOPA. W4VR was due to take a trip to his home in Los Angeles. W4AAY is on 14. W4DS has a new screen-grid detector. W4INL had his antenna down for repairs. W4AGN is used exclusively by the Naval Reserve. W4AOV expects to use two '45s in push-pull. W4ABF is going back home from school. W4AB is very quiet this month. W4SS is on again with a '10. W4ACW, W4AIW, W4IWO and W4ACK have started a Radio Club in Tampa. W4AJD and W4CK are Official Observers. At the banquet given by the Miami Amateur Radio Club, 32 fellows were present. W4QZ was away on vacation. Traffic is very quiet. W4AYW in Lawson Hill's new call. W4AEQ is a newcomer in the ham stations of Pensy. Three new licenses have expired. W4AG has a new MOPA. W4AT is going to rebuild. W4ANL is a new ham in Okmulgee. W5GA is down on 14 mo. now. W5MM has a new MOPA. W5QL is building a new job for the 15-meter band. W5AB has a new MOPA. W5UQ has a new transmitter. W5AO has a new crystal rig going soon. W5AMC has the high traffic total this month. W5BQW hopes to have his new crystal rig going soon. W5KZ has been trying to get his crystal to perk. W5AYJ has a new ham. W5MO is working 'phone now. W5AB has a new crystal rig going. W5ON has a new MOPA. W5BQ has been trying to get his crystal to perk. W5AV has a new MOPA. W5OZ has a new transmitter. W5PO has a new MOPA. W5GQ is working 'phone now. W5ATM has a new MOPA. W5ALD is working 'phone now. W5AO has a new MOPA.

SOUTHEASTERN DIVISION

WESTERN FLORIDA — SCM, Edward J. Collins, W4MS — Our Route Manager, W4CB, has moved back into his shack. W4QR has been building a portable transmitter for camp. W4SC has been active in F.N.G.Q. work. W4AXX is burning up the air with his 'phone. W4UAU is working hard to get his U.S.N.R. gang together. W4ARD-W8FCY reports that flying kept him pretty quiet. W4AIW, a newcomer, is also W91ZL. W4APF is on with low power. W4AYR is another low power station. W4AUS is going to rebuild. W4AJJ has wrecked his MOPA. W4WJ and W4JN have been very quiet. W4AIO is a newcomer in the shack. W4WJQ is building a broadcast license. W4QP has sad reports. W4QF is on. W4VL has a new MOPA. W4KX has a new transmitter. W4LZ has a new MOPA. W4AJH is back on the air. W4PD has a new 3750-ke. crystal. W4AXY is back on the air after working hard at school. CM2JM has been experimenting with a doublet receiving antenna. W4CE1 is on air with P2 oscillator and PP amplifier. W4AXX worked all districts on 3600-ke. 'phone. W4SS is building an MOPA. W4QZE is a new ham. W4AJN has a new MOPA. W4QZK has a new transmitter. W4AQP is working with the Eastern Air Transport Co. W4YW uses 2 '30s in PP TWT. W4AHM, star blind student at Ga. Tech, is operating on 7 mc. W4FH has been active in F.N.G.Q. work. W4ADL has a new 3750-ke. crystal. W4AYJ was QSO Y A61 on May 30. W4AYJ is a new ham. W4AOV in Lawson Hill's new call. W4AHJ is working 'phone now. W4AT has a new MOPA. W4APF is on. W4VL has a new MOPA. W4ATM has a new MOPA. W4AHJ is working 'phone now. W4AT has a new MOPA. W4AOV is Lawson Hill's new call. W4AEQ is a newcomer in the ham stations of Pensy. Three new licenses have expired. W4AG has a new MOPA. W4AT is going to rebuild. W4ANL is a new ham in Okmulgee. W5GA is down on 14 mo. now. W5MM has a new MOPA. W5QL is building a new job for the 15-meter band. W5AB has a new MOPA. W5OI has a new MOPA. W5BQW hopes to have his new crystal rig going soon. W5KZ has been trying to get his crystal to perk. W5AMC has the high traffic total this month. W5BQW hopes to have his new crystal rig going soon. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA. W5GQ is working 'phone now. W5ALD has been trying to get his crystal to perk. W5OZ has a new MOPA.
W5ASQ has resigned as RM. W5AIR has moved to Okla. City. W5BPF is using a 75-watter. W5BPM is plugging along. W5AYF wants the RMMITES continued through the summer. W5BRD is a new ham in Shawnee.


NEW MEXICO — SCM, Leavenworth Wheeler, Jr., W5AHI — W5AUI makes a fine report. W5AUR has recently returned from a visit in Oklahoma. W5AQB has been helping W5AUO at Madrid get started. W5AVB is going on "phone" for W5AUV. W5AXY is a new station in Albuquerque and another is W5AFY. East Vaugan. Results of the events at the state track meet in Albuquerque were handled by W5CV (portable of W5AUI, W5AUK and W5ABY, who reported to the student body of Las Vegas High School. W5QRE has been working some DX. W5TV is very QRL with his combined crystal rig, soda fountain, luncheonette, and radio shop. W5AHI was off for a couple of weeks.

Traffic: W5AUI 102, W5AHI 71, W5BQG 17.

NORTHERN TEXAS — SCM, Roy Lee Taylor. W5RJ — W5AUL makes the BPL. W5AUN and W5AUF are new hams in Abilene. W5HY has new location and new filter. W5RH wants some live schedules. W5RI installed a pair of "73s. W5QU is leaving for school. W5BAM moved this month. W5QY, a new ham in Ft. Worth, has an MOPA. W5BRH is rebuilding. W5LY is on with new MOPA. The W5AUX station moves through with a report from W5ASX-W5BJX and W5AVA. W5FT reports for the Big Springs gang. W5FT has a pair of '10s in push-pull. W5LQ has a schedule with W4PT. W5HB-W5QG is having trouble with transmitter. W5BMT is going on "phone. W5AHI is going well in Ft. Worth.


SOUTHERN TEXAS — SCM, H. C. Sherrod, Jr., W5ZG — From the number of reports and interest manifested by members of this Section all indications are for better organization and a better section report. This is encouraging. Houston: W5TD has been adding a stage to the crystal rig. W5ERL is getting out well with a 50-watter. W5LYC is now in Houston. W5AHI is on with a 50-watt crystal rig. W6OX occasionally handles the key at W5AH. W5AHW is a new ham in Houston. W5ANW and W5AVU are on 3500 kc. with a good 'phone. W5HRW is handling quite some traffic. W5BPO has not been on much. W5QO is using '10s in a push-pull. Dodge is on intermittently at this time.

Traffic: W5AUX 19, W5DQ 11.

ON TARIO — SCM, C. D. Lloyd, VE5CB — The opening of the radio stations of the Ontario Forestry Branch in Northern Ontario has made possible a number of amateur activities. VE5ET is building up a new outfit. VE5AQ is at Sault Ste. Marie. VE5BT and VE5CD have reported to the SCM. VE5ET is getting his new outfit in shape. VE5DQ has arranged with VE5CD and VE5AU to handle his schedules while he is busy plugging at studies. First reports are to hand from VE5QB, VE5GL and VE5GB. VE5BT and VE5DC are the only ones on the air at Hamilton present. VE5XK has moved to Montreal, and is working under the call VE5X. VE5CA is helping to keep a number of schedules. VE5EB is on 40-meter band.

Traffic: VE5C 335, VE5CD 110, VE5AD 41, VE9A 30, VE5KE 30, VE5QG 6, VE5SB 5, VE5LA 3, VE5GB 2, VE5GL 1, VE5ID 1, VE5CE 3.

QUE BEC DIVISION

QUEBEC — SCM, Alphay Blais, VE2AC — VE2AC is proud of his push-pull transmitter. VE2AA is getting out very well. VE2AC has carried away the prize for Canada for the British Empire Radio week tests of the R.S.G.B.
HOW many of you fellows in parts of the world other than the North American continent are making full use of the special Standard Frequency System schedules run for the convenience of international listeners? If all of the 30,000 amateurs scattered over the globe were to make use of this million dollar service (as evaluated in May QST) its value would soon rise to a million and a half! A decidedly worth-while consideration, particularly since these early Saturday morning transmissions so correlate the regular schedules that it should be possible to receive standard frequency transmissions in every part of the world.

Many are doing it. The S. F. System receives reports frequently from the Antipodes, all over Europe and Africa, and even from Asia. But it is, nevertheless, hard to secure general adoption of the service. We read in a newspaper last night that it took an hour’s constant harangue to a huge street crowd in one of the large cities to dispose of five perfectly good $5 gold pieces at the cut rate of two dollars and a half each. Don’t be like that! Turn to the Standard Frequency News and Schedules section of this issue of QST and select the next suitable schedule. You can quite readily calibrate your frequency meter to an accuracy of within .01%, and have definite assurance of just where all those kilocycles are located.

At the End of Five Years . . . . . . . . . . . . . .

. . . the WAC Club boasts a membership of 500 different amateurs, since a small and honored group of four have acquired the radiotelephone class of membership as well as that for c.w., and an occasional few have duplicated the feat by working all the continents from more than one station.

They are scattered all over the world, these prize stations of international amateur radio communication, and are to be found in 47 countries. The membership of each country is listed in the table below, with a further classification for the change in the sponsorship of the WAC Club to the I.A.R.U. in January, 1930. The first column of figures indicates the total number of members accepted from that time until April 15th of this year. The second column shows those granted the old A.R.R.L. WAC certificates before that time, extending back to April 13, 1926, when the Club was founded.

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</table>
Lists of WAC Club members by names, calls, and years will be found in this department of past issues of *QST*.

Some time ago we received a postal card from Frank Lucas of W8CRA, in Canonsburg, Pa., on which he said, in part: "... so much talk about that 11-year sun-spot cycle ... all indications here show conditions reversing only for the Southern Hemisphere, South Africa and South America come through better a.m.'s than in afternoon or evening, but not many stations on the air. Don't let this hold us apart fellows! ..."

That observation was mighty interesting, you may be sure, so an effort was made to correlate the data giving rise to that thought into more detailed form. Among the various general conclusions reached, it was recalled that back until 1927, or through the period of sun-spot maxima, from a particular locality in the Antipodes such as Australia or New Zealand 14 mc, was capable of carrying steady signals through from 1 a.m. to 5 a.m. W8CRA, for example, states that he has worked as many as sixteen during one morning, in mere general operating, with no contest or any stimulation of that sort going on. And much the same was true with the South American countries.

But now? It's entirely different. Signals generally are weaker, and instead of appearing at one general time, growing stronger until a peak was reached sometime during early morning and then fading away, two or more distinctly different periods appear during which these signals are present — usually at the beginning and end of the accustomed 1928 time. Most interesting of the results which lead to this generalization is the fact that during late March and April South Africans have once more put in an appearance at W8CRA. In fact, stations have been worked all the way from Egypt to Cape-town, including Kenya, Sudan, and Rhodesia. Eurasia, too, in general blasts in with much better strength and consistency than hitherto.

In order to portray these results with the fullest possible clarity, Mr. Lucas has prepared a rather novel sort of DX Time Table, in which he takes us for a full day's visit at his station W8CRA. The scene is that of the operating shack; the time, bright and early some Sunday morning about 6 a.m.; the characters, he and you and I.

"No doubt we will hear VK's and ZL's coming through. We'll raise and work a few of them, meanwhile keeping a sharp lookout for the elusive Africans. Around seven we raise one of them, then another, and thus occupy ourselves until 7:30. From then until 9 a.m. South America will come through, after which Europeans will be heard weakly, growing stronger until twelve o'clock. During our noon hour they are heard growing stronger until a peak was reached sometime during early morning and then fading away, two or more distinctly different periods appear during which these signals are present — usually at the beginning and end of the accustomed 1928 time. Most interesting of the results which lead to this generalization is the fact that during late March and April South Africans have once more put in an appearance at W8CRA. In fact, stations have been worked all the way from Egypt to Cape-town, including Kenya, Sudan, and Rhodesia. Eurasia, too, in general blasts in with much better strength and consistency than hitherto.

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"No doubt we will hear VK's and ZL's coming through. We'll raise and work a few of them, meanwhile keeping a sharp lookout for the elusive Africans. Around seven we raise one of them, then another, and thus occupy ourselves until 7:30. From then until 9 a.m. South America will come through, after which Europeans will be heard weakly, growing stronger until twelve o'clock. During our noon hour they are heard calling VK, ZL, PK, J, XJ, AC, AU, YI and a lot of Asiatic countries.

"It is now — from twelve to 1:30 p.m. — that we want to tune very carefully, as this is the time when Asian stations fade into the East coast of the U. S. A. During the rest of the afternoon we can hear fifteen or twenty Europeans. At about 4:30 or 5:00 North Africans come in for a while, reaching a high peak of signal strength and then fading out again. Europeans still remain R5 to 9, but they soon start fading also, and then South America comes to bat.

"At about 8:30 and 9:00 W6 and W7 grow strongest, and if we are lucky we'll hear some K7 and K6. After this we get another chance at Japan, China, Siberia and the other Asiatic countries along the Pacific. About 10:30 p.m.

(Continued on page 84)
Operating Practices

725 East Hill St., Long Beach, Calif.

Editor, QST:

I have just finished perusal of K. B. W.'s editorial in the May issue of QST and believe me, he has hit the nail squarely on the head in regard to a variety of "ham" practices. I use the word ham in a double sense.

I have just recently got back into the amateur game after a number of years at sea and at various coast stations since 1922 and I find conditions rather changed, to put it mildly.

K. B. W.'s statement regarding the use of "OB" and, I might add, "OT" has in me an ardent backer. "OM" has been and always will be the term of friendship used by radio men and other terms such as "OB", "OT", etc., are but childish attempts to be different and perhaps funny, and are extremely gripping to anyone who has been in the game long enough to really get into the spirit of it. As a matter of strict fact even the use of "OM" on commercial waves is frowned upon as being slightly "liddish" but it can get by, whereas anyone using "OB" or "OT" would be looked upon as a boot of the direst sort.

I merely cite this commercial example as an instance of the attitude radio men assume toward the use of these terms.

While on the subject of terms, the use and misuse of "73" is another touchy subject to an old timer. "73" is in itself all that anyone could require for a term to signify "best regards" and the addition of "very", "best" and the suffix "s" is an indication that the user is ignorant of the meaning of the term. Let's cut out the superfluity in our use of "73."

The next in line are the bug "senders" who persist in screwing the dots on a rickety, haywire bug and then sending at a rate of probably 15 to 20 w.p.m. and then sending at a rate of probably 15 to 20 w.p.m. at most by simply murdering the good old Continental Morse, spacing dots and dashes, holding dashes to unbelievable lengths and repeating every other word two or three times due to bulling them with the bug.

It would be a revelation to some of these would-be high speed artists to listen to some of our shore stations from 650 to 750 meters handle traffic with ships. Half of our coast stations rarely use a bug and those that do never have it set to more than 20 or 25 w.p.m., hardly faster than hand sending, although we have some of the best operators in the world at our shore stations and at sea. Handle traffic? I should say!! When you can bat out 40 and more marine messages per hour you are handling traffic, and our transatlantic and trans-Pacific seagoing friends do it for hours at a stretch when traffic is heavy. No superspeed bugs here. Just nice, readable, clean bug or hand sending that carries through QRM, QRN, and sundry other annoyances. Yes indeed, a couple of hours on marine waves would do the high speed (?) boys a lot of good besides the snappy operating procedure they would observe and mayhap, absorb. There are no "R R OK's" up there without the operator having gotten the message en toto without the shadow of a doubt. If he ever should do so he would receive a "package" of correspondence that would take a wheelbarrow to haul around — and who knows what else. After all, radio is like anything else in that it is a question of amassing experience, and why not profit by others?

Rotten signals are very much in evidence as yet in the 7- and 14-mc. bands despite much propaganda on the part of QST and public-spirited amateurs to clean them up. I have observed that most of the rotten sigs come from fellows who are trying to slap their transmitters with everything from the baby's rattle to the kitchen sink in the hope they will raise that "R" report a point. After all, which is more important, a loud signal or readability? What profit it a ham to smear a section of the band with a lot of mush if his signals are practically unreadable and cause all amateurs within 10 or 15 kilocycles either side to gnash their teeth and heartily cuss the offender? Nothing is prettier to listen to or easier to copy than a pure or near d.c. note with capacity in the plate tank is perhaps the most important item and easiest to obtain. It reduces the power output slightly due to increased tank current but what of it? Readability!! That's the important point. Again, we find high rectifier voltages and no filter. Buy lower rating condensers and reduce the plate voltage if the cash is low. Any ham radio supply house sells 500- or 600-volt filter condensers so cheap it is almost a give-way. The power input will have to be reduced slightly but again what of it? Readability!! That's the thing. An excellent choke for
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Features of Model 590

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How to Get DX With a 210 Tube

615 Ambler Ave., Rockymount, N. C.
Editor, QST:
I wonder if you have room for a few words from a young squirt. That’s what I am, for I have only been in the game for a little over a year.

Please understand in the beginning that it is not about the high-power holiday, as that subject has been worn to a frazzle and the frazzle bursted. I say let’s table it forever and try to forget it and forgive our brother who started it, for I am sure he meant well.

This high-power argument has brought a problem to my mind, which is how can I get DX with a Type ‘10 tube. For all poisons there is an antidote, if we can find it. So it is with all problems — there is a solution if we can find it.

After working and studying overtime I have found the solution. It works, and I would like to pass it on to the rest of the gang that they too may get the most out of their Type ‘10 tubes.
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One color (black) heading now being used at greatly reduced cost to members.
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The first time I tried to get two VK’s; the next time I got a K7. The last test was on the morning of May 2nd and I worked all districts in six hours, taking fifteen minutes recess four times. Do the three tests prove its worth? It is very simple — anyone can do it. Here is the trick:

Get up early in the morning and take a nickel from your pocket. If you don’t find one there, borrow one — or better still snatch one from the O.W. Now stand flat-footed; toss it up and if it falls head-up DX is yours. But if it falls tails-up, go back to bed, for DX is as high-low to you as ice cream is to a turkey-buzzard.

— M. J. Duke, W4VB

A Curious Coincidence?

132 Montrose St., Winnipeg, Canada

Editor, QST:

Here’s an item that may be of some interest to QST readers.

A few evenings ago I happened to be listening to a lecturer on the air from the local b.c. station discussing the meteorological phenomena of this past winter. During his talk he told this story:

On the morning of Feb. 25th two physicists at the Smithsonian Institute while walking around the building happened to notice what appeared to be a very large image of the sun on the floor. On investigating, they found that light was coming through a small crevice in the roof, and that the image was being formed in the same way that a pinhole camera forms an image, the height of the roof from the floor making the image very large.

By an inspection of the image they found that at least 40 well-defined sun spots could be observed with the naked eye, this being a condition never before approached.

Out of curiosity, I looked up my log for the day in question, and was surprised to find that at 11:15 a.m. on that one particular morning I have recorded hearing the first ZL of the year. Practically every night in the winter it has been my habit to listen for a few minutes on “20” at about midnight, so that I know this was out of the ordinary. Also, although I listened practically every night from then on at the same time, it was not until March 28th that I again heard a ZL on 20 meters.

Though sort of an old timer (busting ether with spark coils, etc., in 1914), I seldom write, but

— R. A. Chipman, VE41C

Hi!

559 Van Cortlandt Park Ave., Yonkers, N. Y

Dear OM (not O.B):

I know you will take time off to struggle through this one because it contains no BRICKS. Though sort of an old timer (busting ether with spark coils, etc., in 1914), I seldom write, but

— H. M. Chipman, VE41C

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Ec — -3 Volts minimum
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C-335 is a very effective tube for reducing cross-modulation and modulation-distortion over the normal range of received signals. Its design permits easy control of a large range of signal voltages without the use of local-distance switches or antenna potentiometers.

The mutual conductance of this tube is 1050 when operated with a grid bias of -3 volts and 15 with a -40 volt grid bias at the above plate and screen voltages. This large range of mutual conductance makes it possible to give, with several control stages, satisfactory volume control operation under normal signal conditions.

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

Communications Department
(Continued from page 54)

VE2AP has been rebuilding. VE2BB is a top-liner this month. VE2BO is working on his crystal outfit. VE2BY is building a super unit for next fall. Our C.G.M. is busy with organization work. VE2BF in Metabethehousaw is a newcomer. VE2AC is busy preparing for 28-mc. work next fall. We need an amateur station in Montreal for the net for the American Legion. Who wants the job? VE2BO, VE2CO, VE2CU will resume operating soon. VE2CM has finished the power supply for his transmitter. VE2EM reports his first traffic handled via 3.5-me. "Say you saw it in QST - It identifies you and helps QST".
Outstanding A.C. Traffic-Tuner

NATIONAL A. C. THRILL-BOX SW5

A mechanically and electrically stable true A.C. High-Frequency Traffic-Tuner and Receiver for amateur use. Will work with different sorts of antennas without readjustment except of antenna trimmer. Once trimmer is set, Thrill-Box tunes and logs with true single control. Extremely simple to operate. 1080 dial degrees available between 21.2 m.c. and 2.61 m.c. Easily adapted to still wider spreading of bands, if desired with special band spreading coils. Works down to 33 m.c. Very smooth sensitivity control, no grunting, no backlash, or clicking on higher frequencies. No hand capacity.

New model uses the new UX 235 variable screen grid tubes. Push-pull audio, with special phone-jack before the last stage. Special broadcast receiving model is now available with 245 push-pull output. Also made in Low-drain D.C. Model.

Write to-day for Amateur Bulletin No. 116-Q

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Exclusive Eastern Distributors for PURADYNE PRODUCTS

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waits in case with stand-off insulators.............................$16.50

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2-7½V, windings, 200 watts......................................$4.50

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at 10 amps, 2-½V, at 6 amps, c.t. 150 watts........................$9.50

PURADYNE 280 power transformer 600V, c.t. 2½V, 12V
5½V, 3½V, windings, 500 watts......................................$9.50

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at 10 amps, 2-½V, at 6 amps, c.t. 150 watts........................$9.50

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20,000 ohms $2.50
30,000 ohms $3.00

10,000 ohms $1.25
20,000 ohms $1.50
50,000 ohms $2.00

OMHTE 150 watt gridleaks — 5000, 10,000 ohms; 11,000
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OMHTE microphone transformers. A transformer
designed to fill the needs of broadcast stations, F.A. Size,
41/2 x 4 x 2½ ; adjustable for continuous working voltage:
Capacity 1000 volts 1500 volts 2000 volts 3000 volts
1500 3.00 3.25 3.50 3.75
2 mfd. 2.00 2.15 2.30 2.45
3 mfd. 1.50 1.60 1.70 1.80
4 mfd. 1.25 1.35 1.45 1.55

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10,000 ohms $1.75
20,000 ohms $2.50

15,000 ohms $2.25
50,000 ohms $3.75

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Secondary impedance, 400,000 ohms; neat shielded case.

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OMHTE 210 tapped voltage divider 42,000 ohms, $10.50
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ANY SIZE TO ORDER

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**Say You Saw It in QST — It Identifies You and Helps QST**
**RCA TUBES**

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>200-600</td>
<td>$1.75</td>
</tr>
<tr>
<td>B</td>
<td>350-750</td>
<td>4.95</td>
</tr>
<tr>
<td>C</td>
<td>500-1000</td>
<td>6.25</td>
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<tr>
<td>D</td>
<td>750-1500</td>
<td>9.50</td>
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<tr>
<td>E</td>
<td>1500-2000</td>
<td>13.00</td>
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<tr>
<td>F</td>
<td>2000-2500</td>
<td>19.00</td>
</tr>
<tr>
<td>G</td>
<td>2500-3000</td>
<td>25.00</td>
</tr>
</tbody>
</table>

**FILAMENT TRANSFORMERS**

- 1.20 Volts: 1000-0-1000.
- 1.50 Volts: 1500-0-1500.
- 2.40 Volts: 2500-0-2500.
- 3.85 Volts: 5000-0-5000.

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- 65c.

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3500-kc. phone band (March)

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New Tube! New Price
845B Modulator & Power Amplifier

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
<th>Regularly $21</th>
<th>Our Special Price</th>
<th>$12.60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fil. Volts</td>
<td>10.</td>
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<td></td>
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<tr>
<td>Fil. Amps</td>
<td>2.5</td>
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<tr>
<td>Voltage Amp. Factor</td>
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<tr>
<td>Plate Current</td>
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<tr>
<td>Rated Plate Volts</td>
<td>800.*</td>
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<tr>
<td>Plate Dissipation Watts</td>
<td>50.</td>
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<tr>
<td>Grid Bias Volts</td>
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<tr>
<td>Undistorted Output Watts</td>
<td>15.</td>
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</tr>
<tr>
<td>Plate Resistance</td>
<td>2160.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

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I.A.R.U. News
(Continued from page 87)

the ZL's start rolling in, then a few VK's. They burst along intermittently, fading out during the early morning, then coming back in time to start another similar day.”

As we all know, the time of day for all DX experiences seasonal and (we now recognize) multi-seasonal changes, but in general the relationship between the arrival of signals from different points remains much the same. Therefore, with summer now in the northern hemisphere, the typical day described above will start and close at a later hour, but the same relationships will probably be preserved. Amateurs in both the northern and southern hemispheres gauging their operating periods on the times given above should take this seasonal variation into consideration.

There remain but two more facts to emphasize in connection with this highly worthwhile study. First, to repeat that the frequency band is 14 mc. Second, that the time is Eastern Standard, five hours behind G. C. T.

The following information on amateur radio conditions in Colombia, South America, comes from Robert E. Lee, ex-RL of W4LK, who is stationed there with the communications organization of the Pan American Airways. From their Barranquilla quarters he writes:

“Amateur radio telegraphy is not permitted here in Colombia at the present time, although it will be allowed as soon as the government feels able to control it. Since only telephony is permitted, most of the fellows have gone in for broadcasting. Of course, there are no doubt a
QST Oscillating Crystals

"SUPERIOR BY COMPARISON"

AMATEUR BANDS:
How does YOUR signal compare with the accepted IDEAL signal? May we suggest our product to attain this IDEAL signal? HERE'S HOW:

One item of great importance is the frequency stability of your set. Does it stay on one frequency? If not, our power crystals will solve that problem. SCIENTIFIC RADIO SERVICE crystals are known to be the best obtainable, having ONE single frequency and highest output. With each crystal is furnished an accurate calibration guaranteed to better than a tenth of 1%. New prices for grinding power crystals in the amateur bands are as follows:

1715 to 2000 Kc band ........ $15.00 (unmounted)
3500 to 4000 Kc band ....... $20.00 (unmounted)
7000 to 7300 Kc band ...... $40.00 (unmounted)

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Power crystals ground in the 550-1500 Kc band accurate to plus or minus 500 cycles of your specified frequency fully mounted for $55.00. In ordering please specify type tube, plate voltage and operating temperature. All crystals absolutely guaranteed regarding output and frequency and delivery can be made within two days after receipt of your order.

CONSTANT TEMPERATURE HEATER UNITS:
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85
Type 866s, first quality, new, $4.50 each. (30 day replacement).
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Cerdwell transmitting variable condensers, type 166B (broadcast). $75 list. New condition, each $27.50.

23 plate Cerdwell amateur transmitting condensers. New condition, $3.75 each.

Taper plate receiving type Cerdwells (7 plate). Good condition, $1.10 each.

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National Precision Vernier Dials. $2.75 each. (Some new, all new condition).

500 volt test .002 Sangamo molded receiving type condensers 45c each.

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Dublmerica mica condensers (aluminum case), 12,500 volt working .004 mfd. Perfect condition, $8.

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A.R.R.L.
38 LaSalle Rd.,
West Hartford, Conn.
SEND IT AT ONCE.

(Name)

(Street or P. O. Box)

(City and State)

Say You Saw It in QST — It Identifies You and Helps QST
FROST-RADIO
Here is an achievement!

The perfection by our engineers of our new No. 20 Series Wire-Wound Volume Controls to a degree that practically eliminates all noise in operation, is a distinct Frost-Radio achievement. Many months of research and ceaseless endeavor are back of this new type noiseless unit. Its construction embodies a new principle of design, the use of the finest materials available, and an extremely high standard of accuracy in manufacture, which had the courage to reject previous precision attainments and recognize that accuracy within limits of tenths of thousandths of an inch was not only possible, but well worth attainment... Unquestionably the year's highest achievement in the volume control field!

CHICAGO TELEPHONE SUPPLY CO.
HERBERT H. FROST, Inc.
Sales Division
General Offices and Plant: ELKHART, INDIANA

A New Akra-Ohm Wire-Wound Resistor
10 Watts

Type R-M
10 to 100,000 ohms

The Type R-M Akra-Ohm 10-watt Resistors afford an inexpensive means of building test equipment and A.C. and D.C. multi-range voltmeters where heavy duty (10-watt) resistors are required for low resistance meters.

Type R-M Akra-Ohm wire-wound Resistors are carefully designed to insure an accuracy of 1% and a constant permanency of calibration. We can highly recommend their use for High Voltage Regulators, Telephone Equipment, Television Amplifiers, Plate Resistors and other electrical apparatus.

Send us your dealer's or jobber's name and we will send you a copy of our Bulletin 101-C

Shallcross Mfg. Company
ELECTRICAL SPECIALTIES
20 PARKER AVENUE
Collingsdale, Pa.

Sendig Is EASY
With the New VIBRPLEX
Reg. TRADEMARK: VIBRPLEX Bug Lightning Bug
In Colors Blue Green Red

Improved MARTIN Vibroplex
Black or Colored. $17. Nickel-Plated. $19

The smoothest, easiest—working bug on the market. Easy to learn. Easy to operate. Made for easy sending.

Special Martin Radio Bug — Extra large, Specially Constructed Contact Points for direct use without relay. Black or Colored.

Old Vibroplex accepted as part payment
Remit by Money Order or Registered Mail

THE VIBRPLEX COMPANY, Inc.
825 Broadway, New York City
Cable Address: "VIBRPLEX" New York

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

HILET
Attenuator network, T system, 60 db in 3 db steps, 500 ohm line, units $27.50. Adjustable gap, open type choke, actual inductance at the 1,000 rating, 50 Henry at 100 MA, 15 lb; 9.75, 200 MA, 20 lb; 11.50, 300 MA, 21 lb; 16.50, 500 MA, 40 lb; 21.50, 1 amp, 10 lb. $26.50, 3 amp, 25 lb. $31.50, 5 amp, 50 lb. $40.00, 8 amp, 100 lb. $50.00, 15 amp, 150 lb. $60.00, 20 amp, 200 lb. $70.00, 30 amp, 275 lb. $100.00, 50 amp, 425 lb. $150.00, 100 amp, 1.5k. $200.00, 150 amp.

TRANSMITTERS — (See our June ad).

ONE DAY DELIVERIES
HILET ENGINEERING CO., ORANGE, N. J.
Every Ham Needs
THIS!
SPECIAL
Hookup Wire
Assortment
25'—No. 18 Tinned Pushback
25'—No. 20 Stranded R. Covered
25'—No. 18 Stranded R. Covered
25'—No. 16 High Tension Cable
Colored Outer Braid
All Heavily Lacquered
Enough to Wire Up All Your
Apparatus
$1.00 Postpaid Anywhere

AMATEURS IN CANADA!
Obtain lowest prices in Canada. We have a complete line of TRANSMITTING & RECEIVING EQUIPMENT.

Radio Engineering Labs, Inc.
Spaulding Bakelite
Esco Generators
Pyrex Insulators
Jewell Meters
Ward Leonard and others

WRITE FOR LITERATURE
CHARLES J. BODNAR
641 BARRINGTON STREET
HALIFAX, N. S., CANADA

contributes the following DX Time Table for his region, pointing out that in common with most others it varies greatly from similar tables prepared during previous years. This should be useful during the summer months if some allowance is made for seasonal change in the times, which are given in Eastern Standard, five hours behind G. C. T.

<table>
<thead>
<tr>
<th>Country</th>
<th>14 mc.</th>
<th>17 mc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern</td>
<td>0700-1900</td>
<td>1700-0700</td>
</tr>
<tr>
<td>Western</td>
<td>1800-2100</td>
<td>0200-0700</td>
</tr>
<tr>
<td>South America</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>1700-2000</td>
<td>Not worked.</td>
</tr>
<tr>
<td>Brazil</td>
<td>1800-2000</td>
<td>1800-2000</td>
</tr>
<tr>
<td>Uruguay, Bolivia, Chile, Peru</td>
<td>1500-1800</td>
<td>Not worked.</td>
</tr>
<tr>
<td>Europe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All countries</td>
<td>1500-1830</td>
<td>1700-2000</td>
</tr>
<tr>
<td>Africa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algeria</td>
<td>1630-1800</td>
<td>2030-0100</td>
</tr>
<tr>
<td>Morocco</td>
<td>1800-1000</td>
<td>Not worked.</td>
</tr>
<tr>
<td>South Africa</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not worked.</td>
<td>2400-1000</td>
<td></td>
</tr>
<tr>
<td>Asia</td>
<td></td>
<td></td>
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<tr>
<td>Iraq</td>
<td>1730-1830</td>
<td>2030-2400</td>
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<tr>
<td>Afghanistan</td>
<td>1700-1830</td>
<td>Not worked.</td>
</tr>
<tr>
<td>Oceania</td>
<td></td>
<td></td>
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<tr>
<td>Australia</td>
<td>2400-0200</td>
<td>0430-0600</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2330-0130</td>
<td>0400-0600</td>
</tr>
</tbody>
</table>

British Report
By J. Clarricoats, Hon. Sec'y R.S.G.B.
Amateurs throughout the world will join in congratulating Trevor Evans, VK2NS, on winning the "B.E.R.W. Challenge Trophy," presented to the station effecting the most contacts with British Empire stations during British Empire Radio Week. Mr. Evans scored 64 points, 55 of which were obtained by working New Zealand stations.

Many of our old B.E.R.U. members returned excellent reports. Zone certificates have been awarded to Mr. Fred Miles, G5ML (42 points); Mr. Rahim, VS7AP (40 points); Mr. Hamblin, Y16HT (40 points); Mr. Sampson, ZLA41 (41 points); Mr. N. H. Auret, ZU6W (26 points); Mr. H. Mahrstadt, SU1AQ (21 points); Mr. Earle Turner, VE2CA (16 points); Mr. H. H. Cox, VQ4CRF (19 points); and Mr. J. O'Brien, VS6AE (24 points).

We take this opportunity of thanking everyone who assisted in any way to make our premier B.E.R.W. a success. The Council in London look to our large overseas membership to forward suggestions for future Empire projects.

The recent 1.7-mc. tests proved an unqualified success, the winner of the transmitting trophy being Mr. J. B. Scott, EI7C. Mr. Winchcombe, G6ZH, the present holder, was runner-up only two points behind. Miss Barbara M. Dunn, G6YL, again won the receiving trophy. The one-watt tests were well supported, and many interesting contacts were established. The results will appear in the "T & R Bulletin."

The final London meeting for the season was held on April 29th, when Mr. G. G. Blake, M.I.E.E., chose as his subject "A Journey into the World of Science." About 150 persons were
Guaranteed New Radio Bargains

Aero Shortwave Converter Superheterodyne. Converts your AC or DC radio set into a short wave superheterodyne, 15 to 200 meters. $12.50

Auto Radio — Uses 2-224, 3-227 tubes and 1-245 Power tube, single dial, tremendous volume. Compact. Fits any car. We guarantee this set to pull in stations within a radius of 1000 miles and that it will deliver the volume and tone qualities of an Electric set, or your money refunded. $20.00

International Microphones — Two buttons for public address, systems and transmitters. Speech or music. $9.75

Complete Phone and CW Transmitter 15 to 30 Watts. $39.50 including tuned plate, tuned grid oscillator with provision for crystal control. Wired for one or two UX 210 tubes. One or two UX 250’s as modulators, two stages of speech amplification. Mounted in beautiful two-tone Walnut cabinet. Has ample space for AC power supply. Price includes one Stromberg-Carlson microphone.

Power Supply Unit for 15 to 30 Watt Transmitter $19.75. Will deliver 600 volt 150 milliamperes for plate current. Has filament for UX 210, 277, 226 tubes.

World Wide 2-Tube Short Wave Receiver. $11.75. A two-tube receiver in a beautiful shielded metal cabinet. An ideal all around set which will give loud speaker reception on many stations, very flexible in tuning. Complete with a set of 6 dip-in coils. Covers 14 to 550 meters. Can be used with any standard base tubes.

Tubes UX Type, 30 day replacement guarantee, No. 210, $2.25; No. 225, $2.25; No. 281, $1.15; No. 280, 95c; No. 245, $1.35; No. 224, $1.25; No. 227, 75c; No. 220, 65c; No. 211, 75c.

Low Power Transmitter, adaptable for phone or code. With plug-in coils. $6.45

Short Wave Sets, one tube complete with 5 coils, 14 to 550 meters. $8.75

Stromberg-Carlson telephone transmitter on desk stand, $2.75. B Eliminator, Drv. 180 volts, will operate up to 10-tube set with 260 tube, fully guaranteed. $6.75.

AC-A, B, C Power Packs, completely assembled. $8.75. 250 V. B. also has A, C. filament for up to 9-tube set. Can be used as B eliminator. Make your battery set all electric. $1.25. A, C. act around this pack. 260 tube for this pack, 95c extra.

SIEMENS & HALSKE CONDENSERS

for transmitting and receiving — the result of 43 years’ experience.

Made Right

Rated Right

Priced Right

Send for Circular

MORRILL AND MORRILL

Sole U. S. A. Distributors

30 Church Street, New York City

TRANSMITTING GRID LEAKS

For transmitting tubes of the types listed appear in the revised and enlarged circular 507, which contains many new items and lower prices.

Send for your copy today

<table>
<thead>
<tr>
<th>Tube</th>
<th>Catalog Number</th>
<th>Resistance Ohms</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>'10</td>
<td>507-8</td>
<td>10,000</td>
<td>$1.50</td>
</tr>
<tr>
<td>'45</td>
<td>507-68</td>
<td>50,000</td>
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<td>'52</td>
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<tr>
<td>'04A</td>
<td>507-51</td>
<td>10,000</td>
<td>3.50</td>
</tr>
</tbody>
</table>

WARD LEONARD
ELECTRIC COMPANY

MOUNT VERNON, N. Y.

Say You Saw It in QST — It Identifies You and Helps QST
The value of your back copy file of *QST* is determined only by your ability to find a certain issue when you want it.

Can you always find the reference copy you seek?

Your answer will always be in the affirmative if you preserve each year’s issues, and each copy as issued, in a

**QST Binder**

(Holds 12 issues of *QST*)

Note the wire fasteners. Unnecessary to mutilate copies. Opens and lies flat in any position.

$1.50 each postpaid

A binder will keep your *QST*’s always together and protect them for future use. And it’s a good-looking binder, too.

**A. R. R. L.**

38 LaSalle Road

West Hartford Connecticut

---

**Norwegian Report**

By G. H. Petersen, Pres. N.R.R.L.

The results of the Norwegian Message Relay Tests during March proved that reliable inland communication might be established at any time, using either the 3.5- or 7-mc. band. The tests also showed that our amateurs are able operators, and every step is being taken to establish relay lines for League work. The winner of the contest was LA2B, B. F. Larsen, Vestaidens Apotek, Fredrikstad.

DX Conditions, especially on 14 mc., continue to improve, and the expected utility of our lower frequency bands for DX is also increasing.

---

**South African Report**

By Dr. S. H. Walters, S.A.R.R.L. Correspondent

The Annual Conference of the South African Radio Relay League was opened on April 4th by our new President, the Governor General, His Excellency the Earl of Clarendon, late chairman of the British Broadcasting Corporation. His address was inspiring, and our enhanced status should be a direct benefit.

Constitutional matters, a perennial problem, were suitably dealt with and a new scheme which will be more representative was suggested to Headquarters. It was decided to hold the next conference at Port Elizabeth.

The proceedings were relayed by ZS1P on 7 mc. and this was a huge success. 7 mc. has been thrown open to ‘phone for the ensuing year.

ZULJ, ex-G6UO, is leaving for Japan. Our good wishes accompany him.

14-mc. DX has been poor, with 7 mc. giving better results, but even on this frequency skip distance and wipe-out has made its appearance earlier than usual.

---

The Annual Convention of the Krátko-Vlnní Amatérů Českoslovenšti, one of the amateur societies of Czechoslovakia, was held in Prague, the capital of the country, on April 18th. It proved to be quite successful, amateurs from most districts in Czechoslovakia being present. The following officers were elected:

- **President**: Dr. Jar. Šafránek
- **Vice-president**: Ingenieur J. Buchar
- **Secretary**: Professor V. Vopička
- **Treasurer**: Prav. Motýčka
ARCTURUS PZ PENTODE

SENSITIVE...

4 times the sensitivity of a 45 Power Tube

...a feature of decided importance when considering output, detector overload and plate supply arrangements. Greater volume, increased efficiency, and compactness of set design are the natural results.

ARCTURUS 551 VARIABLE-MU

DISTORTION IS NEGLIGIBLE...

even at 20 times the voltage of a 24 tube

This and other features of the Arc­
turus 551 eliminate the need for double pre-selectors, dual volume controls, and "local-long-distance" switches. Maximum cross-talk is divided by 500; receiver hiss is reduced. Circuits using this new tube are simplified as well as more efficient.

Send for Technical Bulletins giving complete performance data on the Arc­
turus Type PZ Pentode and the Arc­
turus 551 Variable-Mu Tube. Arc­
turus Radio Tube Company, Newark, N. J., U. S. A.

ARCTURUS
"The TUBE with the LIFE-LIKE TONE"

It’s Popularity DEMANDS a SECOND EDITION

New circuits and new refinements call for additional information incorpo­
rated in the NEW VOLUME CON­
TROL guide. Send 25c for the 2nd edition which shows how a mere handful of CENTRALAB volume controls enables you to service practically any old or new set.

H. C. Barton Electric Company
LEROY
The Home of Jello
NEW YORK

Amateur Band Monitor
Model No. 140

Dimensions
10" x 8" x 3 1/4"

Weight
6 1/2 lbs.

PRICE
$18.00

Due to the close frequency limitations on amateur band transmitters, it has been necessary to use a monitor for checking the frequency of the transmitted signal regularly. The No. 140 monitor using a UX 199 has been especially designed for this purpose. A Vernier dial is used for the frequency variation. Three coils are provided with the monitor for the 20, 40 and 80 meter bands, respectively. The condenser has a straight-line frequency characteristic, and the resultant frequency variation varies directly with the degrees setting on the dial. The unit presents a handsome appearance. An aluminum front panel and a black crystal­
lized box is used. Space is provided in the cabinet for two No. 6 Burgess regulation dry cells and one small 2 1/2 volt Burgess battery No. 4156. A jack is provided for plugging in the phones. This jack controls the filament of the tube.

Centralab
MAIL COUPON TO-DAY!

CENTRAL RADIO LAB.
929 Keefe Avenue, Milwaukee, Wisconsin
Here is 25c. Send me new VOLUME
CONTROL GUIDE

Name...................................................

Address...........................................

City..................................State........Q.S.T.

Say You Saw It in QST — It Identifies You and Helps QST
HAM-ADS

(1) Advertising shall pertain to radio and shall be of such character as to become advantageous to its dissemination.

(2) No character shall be accepted, nor can any special typographical arrangement, such as all or part of a page, be guaranteed.

(3) Closing date for the next issue is the 25th of the preceding month, issue date date.

(4) Special rate of 25c per word will apply to advertising with a minimum of 10 words.

(5) A special rate of 25c per word will apply to advertising with a minimum of 10 words.

(6) A special rate of 25c per word will apply to advertising with a minimum of 10 words.

ELIOT M. MASON, 1092 W. 18th St., Linden, N. J.

CHICAGO, 1/2 PAGE 3 DOLLARS.

THE AMERICAN RADIO RELAY LEAGUE, 720 Wood St., Valparaiso, Ind.

QUARTZ, direct importers from Brazil of best quality pure quartz. Guaranteed free from twinning. Prices attractive. Write us for full particulars. QSLs, message blanks, wall cards, stationery, etc. Hillcrest, Cranberry, Pa.

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CRYSTALS — be ready for the new fone regulations, use QRG crystals. 1715 to 4000-kc. only $4.50 each. C.O.D. guaranteed accurately calibrated to your specified frequency. QRG Crystal Labs, Roseland, N. J.

POWER crystals: Guaranteed excellent oscillators. Carefully ground around one inch square sections. Your approximate frequency: 1715 and 3500 kc. (8 sets, $2.25, 7000 kc. $10. Within 5% of your specified frequency: 1715 and 3500 kc. $7, 7000 kc. $15. Plus, dustproof housing, $3. Precision Pico Selenium, 427 Asia St., Hartford, Conn.

$65 and mercury $5 at $5 and $4 each, 7500 volt peak inverse. Unconditionally guaranteed. W2RAL, 61 Devon St., North, Arlington, N. J.

SELL — WE212D class @ (case-mod.) w/without WE113A mod. 1715 to 3500 kc. Where? Woods, 427 Elm, Youngstown, Ohio. WANTED: a: a: Recrast or Thrill Box. Trade gun or cash. Also 40 meter crystal plug-in holder. H. Siebera, Storm Lake, Iowa. SELL — Dickerson d.c. superhet with Aleco loop, $25. O. Willard, Box 889, Coffey, Iowa.

RADIOSHORSEMKT has developed code speaking speed 25 per one week. Hopped speed boosted to 35 few hours — 15 minute sessions. Greatest time savers, $5. each. Dodge, Box 100, Mansfield, N. Y.


WANTED: 1-KVA transformer 220 v. pri., 220 c.t. sec. Wheelock, Harrison Ave., Mineola, N. Y.

TELEPHONE transmitters. Western Electric Co. type used on telephone, tested and guaranteed, $1. each. Mouthpieces 10¢ each, and mounting cap for same 15¢ each. Money order or stamps with order or C.O.D. Buckeye Telephone & Supply Co., Columbus, Ohio.

Q R A SECTION

50c. straight with copy in following address only for:
WIALI — Louis Gianuario, 11 Free St., Milford, Mass.

W9CIV — W. J. Ryder, Jr., Hibbing, Minn.

VESDM — Geo. L. Booth, 233 Pridesaux St., Nanaimo, B. C., Canada.

WMK, A.R.R.L. Headquarters

R. B. Parmenter, Chief Op. *rp*

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

WlAKW-W1KIP Clyde J. Houlton "ch."
W1BAX R. T. Besuun "rp."
W1BD P. E. Head "hp."
W1C6D-W9ZDF Clinton, B. DeSoto "dc."
W1AL J. Lamb "jm."
W1DE Geo, Graumner "hg."
W1FF K. B. Warner "jen."
W1BE A. H. Hebert "ah."
W1FLG Donald Merson "dm."
W1Z-W1BIZ C. C. Rodmon "rd."
W1UE E. L. Battey "ev."

TRADING— practically new 860 Gibson mandolin, "$A", for set analyzer or AC super-wasp. S. S. Pechel, Box 34, Carmel, N. Y.


WANTED: L-KVA transformer 220 v. pri., 220 c.t. sec. Wheelock, Harrison Ave., Mineola, N. Y.

QSL cards, stationery, etc. W8AXD, Smithport, Pa.

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W1Z-W1BIZ C. C. Rodmon "rd."
W1UE E. L. Battey "ev."

To Our Readers who are not A.R.R.L. members

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

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

AMERICAN RADIO RELAY LEAGUE
West Hartford, Conn., U.S.A.

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

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For Your Convenience

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95
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