In this Issue—
Building a Ladder Mast
More About Noise Silencing
AFTER careful investigation, Father Hubbard chose Collins as the outstanding radio equipment. A Collins 32G, 40 Watt Transmitter was selected by the "Glacier Priest" to contact the outside world during his year and a half stay on bleak, frozen King Island in the Arctic. From there will be transmitted scientific reports, weather data and news stories. This region is the birthplace of the Arctic's fiercest storms, and is a most rigid proving ground for a transmitter. The expedition will be convoyed by the United States Coast Guard Cutter "Northland," which has likewise been Collins equipped for broadcasting.

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The American Radio Relay League

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

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

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

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

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West Hartford, Connecticut

General Counsel ........ PAUL M. SEGAL
1010 Shoreham Building, Washington, D. C.

Address all general correspondence to the administrative headquarters at West Hartford, Connecticut.
ONE of the most important actions of the Board of Directors of the League at its annual meeting last spring was in instructing the Communications Manager to coordinate a study, along engineering lines, of the possibilities of making a better planned use of our bands. With the advice of the division directors he is to form a group of collaborators, then digesting the available ideas in this field with the aid of the technical staff of QST, and reporting the results to the Board for its meeting next year.

There is growing amateur recognition that for improvement in our operating position we have now to look within our own structure of allocations. Technically we have made marvelous strides in more stable transmitters and more selective receivers. There is still room for technical development in 'phone operation but there seems to be very little more in sight to give c.w. additional relief by technical means. However, there is an increasing feeling that much could be accomplished by a more intelligent use of our present assignments, particularly in the form of an engineering system for the use of our bands for different purposes.

Our present allocation system is not a bad one, but it must be admitted that it has “just grown.” We commented on this subject on this page last October. It all revolves about the fundamental theme that it is rather foolish of us as individual amateurs to insist that any amateur ought to be permitted to use any frequency at any time for any purpose over any distance. Certainly we all enjoy our rights and our liberty of action, but it seems quite possible that a few mutual concessions would improve the operating lot of every one of us.

Suppose the day had two hundred and forty hours and you had a kilowatt of c.w. and ‘phone on every band, and nothing else to do but operate. Suppose you were thoroughly acquainted with conditions on every band, and knew all the separate “gangs.” Suppose you accumulated a lot of ideas as to the best purposes for each band, and just where each branch of our service could best work. Then suppose that you were absolute dictator of amateur radio. How would you employ the bands, what branches of amateur radio would you put in each, where would ‘phone go, and so on? This is a fascinating subject for every serious and well-informed amateur. It is well worth a lot of study. There is no particular reason why we should be bound by anything that has happened in the past. Some rainy Sunday afternoon when the power has gone off you might draw yourself a picture of the amateur bands in their harmonic relations and do a little “supposing.”

Isn’t it a little absurd that our various ‘phone bands are not in harmonic relationship? What about the possibilities of some sort of an international agreement in the I.A.R.U. to subdivide the DX bands so that foreigners would be in some portions of the bands in which we would agree to refrain from transmitting, so that we could work them without interference from other W’s and VE’s and XE’s? Certain bands for relay traffic, to be sure. Places for Army and Navy drills. Perhaps definite assignments for QRR work. Some rules against employing busy or DX bands for cross-town work. A scheme to minimize b.c.i. interference from Class B ‘phones. What to do with 1715–1750? Deciding whether beginners ought to be “confined” somewhere during a probationary period. Providing not only for the distinction between ‘phone and c.w. but for that between traffic, rag-chewing, emergencies and experimental work. And bearing in mind all the time the desirability of harmonic relationship between the different sub-bands used by the same kind of service. Remembering, too, the difference in ranges and how these vary between day and night and from season to season.

This is to be the field of study of the Communications Manager’s group. It seems to us the most pressing problem, and at the same time the most interesting one, of our day. Leaning heavily on engineering considerations, and divorced from “amateur politics,” it ought to yield us some important suggestions. Perhaps it ought to be a continuing study that would go on from year to year, polishing up its plan as changes take place in the art. At any rate, we are making a start and we shall soon see, as the Board’s minutes say, “whether the idea has large future value or not.” We think it has.

K. B. W.

July, 1937
W8DPY Wins Paley Award

The William S. Paley Amateur Radio Award for 1936 was presented to Walter Stiles, Jr., W8DPY, at a presentation luncheon in the Waldorf-Astoria Hotel in New York on May 24th.

This award, originally announced in the December 1936 issue of QST, is being presented annually by Mr. Paley, the youthful and brilliant president of the Columbia Broadcasting System, to "that individual who, through amateur radio, in the opinion of an impartial Board of Awards, has contributed most usefully to the American people, either in research, technical development or operating achievement." It is open to all amateur radio operators in the United States and Canada.

The presentation ceremonies, which were broadcast over the entire C.B.S. network at 2:30 P.M., sparkled with tributes to W8DPY and amateur radio as a whole. The principal address was by the Hon. Anning S. Prall, chairman of the F.C.C., while Mr. Paley, Mr. Stiles, and K. B. Warner, managing secretary of A.R.R.L., were also heard. Mr. Prall's address is of such general interest that it is here reproduced in full:

Mr. Paley, Mr. Warner, ladies and gentlemen and fellow amateurs: I am glad to participate in this tribute to the amateur radio operators of America.

The award that to-day is being presented is not only a recognition of the heroic services of an individual. It likewise symbolizes the development and progress of a great service; a service of tremendous importance to the nation. The contribution of the amateurs to the radio art is not confined to the job they do in emergency communication. Since the early days of radio, the attics and basements, of thousands of ingenious amateurs have served as laboratories from which have come many valuable technical improvements.

Following Marconi's first transatlantic transmission in 1901, the amateur radio movement developed rapidly. Solitary experimenters in one city became linked through the magic of radio to their fellow amateurs in other communities. And in the years just preceding the World War, the development of amateur activity was so rapid that inevitable conflict developed with commercial and governmental radio activities.

But by this time there were several thousand amateurs linked together through numerous radio clubs and, although not highly organized, they were able to gain a place in the radio spectrum, when in 1912 the first comprehensive federal radio law was enacted.

With the establishment of the American Radio Relay League in 1914 by the late Hiram Percy Maxim, the amateur groups were able to expand and survive under new regulations that necessarily followed the rapid development of radio. So successful was the encouragement given to amateurs during this formative period that, when America entered the World War, amateurs were able to provide some four thousand trained radio operators to the military service. This gave the United States the most competent radio corps of any of the nations and they unquestionably played an important part in attaining victory. To-day wherever the American flag flies, there are radio amateurs whose technical qualifications and equipment meet the conditions of the licenses. Only last week an application was received by the Federal Communications Commission for a license to an operator in Wake Island. Many of you will recall that a licensed amateur accompanied Admiral Byrd to Little America and the programs originating there were re-broadcast over the facilities of the Columbia Broadcasting System. There are now licensed amateurs in all the states and territories.

We have to-day approximately forty-seven thousand amateur radio operators licensed by the Commission. They are definitely an important part of the American radio system and constitute about three-fourths of the amateurs of the world. They stand ready as a reserve corps, these emergency sentinels of the air, to perform whatever service the nation may require. Peacetime emergencies find them ready and competent to discharge important duties, and in the event of war this nation would again have trained personnel which would provide the most efficient communication corps of any nation in the world.

As Chairman of the Federal Communications Commission, I wish to assure the forty-seven thousand amateur radio operators of this country of our sustained interest in their problems and their continued welfare. The Commission has always maintained and I think will continue to maintain a liberal attitude toward the amateurs. We recognize that the service they have performed and can perform in the future is one of our country's great assets. We will continue to encourage the development of the amateur movement. I wish to tender my congratulations to Walter Stiles, Jr., of Pennsylvania, whose conspicuous service during the disastrous flood of March 1936 has brought him this distinguished award. And through Mr. Stiles, I desire to salute the thousands of other amateur radio operators who have from time to time rendered similar distinctive services.

Following this address, Mr. Paley presented a replica of the award to W8DPY, with a citation from The White House by Walter Stiles, Jr., following announcement of his winning of the Paley award:

"I have learned of the splendid services you performed as an amateur radio operator during the flood emergency of March 1936 and desire to congratulate you and all those who have achieved similar work which you accomplished. What you were able to do in aid of the flood sufferers emphasizes how important the continued development of amateur radio activity is to the best interest of the nation. "Sincerely yours, Franklin D. Roosevelt."
of the performance record which had earned him this outstanding recognition. Stiles, in acknowledging the trophy, stated that he did so “with great humility” and the feeling that it was being given to him “merely as a representative of the great army of hams whose world knows no boundary and whose proudest and happiest moments are when they are able to alleviate distress and disaster.”

Thereupon Mr. Paley entrusted to Secretary Warner, on behalf of the A.R.R.L., the permanent award, of which the League is to act as permanent custodian. In doing so he said that he had “long looked forward to this opportunity to honor your splendid organization, which is doing such a continuously constructive service in the field of radio operations and which has given to present-day broadcasting much of the stimulus responsible for its tremendous growth and development.” Warner, in his acknowledgment, expressed the gratitude and appreciation of the amateur fraternity to Mr. Paley and the Columbia System, and congratulated W8DPY.

Selection of Stiles for the award was made by a distinguished Board of Judges, comprising Rear Admiral Cary T. Grayson, chairman of the American Red Cross; the Hon. C. P. Edwards, director of radio for the Canadian Department of Marine; the Hon. Anning S. Prall; Dr. J. H. Dellinger, chief of the Radio Section of the U. S. Bureau of Standards; and Professor A. E. Kennelly, professor emeritus of electrical engineering at Harvard University. Stiles, who was originally nominated for the award by the A.R.R.L., was chosen from a total of 40 nominees.

W8DPY's selection for the award was on the basis of his performance during the March 1936 flood emergency. When on Wednesday, March 17th, of last year the Allegheny River reached flood stage at Coudersport, his home, he decided that a major flood emergency was in the making and, being a member of the A.R.R.L.'s Emergency Corps, he started assembling his portable equipment. This consisted of a National ACSW-3, a re-vamped Collins 4-A transmitter, and a gasoline-driven 5-kw. generator and associated gear. Throughout that night flood traffic was handled at the permanent station, this operation continuing until 9:30 Thursday morning when an urgent plea for aid came from an amateur station at a C.C.C. Camp near Renova, Pa. The message stated that Renova was isolated and in dire need of food, clothing and medical supplies. Stiles attempted to telephone the message to the Governor at Harrisburg, but the telephone lines were down. It was eventually delivered, but in the meantime a meeting of the local Coudersport Red Cross chapter was hurriedly called and a relief expedition organized. By 6 P.M. large quantities of medical and other supplies were

![Image of William S. Paley presenting the award to Walter Stiles, Jr., W8DPY, 1936 Winner.](image-url)

WILLIAM S. PALEY, PRESIDENT OF C.B.S., PRESENTS HIS ANNUAL AMATEUR RADIO AWARD TO WALTER STILES, JR. W8DPY, 1936 WINNER

Stiles has a replica of the award in his hand. The permanent award, a massive man-size affair of striking beauty, is on display at A.R.R.L. Hq., its permanent custodians. The design is due to Alexander Calder, internationally recognized young American sculptor and foremost exponent of the new "mobilist" school. It is made of bright stainless steel, and typifies a lightning bolt, radio antennae, and world-wide amateur communication. Other of Calder's works are on display at the Smithsonian in Washington, John Herron Art Institute in Indianapolis and the New York Metropolitan Museum of Art.

(Continued on page 78)
Recording Ultra-High-Frequency Signals over Long Indirect Paths
A Description of the Receiving and Record-Analyzing Equipment

By Ross A. Hull*

Part Two**

Hull's story of his work in recording ultra-high-frequency signals and the relationships he has observed between their behavior and the prevailing air masses constituted the first part of this series. Now we have the description of some of the equipment, presented in the hope that others will look it over, plan something similar and start recording some available u.h.f. broadcast signal (of which there are now plenty). In articles planned for the early future Hull will discuss some of the problems of calibrating the equipment and will outline some of the quantitative results obtained.—EDITOR.

In Part I of this series we suggested that investigation of the refraction field in ultra-high-frequency transmission was a study in which the amateur could make invaluable contributions. We repeat the suggestion that prolonged observation—preferably recording—of ultra-high-frequency signals received over long indirect paths in various parts of this country and other parts of the world would be of very great value, particularly if these observations were studied in conjunction with meteorological soundings made with airplanes or balloons somewhere in the general vicinity of the path. It is, of course, a subdivision of amateur activity which may seem at first glance to be not nearly so much fun as routine two-way communication. On the other hand, it can be every bit as intriguing as the more conventional ultra-high-frequency work and, without any doubt, is more likely to result in a contribution of general importance to the art.

We continue, then, with the description of the equipment used in this particular program with no suggestion that the apparatus is in any way an approach to perfection but merely offering it as the outcome of much practical cutting and trying.

The original receiver used for recording W1XW was a conventional SRR superregenerative receiver fitted with an r.f. stage and the audio output driving a rectifier type voltmeter included in the photographic recorder. This receiver proved fairly satisfactory for recording the modulated signal transmitted but it had many faults. In spite of the r.f. amplifier stage, heavy rain, and more particularly, ice on the antenna and transmission lines still influenced the loading of the detector sufficiently to upset its sensitivity appreciably. Also, the frequency stability was inadequate, tuning having to be checked at least four or five times each day.

In spite of these weaknesses, this set-up provided us with some eighteen months of continuous recording with relatively few periods that had to be disregarded because of mis-tuning. The only difficulty was that the equipment could not be left to look after itself for more than half a day or so.

The logical development was to use crystal control in the transmitter and some type of

FIG. 1—A PLAN VIEW OF THE CRYSTAL-CONTROLLED ULTRA-HIGH-FREQUENCY RECEIVER BUILT ESPECIALLY FOR CONTINUOUS RECORDING

A low-drift or temperature-controlled crystal is used to insure freedom from frequency drift. This means, of course, that the receiver can only be retuned to another signal frequency by changing crystals or by retuning the complete i.f. amplifier.

* Associate Editor.
** Part One of this series appeared in the May, 1937, issue.
superheterodyne receiver. Preliminary experiments with a conventional receiver indicated, however, that unless an exceptionally broad intermediate frequency amplifier was provided, the instability of an even a carefully-built oscillator would result in much more serious tuning errors than had been experienced with the super-regenerative rig. In order to preserve a favorable signal-noise ratio it was decided to use a narrow band i.f. amplifier providing a crystal-controlled oscillator and appropriate frequency multipliers. This arrangement, with a simple constant-temperature oven for the crystal, proved eminently satisfactory and all our recording receivers are now planned along these lines. The resulting apparatus is relatively complicated but the reliability of its operation justifies the few extra hours of work involved in its construction.

The receiver used for 41-Mc. recording consists of a simple glass tube converter (a 606), the oscillator grid being driven from the output of a 6D6 doubler excited from an 8U Tri-tet oscillator-tripler using a 7250-kc. crystal. The output from the crystal unit is therefore of 43.5 Mc. and the intermediate frequency resulting is 2500 kc. This i.f. frequency is fed to an HRO receiver—

FIG. 2—UNDERNEATH THE CRYSTAL-CONTROLLED RECEIVER

The crystal oscillator and doublers are located at the right lower corner. Immediately above that section is the input r.f. amplifier tube mounted below the chassis to provide simple isolation of the grid and plate circuits. The row of jacks provides a means of rapidly checking the plate current of each tube in the receiver in the interest of quick fault-finding. The meter used in this work may also be switched into the a.c.e. circuit in order to permit visual monitoring of the signal level.

The receiver used for 41-Mc. recording consists of a simple glass tube converter (a 606), the oscillator grid being driven from the output of a 6D6 doubler excited from an 8U Tri-tet oscillator-tripler using a 7250-kc. crystal. The output from the crystal unit is therefore of 43.5 Mc. and the intermediate frequency resulting is 2500 kc. This i.f. frequency is fed to an HRO receiver—

FIG. 3—THE CIRCUIT OF THE INTERMEDIATE FREQUENCY AMPLIFIER AND DETECTOR SECTION OF THE CRYSTAL-CONTROLLED RECEIVER

the final result being a triple detection superheterodyne. Another receiver, used for simultaneous recording on the same frequency, has a somewhat similar converter and crystal oscillator unit but utilizes a standard broadcast receiver for the i.f. amplifier. In this case, the crystal

into these jacks and so to make the necessary connections.

The output circuit of the receiver includes a plain diode detector which supplies a.v.c. for the three r.f. amplifiers and audio voltage, driving a 6G5, for monitoring purposes. The circuit used for operating the recorder is borrowed directly from the HRO. It is a bridge arrangement with the plate current of the two i.f. amplifiers on one arm and the screen current of the three r.f. amplifiers on the other. Not shown on the circuit is a double-pole double-throw toggle switch with which the 1-mil meter is connected either in the plate current measuring circuit or in the a.v.c.

circuit. In the former position, the meter is shunted to give a full-scale reading of about 15 milliamperes.

The crystal section of the receiver, shown in Fig. 4, comprises a 6F6 Tri-tet crystal oscillator with the plate circuit tuned to four times the crystal frequency. The two sections of a 6N7 are then used as doublers to provide an output on 58.5 Mc. The i.f. amplifier is tuned to 1600 kc.—the frequency difference between the output of the crystal unit and the 60.6-Mc. signal.

The only problem in setting up the receiver is in adjusting the i.f. amplifier to the desired frequency. This calls for an accurate knowledge of the transmitted frequency, the frequency of the crystal used in the receiver, and requires an accurately calibrated test oscillator for the i.f. alignment. The procedure would be considerably simplified if a variable-gap crystal holder were

(Continued on page 78)

![Diagram of the circuit of the crystal oscillator and frequency multiplier unit in the crystal-controlled receiver](image)

### Component Values

- $C_1, C_2$: 75-µfd. Midget variable.
- $C_0$: 50-µfd. Midget variable.
- $C_4$: 100-µfd. mica condensers.
- $C_5$: 250-µfd. mica condensers.
- $C_6$: 100-µfd. mica condensers.
- $R_1$: 40,000-ohm, 1-watt resistor.
- $R_2, R_3$: 50,000-ohm, 1-watt resistors.
- $R_4$: 100,000-ohm, ½-watt resistor.
- $L_1$: 21 turns No. 18 enamelled wire on a 1-inch diameter form, with no turns spacing.
- $L_2$: 20 turns No. 22 d.c. wire on a ½-inch diameter former, with no turns spacing. Tap 3 turns from upper end.
- $L_3$: 10 turns No. 14 wire, ½-inch inside diameter, self-supporting with turns spaced to occupy 1½ inches. Tapped 3 turns from top end.
- $L_4$: 7 turns No. 14 wire, ¼-inch diameter with turns spaced to occupy 1 inch.
- $RFC$: National Type 100 choke.

frequency is so chosen that the difference frequency is of the order of 1500 kc.

A complete crystal-controlled receiver used for recording on 60.5 Mc. is shown in Figs. 1 to 4.

Though the entire equipment is built on a single chassis, the circuit is divided into two sections in order to simplify the presentation. From Fig. 3 it can be seen that the r.f. amplifier, the first detector and the i.f. amplifier are quite conventional in their circuit arrangement, the only innovation being a series of jacks functioning as switches to permit reading the plate current of any tube in the receiver. A piece of shafting fitted with a knob is used to insert

![Diagram of the analyzing equipment used to reduce the recordings of ultra-high-frequency signals](image)

The recording is driven through the "console" affair in the foreground by a phonograph motor geared to an appropriate driving roll to give a driving rate 60 or more times that at which the original recording was made. The trace is followed manually and a contact is caused to run across a series of metallic segments cut in accordance with the calibration of the receiver. These segments are in turn connected to relays and eventually to the clocks. A full description is given in the text.
**The See-Saw Noise Silencer**

Applying an Electronic Gate to Improve Signal-Noise Ratio

By B. S. McCutchen* and D. A. Griffin,** W2AOE

The subject of noise silencing in radio receivers is a very lively field for discussion and investigation at the present time. The disclosure of the system developed by QST's technical editor over a year ago aroused widespread interest in both amateur and commercial circles. The amateur is not alone in a desire to minimize or eliminate one of radio's most annoying handicaps, noisy reception. Hence the present scramble in the laboratories throughout the country to improve existing means of noise suppression and to develop others if possible.

Through an inadvertent "leak," unauthorized publication of an elemental version of this circuit of rapid negative pulses which are used to bias the injector grid of a 6L7. The output of the i.f. stage is controlled by the amount of this negative voltage. If the voltage is large enough, the tube is cut off completely and a hole of silence takes the place of a pulse of noise.

It has also been found that satisfactory noise silencing can be obtained in a circuit arranged to pass the desired signal voltage without distortion, but which will not pass that portion of a noise pulse which exceeds signal amplitude. For convenience a circuit of this type is known as a "gate." The reason why such gates produce good results is that while signal energy is continuous, excessive noise voltages are generally of very short duration though frequently of very great amplitude. Hence if noise voltages are reduced to signal amplitude, the ratio of signal energy to noise energy at the output of the gate will be very favorable. This gate action is obtained in the reverse diode circuit which will now be described.

As an introduction, let us review the action of the Lamb silencer.1 As most amateurs know, a noise amplifier is connected to a full-wave rectifier so that noise pulses are developed in the form of rapid negative pulses which are used to bias the injector grid of a 6L7. The output of the i.f. stage is controlled by the amount of this negative voltage. If the voltage is large enough, the tube is cut off completely and a hole of silence takes the place of a pulse of noise.

It has also been found that satisfactory noise silencing can be obtained in a circuit arranged to pass the desired signal voltage without distortion, but which will not pass that portion of a noise pulse which exceeds signal amplitude. For convenience a circuit of this type is known as a "gate." The reason why such gates produce good results is that while signal energy is continuous, excessive noise voltages are generally of very short duration though frequently of very great amplitude. Hence if noise voltages are reduced to signal amplitude, the ratio of signal energy to noise energy at the output of the gate will be very favorable. This gate action is obtained in the reverse diode circuit which will now be described.

**FIG. 1—FUNDAMENTAL CIRCUIT DIAGRAM OF THE “SEE-SAW” SILENCER**

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>0.5 megohm</td>
</tr>
<tr>
<td>R2</td>
<td>1000 ohms</td>
</tr>
<tr>
<td>R3</td>
<td>25,000 ohms</td>
</tr>
<tr>
<td>R4</td>
<td>0.5 megohm</td>
</tr>
<tr>
<td>R5</td>
<td>0.25 megohm</td>
</tr>
<tr>
<td>R6</td>
<td>1000 ohms</td>
</tr>
<tr>
<td>C1</td>
<td>350 ohms</td>
</tr>
<tr>
<td>RFC</td>
<td>20- mh. choke</td>
</tr>
<tr>
<td>C10</td>
<td>0.1 µfd.</td>
</tr>
<tr>
<td>C2</td>
<td>0.01 µfd.</td>
</tr>
<tr>
<td>C3</td>
<td>0.05 µfd.</td>
</tr>
<tr>
<td>C4</td>
<td>0.01 µfd.</td>
</tr>
<tr>
<td>C5</td>
<td>0.01 µfd.</td>
</tr>
<tr>
<td>C6</td>
<td>0.05 µfd.</td>
</tr>
<tr>
<td>C7</td>
<td>0.01 µfd.</td>
</tr>
<tr>
<td>C8</td>
<td>0.05 µfd.</td>
</tr>
<tr>
<td>C9</td>
<td>0.05 µfd.</td>
</tr>
</tbody>
</table>

amplitude of this voltage varies with the modulation of the received signal. This constitutes diode detection. Let us assume that the moving arm of potentiometer $R_3$ is moved all the way to the ground end. The right-hand diode elements, which are reverse-connected, will try to build up a positive potential across $R_1$. In this condition our see-saw is in balance except for the effect of $R_2$, which for the moment we can forget. One half cycle of i.f. builds up a negative potential and the next half cycle of i.f. drains it off again, the net result being that no audio signal is produced, and the gate is tight shut. Obviously, we receive neither signal nor noise.

If we now apply negative bias potential to the anode of the gate diode by moving the arm of the potentiometer away from ground, we can prevent the gate diode from functioning until the amplitude of the received signal exceeds the value of the bias potential. The correct setting is easily determined in practice by simply reducing the bias until the quality of the received signal begins to be hurt, and then increasing the bias very slightly. When operating in this manner the gate diode is kept out of the picture during normal signal reception, but the instant a noise pulse of amplitude in excess of the signal carrier comes in, the gate diode goes into operation and balances out that portion of the noise pulse which is above carrier level, thus preventing it from being demodulated into an audio pulse.

The purpose of $R_2$ is to handicap the signal diode slightly, so that when noise pulses bring the gate diode into operation, it will have a little leverage on its end of the see-saw. In practice it has been found that the effect of this resistance is important, as it not only improves the degree of elimination, but also makes the setting of the potentiometer less critical. In most cases a value of 1000 ohms has been found satisfactory, but this depends to some extent on the particular receiver, and it is suggested that a range of values from several hundred to several thousand ohms be tried.

As resistance $R_3$ handicaps the signal diode, in the presence of very strong noise interference the gate diode will win out, and a positive resultant audio voltage will tend to be built up across the load resistor $R_1$. To overcome this condition, the leakage diode is connected as shown across the load resistance. Obviously this will drain off any positive potential.

Successful elimination of noise by the circuits described in this article depends on the truth of the assumption that if the amplitude of interfering noise voltages is “chopped down” to approxi-\martly the amplitude of the received signal voltages, the results will be satisfactory. Believe it or not, this is the truth and it has been demonstrated many times in our laboratory by simultaneous oscillograph and ear tests. The reason back of this is doubtless the fact that the signal is relatively continuous while the noise pulses are each of short duration.

**FIG. 2—AUTOMATIC SILENCER CIRCUIT WITH AMPLIFIED AVC**

The 6FS a.v.c. tube is used as a triode, with screen tied to plate.

<table>
<thead>
<tr>
<th>$C_1$</th>
<th>100 µfd.</th>
<th>$R_1$</th>
<th>25,000 ohms.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_2, C_3$</td>
<td>0.5 µfd.</td>
<td>$R_2$</td>
<td>50,000 ohms.</td>
</tr>
<tr>
<td>$C_4$</td>
<td>10-20 µfd.</td>
<td>$R_3$</td>
<td>5,000 ohms.</td>
</tr>
<tr>
<td>electrolytic.</td>
<td></td>
<td>$R_4$</td>
<td>0.5 megohm.</td>
</tr>
<tr>
<td>$C_5$</td>
<td>0.1 µfd.</td>
<td>$R_5$</td>
<td>1 megohm.</td>
</tr>
<tr>
<td>$C_6, C_7$</td>
<td>0.01 µfd.</td>
<td>$R_6$</td>
<td>1,000 ohms.</td>
</tr>
</tbody>
</table>

**AUTOMATIC NOISE GATE**

The automatic circuit shown in Fig. 2 is the final arrangement to be discussed. In the manually-adjusted circuit, if the bias voltage that "delays" the reverse diode is set so that it passes a signal that is producing a rectified voltage of ten volts, for example, across the diode load resistor, the receiver will block if a signal capable of producing 20 volts is tuned in unless the reverse diode is biased off further. If this is not done the reverse diode takes control of the situation, the direction of the a.v.c. voltage is reversed, and the receiver goes dead. This same difficulty occurs with the i.f. type of silencer without automatic control, unless readjustment of the threshold bias of the noise rectifier is made.

Several modifications of the basic circuit have been made to overcome this necessity for constantly adjusting a silencer control in addition to all the other controls found on the modern receiver. The circuit in Fig. 2 seems to provide the best performance of any of them. The first departure from the circuit shown in Fig. 1 is that the signal diode is reversed. That is, the negative half of the incoming signal is rectified. The second is the use of the plate and cathode of a triode tube as a diode with the grid acting as a control of the "diode's" effectiveness. This gate diode is given a small starting delay by the positive potential.

(Continued on page 68)
A Fundamental-Reinforced Harmonic-Generating Circuit

Efficient Frequency Multiplication for Four-Band Output from a 3.5-Mc. Crystal

By John L. Reinartz,* W1QP

WHY it should be customary to use the oscillator tube as a frequency multiplier from the crystal frequency to the second and fourth harmonics and the amplifier tube as only a doubler, I do not know. To prove that the ordinary frequency multiplier can be just as effective as the oscillator when it comes to higher harmonic generation, I tried it out with the circuit combination shown in Fig. 1. The results are such that with a 3.5-Mc. crystal in the oscillator one can obtain enough output from the frequency multiplier at ten meters properly to excite a following ten-meter amplifier.

The circuit is unique in that we make use of the power-output capabilities of the crystal-oscillator circuit not only to excite the grid of the harmonic generator, but also to supply additional power over that obtained from the harmonic generator (up to the value of full load for the crystal-oscillator tube) to keep the harmonic generator going at the higher-order harmonics, such as the 10th, 11th or 12th. The ordinary frequency multiplier gets a "kick" from the exciting source only once every second, third, fourth, etc., cycle of its output frequency, depending upon the order of harmonic being taken from its plate circuit. When the multiplication is great, the oscillations in the plate circuit die down or decay in amplitude between fundamental pulses, thus limiting the output. With the arrangement shown in Fig. 1, additional energy is supplied to the output circuit between the fundamental plate-current pulses caused by the exciting grid voltage, thereby raising the output at the harmonic through the addition of normally-unused energy available from the crystal oscillator. Output can be obtained at even and odd harmonics equally well, and 10 watts output at 10 meters is to be expected using an 807 harmonic generator and an 802 crystal-oscillator.

The circuit arrangement really is quite simple. It is necessary only to excite the grid of the harmonic generator in the usual way through a coupling condenser, and to bias the grid of the driven tube to twice cutoff as would normally be done in any class "C" stage. The next step is to couple the plate coil of the crystal oscillator to the plate coil of the harmonic generator. It will be found that proper phasing of the two tuning systems is required; one way it will work and the other way it will not. The amount of coupling is determined by the load that the crystal oscillator can carry, and should be adjusted to make the oscillator tube take normal plate current.

Since with fixed bias the harmonic generator takes no plate current when not excited, it follows that as the crystal oscillator goes to work the plate current of the harmonic generator rises. The current goes through the usual dip when the plate tank is tuned to the fundamental frequency or any harmonic. For instance, should the tank circuit of the harmonic generator be capable of tuning continuously through the 8th, 9th, and 10th harmonics of the crystal frequency, a dip will occur in the plate current as the plate tuning

(Continued on page 82)
A New Kind of Skyhook—The Ladder Mast

Simply-Constructed and Easily-Climbed Tower

By James Millen,* W1HRX

A T ONE time or another just about every­
thing from a ragtime lattice tower made
from furring strip and tobacco lath, to a
dural miniature of a broadcast-station vertical
radiator, has been used as an amateur antenna
sky-hook. Some are extremely ingenious, practical
and inexpensive; some stay up seemingly by
faith alone; some are inexpensive to build but
difficult to raise; some are expensive to build but
easy to raise; and so on.

One evening quite a few months ago we had a
pleasant visit with W6GWX in his shack at
Pasadena. In fact, it was a very pleasant visit,
and as the evening progressed, Mac decided that
the problem that had been worrying him for many
weeks previously, namely, that of getting another
pulley and halyard attached to the top of his
home-constructed lattice mast, was really no
problem at all! He would just climb right up on
the lattice work, as if it were steel instead of red­
wood—which he promptly proceeded to do with­
out mishap. All of which leads up to the reso­
lution that we made upon exami
n ing that same
tower in broad daylight the next morning—that
if ever we were to be so aristocratic as to have a
lattice tower of our own, it would be one that
could be climbed without requiring the particular
brand of inspiration used by W6GWX.

And so last summer when we built a tower at
W1HRX to support a “signal squirter” inspired
by observation of the result being had at W5BDB,
it was a most rugged
affair
with a conventional
ladder firmly bolted on one side and with a large
platform and railing at the top.

But now we have been intrigued by the Quist
articles and Ross Hull’s admonitions into taking
a whirl at “V’s.” Fortunately, a tree was ideally
located at the end of one leg and our big tower at
the apex, but just nothing but small birches at
the remaining end of the proposed “V.” Of
course, we could have set an undressed flag pole,
a 4 X 4, or something of the sort, and guyed it—
but, no indeed, it was just too good an opportu­
ity to try out the construction of an un guyed
affair—after the nebulous design that had been
slowly taking form in the back of our head ever
since that eventful night in Pasadena, and which
began to crystallize when we examined the stack
of ladders at our local hardware store last sum­
mer, while selecting the one to bolt on the side
of our main tower.

But why say more—the accompanying illus­
trations and captions rather succinctly tell the
story of our latest attempt at mast construction!

TOP—THE FIRST REQUIREMENT IS A HOLE ABOUT
THE SIZE OF THE ONE SHOWN IN THIS PHOTO­
GRAPH
The ladders will later be spliced together to make the
mast.

CENTER—THE FOUNDATION, READY TO BE
FILLED WITH CEMENT
The anchor strips are spiked to a triangular frame to
keep them in position during pouring.

BOTTOM—READY TO TAKE THE MAST
The bottoms of the ladders later will be bolted to the
anchoring strips.
While these supports were quite ample for our particular mast, we feel that on a higher mast it would be well to use much wider strips for this purpose and to have them extend quite a distance farther up each ladder leg than in our case. In an unguyed mast of any appreciable height, there is considerable strain on the corner posts at the position of attachment to the base, and a large overlap between the corner posts and the steel inserts, consequently, is very advisable.

The cement base should be given ample time to harden before starting the erection of the tower; three or four days is not at all too much. If any old iron wire, steel re-enforcing rods or other such material is handy, it is wise to throw a few pieces into the hole while pouring the concrete.

In some sections of the country it is difficult to obtain the shorter length ladder with parallel sides; that is, one in which the top rung is not shorter than the bottom rung. Also, it is sometimes hard, we find upon inquiring at different Boston hardware stores, to get 10- or 15-foot ladders that are exactly the same width as the 20-foot ones. We solved the problem by buying only 20-foot lengths and cutting them into the required sections for staggering the joints. If the mast is to stay in service a long time, it is strongly recommended that heavy plates and bolts be used in the assembly, so that if

SPLICING AND PAINTING

Twenty- and ten-foot ladder sections are bolted together with angle-iron strips (the bend in the strips is 120 degrees).

THE BOTTOM SECTION IN PLACE ON THE FOUNDATION

The plumb bob is an essential to keep the mast exactly vertical as its construction goes up.

SOME USEFUL POINTERS

The first step in the erection of the mast is the construction of a suitable base. The hole for the base should be at least three feet deep and three feet square, preferably larger at the bottom than at the top.

Cement economy can be achieved by using quite a few rocks in with the cement. Before pouring the cement and placing the rocks, the steel inserts for attaching the ladder to the base should be put in place. A triangular frame of 2 X 4's was found quite practical for this use. The steel inserts were attached to the ends of each of the 2 X 4's with a spike. The entire assembly was then placed in the hole and carefully leveled. Care must be used in shoveling the concrete into the hole and in throwing in rocks to see that the alignment of the inserts is not disturbed.

For inserts we used standard building irons as stocked by most building supply companies for tying masonry walls to timber frames. They are iron straps approximately 3/4 inch thick, 1 1/2 inches wide and 2 inches long, with a crow-foot end for anchoring in the concrete.

UP WITH ANOTHER SECTION!

The author recommends a linesman's belt for this job, although he doesn't seem to be wearing one.
neglected and allowed to rust, it will be many years in reaching a dangerously weak state.

The tower is first completely assembled on the ground, painted, and all parts carefully numbered; then all but the bottom section disassembled. (A convenient time for painting is when the tower has been pre-assembled; then, before disassembling it for erection, the different sections can be numbered on top of the paint. We made the mistake of numbering first, disassembling, painting, and then trying to fit the pieces together when the tower was half in the air!) The bottom section is easily up-ended by two people and bolted in place to the base inserts. If necessary, thin shims can be driven under some of the corner posts to bring the entire unit truly vertical. A plumb bob dropped through the center is the most practical way to determine when the mast is properly lined up. When the lower part is properly lined up and rigidly fastened, then proceed to add one ladder at a time, as you climb spirally up the assembly. Always advance the suspension point of the plumb bob as you add another unit, and carefully adjust its alignment. Incidentally, be sure to use a belt, rope with the right kind of knot, or other means of securing yourself to the tower during this process, so that both hands are free for fastening bolts and hauling up additional ladder sections. Don't, however, indulge in the trick attributed to W6ZIH. As his friends know only too well, Herb is a most meticulous sort of fellow, and when, not so long ago, he wanted to try out some large vertical V's for 60-megacycle work, he found he needed another 8-foot or so extension on one of his California telegraph poles (California used in the same sense as in "California kilowatt"). Not having a linesman's belt, he took some sash cord and carefully fastened himself at the top of his pole, then proceeded to spike in place an overlapping piece of 2 by 4 to give the required additional extension. Just about that time, he was suddenly faced with the problem of how to get the several turns of sash cord out from under the 2 by 4. We have heard that someone finally came to his rescue with a knife!

Just how high a ladder mast can safely be carried without guys is a matter on which we hesitate to express a definite opinion. Maximum local wind velocity will, of course, have much to do with the matter. In our case, the original unguyed mast was limited to thirty feet, plus a three-foot extension to make it suitable for use also as the support for a half-wave vertical radiator at twenty. By the addition of three guys, however, the height may safely be extended a great deal higher. Of course if we want to work on the same narrow factor of safety by which some of our friends seem to have been getting by for quite a few years now, we might suggest much greater heights. Cost? In Boston the ladders come to 25¢ per foot—thus becoming 75¢ per mast foot.

New Beam Power Transmitting Tubes

The success of the small beam tubes has led to considerable development work on the part of at least one transmitting tube manufacturer in the attempt to produce larger tubes with equally-desirable characteristics. This work has now proceeded to the point where Raytheon is announcing tentative characteristics and data on beam counterparts of the RK-20 and RK-28. The new beam tubes will be known as the RK-47 and RK-48, respectively. A hard glass bulb and larger filament on the smaller tube have made possible increased ratings over the RK-20. These tubes are tetrodes, the suppressor having been replaced by beam-forming plates, although secondary emission from the plate is absent, as in all beam tubes, because of the formation of an electronic suppressor. The lack of a physical suppressor grid of course obviates the possibility of suppressor modulation, but either grid-bias of plate modulation can be used.

**The RK-47**

Tentative ratings and characteristics of the RK-47 are as follows:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament voltage</td>
<td>10 volts</td>
</tr>
<tr>
<td>Filament current</td>
<td>3.25 amp</td>
</tr>
<tr>
<td>Plate voltage, max.</td>
<td>1200 volts</td>
</tr>
<tr>
<td>Plate dissipation, max.</td>
<td>50 watts</td>
</tr>
<tr>
<td>Screen voltage, max.</td>
<td>15 watts</td>
</tr>
<tr>
<td>D.C. grid current, max.</td>
<td>10 ma.</td>
</tr>
<tr>
<td>R.f. grid current, max.</td>
<td>5 amp.</td>
</tr>
<tr>
<td>Interelectrode capacities:</td>
<td></td>
</tr>
<tr>
<td>Grid-plate</td>
<td>0.12 µfd.</td>
</tr>
<tr>
<td>Input</td>
<td>13. µfd.</td>
</tr>
<tr>
<td>Output</td>
<td>10. µfd.</td>
</tr>
</tbody>
</table>

In normal operation as a Class-C amplifier, the grid bias at the maximum plate and screen voltages recommended above should be 70 volts negative. Under these conditions the plate current, power output and efficiency are largely a function of the d.c. grid current. Plate dissipation is practically constant at 50 watts at grid currents from 1 to 10 milliamperes. With 10-ma. grid current, typical operation gives the following data: plate current, 150 ma.; power output, 138 watts; plate dissipation, 50 watts; screen current, 25 ma.; driving power, 1.55 watts. Except for the low driving power, these operating conditions about correspond with those recommended for the 203-A. The filament places the tube definitely in this class, although it should be noted that the maximum recommended plate dissipation is lower. In external appearance, the RK-47 is like the RK-20. It has the same five-prong base, and base connections are the same except that the beam-forming plates are connected to the suppressor pin. This connection should be grounded.

(Continued on page 90)
An Effective Linear Filter for Harmonics

Suppression of Even and Odd Harmonics with an Inexpensive and Easily-Constructed Transmission Line

By J. N. A. Hawkins,* W6AAR

Practically all the odd harmonics, and some of the even harmonics, generated by amateur transmitters fall outside the amateur bands. Therefore to avoid causing interference to other stations and services it is necessary that every amateur station provide means for attenuating the radio-frequency harmonics of the transmitter frequency. The balanced push-pull amplifier helps to reduce the even harmonics, but unfortunately it is a prolific generator of odd integral harmonics. There are several filter circuits and antenna arrangements which will either eliminate the even or the odd harmonics but few arrangements will cut out both the even and the odd, and they are complicated and hard to adjust.

The quarter-wave stub arrangement shown in Fig. 1 represents a simple and effective answer to this problem. This filter is tapped on to either the transmission line, antenna or the transmitter output terminals, the latter point being preferable. The line is connected to the stub at a point one-third of the length of the stub away from the open end of the stub. Thus the arrangement consists of an 0.08 wavelength open-end stub in parallel with a 0.16 wavelength closed-end stub. These electrical lengths refer to the fundamental transmitter wavelength. The total length of each side of the filter is a quarter wavelength at the fundamental, so that the filter represents practically an infinite impedance at the fundamental wavelength and has no effect on the desired transmissions. The filter represents a short circuit of only a very few ohms impedance to both the even and odd harmonics, and thus prevents them from reaching the antenna system. The stub filter can be used across either a tuned or untuned line and has no detuning effect, since it introduces no reactance at the fundamental or any of the integral harmonic frequencies of the transmitter.

The operation of the filter is quite simple. On the second harmonic, for example, the filter acts as a half-wave section, short circuited at a high-voltage point. This short circuit at a high-voltage point prevents the second harmonic voltage from building up and thus reflects back into the transmission line a short circuit of only a few ohms impedance at the second and other even harmonics.

On the third harmonic the stub becomes two filters in parallel. The length of each side of the stub filter becomes three quarter-waves, so that the filter now represents a quarter-wave open-end stub in parallel with a half-wave closed-end stub, both of which offer practically zero impedance (a short circuit across the line) to the third and higher odd harmonics.

The stub can be practically any size wire and any convenient spacing can be used. The length of the stub will approximate 0.24 wavelengths but will vary slightly with the wire size and spacing. Thus, the shorting bar at the closed end should be

* 2807 8th Avenue, Los Angeles, Calif.

(Continued on page 68)
Candid Shots at the 1937 Board Meeting

Paul Segal, general counsel and unofficial photographer-extraordinary to the Board, grabbed these shots during the May session of the A.R.R.L. Board. Names if you want them, down the columns, left-hand one first: McCargar behind the pipe, Mathews listening. Reid smiles as Gibbons expounds. Handy lays something before Vice-President Bailey. Matzy telling ‘em, Martin and Caveness in background. Next column: Blalack in a study, Jabs amiable. Dinnertime full with Budlong, Bailey, Reid, Hebert, Arledge. Cross-table luncheon talk, Stockman, Jabs, Ken Hill, Adams. Early workers, Stockman and Groves.

QST for
# What the League Is Doing

## League Activities, Washington Notes, Board Actions—For Your Information

### League Notes

A.R.R.L. membership cards (instead of certificates) are now available to members who prefer them and so specify when paying their dues. However, extra cards are not available for those who already have certificates—not until their dues are again payable. . . . President Woodruff has named Directors Martin, Norwine and Blalack to constitute the Board’s committee to sponsor an increase in League membership, Mr. Martin being the chairman. . . . The Constitution and By-Laws of the League have been reprinted to show changes up to the end of the last Board meeting. Interested members may obtain a copy upon request.

### Notes

The Communications Manager is busy these days examining sites for the new W1AW and making plans for the new station building, upon which work will be hurried during the summer. The Secretary is similarly occupied with plans for rearranging the headquarters offices as the League takes over the entire building in which it has been located. Office quarters have been cramped for a year, and the new arrangement will permit many pending plans to go ahead. By autumn we should have a “plant” of which anyone could be proud.

### F.C.C. Notes

The Federal Communications Commission now has before it the request of the A.R.R.L. Board for a change in the 28-Mc. phone assignment, its proposals concerning emergency communication by amateurs, and its suggestion about a change in licensing policies to require a year of c.w. experience before phone operation. The 28-Mc. matter probably will be enacted soon; but up to the moment of writing these lines no information has become available as to the Commission’s attitude towards the Board’s other proposals. . . . Lieutenant Jett, active administrator of amateur radio in his office of assistant engineer in charge of the Telegraph Division, has been out of the country, attending the C.C.I.R. meeting at Bucharest. . . . To our immense disappointment, Dr. Irvin Stewart, vice-chairman of the F.C.C. and chairman of its Telegraph Division, has announced that he is not a candidate for reappointment to the Commission when his term expires on June 30th. The Commission’s loss is here our loss, for Dr. Stewart has been a thoroughly competent and intellectually-honest administrator and in our opinion one of the most valuable men who have ever served the Commission . . . B.C.L. QRM complaints are slightly decreasing in number. . . .

In Rule 411, the words “90 days” have been changed to read “3 months.” . . . Through the efforts of the League, the half-dozen W7 stations cited for operation during the Oregon blizzard, at which time the F.C.C. had a stop order on normal amateur work, have been given clean bills of health on all the major citations. However, some of these stations were cited for insufficient filtering, A-2 emission and similar infractions regarding the quality of signals, and they will have to answer on these. . . . The Commission is examining the possibilities of holding amateur examinations in a number of additional cities during the next fiscal year—points which the Inspectors have set aside in any event for the purpose of inspecting other classes of stations. We shall have word soon.

### Habana

The League has asked the government of the United States to propose the addition, to the agenda for the Pan-American conference to be held at Habana in November, of the question of permitting amateurs of all of the American countries to interchange third-party traffic of a nature that would not normally go by any paid service. The recent successful Buenos Aires peace conference emphasizes the community of good feeling existing amongst the twenty-odd nations of the Americas. The League feels that such a proposal emphasizes the common destiny of the people of the Americas and is in keeping with the aspirations of the President. . . . As was reported last month, our Board has expressed itself on a proposal on the Habana agenda that the Latin-American countries be permitted to use telephony between 7000 and 7100 kc. Our Board is opposed to any phone operation in this band, but recognizes the right of the countries to the south of us to permit telephony in this band if they so insist, and feels that, if it is to be permitted, it is highly desirable to confine it to a portion of the band, instead of permitting it to appear all through the band—as many gnashing teeth now testify.

### Financial Statement

The League has enjoyed the largest quarterly gain in its history during the first quarter of this year, with a net of over $20,000 before disbursements against appropriations. The first quarter is generally the best of the year, to be followed by two lean ones. We should also point out that appropriations by the Board now take on very sizable proportions, and the funds to make them
possible are provided by these initial gains from operations. By order of the Board, the quarterly statement is here reproduced for the information of members.

STATEMENT OF REVENUES AND EXPENSES, EXCLUSIVE OF EXPENDITURES CHARGED TO APPROPRIATIONS, FOR THE THREE MONTHS ENDED MARCH 31, 1937

REVENUES

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Membership dues</td>
<td>$15,572.40</td>
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<tr>
<td>Advertising sales, QST</td>
<td>24,007.12</td>
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<tr>
<td>Advertising sales, Handbook</td>
<td>10,990.95</td>
</tr>
<tr>
<td>Advertising sales, booklets</td>
<td>525.00</td>
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<tr>
<td>Newsdealer sales, QST</td>
<td>12,011.37</td>
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<tr>
<td>Handbook sales</td>
<td>15,272.35</td>
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<tr>
<td>Booklet sales</td>
<td>3,079.09</td>
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<tr>
<td>Calculator sales</td>
<td>538.41</td>
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<tr>
<td>Membership supplies sales</td>
<td>3,584.91</td>
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<tr>
<td>Interest earned</td>
<td>416.43</td>
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<tr>
<td>Cash discounts received</td>
<td>640.75</td>
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<td>Bad debts recovered</td>
<td>59.86</td>
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<tr>
<td><strong>Total Revenues</strong></td>
<td><strong>$88,254.62</strong></td>
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</table>

EXPENSES

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<td>Returns and allowances</td>
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<tr>
<td>Collection and exchange</td>
<td>21.86</td>
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<tr>
<td>Cash discounts allowed</td>
<td>529.92</td>
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<tr>
<td><strong>Total Deduct</strong></td>
<td><strong>$4,057.25</strong></td>
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<table>
<thead>
<tr>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Less decrease in provision for newdealer returns of QST</td>
<td>16.58</td>
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<tr>
<td><strong>Net Revenues</strong></td>
<td><strong>$84,213.95</strong></td>
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<table>
<thead>
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<th>Description</th>
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<tbody>
<tr>
<td>Publication expenses, QST</td>
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<tr>
<td>Publication expenses, Handbook</td>
<td>10,050.95</td>
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<tr>
<td>Publication expenses, booklets</td>
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<tr>
<td>Office supplies and printing</td>
<td>1,261.03</td>
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<tr>
<td>Postage</td>
<td>2,140.46</td>
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<tr>
<td>Telephone and telegraph</td>
<td>799.70</td>
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<tr>
<td>General expenses</td>
<td>808.37</td>
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<tr>
<td>General Counsel expenses</td>
<td>260.90</td>
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<tr>
<td>Insurance</td>
<td>449.02</td>
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<tr>
<td>Rent, light and heat</td>
<td>848.50</td>
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<tr>
<td>Travel expenses, business</td>
<td>979.62</td>
</tr>
<tr>
<td>Travel expenses, contact</td>
<td>714.20</td>
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<tr>
<td>Provision for depreciation of furniture and equipment</td>
<td>312.90</td>
</tr>
<tr>
<td>Communications Dept. field expenses</td>
<td>132.20</td>
</tr>
<tr>
<td>Headquarters station expenses</td>
<td>13.54</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td><strong>63,673.83</strong></td>
</tr>
</tbody>
</table>

Net Gain before Expenditures against Appropriations: **$20,583.12**

Age-Limit Bills

The House so far has done nothing with a bill which would require a minimum age of twenty-one years for the holder of any radio operator license. Although never intended to apply to amateurs, the text of the bill unfortunately does. The League has made suitable representations, and is pleased to report that the F.C.C. itself has recommended that an exception be made in the case of amateurs. At this writing a somewhat similar bill has just been introduced in the Senate, specifying a minimum limit of twenty-one years but authorizing the Commission to relax this requirement in the case of amateurs. This is better, but not quite good enough. We see no reason why age should be a factor in the case of amateurs who are otherwise qualified, and we much prefer to be left in our present status with no mention at all of an age limit for amateurs.

C.C.I.R.

Word from Messrs. Labu and Stadler during the early days of the C.C.I.R. meeting at Bucarest is that everything is going smoothly enough, with no complications involving amateur radio. We had hoped that during this conference in Bucarest we might have a "special arrangement" permitting the exchange of third-party messages on behalf of the numerous Americans attending the conference, but the Roumanian government regrets its inability to relax its traditional restrictions. . . . En route to Bucarest, Messrs. Lamb and Stadler were the guests of the D.A.S.D. in Berlin, where they were most hospitably received. Returning, they are being similarly received in Paris by the "Revue des Emetteurs Français," and in London by the Radio Society of Great Britain. Thanks, OM's—FB!

Cairo

The Book of Proposals for the Cairo conference arrived in this country in early April and is in process of official translation. Meanwhile we have made our own abstract of the proposals affecting amateur radio and they are to be found hereunder for the information of members. Reference is also to be made to an item on this same subject in this department last month. It will be noted that good old Europe hands us a stiff dose of its usual medicine, accompanied, as usual, by at least one large pill from Japan. France, however, proposes widening our 7-Mc. band to 7500. "Vive la france!" Credit for this goes to the R.E.F., the only amateur society in the world that succeeded in inducing its government to propose widening!

Cairo Proposals

In Article 1, definitions, the United States proposes a new definition for the fixed service: "A service carrying on radio communications between specified fixed points," and gives as one of her reasons the desirability of avoiding a definition that would also cover amateurs. She then proposes the insertion of the following new definition: "Amateur service: the service of experimentation, self-training and intercommunication carried on by amateur stations." She gives as her reason the desirability of making it clear that the definition of the fixed service does not include the amateur service.

No. 19 & 20, United States:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Gain before Expenditures against Appropriations</strong></td>
<td><strong>$20,583.12</strong></td>
</tr>
</tbody>
</table>
A Four-Band Portable or Mobile Transmitter
A Compact Crystal-Controlled Unit for 56, 28, 14 and 7 Mc.
By Frank Jacobs,* W2BSL-W2XHV

FIVE-METER mobile activity has been on the increase each successive year since its introduction several years ago. The squealing transceiver provided a wedge into the region of the ultra-high frequencies, but the time has arrived for the introduction of more stable equipment following the lines of good practice in other bands.

The transmitter to be described in this article not only has real output and frequency stability on 5-meter 'phone, but may be used on 10-meter 'phone as well. At this writing, word has been received that amateur contacts have been made across the continent from a mobile station. One need not lack communication, no matter where he may be; even 40- and 20-meter c.w., using a portable antenna, is now open to the ham using a transmitter of this type, although the regulations do not permit mobile operation on these two bands.

The experienced amateur who has followed the popularity trend from the 10 crystal oscillator to the 47 and then to the 6A6 oscillator-doubler will not be surprised to learn that the 6L6 beam tube oscillator is rapidly coming to the fore. The fears expressed for the older types have disappeared, as will those expressed for the 6L6 power oscillator by reason of careless usage.


FIG. 1—CIRCUIT OF THE MOBILE TRANSMITTER

- Diagrams and specifications for the transmitter are given in the article.
are easily broken by experimenters who do not
give proper consideration to the characteristics of
the tubes and the circuit constants is well known.
The reader is referred to these other sources for
the factors involved in successful and sane
crystal operation. This article is concerned only
with the practical performance of modern types
chosen to save expense and space.

The heart of this compact four-band trans­
mmitter is the 6L6 crystal circuit, which employs a
40-meter crystal. By the use of only two coils and
one tuning condenser, outputs may be had on 40,
20 and 10 meters. The crystal current is low com­
pared with conventional tuned-cathode Tri­
teis; whereas the latter may run from 50 to
100 ma. of r.f. crystal current this oscillator
does not approach 25 per cent of that value
when used straight through or as a doubler.
When quadrupling to 10 meters the crystal
current is highest.

It is a simple and inexpensive matter to
check the crystal current and at the same
time protect quartz with a fuse. The 6.3-
volt No. 40 Mazda pilot lamps are rated
at 105 ma. at maximum brilliance, and 50
ma. of crystal current will cause just a
barely-visible glow. The oscillator used in
the four-band transmitter has a crystal
current which just lights the bulb when
quadrupling to 10 meters, while 20- and
40-meter operation give no visible indica­
tions, and may be assumed to be well below
50 milliamperes. The plate voltage is 325
and the automatic screen voltage 275 volts.
Higher voltages may be employed safely
if the lamp “fuse” is closely observed.

The schematic circuit of Fig. 1 indicates
how the output of the crystal tube is utilized for
c.w., or for the external excitation of other tubes,
on 40 and 20 meters. A second tube is employed
as a doubler-amplifier for 10 and 5 meters, the fa­
miliar push-push circuit employed using a 6N7

2. Regeneration is employed here and
the resultant output greatly exceeds the driving
input, in spite of the doubler action. Proper
shielding and wiring is important in order not to
introduce self oscillation. The by-pass capacity
C4 is important in determining the degree of
regeneration. Values over 100 µfd. may cause
oscillation, as has been previously described.2
The writer tried several values from 30 µfd.
upward and found that the layout used required
about 40 µfd. Oscillation took place at about 45
µfd. It is well not to approach the threshold of
oscillation too closely, and for that reason a
variable trimmer is employed and is backed down
to a safe value consistent with high output
power. If the trimmer is not large enough a small
fixed capacity may be shunted across it.

An audio amplifier consisting of a 6C5 resis­
tance-coupled stage feeding a 6L6 is employed for
voice or tone modulation of the carrier. A gain
control permits adjustment for various input
levels. Average single-button microphones require
a gain advancement of about one-third of the
total scale for 100 per cent modulation. An
interesting feature of the integral i.e.w. is the fact that
the tone may be varied over a wide range to suit
the operator, by manipulation of the same con­
trol. 'Phone and i.e.w. are employed on 5 and 10
meters only; c.w. on 20 and 40 meters.

The reader may assume that a transmitter
employing only two r.f. tubes for four-band
output with a single crystal would be difficult to
tune and operate. Furthermore, he might believe

that a multiplicity of coils are required. Neither
assumption is true.

The crystal oscillator is tuned to 40 meters by
(Continued on page 84)
How Would You Do It?

Designs for Convenient and Easily-Constructed Operating Tables:
Announcing the Seventh Problem

IN Problem No. 5, our Hero was in need of plans for an operating table which would accommodate the usual collection of stationery, books, tools and the usual odds and ends, which often clutter up an ordinary table, as well as the receiver, monitor, etc. At the same time, the design had to be sufficiently simple to permit construction with ordinary hand tools. Since O.H. is not a cabinetmaker by trade, he wished to avoid making close-fitting or complicated joints.

Of the multitude of suggestions received in reply to his request, we have chosen the two designs which follow.

First Prize

Suggested Design for a Radio Table
By Thomas O. Crow, W6HGW

This bench or table may be built by anyone possessing a fair degree of mechanical skill and with a minimum number of carpenter's tools. There are no complicated joints to make and, for the most part, it is simply a matter of cutting the material and nailing it together. A bench similar to the one described has been in use at W6HGW Wall...

for two years and has proved to be very satisfactory. It is shown in the diagram of Fig. 1.

The most important, and at the same time the most difficult, part of a table to construct is the top. It must be smooth to permit writing with ease. At the same time it must be perfectly rigid. For one who is not equipped or inclined to go to the labor of joining and gluing several boards together to form a top there are two solutions.

and fasten them to the wall by means of large wood screws driven through the plaster and into the studding of the wall. In this way there are no table legs to get in the way of one's feet. The studding in the walls may be located by tapping along the wall with a hammer until it feels solid. The studding is generally on 16-inch centers, hence, having located one stud, it is an easy matter to locate the others by a little measuring.

If the bracket form of construction is used, it...
will be necessary to stiffen the top between the brackets. This may be done by nailing a 1-inch by 3-inch piece across the front end of the brackets, and a 1” × 6” piece across the front of the vertical legs of the brackets, notching it so as to clear the horizontal bracket members.

If the mention of fastening the table to the wall brings forth the storm clouds, it would be best to employ the more orthodox method of using four legs, as shown in Fig. 2. These may be made of 3” × 3” material, fastened at the top with 1” × 4” pieces, and with a cross piece at each end about eight inches from the floor and a longitudinal brace between them, as shown by the sketches.

The table should be about 30 inches wide, and from 4 to 6 feet long, depending upon one’s individual ideas. For best operating convenience the top should be from 29 to 30 inches above the floor.

By buying all lumber surfaced on four sides, the labor of building this table is reduced to a great extent. The greater part of the work will be simply cutting the material and fastening it together. A good grade of pine looks well and, when sandpapered and finished with dark mahogany stain, it will make a table of which no one need be ashamed.

Now having the table, comes the question of arranging for log books, stationery, spare coils, a monitor, control panel and other miscellaneous gear besides the receiver. One’s personal likes and dislikes enter into this to such an extent that it is hard to plan any definite setup. However, the arrangement shown has proved satisfactory, and it is offered as a suggestion. The back panel may be the 18-inch piece left over after having cut the four-foot panel down to 30 inches. The rest of the shelves and pigeonholes may be made of 1” × 12” pine, which may be bought at the lumber yard surfaced on four sides, ready to be cut and nailed into place. All joints should be nailed with eight-penny finish nails.

The receiver occupies the center of large space, with the key and control panel on the right and the monitor on the left. The power supply rests on a small shelf under the table out of the way. The long spaces above the receiver are for spare coils, log book and call book. The speaker sits on the top shelf along with an electric clock. The small shelf on each side will receive stationery, pencils, magazines and books. These shelves may be made of wood, or better, by making saw cuts in the side pieces about an inch apart and ½-inch deep, to receive pieces of 20 gauge galvanized iron which are slid into them to make shelves that are easily adjustable, to suit one’s convenience.

Problem No. 7

Our pal has been bitten by the mobile bug and is all set to fix a 28- and 56-Mc. rig in his automobile. The car has one of these all-metal tops and no amount of argument with the ex-YL has softened her demand that no holes be made in the tinware. His problem is to find a complete plan for the installation of an antenna and feeder system. The arrangement must be capable of operation on both 28 and 56 Mc., but it is not essential that the change from one band to the other be made from inside the car. On the other hand, the antenna must serve for both transmission and reception and some appropriate method of changing over the feeders must be provided. If any brackets or fitments are called for, our hero will need complete drawings and details.

Second Prize

Rack Style Operating Position

By Winston V. Bradbury, W5CIQ

My solution to Problem No. 5 is shown in the drawings of Fig. 3. The use of the space is as follows:

A—loud speaker.
B—antenna tuner.
C—small monitor.
D—final amplifier.
E—Exciter stages (two or three).
F—power supplies (receiver supply included).
G—receiver.
H—log, call book, writing paper, etc.

(Continued on page 80)

1825 Baronne St., New Orleans, La.
For the third consecutive year, the five-meter band put on a grand May-time show.

This business of the band opening up for long-distance work in May is now getting to be a well-established habit. It must surely be a phenomenon of definite interest and importance in scientific circles. Enough hams are on the job enough of the time to suggest that the May opening, while not necessarily the only one, is at least the major one. Just why this should be so is a question very much in need of an answer.

The only really unfortunate thing about this year's 56-Mc. orgy is that while a great many contacts are believed to have occurred, only four individuals considered the work important enough to be reported. This, of course, is a perfectly punk state of affairs. For many years we have been trying to get a thorough understanding of ultra-high-frequency behavior and because of our numbers, if for no other reason, we have been able to do things that would be impossible or at least improbable in commercially-sponsored experiment. But the work itself is of precious little importance until it is reported and included in the record. Thousand-mile contacts on 56 Mc. are more common now than they were a few years ago but they are still of tremendous significance. We hams are simply falling down on the job if we fail to record every single instance of long-distance u.h.f. working. We at Headquarters try to track down every rumor in the best way we can but we are licked without reports from participants.

Our best report this time comes from Rev. Hollis M. French, W1JLK. He heard and was heard by W9ZEQ during the late evening of May 14. On May 15 shortly after noon, he heard W9UA, W9CLH and, please note, G5BY. Also he had a 12-minute QSO with WSQAR of Dayton, Ohio. During the same period, W1JLK's signals were copied by two short-wave listeners, one in Indianapolis and one in Cincinnati.

The longest DX was reported by Whit. Griffith, W5CSU, operating at M.I.T. in Cambridge, Mass. W5CSU-I rang the bell by maintaining contact for one hour during the late evening of May 14 with W9URO at Watertown, S. Dakota. It seems that the "9" was hearing several Boston stations, other Boston stations also hearing him.

Kenneth A. Bishop, W1EWD, reports working W8RLS in Cincinnati at 11:30 p.m. E.S.T. on May 15 and hearing W8QVB, W9CLH, W9UAQ and W9RBK (the latter call a bit doubtful).

The fourth report is from Owen Shepherd, Jr., W1IJ who, in spite of being on the band most of the time and in close contact with W1JLK, failed to hear more than a brief slice of one unidentified DX station. W1IJ was using an eight-element directive array pointed west and both transmitter and receiver were in completely satisfactory condition. Whether his location—30 miles east of W1JLK—explains the phenomenon or whether it is the result of an unfavorable angle of radiation from his antenna in the vertical plane is a question well worth looking into. At any rate, his report of negative result is really of just as much interest as the others.

Our congratulations to those who had a hand in this work; our sincere thanks to the four gentlemen who turned in reports; an earnest plea for complete reports of all long-distance u.h.f. work done in the future.

—R. A. H.

Just as we go to press a fifth report arrives from W9RBK at Newport, Ky. W9RBK tells of hearing W1KBM at 1:50 p.m. on May 12th and working W11WR at 11 a.m. on May 15th.

—EDITOR

I DON'T see no sense in all this palaver in the Handbook about how embryo hams should oughto study up and go git a license and a ham call of their own. They're doin' ok as it is. Just pick one outa the book and go to it. Some of 'em's gittin' nice dx for me. The latest, outsidea what I got already, is a card from a German gentleman in Muenchen and another'n from an Irish gentleman in Belfast who are "psed to qSO" which is news to me. I wisht these call thieves would hurry up and git Japan and South Africa for me. A bootleg WAC certif oughta be sumpn special.

—W4IR of the "Dixie Squinch Owl"

Correction

In Fig. 2 on page 54, June QST, the negative return between transmitter and power supply of the line-powered beam crystal oscillator was omitted. A connection should be made between the left-hand end of R3 and the lower end of R3 in order to apply plate voltage to the oscillator.

Incidentally, we hope nobody was confused by that type "2575" tube in the same diagram! The draftsman left off the bottom of the Z.
Note on Reduction of Distortion and Noise with Inverse Feedback

A FEW of our readers have disagreed with some of the conclusions reached, with respect to optimum inverse feedback conditions for reduction of distortion and hum, in the article describing the construction of a speech-amplifier-modulator unit in April QST. Since the criticisms are all of the same nature, we have selected for publication a letter from J. R. Davey, 419 West 119th Street, New York, which gives a rather complete explanation of the operation of the inverse feedback circuit in this respect:

"The section of the article headed 'Curing Distortion and Noise' contains several statements which I believe to be incorrect. The author begins this section by showing how a 5-volt third harmonic in the 20-volt fundamental output of the amplifier used as an example is eliminated by using a feedback ratio of 1:10. A feedback ratio of 1:10 and a stage gain of 10 would actually cut the distortion and noise introduced in the stage to one-half its original value, and not eliminate it completely.

"The author also applies the same reasoning to the hum elimination problem, reaching the general conclusion that the feedback ratio should be the reciprocal of the gain of the stage. Here again this actually gives a reduction of 50 per cent in noise, distortion and the effective gain of the stage. The statement that if this ratio is exceeded overcompensation would result, and that the distortion would increase, is quite incorrect. As the negative feedback is increased, the noise, distortion, and effective gain all continue to decrease. To get complete cancellation of the noise and distortion would require infinite negative feedback and consequently zero gain. The error in the reasoning is that it neglects the fact that as soon as the noise or distortion is cancelled out in the output by some means, there is no longer any signal component to feedback and continue the cancellation.

"The usual type of nomenclature used in feedback amplifiers is given in Fig. 1. It is to be found in numerous publications treating the subject.

"The reduction of gain caused by the feedback

\[ \frac{1}{1 - \beta} \]

This is also the reduction in noise and distortion produced in the stage. The characteristic with feedback approaches that of the feedback or \( \beta \) circuit. When, as in this article, \( \beta = - \frac{1}{A} \), the factor \( \frac{1}{1 - A\beta} \) becomes \( \frac{1}{2} \).

\[ \text{Effective gain} = \frac{2\beta}{1 - \beta} \]

FIG. 2

1 Carter, "Inverse Feedback Applied to the Speech Amplifier for the Amateur 'Phone Transmitter," QST, April, 1937.

The above factor is demonstrated below in obtaining the table given on page 47, April QST:

<table>
<thead>
<tr>
<th>Freq.</th>
<th>Gain, no feedback (A)</th>
<th>Gain with feedback ratio of (\frac{-1}{5})</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>5 (\frac{A}{1-A\beta}) = (\frac{5}{1-(\frac{5}{6})\frac{1}{5}}) = (\frac{5}{2}) = 2.50</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>10 (\frac{10}{1-(\frac{10}{11})\frac{1}{5}}) = (\frac{10}{3}) = 3.33</td>
<td></td>
</tr>
<tr>
<td>10,000</td>
<td>8 (\frac{8}{1-\left(\frac{8}{9}\right)\frac{1}{5}}) = (\frac{8}{1.6}) = 5.00</td>
<td></td>
</tr>
</tbody>
</table>

"The actual case of the author's distortion example is shown in Fig. 2. The 5-volt third harmonic produced in the amplifier is reduced one-half, to 2.5 volts, but not eliminated. If \(A\beta\) should be made as high as 15 to 20, then much more reduction of distortion \(\left(\frac{1}{16}\right)\) and \(\frac{1}{21}\) would be obtained. I have no doubt that the amplifier as described works very well, but there appears to be no foundation for the desirable feedback ratio of \(\frac{1}{5}\) gain of stage."

Improving DX

A Plan for Internationally Subdividing the Long-Distance Bands

In the course of a discussion at the last meeting of the Board of Directors on the possibilities of a "planned use" of amateur frequencies, the Board instructed that there be published in QST the substance of a proposal now under study in the International Amateur Radio Union. The proposal was made by the Réseau des Émetteurs Français, the French member-society of the I.A.R.U. It was the Board's desire to bring this proposal to all of the members of the League, that amateurs may judge for themselves what potentialities for improvement reside in such a plan, and what sacrifices they would be called upon to make to secure its benefits.

Briefly, the R.E.F. proposes that we all contract amongst ourselves to confine our operations in the 7-Mc. and 14-Mc. bands to certain portions of those bands, in each continent, keeping out of the other portions. In these other portions we would then find the amateurs of other continents free of interference from our own fellows. It is an idea that has often been discussed but on which no action has ever been taken. The present plan

(Continued on page 84)

W3FAR Wins 28-Mc. Contest

The 1936 A.R.R.L. 28-Mc. Contest winner is Mr. John J. Michaels, W3FAR, of North Wales, Pa. The power input at his station was kept under 50 watts during the entire 12 months, and during March 1936 was kept at 5 watts with results comparable to those at any other time, showing the predominating influence of transmission conditions (rather than power levels) in determining successful communication at 28 Mc.

It will be a pleasure to send W3FAR the bronze medallion Achievement Award given by the League in token of his outstanding ten-meter work throughout 1936. The scoring in the competition depended on a weighting of 50 per cent for QSO-points (one per each 100 miles of completed contact), 25 per cent for development-research work reported, and 25 per cent depending on weekly condition reports to Headquarters.

The standing of the four leading participants speaks for itself:

<table>
<thead>
<tr>
<th>Call</th>
<th>Total QSOs (50 max.)</th>
<th>Research Eqpt. Report$ (25 max.)</th>
<th>Reports (25 max.)</th>
<th>(50 max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W3FAR...</td>
<td>88.6 38.6 (10,664 pts.)</td>
<td>25 25</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>W3JFC...</td>
<td>61.0 50 (14,770)</td>
<td>10 10</td>
<td>22.8</td>
<td></td>
</tr>
<tr>
<td>W9BRZ...</td>
<td>53.1 10.3 (2,700)</td>
<td>20</td>
<td>2.7</td>
<td></td>
</tr>
<tr>
<td>W9HUV...</td>
<td>47.5 24.8 (7,211)</td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Honorable mention goes to OE1FH, who would have placed third had formal entries from outside W/VE been eligible. OE1FH had 360 W—VE contacts alone in the year '36. Seventy-seven other individuals were in the running by having submitted at least one weekly report, but failed to enter summaries for consideration. Meritorious work was reported especially from W9JUQ W1EWD W9FWG W6CPT W9GHN W9JZJ W9DBG W8CZR W6JN.

W3FAR's 45-page log is a valuable treatise on 28-Mc. communication. Scoring points dropped from 1820 in January to but 30 in June, rising to more than 1100 per month for September, October and November, with the record of 2619 points for December 1936. W3FAR found horizontal doublings better for reception than vertical antennas, due to polarization of man-made static. He states that his five-wavelength long flat top (197 ft. horizontal) exactly 33 feet above ground (or one wavelength), having lobes running through South America, N. Z., Australia and Japan and bringing S5 reports from all, was preferred to sharper beams tried giving S9 from Europe or other line of fire and fewer reports elsewhere. Careful orientation of any such antenna is required, the horizontal pattern directivity being especially important. In summer, when

(Continued on page 61)
A Simple Bread-Board Crystal-Controlled Transmitter for 56-Mc.

By Harry A. Gardner,* WEEHT

THE question of stable transmitters on five meters is a subject which is rapidly coming to the front with all amateurs who are interested in this band.

In looking over the various circuits which have been published on crystal-controlled transmitters for 56 Mc., it seemed as though most of them were somewhat complicated or used tubes which the average amateur would not have or would not wish to buy just to use on this band, so it was decided to try and see what could be done using common tubes and parts which most amateurs could find in their junk boxes.

THE CIRCUIT

Since the transmitter was to be used primarily on 56 Mc., it was decided to use a 14-Mc. crystal, nearly sufficient to drive the RK34 on 56 Mc. with this arrangement.

Using the 6A6 as the crystal oscillator and first doubler, however, permitted the use of a second 6A6 as a push-push doubler from 28 to 56 Mc., giving much better output on "five," as would be expected.

The amplifier is conventional push-pull. The RK34 was used because one was available, but a 6A6 would work very well in this circuit, especially if it were used as a buffer to excite a following stage. Type 53 tubes could be used in place of the 6A6's with equally good results.

Care should be taken to see that the filament voltage is at least the rated value. A low value of voltage will cause creeping of the plate current.

FIG. 1—CIRCUIT OF THE BREAD-BOARD 56-MC. TRANSMITTER

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>4 turns 3/8&quot; copper tubing.</td>
</tr>
<tr>
<td>L2</td>
<td>3 turns No. 14 wire.</td>
</tr>
<tr>
<td>L3</td>
<td>3 turns No. 14 wire.</td>
</tr>
<tr>
<td>L4</td>
<td>6 turns No. 14 wire, tap 3 turns.</td>
</tr>
<tr>
<td>L5</td>
<td>6 turns No. 14 wire.</td>
</tr>
<tr>
<td>L6</td>
<td>8 turns No. 14 wire on 1/4 inch isolonite form, tap 3 turns from plate end.</td>
</tr>
<tr>
<td>C1</td>
<td>Split-stator, 50-µfd. per section.</td>
</tr>
<tr>
<td>C2</td>
<td>Split-stator, 35-µfd. per section.</td>
</tr>
<tr>
<td>C3</td>
<td>35-µfd.</td>
</tr>
<tr>
<td>C4</td>
<td>Split-stator, 35-µfd. per section.</td>
</tr>
<tr>
<td>C5</td>
<td>35-µfd.</td>
</tr>
<tr>
<td>C6</td>
<td>15-µfd.</td>
</tr>
<tr>
<td>C7</td>
<td>2-stator l-rotor, double-spaced.</td>
</tr>
<tr>
<td>C8, C9</td>
<td>0.01-µfd. fixed.</td>
</tr>
<tr>
<td>C10, C11</td>
<td>0.001-µfd. fixed.</td>
</tr>
<tr>
<td>R1</td>
<td>1000-ohm.</td>
</tr>
<tr>
<td>R2</td>
<td>10,000-ohm.</td>
</tr>
<tr>
<td>R3</td>
<td>20,000-ohm.</td>
</tr>
<tr>
<td>R4</td>
<td>5000-ohm.</td>
</tr>
<tr>
<td>R5</td>
<td>100,000-ohm.</td>
</tr>
</tbody>
</table>

CONSTRUCTION

Since the transmitter was experimental, a bread-board arrangement was used. A sheet of Tempered Masonite 24 inches by 10 inches was obtained for this purpose. On one end of this a 12-inch by 7-inch sheet of aluminum was placed, on which the exciter was mounted, which made grounding of the parts easily accomplished.

The order of parts is as follows: Starting at the right, first in line is the oscillator condenser C5 with the coil L4 mounted directly behind it. Next to the coil is the oscillator-first doubler tube

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* 80 Washington St., Stoneham, Mass.
and back of this is the crystal, which is mounted in a five-prong socket. Next in line is the first doubler condenser \( C_5 \) with the coil mounted directly on the contacts. Next comes the push-pull grid coil \( L_4 \) with the split-stator grid condenser \( C_4 \). Again the coil is mounted directly on the condenser contacts. Following this is the second doubler tube, the plates of which are connected in parallel and tuned with the condenser \( C_3 \) and coil \( L_3 \), the coil again being mounted on the condenser terminals. Following in line is the push-pull grid coil of the RK34, \( L_9 \), which is mounted on the terminals of the condenser \( C_2 \). The RK34 is next in line followed by its split-stator condenser and coil, \( C_1 \) and \( L_1 \). The neutralizing condensers \( C_7 \) are mounted in front and back of the RK34.

Jacks for metering the plates of all stages and the grids of the amplifier stage are provided. Grounds are made directly to the aluminum sheet by the shortest possible connections.

All variable condensers are of the midget receiving type, with two of the split-stators being made by coupling two midgets together with a brass bushing. This was done simply because these parts were available in the junk box. The coils were mounted on the condenser terminals to make the leads as short as possible, which is very necessary on the higher frequencies.

**Tuning**

The tuning of the rig is very simple, and anyone having any experience in the use of crystal-controlled transmitters will have no difficulty in this respect. For others, the A.R.R.L. Handbook gives complete details. The neutralizing of the amplifier is conventional, and is very easily accomplished with this type of tube, very low capacity condensers being used. The usual procedure should be followed as described in the Handbook.

**Operation**

With 220 volts on the 6A6's, the value of the d.c. grid current in the RK34 was 17 ma., and when the voltage was increased to 300 the grid current increased to 28 ma., which is sufficient for this tube. If the RK34 is to be used as a buffer to drive a following higher-powered stage, the lower value of voltage will be found sufficient; but if it is to be used as a final amplifier with rated plate voltage (400 volts) the higher plate voltage should be used on the 6A6's.

The actual operation of the transmitter exceeded expectations. Using 220 volts on the 6A6's and 280 volts on the RK34, an output of better than 10 watts was obtained with an input of about 25 watts. This in itself is not startling. But when the outfit was put on the air, the reports were most gratifying. The regular transmitter used previously was a pair of RK10's in push-pull as a modulated oscillator, with an input of 100 watts. Using the lower-powered crystal-controlled transmitter, all reports were as good if not better with 85 watts input as had previously been obtained with 100 watts input to the modulated oscillator, the voice quality was much better, the signal much sharper, and very much more readable.

This circuit, by using plug-in coils and link coupling, could be used as a six-band transmitter, with a 1.75- and a 14-Mc. crystal. With a pair of 807's or RK39's in place of the RK34, a very nice all-band transmitter for low power would result.

**High-Capacity Midget Switches**

A NEW type of power switch especially adaptable to primary switching for 'phone push-to-talk has recently been marketed under the name "Micro Switch." In appearance it is entirely different from the ordinary knife or toggle switch, being enclosed in a bakelite case approximately two inches long by one inch high by three-fourths of an inch wide.

The moving contact is mounted on a beryllium copper snap spring which is actuated by a plunger whose end extends through the case. Pressure on the plunger (the actual movement is only about one-thousandth of an inch) snaps the spring and the contacts "make." On releasing the pressure, the spring snaps back to its original position and the contacts open. The contacts have large area and are silver plated.

Several varieties of switch are available besides the normally-open type described above. There is a normally-closed type, and also a double-throw. The plunger tip for mechanical contact is about the size of a ball bearing on the usual model, but the switch also can be obtained with a

(Continued on page 32)
A Third-Harmonic Filter for Push-Pull Amplifier

The generation of odd harmonics of the fundamental radio frequency, which is an inherent characteristic of the push-pull Class-C amplifier, can be greatly reduced by the circuit trick shown in Fig. 1. Instead of tapping the plates on the opposite ends of the tuned plate tank, the plates are tapped in one-sixth of the total coil turns from each end. This type of circuit arrangement provides a very low load impedance to the third harmonic of the amplifier frequency. As the push-pull arrangement already tends to neutralize even harmonics, this arrangement should prove a desirable improvement over current practice.

For best results, the plate taps should be varied over a small range on each side of the two-thirds point each side of center. By using a wave-trap, field strength meter, or a well-shielded receiver equipped with an S meter and tuned to the third harmonic, the taps can be varied until the third harmonic output or tank current is lowest.

Note that this arrangement will increase the r.f. tank voltage and circulating tank current about 50% for a given amplifier, for the same tube loading. This will increase the circuit Q with its attendant benefits. The disadvantages are that the tank losses will rise slightly and that the tank tuning condenser may arc over. For the same circuit Q as a conventional push-pull amplifier operating under the same conditions, only about 44% of the conventional tank C, with proportionately more tank L, will be necessary. Thus the cost of a tank condenser will be about the same in either case for the same circuit merit.

---J. N. A. Hawkins, W6AAR

Improving Efficiency on 56-Mc.

Referring to Fig. 2 we have the conventional push-push doubler circuit for doubling to five meters from ten. Its principle disadvantage is that the plate tank offers a very low load impedance to the two paralleled plates. This in turn means rather indifferent performance of the circuit from the standpoint of efficiency. In our setup, the plate tank condenser was a 25 µfd. midget and the inductance was a single turn of No. 12 wire about an inch in diameter. Rather a poor LC ratio, and the output was only what might be expected from such an arrangement. One other difficulty at 5 meters has been efficient...
coupling between the output of the final stage of the rig and the antenna. This is taken care of rather nicely in the circuit suggested in Fig. 2B. The front end of this circuit is identical with that at A. However, the plate circuit presents a radically different picture. Series tuning of this circuit is employed with the tank condenser and the paralleled output capacities of the two tubes effectively in series. Furthermore, the plate tank condenser is made up of two units; $C_2$ is small for tuning the whole thing to resonance, and $C_3$, a fairly large condenser across which the antenna is connected. The voltage drop across $C_3$ is therefore impressed across the input to the antenna, and by varying $C_3$ to control coupling, and by employing $C_4$ to restore the circuit to resonance, any desired degree of loading may be accomplished.

Typical performance of a pair of 45's may be interesting. Operating in a push-pull oscillator circuit, these two tubes could be run at about 40 watts input with rather less than complete modulation. Frequency stability and other characteristics were what they always are with such an arrangement; poor. The same tubes in Fig. 1 could be modulated fully at 20 watts input to the plates, while in Fig. 2B they could be modulated fully at 40 watts input to the plates.

With plate voltage applied (300 volts) the d.c. grid current should run about 12 to 20 milliamperes. Do not apply full excitation to this stage unless the plate voltage is on! The grid leads will break down in the stem and the tubes will be ruined. Probably tubes such as the Taylor T-20 or T-55 or the Eimac family of the rig and the antenna. This coupling between the output of the final stage of the rig and the antenna. This is taken care of rather nicely in the circuit suggested in Fig. 2B. The front end of this circuit is identical with that at A. However, the plate circuit presents a radically different picture. Series tuning of this circuit is employed with the tank condenser and the paralleled output capacities of the two tubes effectively in series. Furthermore, the plate tank condenser is made up of two units; $C_2$ is small for tuning the whole thing to resonance, and $C_3$, a fairly large condenser across which the antenna is connected. The voltage drop across $C_3$ is therefore impressed across the input to the antenna, and by varying $C_3$ to control coupling, and by employing $C_4$ to restore the circuit to resonance, any desired degree of loading may be accomplished.

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With plate voltage applied (300 volts) the d.c. grid current should run about 12 to 20 milliamperes. Do not apply full excitation to this stage unless the plate voltage is on! The grid leads will break down in the stem and the tubes will be ruined. Probably tubes such as the Taylor T-20 or T-55 or the Eimac family will take the excitation without flashing but not any tube we have tried where all the leads pass through the stem.

The thing can be built cheaply . . . the performance is all anyone could ask for, and 30 watts input to a pair of 45's in this circuit will lick the socks off twice that input to a pair of 10's in a self-excited oscillator. Furthermore, this rig can be modulated very nicely and the envelope patterns look very decent on the oscilloscope.

---B. P. Hansen, W9KNZ

"Junk-Box" Frequency Standard

The crystal oscillator circuits shown in Fig. 3 probably will have a great deal of novelty for most hams. They are suggested by Christoph Schmelzer, D4BIU, for use in home frequency standards for calibration purposes. He writes:

"I cannot claim any originality for the circuit since I discovered that it had already been used by Cady in his fundamental work as far back as 1924. The thing is an ultraudion with a quartz crystal substituted for the usual tank circuit. The fundamental ultraudion is shown at A, while the corresponding crystal circuit is at B. The circuit works very nicely with crystals up to 7 Mc., but for higher frequencies a small condenser, $C'$, may be needed to get oscillation, since the high static capacity of the crystal, which is parallel to the plate-grid capacity of the tube, changes the capacitive voltage divider so that no oscillation occurs. In this case $C$ (100 µfd.) is used to add to the plate-filament capacity of the tube and thus restore the right ratio. Any old triode will work nicely.

"The oscillator works well with 100-ke. bars also, and it was possible to get good beats from the 300th harmonic. Sometimes a small 'antenna,' consisting of a 3- to 5-inch length of stiff copper wire, clipped to X, Fig. 3B, helps in getting better signal strength.

"This little oscillator is very useful for many purposes, and its output is high enough to check heterodynes of 'mixed harmonies'—for instance, the 15th of an oscillator with the 14th of the 'standard,' which is very helpful for many calibrating purposes with a crystal of high fundamental frequency.

"A recommended change to get still more harmonic output is to use a screen-grid tube, as shown in Fig. 3C."

High-Capacity Midget Switches

(Continued from page 81)

half-inch square flat pressure surface which is considerably more comfortable for finger operation. The switch may be operated in any position, and can be mounted on a flat surface by means of wood or machine screws.

For inductive loads such as the primary of a power transformer the switch is rated at 10 amperes at 110 volts. In addition to the push-to-talk application mentioned above, it is also well suited to use as a door switch on a transmitter cabinet, as a vibrator interrupter, and as a contact for a relay. It is manufactured by the Micro Switch Corporation, Freeport, Ill.

Traffic for the Philippines may be routed via W7AYO, Yakima, Wash., who schedules KAIHR daily at 5:30 a.m., PST. Also via W6CJU and W6CDU and Alternates (W6MFX and W6IMI), who also schedule KAIHR.

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Conducted by Byron Goodman

It should doubtless be pointed out that this recognition does not accord voting privileges or the right to initiate proposals. The Union’s delegates may, however, attend all sessions and be heard in comment on such proposals as may be introduced.

The growing strength and importance of national amateur societies in influencing the policies, both national and international, of their governments is perhaps not realized by the majority of the readers of QST. It used to be, particularly in some of the European countries, that the amateur radio society was looked down upon and had little or no opportunity to be heard. Now, however, thanks to a great deal of earnest and steady effort, recognition has been achieved by many. One of the best examples is the splendid work done by the R.E.F., which has secured the adoption by a sub-committee and by the entire French preparatory committee of the principle that the 7-Mc. band should be enlarged. No specific figures for enlargement were urged, but it was stipulated that the enlargement should be in the high-frequency direction and as far toward 7500 kc. as possible in consideration of other

James J. Lamb (L.) and John C. Stadler I.A.R.U. Representatives at the C.C.I.R. Meeting at Bucharest

Mr. Stadler, VE2AP, is with the Canadian Broadcasting Corporation, and Mr. Lamb, W1AL, is technical editor of QST.
services. While it should be made plain that these decisions are not necessarily final, since they were arrived at before any other country's proposals were seen, and there is always the possibility that the French will wish to modify their point of view, it demonstrates clearly the prestige that our member-societies are gradually achieving.

Bucarest:
We receive word from Messrs. Lamb and Stadler via several of the Rumanian stations, but must delay a full report of their work until their return.

The following radiogram from Berlin tells part of a story:

IARU HARTFORD CONN. THE SHORTWAVE AMATEURS OF THE DASD HAVING MET ON OCCASION OF THE VISIT OF THE IARU REPRESENTATIVES IN BERLIN ARE SENDING THEIR MOST CORDIAL GREETINGS TO THE PRESIDENT OF THE IARU AND ARRL AND TO ALL THE ARRL MEMBERS.

GERBARDT PRESIDENT DASD

France:

The R.E.F. extends a cordial invitation to all amateurs visiting the 1937 World Fair in Paris to make themselves known at the office of the French society. The address is: R.E.F., 6, square de la Dordogne (122 Bld. Berthier, Paris, 17e).

Finland:
The fifteenth annual meeting of the S.R.A.L. was held during February at Hämeenlinna. Mr. K. S. Sainio, OH2NM, who has been president for the past ten years, was reelected. Under Mr. Sainio's guidance the society has become thoroughly organized, and is now solidly established with the Ministry of Communications and the Ministry of National Defence. The society has over 235 members, only seven of which are without licenses.

QSL Bureaus:

Supplementing the May list, the following additions and corrections should be made.
Antigua: R. V. Tibbits, High Street, St. Johns, Antigua, B.W.I.
Barbados: see Antigua.
British Guiana: see Antigua.
Luxembourg: J. Wolff, Rue Pierre D'Aspelt 8, Luxembourg.
Madeira: see Portugal.

Southern Rhodesia: see South Africa.
Trinidad: see Antigua.


THE "annual" type of 56-Mc. contest, which in some respects paralleled the annual 28-Mc. competitions in its provisions, did not bring forth the same number of condition reports and points for contacts that was anticipated. In fact, after consultation with the Milwaukee Radio Amateur' Club, donor of the beautiful spun-gold cup trophy we now announce "no competition" for the 1936 twelve-month 56-Mc. contest in view of the circumstance that the entries are insufficient in number and quality to make an award justified.

Instead of extending the 56-Mc. Cup competition in the same form, the cup trophy will now be offered for specific work in this frequency range and in two-way DX communication accomplishment at 56 Mc.

The Milwaukee Radio Amateurs' Club 56-Mc. Achievement Award will be made for the first licensed United States amateur work two-way, between continents, properly certified by documentary evidence in accordance with the following:

1) The licensed United States amateur qualifying must be utilizing transmitter frequencies in the range 56,000-60,000 kc.

2) The great circle distance covered must be in excess of 2,000 miles and the terminating stations must be located in different continents.

3) Documentary or written evidence from all parties who are principals in this radio communication must prove to the satisfaction of the officers of the A.R.R.L. and the M.R.A.C. that two-way communication was effected, and show what information was exchanged.

4) In the event of any doubts in the mind of the judges, or in the event of simultaneous claims based on single intercontinental contacts, it shall be required that the United States station show documentary proof of contact with two different stations outside the North American continent, each at distances in excess of 2,000 miles, each confirmed by appropriate and satisfactory written evidence, in claiming the cup award.

—F. E. U.
THE A. R. R. L. Copying Bee Results have just been completed and full report on this activity is scheduled for August QST. Three operators turned in 98 per cent correct "copy" of the difficult text transmitted and tie for the medalion award offered by the League in token of highest proficiency in this field. Three duplicate engraved awards will be made, and they go to:

J. Y. Bowman, W5FCQ, Dallas, Texas.
L. R. Clements, W2HHG, East Hampton, L. I., N. Y.
H. G. Martin, W6GVT, Los Angeles, Calif.

Proficiency in copying, in manipulation of the controls, in the ability to put on paper exactly what is sent in neat and legible fashion, or to reverse the process and convert thought into accurately transmitted electrical impulses has always been the aim in amateur radio. The operator is the supreme determinant in the communication equation. Equipment may be 100 per cent, but in the hands of the inexperienced it cannot be made to perform . . . or at any rate its performance will fall short of the ultimate. Too little study and attention is given good operating and copying ability by the newcomer today. The real amateur above all things knows his code. He has passed through his days of putting. His ears are keen, and his ability to transcribe has been cultivated by practice. It is no soft proposition to get the Copying Bee texts converted from electrical impulses into black and white. To win the Copying Bee is an indication of the highest ability. It takes a real amateur in qualifications and experience to do it. This is not a matter of luck, but one of amateur training. One must be mentally keen and on his toes to deliver the goods. Our hat is off to all the excellent amateurs who entered the list of competitors for this activity. May there be more of them. Heartiest congrats to the winners.

Hamfests and visiting season now here! Hamfests and conventions are held the year round. The summer season, however, offers the best time for arranging meetings and outings. Probably three quarters of all such gatherings for the year will be held in the coming months. Club meetings, held on the average twice each month during the winter season, are in most cases discontinued during the summer vacation, or to amateur radio the "rebuilding" season. There is more incentive to go places and see things when the roads are passable and the weather favorable. At Hq. the latching is out to all visitors. At individual ham shacks also a warm welcome is awaiting the vacationing fraternity brother who drops in for a brief chat, renewing the radio acquaintances of the past season.

This is just a hint to the radio newcomer to take with him in his summer travels a call book and batch of QSL's. The winter has been devoted to making new radio acquaintances (unless you are one of those deplorable fellows who never says anything but 73-CUL after swapping reports) and building up individual stations and station records. But there's more to amateur radio than this. With this season our advice is to lay aside the restless pushing of self and station for "more DX," "more traffic"—and competition for records. It is healthy to vacation in the vacation season. To be a balanced amateur learn to find the fullness of enjoyment in the fraternal relationships that are possible within the framework of amateur radio.

Let us visit our fellow hams, not to boast of what we have done in amateur radio, but to broaden our interests to include theirs. Many a useful idea and notion may be found in stations visited that will be adaptable to our own; constructive plans for the new unit or schedule work to be started in fall may result from impromptu discussion. It may be time to try new edies of our hobby; there is the subject of net organization and amateur emergency work and the different A.R.R.L. appointments to the qualified to be discussed. So we say one should take in all the meetings possible, visit all our special ham friends we can. This is bound to be mutually pleasant and profitable, especially if we make the visits with no special personal aim in view except to swap talk about apparatus, new and old, and operating of the past, and future plans. Take portable set and log if you can, but at any rate let the call book be your companion. Take your F.C.C. operator license if you expect station operating courtesy to be extended. Be tactful and considerate of others in your visiting—the folks visited may have plans, too. If you are making a first-time visit, make it just a short friendly visit to say hello. You will be pleasantly surprised we are sure.

This is the season for true rag chewers, and all
56-Mc. Field Day

In the last few years VE3 amateurs have taken a keen interest in 56-Mc. work and have been able to secure some very fine two-way contacts, VE2KM, VE3NH and VE5OF of Hamilton, and VE3KV, VE3MJ and VE3ADO of Toronto were invited to participate in the Field Day test of the Western New York 56-Mc. Club on May 23d. In 1936 WS and VE3 enjoyed their first two-way QSO across Lake Ontario. This year they were out to better last year's record. The Hamilton stations assembled their portable gear on top of Hamilton Mountain: VE3KV and VE3MJ set up in Toronto and VE3ADO transported a complete apparatus 90 miles to Port Colborne. With the help of VE3XX, VE3HR, Mr. Robinson and Mr. Pennock, 3ADO succeeded in setting up the apparatus on top of the grain elevator at Port Colborne. From there they were able to make several contacts with portable WSRY, WS2OP, WS3Q8S, WSMLQ, WS5EMM, WS8NOR, WS8CDM, WS8EDM, WS8HC, WS8POL, VE3HR and mobile WS6GU, who was in the hills near Erie, Pa. The home station of VE3ADO at Toronto was also heard. The contact between VE3ADO and WSRY marked the first 56-Mc. communication between Port Colborne and the United States. A letter from Mr. Paul D. Behning, Tulsa, Okla., reports that his portable VE3EMF, May 23d at 12:07 C.S.T., WS8CG and WS6PO were also heard in Tulsa on the same day.

On the New York end, WS8R, Hobart Hyde and Jack Von Scheidt let 56-Mc. with VE3EMF, heading for a hilltop near Colden. They were on the air by shortly after 1:00 P.M. First contact was with WS8HCQ, operating at Elma, N. Y., a distance of about 14 miles. Then came the contact with VE3ADO, setting a new record. From then on contacts came thick and fast. WS8CM, backed up on a 2100-foot elevation at Cherry Creek, N. Y., had a message for North Tonawanda. WS8RY relayed to WS8NR, right in North Tonawanda. During the afternoon a kite was sent up and about 300 feet of wire released. A decided increase in signal strength was noted, both in transmitting and receiving. Other stations worked by WS8RY included W8XX, Saratina, WS8MCW, Batavia, WS8MBK, Rice Hill and WS8OS. Warren Township had several contacts logged: WS8QF BS8M, EX8 CD8 OK8 NRC MLQ Q8S IOW CMW GKE DBS W2PNA and VE3ADO. WS8GU, who operated near Erie, Pa., using a c.c. transmitter with an input of one watt, made the record contact of the day—with VE3ADO.

"On Saturday evening, January 9, 1937, a drenching rain began to fall, freezing as it struck. By the following morning all Tyler (Texas) was a mass of ice, with all communication lines down and no electric power except for a small auxiliary plant at the power company's sub-station. Wires and trees were down all over the town. My antenna saged low under the strain of a two-inch diameter of ice on a Nobember 12 wire! Fortunately Mr. H. Knapp was marooned in the city with his R.C.A. magic show coach, which carried a 3 kw., 110-volt a.c. power plant, he cooperated unhesitatingly and we were on the air: 1.75-Mc., 'phone, input 500 watts. A fairly large number of messages was handled, mostly to Dallas and Houston, with stations KAGU, WS8KV, WS8VAH, WS8OL, WS8DE, WS8FQ and WS8GU cooperating. Messages were handled for two days until Western Union put a wire through. Communications were handled for W.U., Postal Telegraph, Texas Power and Light Co., Southwestern Bell Telephone Co., Tyler Morning Telegraph and Courier Times and a few individuals."—J. M. Burke, Jr., WS8EME

W6FBW would like to see a skeleton trunk or "owl net" formed connecting the east and the west through the summer months. A route made up of several reliable stations is needed to carry east-bound traffic from the Central California Net which operates the year-round. Interested operators please get in touch with W6FBW, stating frequency and time available.

W9XAZ

The Milwaukee Radio Amateurs Club, Inc., is again broadcasting an amateur program over the Milwaukee Journal station W9XAZ on a new frequency of 26,400 kcs. The program goes on the air every Saturday from 3:00 to 4:00 P.M. C.S.T. Reports and comments are solicited and should be addressed to the Milwaukee Journal Radio Station, W9XAZ, Milwaukee, Wis.

July, 1937

37
Making the Most of QSO's

By Jack Burgess, VK3UW*

The more one puts into a QSO, the more one gets from it in return. The full benefit and enjoyment of a contact with another ham station cannot be obtained in one of those frantic three minute hook-ups, which are, unfortunately, so common.

Perhaps a little parable will help illustrate the point. Scene is a starry evening in southern Australia. A certain VK3 has managed to elude the YL and finds he has a free evening. Naturally it is not long before the bug bites and he pounds the air with another QSO. VK3 has managed to elude the YL and finds he has a free evening. Naturally it is not long before the bug bites and he pounds the air with another QSO.

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W6KFC Leads April O.R.S. Party

In spite of generally adverse conditions due to severe magnetic storms, with practically all signals sounding "hollow" and lacking in "fullness," and with one period of complete "fade-out," many good scores were made in the West Coast O.R.S. get-together, April 24th-25th.

For the first time in a contest, we present the list of high O.R.S. Party scores made by W6KFC with 41,724 points. In second place, W4NC with 35,825 and third time, old-time O.R.S. party-ite 9A9UH places third. It was a "large" party ... 16 scores over 20,000; 40 over 10,000! The figures below will give the complete story of the party.

The next party comes on July 24th-25th. All O.R.S. appointees should plan to take advantage of the opportunities to give the station a real work-out...

The Official Relay Station appointment is primarily a traffic assignment, for amateurs interested in regular traffic work, schedules, etc. Opportunity is given all O.R.S. appointees to test station performance during quarterly QSO work. The pleasure derived from these get-togethers can be fully appreciated only by participation. If sincerely interested in traffic handling, take steps now to obtain O.R.S. appointment! Drop a line to A.R.R.L. Headquarters or e-eomplete details on how to become O.R.S. Act now and get ready for the big fall/winter season ahead.

Did you say "rag chew"? Here’s one lasting for over 5 hours! On May 9th W4DUU/4 of Greenville, Ala., QSO’d W4DMQ, Chrichton, Ala., from 6:45 a.m. until 12:10 a.m. (May 10th)—a solid 5 hours, 35 minutes of rag chewing.

"Our Alisam Trail" 160-meter 'phone traffic net is still going FB on 10 kHz. daily at 7:00 P.M. This is the membership list: W6MYL, NOG BF OAD KH6E NOE MVA KKL HZV NAL OJE JRU JUQ LMF OEC NVR OND HHE FIS MPM NFT MUN."

Correction

On page 23 of the May issue of QST, in an article by F.E. Handy entitled "DX Competition Policy," a footnote statement is made that among the scores of disqualified calls listed prominently in August '28, August '29 and August '31 issues of QST in the official report of previous events, was the call of W2BYP. The italicized "aud" should have read "or." Our attention is called to the fact that W2BYP was not disqualified in '28 or '29, and that he was disqualified in 1931 upon the report of a single observer.

This station was disqualified in the 1937 competition on the basis of three off-frequency reports. We are pleased to make this correction.

Speaking of DX Competitions, our footnote above referred to had as its purpose emphasis of the fact that the policy of disqualification for off-frequency work in A.R.R.L. activities is a continuing one. Plans for the 10th International DX Competition involve P.C.C. monitoring cooperation for off-frequency operation and improperly-filtered or broad signals.

July, 1937
How's DX?

How:

"Come now a brief discussion of call-bootlegging and "phonies." Without delving into the ethics of the thing, and considering it only from a DX standpoint, there is little or no objection to this type of operation as long as all amateur radio is not jeopardized by the bootlegger operating in a manner that draws attention to his illegality, such as by interfering with commercials outside the bands. To a DX'er, contacts with these stations represents legitimate DX, and that's good enough. But the donkeys that get in our hair are the poor misguided souls who think it's awfully funny to loosen the coupling to their antenna and sign a nice juicy DX call when they have an assigned call of their own. They probably take great delight in listening across the band and hearing stations hopefully calling. But then they probably took delight in the reaction of the girl who sat in front of them in school the time they dipped her curls in the inkwell, to which we say, "If you can't have fun with wireless without going phony, ham radio isn't the hobby you want."

So, some of this would have been mentioned if we hadn't spent an hour calling DX4U and NT2ZU . . . .

Where:

From various sources, including VE3DA, W4MR and W1TS, we learn of a station in a country you'd like to get. KF7X (14,330 kc., T7) gives his QRA as Paul Bechheveroy, Bolte Postal 61, St. Pierre de Miquelon, and asks for his QSL's under cover. The only dubious thing about it is that St. Pierre and Miquelon are two separate islands, so we don't quite understand that QRA. And the official prefix is CNICR, THE ACTIVE STATION OF CAV. CRISTIANI CARLO IN TANGIER

Using an MOPA with two 6L6's, 30 watts is run to the amplifier on 7 and 14 Mc. The receiver is a TRF affair. Both phone and c.w. are used, and CNICR is active almost every day from 2200 to 2400 TMG and Sundays during 0600-0800 TMG.

FP8. But maybe we'll see his QSL card one of these days . . . . From W2GTZ and W8OUK we bring a gleam of hope for those who are still patiently hoping that the Asian card from OS1HR (14,440 kc., T7) will show up. The story is that OS1HR is prospecting for oil in Heiaz, has about 300 QSL's already made out but no opportunity to mail them yet, and that the "Sultan" address he gave before was correct but apparently something went wrong. The operator is an ex-W5 . . . . W8OJA (ex-W2DEU) sneaked one over on the boys when he worked SMSVQ (7130 kc., T7) the other morning. The station was that of the Swedish East Asiatic Film Expedition (reported in the May issue as using SMSVQ) located near Canton, China, at the time . . . . Our British friends certainly got the break. For example, we learn from W8DAQ that G2YY snagged a honey in the form of T2AB (14,030 kc., T5), and another signing FNIC (14,070 kc., T9x), which should be in French India . . . . On this side of the water, W3DAL, W4MB, and W4ZHI pulled ST2BM (or is it ST2BM?) out of a tall silk hat around 14,335 kc. Another "unknown," X0H1T is the Finnish training ship Suomen Jouten, according to W2HCE. They use 50 watts of c.e. on 7 and 14 Mc, and you can send your card to X0H1T, care of Lieut. Colonel P. Pertamo, Chief of Laboratory, Finnish Meteorological Institute, Sahallihaborcio, Helsinki-Linnanki, 16, Finland . . . . W3GAU reports working a station signing E12A on April 27th, but he was so loud, and the other E12A is horsey, that we think it was a phoney . . . . Incidentally, W2OFP kept a sked with E12M three times a week. Larry passes along the QRA of FY8A (14,370 kc., T9) as Box 62, Cayenne, French Guiana . . . . If you work FEXL (14,280 kc., T9), like W9JKW did, don't think he's a phoney because he works out of a tall silk hat around 14,335 kc., but Clipperton Island, where he may be a phony, but Clipperton Island shows up on the map about a thousand miles northwest of Rapa Nui (Easter Island to those of us who buy balcony seats) . . . . G2YY and W2HCE report EA2B (14,035 T9x) as EA2ST . . . . FZ1AB tells us that the Surinam government is opposed to amateur radio, so if you haven't already worked a FZ you soon may find it hard to score up that country . . . . Although W2GTZ had his card returned to him marked "unknown," W9ERV received a fine acknowledgment from OX3M. The OX station, which had been located at Foreland, Greenland, is no longer in existence, the operator having returned to Denmark . . . . W3GAU didn't do so badly when he worked V6EB (14,380 kc., T8), since the VE5 is located at Resolution Island, Baffin Land. You can QSL via GCS, N. B. McLean, Dept. of Marine, Quebec, P. Q. I won't pay to be impatient, though. The mail is delivered once a year!

When:

For a few days this month we thought that the prediction we had been making about a trans-Atlantic 56-Mc. QSO becoming a reality had come true. We had reports that a W1 and a GB had worked two-way, but we haven't been able to confirm it yet. In the meantime, the boys are down there still kicking away. XU8ZW, whom you have probably worked on 40, is on 5 meters daily at 13 GMT, sending test signals, and W6MEX advises that W6GEI is on daily with 250 watts of c.e. and an "F" type antenna beamed through the northeast. He has been heard in Maine . . . . Ten meters has been acting up, and it has been known to stay open until as late as 2 a.m., according to VE6GW in New Mexico. W4ZHI has been working VR, ZL, LU, PY, ZE, and EZ on ten, but says that no Europeans have been coming through . . . . W6KUR reports a QSO with H6B1J (14,090 kc.), and rates it as easier DX than ZL1AKB. W2HCE gives a few phone frequencies: SP1HI (14,120 kc.), FK4AG (14,375 kc.), HR2A (14,385 kc.), and Q5AA (14,140 kc.) . . . . If it's Asia you need, W6LIF suggests JS5F (14,045 kc., T9) and JSFP (14,125 kc., T9), W2GTZ gives us XU8 10JN (14,090 kc., T7); W9TSV worked XU8H (14,020 kc., T8), VSIAI (14,030 kc., T7), VSIAN (14,270 kc., T9), and JS8CF (14,360 kc., T9x), W9TSV tells W4ZHI in Turkey, but is inclined to think he's a phoney . . . . PK4RO (14,140 kc., T9x) says he is the only Sumatra station on 20 . . . . XTF50 (14,100 kc., T9), worked by W6CIS, was a ship west of Iceland. T2F2Z (14,380 kc., T8) worked by W6ZER is located at Akureyri, Iceland . . . . W2OFP got a rare one when he worked K0A, short time ago. The U0's are way over in Asia . . . . Don't be surprised because YR5AA has a d.c. note now. Jim Lamb is over there for the C.C.I.R. meeting and has probably been visiting ham stations on the side.

40 QST for
N.C.R. Goes to Court
By F. O. Archer

UNIT FOUR, Section Two, Astoria, Oregon, Division of the United States Naval Communication Reserve can be numbered among the many other units of this kind throughout the country that are ready to spring into action at a moment's notice, be the cause flood, fire, or disaster.

Perhaps no other unit was launched under happier circumstances than this one. Feeling the need in the Lower Columbia River region of a swift, sure means of emergency communications to replace regular communication channels in time of disaster, the Clatsop County Court, shoulder to shoulder with virtually every public-spirited organization and individual of Astoria, Oregon, has assured itself of a never-failing means of radio contact, and as a result the Navy has established a Clatsop County Court Unit which bids fair to being one of the finest of the country.

Communication Headquarters was established in the County Recreational Center, Astoria, Oregon. An operating room, office, and a schoolroom containing blackboard and a training table fitted with code practice oscillator and ten operating positions are provided. Space requirements do not permit a full technical description of the portable transmitter-receiver circuits with their associated power supply. Interested readers may gain some insight from the following general specifications: The transmitter uses an 807 crystal or m.o.p.a. with crystal switching arrangement. Parallel 807's, 500 watt, are used in the amplifier, 'phone or c.w. High level modulation is employed with Class A B 6L6's. The unit operates from light socket, or from portable 300-watt gas engine-driven generator. The receiver is a standard super-het with one iron core i.f. stage, a m.o.p.a. to feeding six-inch dynamic speaker or headphones. All units are self-contained in handsome, crackle-finish, carrying case including antenna, antenna rod, key, and hand microphone.

Following the public-spirited example set by Clatsop County, the County Courts of Tillamook, Coos and Lane Counties, Oregon, are now engaged in the preliminary stages of setting up similar N.C.R. units. Information in greater detail, concerning either the apparatus described or the method of procedure in organizing a County-sponsored unit of this nature will be cheerfully supplied by the writer.

U. S. Naval Radio Traffic Station, Astoria, Ore.

Call Bootlegging

The use of another man's identity, or call signal in amateur radio, is one of those things that simply is beyond amateur tolerance. We are glad to say that practically every case where the club * is on its toes, has worked out a system for running down, warning, and reporting the unlicensed and unqualified operator who is trying to pretend he is a ham, and make use of our ham bands to feeding six-inch dynamic speaker or headphones. All units are self-contained in handsome, crackle-finish, carrying case including antenna, antenna rod, key, and hand microphone.

* A.R.R.L. will gladly send a sample affiliated club bulletin to any club requesting information on the system adopted by some of the leading clubs for control of unlicensed operation in their localities.

July, 1937
28-Mc. Conditions in Argentina (Via W9ADN and L77AZ)

Since 28-Mc. activity is at such a low ebb at this time in this country, a report from the Southern Hemisphere may present a different picture than reports from this Hemisphere alone. L77AZ reports: "During April only signals from North America were heard. U.S.A. signals were good but not as good as during February and March. No signals were heard from Asia, Africa, Europe, New Zealand or Australia. ST reports came from Europe. Does this mean that only one way propagation was taking place?" "During May the band was open for the U.S.A. only certain days—from the first to the tenth of May, nothing heard—from the tenth to the twentieth of May, generally open but somewhat uncertain. From the twentieth to the thirty-eighth days were conditions were: one day FB, the next day poor, and the band open only from 5 P.M. to 6:30 P.M. LU time. During May Europe seems FB, coming in again—no VK, ZL, KE, no Africans, no Asians, but heard JNJ harmonic about 29 every night."

On April 28th the Southeast Radio Experimental Association asked by W6GXM, S.C.M., Los Angeles Section, if it could furnish at least three transmitters and receivers working on 56 Mc. to assist in conveying orders to the various patrol boats and land stations engaged in conducting the Annual Inboard Races under the auspices of the Los Angeles Speedboat Association at Newport Bay, California. The Association did a splendid job with less than a week's notice. Much credit for the excellent service rendered is due Andy Abraham, W6MQS, O.R.S./O.P.S., for his work in quickly organizing the network which handled this event. Due to Andy's efforts, seven transmitters and receivers were procured. W6IGO operated his transmitter at the judges' stand. W6MQS, W6HDY, W6LAK and W6EJZ operated portable-marine, receiving many messages and clearing the sources of small craft and debris. W6NAT operated portable-marine in a runabout equipped with fire-extinguishing equipment. W6HEW operated portable-marine in a car at the pits where boats were frequently serviced. A total of approximately 200 messages were handled to and from the boats and land stations. The network functioned from 10:30 A.M. to 3:30 P.M. on May 2d.

In line with W1INB's suggestion (June QST) that we sign the abbreviation for our state after our call letters when signing off, W5CIFZ comes forward to point out that Arkansas hams have done this for years—just listen in, he suggests, and you'll hear "AR K" at the end of most of their transmissions! Hi! And we're reminded of the dilemma of Virginia hams in using the abbreviation for their state—VA. Many changed to VR to avoid confusion with the final sign-off signal V."

O. B. S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 122): W1AW, W2JCC, W2JHB, W5FPM, W3GCP, W5DRB, W5EFP, W5FLU, W5FJS, W6JIM, W7EYD, W8PAB, W8PQQ, W8FWU, W9FZU.

QFS

"I have often been my experience after calling CQ to hear several stations reply. How to 'hook' them all has been a problem because as soon as I would call one, the others generally think that they have missed and begin to hunt for some other possible contact. I offer the following as a possible solution, in the hope that it may be the means of fostering more frequent multiple QSO's with their resultant good-fellowship:"

"Assume that W3QP calls CQ in the usual way, and hears three other stations answering: W3QP will come back with 'QSO QSO QSO (dash) W2CC W2CC (commas) W1M' and W1M (comma) W6UT W6UT (commas) W3QP W3QP (dash) W2CC 7130 kcs W1M 7130 kcs W6UT 7220 kcs (dash) QA W2CC others pls QRM for him K.'"

"The use of the QFS seems important to me as a sure way to attract the attention of the second and third stations only to the fact that a multiple QSO is in the making. QFS is suggested from the initial letters of 'Following Stations please QRM for multiple QSO, getting you all OK.' It is needless to point out that the ratio of QRM to Number of Stations working in a manner similar to that of stations per each multiple QSO increases: two stations, 1:2; three stations 1:3, and four stations, 1:4, etc." —W5OV

There are over 400 licensed amateurs in Seattle, Wash., and its environs. Among all amateurs in and around Seattle, while it's a bit "tough" on the club secretary (hi), it's a very commendable practice.

The Seattle Club has a special red-colored membership card. Around the edge are printed the months of the year, where notations are made as each month's dues are paid. This helps in keeping the dues up to date. The club now has new headquarters in the Seattle Chamber of Commerce, and meets the first and third Tuesdays of each month. The Amateur Radio Club of Seattle was first to instigate the idea of a radio "Field Day," and from that beginning the International and National Field Days developed.

56-Mc. Busy Schedule

During a drive in the Spokane (Wash.) Recruiting District, the fact that recruits were desired for the U.S. Army Air Corps was noted by Lt. E. B. O'Connell, Air Corps Reserves, Kalispell, Mont., who knew of a young man who was anxious to get into the Air Corps. Knowing that the vacancies were few and that recruiting was to stop within a very short time, Lt. O'Connell, a radio amateur himself, turned to ham radio to contact the Recruiting Officer in Spokane. He visited W7BW, Kalispell, and asked his cooperation in contacting Spokane. W7BW made contact on phone with W7FPT, Spokane. It happened that at the time the message to Major Chaddock, Recruiting Officer, was being sent by W7BW, W7FPT, owned and operated by Major Chaddock, opened up with a CQ, W7FIT called W7FPT, told him about the message coming from W7BW, W7FPT tuned to W7BW, established contact, and a two-way conversation between Lt. O'Connell and Major Chaddock made it possible for several questions to be answered, resulting in the enlistment of the Kalispell recruit.

56 Mc.

A method of standardizing transmitting and listening schedules for DX on 56 Mc. is suggested by W9FM: As far as possible, every one without a transmitter listen during the first five minutes of each hour. Those with transmitters, send for any two of the five minutes, listening the other..."
Station Activities

VANALTA DIVISION

ALBERTA—SCM, Alfred D. Kettensbach, VE4LX—4V will operate portable at summer cottage. BW is celebrating arrival of Junior op. Congratulatins, Ted. CX is on 3.9-Mc. phone with new rig. EA continues to fine-tune from FR. FR is busy with new 14-Mc. rig. HJ, MR, XP and ADW are heard on 7 Mc. consistently. VJ has directional array for 14 Mc. ZP will operate a VE9 at Cooking Lake this summer. ADW streams new skywire. AGZ is new Edmonton station. KK of Grade Prairie has worked all "W" districts on 1.75 Mc. 'phone. ZW sports a 35-watt carrier on 1.75 Mc. AFS, with his Irish brogue, is heard on 1.75-Mc. 'phone. The Northern Alberta Radio Club gets good turn-out at meetings.

Traffic: VE4EJ 28 LQ 12 AFT 9 QR 7 WX 1

BRITISH COLUMBIA—SCM, R. Vaughan-Smith, VE3EP—The B.C.A.R.A. staged a QSO Contest which was well enjoyed by all who participated. EN captured the first prize of a T20. HJ snagged the second of a Billey crystal and EH a transmitting dial. The V.S.W.C. has fulfilled its building demolishing contract and is hard at work on new clubhouse. FG still spends 75 per cent of his time handling traffic. R.K., our carrier, is on every day except Sunday from 1 to 2 P.M. OK took a trip on the Anooyh. UL visited Vancouver. Rumors are rife regarding JD and BQ assuming added responsibilities. AX took a trip to Seattle to visit friends and immediately lost his head and immediately sent cable telling them that he had already left for Durban! But Ted was only warming up for the work there. The amateurs responsible for this work were W9ADJ, W9TOP and Gerald Lee.

Amateur radio made possible the accurate timing of contesters in the 1936 Soap-Box Derby held at Rapid City, S. Dak. The Derby was held outside the city limits where no telephones or other forms of communication were available. Due to curves and hills on the track, the starter was unable to see all the cars at the winning line. The local amateurs took the situation in hand and, by use of 50-mc. transceivers, two-way communication was made available. The amateurs responsible for this work were W9ADJ, W9TOP and Gerald Lee.

A.R.L. Headquarters Operators

Hal Bubb, "Hal," Chief Opr. WIAW

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

WIAW, J. J. Lamb, "Jim"

WIAW, A.R.L. Headquarters Operators Club

WIAW, A. R. B. Beaudin, "jack"

WIBD, P. E. Hanby, "perry"

WICB, C. B. DeSoto, "roc" WIDF, George Grimmer, "gr"

WIEH, K. B. Warner, "ken"

WIES, A. A. Hebert, "dick"

WIGS, P. C. Beeley, "beek"

WILJJ, Thomas W. York, "tom"

WILEQ, Vernon Chambers, "vee"

WILFN, A. L. Budlong, "bud"

WILPE, Byron Lawson, "lg"

WILT, Hal Bubb, "hal"

WITS, C. C. Rodimon, "rod"

WITS, Don Mix, "don"

WIUE, E. L. Battey, "ev"

Three if additional times are desired, make the five minutes following the half hour of next importance, and the five minutes after each fifteen minutes, of least importance, relatively, using the same general system as for the first five minutes of each hour.

John Huotson, W9KJY, and H. Reles, W9ERS, tied for second place in the Amateur Code Speed Contest held at the Chicago Convention, September 6, 1936. He set an official rating of 46 words per minute. W. C. Cross, W8SKM, came in third with 43.4 W. m., followed by WOHUM 37.4, W9DZJX 37, W9MKX 33.5, W8SSS 33. All these men used "mills" with the exception of W8SSS, who copied with a "stick." The excellent record of W9ERU in winning first place with 52.2 W. m. is indeed something to shoot at!

"I think Ted Cook, ZT6AQ, should get some credit for about as fine a bit of QSP as ever took place—Van of ZUlT should also get his share. It started with a young lady in distress here needing some dope from her father in South Africa in a big hurry. He was supposed to be in Capetown up because he shot another wire to Durban, supplementing should also get his share. It started with a young lady in distress here needing some dope from her father in South Africa in a big hurry. He was supposed to be in Capetown up because he shot another wire to Durban, supplementing it with an air mail letter explaining the predicament of the YL. The OM got it all and wired back, but misunderstood the questions the first time and Ted had to write again—after which all was straight and the YL got her dope. All this took four days, but the point is that the YL had cubed her dad several days before she came to amateur radio for help, yet said cable finally reached him after he had all the dope via ZT6AQ! It is stuff like that, that makes a fellow think...
The Publishers of QST assume no responsibility for statements made herein by correspondents.

"Constructive Criticism"

Springfield, Ohio

Editor, QST:

May you be congratulated on the commendable attitude and intestinal fortitude shown in the last issue (May) of QST in verballyspanking those of us who, in not playing the game in all fairness by operating outside the amateur bands as well as the law, bring into disrepute not just one or two unthoughtfuls but the group as a whole.

To many of our minds this seems to be a step in the right direction, and is one of the nicest pieces of constructive criticism I have seen in QST for a number of years. It usually smacks of the destructive with the continual harpooning of the Kilowatt, the Fleapower, the Fifty-word-perminute man, the Lid, and, mostly, QST. Let us skip all that and play it as a game, enjoy it as a hobby, forget those petty jealousies. Life is all too short as it is with our allotted three score years and ten without wasting half of it arguing over several schools of thought. It was here before a lot of you were in it and it is going to be here when you’re making a feast for the worms.

—Richard C. Littler, WSJRG

Contests and Courage

415 North 5th St., Minneapolis, Minn.

Editor, QST:

Please accept a metaphorical pat on the back for your stand in regard to disqualification of certain stations in the last DX Contest.

In these times when such sorry efforts have been made to keep the laws, and when everyone is taught that he can play the game without regard for its rules, it is indeed gratifying to find that the A.R.R.L., the governing body of us amateurs, has the courage to continue to stand for the American way.

It probably took a lot of conferring and arguing to decide to do what you did. I admire your guts, and certainly any fair-minded amateur should do the same. You will no doubt receive complaints from a few whiners, but don’t let them influence you.

May our League continue in its strength.

—L. A. Morrow, W9VKF

More on Flea Power

208 Vliet St., Kewaunee, Wis.

Editor, QST:

The boys who are after flea-power allocations on any of the bands are, I believe, barking up the wrong tree. It’s a nice thing to wish for, but the idea is too radical and would entail too much policing of the bands to be workable. There always will be some fellows doing a bit of chiseling, and at a distance of 1000 or 500 miles you’d have to do some tall figuring to know whether a station was using more than 25 watts or had a very efficient rig and antenna.

The best way out of the kilowatt QRM problem, I believe, is W3EEW’s plan of a WAC certificate for low power. And that, too, would let somebody in for a lot of checking up.

Couldn’t we just make a game out of this low-power idea and from time to time print lists of DX worked with small rigs? If I had a kw. I’d be surprised every time I called a DX station and didn’t raise him. But all I have is a 6L6 crystal oscillator and it gives me a tremendous thrill to work a KA or similar DX.

Forty-meter crystals are cheap, and by choosing several good spots in doubling to 14 Mc., you can chase DX around in fine style and select a clear channel at will. To me that plan is a lot more fun than setting a kw. at the edge of the band and blasting away like a space gun; or setting a flea-power rig on one frequency and then complaining about the QRM spoiling your DX.

... But, whatever we do, let’s not rag the high-power boys about being unfair. They’re certainly entitled to a kw. if they can finance it. Rather than trying to chase them off of some parts of the bands, let’s give ‘em the old run-around by showing ‘em that we can work choice DX right under their noses.

To this ham it looks as though the QRM problem isn’t caused by any one group. The QRM that leaves me tearing my hair is when one of those idiots who hasn’t the smallest spark of decency holds his key down for long stretches while tuning his rig. And while QST is about printing the calls of the stations that cheated during the recent DX contest, why not police the bands a bit and print the calls of those stations who cause such needless and irritable QRM.

That would be doing something.

—C. F. Temby, W91OV

(Continued on page 46)
Usually on this page we have told about new developments only when they were pretty well worked out, but for once we are going to use this space just to start something. The rough outline of a rather unusual multi-frequency crystal-controlled exciter is given below. For one reason and another we do not feel justified in taking on the development of the unit ourselves at this time. But it does seem like a pretty good idea, and it is the sort of thing that the amateur can develop to perfection, so we are passing it on.

Basically the idea consists of using two separate crystal-controlled oscillators at the same time. Their outputs are added and fed through a detector. The sum-frequency component is then picked up and passed on to the buffer or doubler.

This arrangement has a number of advantages. For example, if an X-cut crystal ground to 5.54 MC is used in one oscillator, and a Y-cut crystal ground to 8.50 MC in the other, the sum-frequency component will be 14.04 MC, which is just inside the twenty meter band. Since these two types of crystal have temperature coefficients of opposite sign, the combination can be made to have zero drift if the crystals are carefully matched. Theoretically it can, anyway. However, even taking crystals at random the drift of the combination will probably be as low as that of an A-cut crystal.

By using more than one pair of crystals, a large number of frequencies become available. Thus, suppose that two X-cut crystals ground to 5.58 MC and 5.62 MC and two Y-cut crystals ground to 8.62 MC and 8.74 MC are added to the pair above. The six crystals will then give nine frequencies spaced 40 KC apart, covering the twenty meter band. Similarly, a total of ten crystals would give twenty-five frequencies.

As a matter of fact, there are actually many more different frequencies than this present. In addition to the fundamental and harmonic frequencies of the single crystals, there are the difference-frequencies of the pairs, which also have harmonics. These many spurious frequencies probably present the greatest problem that will have to be met in the design of the unit. With the particular crystal frequencies given above, the fifth harmonics of the difference-frequencies will fall in the range between 14.4 and 16 MC, which is bad as it is just outside the twenty meter band. However, being fifth harmonics, they should not be strong enough to give much trouble. None of the other spurious frequencies are nearer than 2.4 MC.

The power output available will undoubtedly depend a great deal upon the method used to combine the oscillator outputs. If the two outputs are merely mixed, the resulting signal is not likely to be very powerful. But if the two frequencies are really added (as by using two pick-up coils in series) the net output should be very nearly the sum of the outputs of the two individual oscillators. This can be fed directly into the grids of a Class C amplifier, of course, since the latter will supply the necessary detector action.

James Millen
Grand Island QSLs

QSL and SWL cards—except those issued by the Government for violation of the rules and regulations of the F. C. C.—are filtering the power supplies of from hum. Use Malloy HD (Heavy Duty) or Malloy HS (High Surge) Condensers for (Heavy Duty) or Malloy HS (High Surge) Condensers for where hum usually starts.

Available in both carton and aluminum can types as follows:

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Recommended for use where the momentary surge voltage does not exceed 555:

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Malloy HS (High Surge) Condensers have been successfully used in power packs with momentary surges as high as 800 volts.

See these new condensers at your nearest Mallory-Yaxley Distributor’s.

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

Correspondence Department

Editor, QST:

... I suggest that the A.R.R.L. petition the F.C.C., for permission for amateur stations using 50 watts input or less to employ smooth R.A.C. notes.

I believe that such a practice would lessen the interference within our bands because of the property of the ear to separate sounds of different pitch even though they be on the same radio-frequency. Also most interference from low-powered stations comes, not from broad waves, but from key clicks caused by breaking the high voltage, and with R.A.C. permissible these stations could use primary keying without "tails."...

---Geo. Ders, W6ITG

Editor, QST:

A swell idea, this flea-power section in our bands, but I don’t believe it is quite practical—even from a legal standpoint.

However, if a week could be run off as "Flea-Power Week," and limit power input to 25 watts one week, later cut it to 20 watts, then in a few more months to 15—when we’re down to 5 watts we’ll be doing something.

One of us using under 23 watts (or whatever the figure is) could call "CQ FP" and expect no calls from stations using over the power limit for that week.

Without any special effort I have accomplished the following miles per possible watt output:

<table>
<thead>
<tr>
<th>Band</th>
<th>Phone</th>
<th>C.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>70 mi.</td>
<td>1250 mi.</td>
</tr>
<tr>
<td>10</td>
<td>400 mi.</td>
<td>250 mi.</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>50 mi.</td>
</tr>
<tr>
<td>80</td>
<td>80</td>
<td>25 mi.</td>
</tr>
</tbody>
</table>

Hundreds have done much better than this—thousands haven’t tried it! I’ve worked several stations whose signal report was about the same as mine—and started bringing in the fact that I was using low power, only to be dug with something like this “... FB OB but ur still using three times mi 2 watts...”!

With low power we’ll learn how to call and break in, how to get efficiency, why we should use the same antenna to send and receive—and how to reduce QR and BCL trouble. ...

---Georg A. Bonadio, WSO,MM

Editor, QST:

... All of us little fellows would have a kw. rig if we could afford it. But if everyone had a kw. conditions would be a lot worse for everyone than they are now. I wonder if these fellows with high-power, who say they went to high-power just to overcome the QRM, ever happened to think that the QRM that they are overcoming is about a dozen "little fellows" who enjoy a good QSO just as well as anyone, but just have to pull the switch and go to bed when a kw. rig lands on or near theirs. ...

---Carlos Vali, Jr., W9MUR

Royal Canadian Mounted Police

"E" Division, Vancouver, B. C., Canada

Editor, QST:

... Concerning the range of the low-power station, I have had very good success with as low power as 5 watts into a 45 TNT, even in the evening hours, working as far east as Minnesota on 80 meters. Also I really believe a person does get a lot more thrill out of working these distances on low power.

Again, considering the efficiency and stability of a rig working away below its rating, there would be a lot better quality signals on the air.

---W. E. Marshall, VE9PZ
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Say You Saw It in QST — It Identifies You and Helps QST
No. 44, Belgium:
“Suppress the so-called sharing of the band of 1715 to 2000 kc. with amateurs. Reasons: Imperative necessity of protecting the fixed and mobile services, notably the maritime mobile A-3 service; experience shows that amateurs possess over-abundant bands for their communications for short as well as for long distances.”

Re Shortwave Broadcasting:
Several administrations point out the need for increasing the allocations given shortwave broadcasting, but without suggesting any specific figures. U.I.R. proposes widening their present bands, without affecting us.

No. 83, Japan:
Replace the language of the first paragraph of Section 5 of Article 8, now providing that the power of amateur stations may be fixed by each administration, with the following language: “The maximum power that private experimental stations may use shall be fixed by the interested administrations, taking account of the technical qualifications of the operators and the conditions under which the said stations must work. As to amateur stations, this power shall not exceed 50 watts measured at the input to the antenna.” “Reasons: To reduce interference.”

No. 191, Hungary:
Add the following text to the provision in Article 14 that each country notifies the bureau of the Union of the calls assigned to its stations: “This notification does not apply to calls assigned to private experimental stations, amateur stations and private radio communication stations.” As an argument it is stated that these data are not used by the bureau and do not occur in any of its publications, since the regulations contain no provision to that effect.

Nos. 885, 928, 109 and 488, Netherlands Indies:
The Netherlands Indies proposes the abandonment of CQ calls not followed by a K as a means for sending broadcasts, and the readoption of the old symbol QST for that purpose.

No. 848, Finland, Norway, Sweden:
In Article 19, on the employment of waves in the mobile service, add the following new paragraph: “The wave of 1850 kc. is the international calling wave to be employed by the mobile radiotelephony service in the band 1500-3005 kc. It may only be used for calling and replying, for distress traffic and for signals and messages of urgency and of security.” See previous proposal above by these countries.

No. 848, Iceland:
A similar addition: “The wave of 1850 kc. is the international calling wave to be employed for the mobile radiotelephony service in the bands authorized between 1500 and 4280 kc. It may only be used for calling and replying, for distress traffic and for signals and messages of urgency and of security.” See previous proposal by Iceland.

No. 868, Finland, Norway, Sweden:
Another proposal for a new paragraph to go into Article 19, again making mention of “authorized wave bands between 1500 and 3005 kc.”

No. 869, Iceland:
Ditto, except making mention of “authorized bands between 1500 and 4280 kc.” See above.

No. 870, Great Britain:
In Article 20, Section 6, paragraph 2, providing that any station making emissions for tests, adjustments or experimental work must transmit its call at frequent intervals in the course of its emissions, introduce after the word “transmit” the words “at as slow a speed as possible.” “Reasons: For more easily identifying an interfering station.”

No. 357a, Germany:
In Article 20, providing for the low-power mobile radiotelephony service, replace the indication 1530 to 2000 kc. by 1530 to 3150 kc. “Reason: The service of mobile sta-
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ions of this category has been operating some years on the band 1350-3515 kc. It exists by virtue of the special ar-
rangements concluded between the European adminis-
trations. (Regional arrangement for radiotelephone service in the North Sea, Lisbon 1934, and regional agreement for radiotelephone service in the Baltic Sea, Stockholm 1938.) The widening results from the increase in the radiotelephone traffic in the mobile service.

No. 358, Belgium:
Belgium, without specifying figures, calls for widening to correspond to the regional arrangements of the North and Baltic Seas.

No. 359, Finland, Norway, Sweden:
Modify the figures in Article 29 to read "within the band 1560-3605 kc."

No. 360, Iceland:
Modify the figures in Article 29 to read "within the authorized bands between 1500 and 4290 kc."

Nos. 361, 362, 363, 364 and 365:
Here occur further reference to minor modifications of Article 29 in which the same editing of the language is proposed, Finland, Norway and Sweden referring to the single band 1500-3805; Belgium citing no figures; Iceland referring to authorized bands between 1500 and 4290 kc.

No. 358, Italy:
Italy proposes a complete new draft for Article 31, controlling the formation and operation of the C.C.I.R. Her draft omits all mention of the admission and participation of international organizations such as the I.A.R.U., of which five are presently admitted. The old language, now omitted, was: "There are also admitted international organizations interested in radio-electric studies which have been designated by the previous plenipotentiary or administrative conference, and which engage themselves to contribute to the cost of the meetings as indicated in the preceding paragraph." The old language also provided that, in principle, the meetings of the C.C.I.R. would be held every five years; Italy proposes that this now be changed to every three years, according to recent practice.

"Limit to 100 kc. the width of the band now 3500 to 400 kc., i.e. 50 kc., in which amateurs may transmit. Reasons: Very great need of the public service; progress in stabilisation technique which easily permits the reduction of the band used by amateurs. In Belgium amateurs are only authorized to use a band of 70 kc. (including tolerances) and this situation constitutes no hardship for them."

"In the band of 14,000 to 14,400 kc., i.e. 400 kc., exclusively reserved in the Madrid table for amateurs, reduce the amateur band to 200 kc. Reasons: Shortage of frequencies for official services; technical progress in the stabilisation of amateur transmitters which easily permits reducing this band without inconvenience."

No. 40, Canada:
In partitioning the ultra-high frequencies between 30 and 100 megacycles, Canada proposes that the assignment 50-60 Mc., now joint to amateurs and experiments, be changed to read exclusively amateurs.

No. 49, Finland, Norway, Sweden:
"Modify as follows the assignment of frequencies: The bands of frequencies 1500-2785 kc., 2910-2900 kc. and 3900-3600 kc. shall be assigned to the mobile service and A-2 and A-3. The frequency of 1650 kc., with a guard band 1630-1670 kc., shall be reserved, as a calling wave and a distress wave, to radiotelephone service with ship stations and airplanes. The bands of frequencies 1550-1560 kc. and 2900-2930 kc. shall be assigned to radio beacons. The bands of frequencies 2785-2810 kc. and 3505-3635 kc. shall be allocated to airplanes."

No. 49, France:
France refers to the 1.75-Mc. amateur band which in the European regime is assigned in two parts: 1715-1925 kc. to amateurs, fixed and mobile; 1925-2000 kc. to amateurs and maritime mobile telephony only. France now proposes the "provision within this band of the following new as-

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No. 50, Great Britain:

The administration of Great Britain is of the view that an enlargement of some of the frequency bands between 6000 and 21,650 kc. now assigned to broadcasting ought to be made. She suggests in passing that an additional assignment (perhaps in the shared bands) of about 50 kc. between 3300 and 4500 kc. could be made to the profit of the broadcasting service for occasional needs of a special character.

Great Britain recommends the exclusive assignment to the aeronautical services of a number of bands of frequencies. Included in these is the band 1810—1830 kc., concerning which she says: "In the North Sea regional arrangement this band was reserved exclusively to touring aircraft. Under the Baltic Sea regional agreement it has been assigned to the coastal stations of Poland but it will perhaps be possible for these stations to be put in a band in the vicinity of 1785 to 1810 kc. which is not now in use."

No. 58, Irish Free State:

Seventeen bands of frequencies are proposed for the exclusive use of the aeronautical services. Included in them are the frequencies 1800—1820 kc.

No. 59, Iceland:


Reasons: The constantly increasing use of the band 1500—1820 kc. has caused considerable interference between the different services. These frequencies are used as well by small fixed stations and small mobile stations (2 to 4 watts) as by land and mobile stations of greater power (50 to 100 watts) without any subdivision of the band between them. In consequence, the small interior fixed and mobile stations experience intolerable interference from more powerful foreign mobile stations which work on the same frequency. For the purpose of improving this state of things it is proposed to divide the band between the different services, that is to say between the mobile service, radio beacons, the fixed service and the interior service."

No. 54, Italy:

The band 1715—2000 kc. in the Madrid table is assigned on two bases, one basis for the European region and the other for other regions. Italy proposes no changes in the column for "other regions" but as to the European region she would change this assignment as follows: 1715—1800 and 1820—1925, jointly to amateurs, fixed and mobile, 1800—1820 kc., only to aeronautics, 1925—2000 kc., jointly to amateurs and mobiles.

Carrying this same idea now to higher frequencies, where it has not previously been employed, Italy proposes maintaining the band 7000—7300 kc. for amateurs in "other regions" but making a new assignment in the European region: 7000—7100, fixed, 7100—7200, broadcasting, 7200—7300, amateurs.

Extending the same idea to the 14-Mc. band, Italy would preserve the exclusive assignment to amateurs in "other regions" but in the European regions would have it read as follows: 14,000—14,150, fixed, 14,150—14,400, broadcasting, 14,300—14,400, amateurs.

Concerning the bands 30—56 Aie. and 56—60 Mc., "The
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Italian administration reserves the right of presenting at Cairo some proposals relative to the assignment of these bands also to the fixed, mobile, aeronautical and broadcasting services."

---

**The See-Saw Noise Silencer**

(Continued from page 14)

placed on its cathode by means of the potentiometer $R_5$. Then if the grid of the $6C5$ is biased negatively as the signal strength, or the voltage across $R_5$ increases, the circuit will operate automatically. This is true only if the negative bias on the grid increases in proper relation to the increase in signal input to the detector. Automatic operation with inputs varying from 10 to 15 microvolts to 100 millivolts is possible with this circuit. The low impedance a.v.c. circuit contributes greatly to this fine performance. The $6F6$ a.v.c. tube has a grounded cathode. Its grid, with no signal input, is biased negatively by means of control $R_7$, which also biases the entire detector circuit below ground at the same time. This bias should be about 30 volts. Then as the grid of the $6F6$ goes in a positive direction it draws an increasing amount of plate current. The voltage drop across resistors $R_1$, $R_2$, $R_3$, is arranged so that with no signal voltage the a.v.c. tap between $R_2$ and $R_3$ assumes chassis or ground potential.

This point then goes in a negative direction when the drop across $R_3$ increases, due to the increase in plate current, thus providing negative bias. The common coupling circuit for the i.f. grid return is then in the neighborhood of 15,000 ohms with a 0.5-mfd. by-pass. This permits the use of decoupling filters as small as 3,000 ohms and 0.01-mfd. condensers, a considerable improvement over the conventional values employed. The negative bias for the control grid of the $6C5$ is also secured from this same source after suitable filtration the $R_4$-$C_4$ network. The size of resistor $R_4$ may require some change in value for best results. Also, the leakage diode connected across the load resistor is not always necessary, although it sometimes provides improved performance with a particular type of noise.

One of the requirements of this circuit arrangement is the necessity of securing a sizable below-ground potential. The resistor $R_{10}$ will vary in value depending on the number of tubes used in the receiver. As this resistor handles all the plate current drawn it should be of the twenty-five-watt size for safety. If the total plate and bleeder current to be drawn is known, the value of resistance necessary to produce a 50-volt drop may readily be calculated by Ohm’s Law. In this arrangement fixed bias Class-AB stages should be avoided, as their varying plate current will cause a shift in drop across $R_9$ that may be quite severe at high audio levels. The use of 6L6 tubes with self bias is recommended if high audio output is desired. For telegraph operation, the a.v.c. supply is shorted by the switch $SW$ so that only the fixed bias remains on the control grid of the $6C5$. This makes a gate with a fixed setting so that it is
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necessary to adjust the receiver sensitivity by means of an r.f. gain control so that the signal "fits the gate". Injection of the beat oscillator on the suppressor grid of the last i.f. stage is recommended. Care should be taken that the input of the oscillator to the suppressor is not excessive, otherwise loss of output and a high hiss level will result.

Now let us go over the basic requirements that must be taken care of if a receiver is to be successfully "noise-proofed," and which at the same time are necessary for optimum receiver performance. A power supply having good regulation, with an electrostatic shield between the primary of the power transformer and the other windings, is necessary. The shield helps materially in preventing or limiting any noise that tries to enter the receiver via the connection to the power source. Despite this precaution in severe noise fields, it is possible to get a substantial noise input which may be picked up in the r.f. tubes (where it can be handled by the silencer), or it may be picked up on audio grid leads and then rectified and amplified. Naturally if this takes place the best silencer in the world will do no good so far as such noise pick up is concerned. The best answer to this problem is the use of a transformer-coupled audio system. In a resistance-coupled amplifier the grid coupling resistors make excellent grid leaks so that the tube functions both as a detector and an amplifier. If a diode detector is used, it should be in an envelope other than that of the first audio stage. A good r.f. choke should be used between the detector and the audio stage and every inch of grid and plate leads in the audio system should be shielded. Then if all the r.f. tubes are removed, the system will be quiet even though a spark coil is operated within a few feet of the amplifier.

Power supply regulation enters into the picture from two angles. First, if loud noise pulses are being received, the plate currents of the r.f. and i.f. tubes are likely to vary over wide limits. If this occurs, the power supply with poor regulation will be modulated in much the same way as a transmitter is modulated. Only in this case the modulation will be noise, not intelligence. The second factor is also important. That is, the adjustment of the silencer with respect to voltage is generally quite critical regardless of the type of silencer employed. As can well be imagined, accurate adjustment of voltage becomes next to impossible if the total voltage available is varying considerably. These difficulties can be overcome easily by using a choke-input filter with a fairly heavy bleeder current drain, or one of the automatically regulated power supplies.

Two more closely related problems remain in the path of a good silencing job. The first of these is that the source of the a.v.c. voltage must be protected against noise impulses. This requirement is fulfilled by the Lamb device as well as by the circuit under discussion. Several systems have been published where this is not the case. With the source of a.v.c. voltage unprotected, a loud and fairly continuous train of noise pulses will develop an increasing amount of negative bias and thus...
Many famous trade-marks identify the leading test instruments used in radio service laboratories. These trade-marks give us confidence in the stamina, precision, and dependability of this equipment. We use them with confidence in the accuracy of the delicate measurements they indicate.

But underneath the trade-mark—inside the box—lies the reason for their satisfactory service—good workmanship—quality materials. It is significant, therefore, that Burgess Batteries are chosen to power practically all the better known, modern radio test equipment. When you renew cells in your test equipment, buy Burgess for continued accurate performance, just as the manufacturer intended. Use Burgess Batteries in all your experimental work for the same reason. They give the greatest efficiency—lowest cost.

BURGESS BATTERY COMPANY
Freeport Illinois
make the receiver insensitive to anything but very loud signals. In this case, as in the case of the "noise susceptible" audio system, a good silencer will do no good.

The second problem is a bit more difficult of solution. In conventional receiver design fairly large values of resistance and capacity are used in the grid return filters, which are used in all stages to which a.v.c. voltage is supplied. These filters act as grid leaks and condensers with very long time constants when the grids of the amplifier tubes are driven positive by noise pulses. In typical grid-leak detector fashion a negative bias is built up on the grids that effectively reduces the receiver gain for an appreciable length of time. The answer to this problem is the use of a low-impedance source of a.v.c. voltage. That is, instead of securing the a.v.c. voltage from the drop across 100,000 ohms or more, this value should be reduced to something around 15,000 ohms with an appropriate by-pass. The source of common coupling between the various grid circuits is thus made very low. Then much smaller values of decoupling resistors and condensers can be employed without difficulty from interaction or feedback.

In conclusion it would be well to point out that in cases where high selectivity is employed, with a crystal filter for example, protection of the filter is necessary as pointed out by Lamb. However, there are many cases where this type of selectivity is not used. Then the case with which the automatic see-saw silencer can be installed is a decided factor in its favor over the i.f. type, as the results obtained in a side-by-side test are comparable.


Omission

The resistor values in the June 3-Stage transmitter, page 23, are as follows: R1, 100,000 ohms, 1 watt; R2, 35,000 ohms, 2 watt; R3, 10,000 ohms, 10 watt; R4, 10,000 ohms, 10 watt; R5, 5,000 ohms, 10 watt; R6, 400 ohms, 10 watt; R7, 400 ohms, 10 watt.

Midwest Division Convention

FIRST announcement is made of the Midwest Division A.R.R.L. Convention to be held in Kansas City, October 9th and 10th, under the auspices of the Heart of America Radio Club. It is planned to make it the largest ever held in the division, and to provide entertainment, lectures and prizes in keeping. The QRA will be the new $6,500,000 municipal auditorium. Tickets are now available. For further information write Bob Cooper, W9KNH, Box 7471, Kansas City, Mo.
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Radio Transmitters

P. A. Systems

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Dependable, inexpensive.—Mallory Vibrapacks are the ideal sources of plate voltage where commercial electric power is not available. Operating from a 6 volt storage battery, the high voltage models of the Vibrapack will deliver up to 300 volts at 100 m. a. of easily filtered, rectified DC for operating portable radio transmitters, P.A. systems and other equipment. Lower voltage models of Vibrapacks are used where less output is required. Mallory Vibrapacks are ideal for converting 110 volt AC receivers for 6 volt operation.

The output of Mallory Vibrapacks is variable in four steps of 25 volts each. The selection of output voltage is obtained through a Yaxley switch connected to various transformer taps. Maximum efficiency is obtained for all load conditions.

Mallory Vibrapacks are made in four models—

<table>
<thead>
<tr>
<th>Type</th>
<th>Nominal Output Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>551—Self-Rectifying</td>
<td>125-150-175-200</td>
</tr>
<tr>
<td>552—Self-Rectifying</td>
<td>225-250-275-300</td>
</tr>
<tr>
<td>553—Tube Rectifier</td>
<td>125-150-175-200</td>
</tr>
<tr>
<td>554—Tube Rectifier</td>
<td>225-250-275-300</td>
</tr>
</tbody>
</table>

Mallory Vibrapacks are supplied complete with special design Mallory Long-Life Vibrator. The rectifier tube is included with Models 553 and 554. Average weight only 5½ lbs.

See the Mallory Vibrapack at your most convenient Mallory-Yaxley distributor. He has your Data Sheet, “Perfect Portable Power”—containing complete specifications and operating instructions. Ask for it!
The new Cardwell Catalog No. 40, with good news for you and handy nomograph charts for choosing the proper variable condenser for any power and band. Ask your dealer or write us.


NP-35-ND — Cap. 35-35 m.m.f. The best bet for the 5 meter rig. Push-pull rigs with low power deserve it — higher power requires it. Small enough for portables — big enough for high power fixed 50 M.C. stations. No closed loops — Isolantite insulation — Airgap .084" — Peak flash over — 4200 V. — $3.60

XE-240-KS

XG-110-KD

The approximate length of the stub, in feet, can be calculated by dividing 240 by the frequency in megacycles. Also one can divide 240,000 by the frequency in kilocycles, the frequency, of course, being the fundamental frequency of the transmitter.

The following table shows stub lengths for the low-frequency end of each band. Thus if each side of the stub is made the length shown, a small adjustment of the shorting bar will allow resonance to be established for any other frequency in the band. Note that, for obvious reasons, this filter stub is a one-band affair!

<table>
<thead>
<tr>
<th>Frequency in Megacycles</th>
<th>Stub Length in Feet</th>
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<tr>
<td>1.75 Mc.</td>
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<tr>
<td>3.5</td>
<td>68.4</td>
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<tr>
<td>7</td>
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<tr>
<td>14</td>
<td>17.1</td>
</tr>
<tr>
<td>28</td>
<td>8.55</td>
</tr>
<tr>
<td>56</td>
<td>4.28</td>
</tr>
</tbody>
</table>

This same harmonic filter arrangement is ideal for those using long-line tank circuits on ultrahigh-frequency amplifiers. Fig. 2-A shows the conventional plate tank circuit arrangement while that of Fig. 2-B is much more desirable since it prevents the generation of odd harmonics as well as even harmonics in the push-pull amplifier. The plates should be tapped down from the open end of the line one-third of the length of the line, which is approximately a quarter wavelength. Copper or dural tubing is usually used for the line in order to get either high unloaded Q or Z, depending on whether the tubes operate as oscillators or amplifiers.
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These receivers are among the best values money can buy. Our 6% EASY CREDIT PLAN makes it easy to own one. Compare our rates. Send down payment with your order today. Set will be shipped as soon as credit is O.K. Entire transaction 1 week. Order now!

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Price Payment Payments Payments Payments
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NATIONAL - 100 complete with tubes and speaker in cabinet. $125.10 $20.10 $20.50 $24.50 $29.50
NATIONAL - 101X complete with tubes, crystal and speaker. $129.00 $20.40 $21.60 $25.60 $30.60
NATIONAL - 100 complete with tubes and coils. $170.70 $27.70 $26.14 $30.14 $35.14
NATIONAL HRO complete with tubes, speakers and coils. $195.60 $33.60 $32.84 $36.84 $41.84
HAMMARLUND SUPER PRO complete with tubes, crystal and 100 watt speaker. $265.70 $53.70 $52.00 $57.00 $62.00
ACR-155 complete with tubes and built-in speaker. $74.50 $14.50 $11.00 $17.00 $23.00
ACR-175 complete with tubes, crystal and separate speaker. $110.00 $20.00 $17.00 $23.00 $29.00
HALLICRAFTER ULTRA SKYRIDER complete with tubes and speaker. $164.50 $31.50 $28.90 $35.90 $42.90
RME-69 complete with tubes, crystal, and speaker in cabinet. $151.20 $25.20 $21.94 $26.94 $31.94
HALLICRAFTER SX-11 complete with tubes and crystal. Speaker $12.00 extra. $195.60 $35.60 $27.84 $18.83 $14.33
HALLICRAFTER ULTRA SKYRIDER complete with tubes and crystal. $164.50 $31.50 $28.90 $35.90 $42.90

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Complete with Tubes, Crystal, and Speaker in Cabinet. $151.20

This precision built communication type receiver has proven itself to be one of the very best in performance. Features continuous band spread coverage of all 9 amateur bands from 9 to 500 meters. The amateur bands are grouped in 200 kc. groups for minimum amount tuning. New large improved dials. Built-in monitor for both phone and C. W. Heavy crackle finish metal cabinet. Uses expensive electrical condenser system of band spreading. Has single crystal filter. (Billet 456 K.C.) as standard equipment. 9 tubes.

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Five band spread ranges, 1.7 to 2.0 megacycles, 3.5 to 4.0 megacycles, 7.0 to 7.3 megacycles, 14.0 to 14.4 megacycles, 28.0 to 30.0 megacycles. Automatic plug in coils. Permanent calibration. Micrometer dial. Amplified delayed A. V. C. Power output 10 watts. C. W. Oscillator, Crystal Filter. Built-in Power Supply. 12 Tubes — 10" speaker. Our time payment plan makes it easy to own this fine set. See terms listed above.

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<table>
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<td>$0.95</td>
<td>$1.25</td>
<td>$1.60</td>
</tr>
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</table>

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No. 14... $0.60 No. 12... $0.80. No. 10... $1.20

Copper clad, steel core insulated. No. 14... $0.65 No. 12... $0.95 Phosphor Bronze — harddrawn—stretchless and kinkless: high tensile strength.

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L1 heavy duty circle cutter, 1 to 4" dia. $1.25 each. No. 5 heavy duty circle cutter, 1 to 6" dia. $1.75 each.

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A Four-Band Portable

(Continued from page 84)

plugging \( L_2 \) into the plate circuit and \( L_1 \) into the grid-cathode circuit. The tuning capacity \( C_1 \) is turned to near maximum capacity, where the plate circuit is resonant at the crystal frequency. To tune to 20 meters the same coils are left in their sockets and the condenser simply moved to near minimum capacity. The tube now acts as a doubler and the output is on 20 meters. Resonance dips are well defined on the plate current meter.

To tune to 10 meters, the coils are reversed and the condenser will hit resonance with the fourth harmonic of the 40-meter crystal at about one-third capacity. The resonance dip of plate current is more pronounced than on 40 and 20 meters, dropping from 70 ma. out of resonance to 60 ma. in resonance, depending upon the activity of the 40-meter crystal employed. Some crystals vary slightly from the above values, but all good crystals will give high 10-meter output. The output will light a 6.3-volt test lamp to full brilliance when coupled loosely to the plate tank with two turns one inch in diameter.

In order fully to excite the push-pull doubler-amplifier the grid circuit is tuned to resonance by \( C_2 \). An untuned, or aperiodic, circuit may be inserted here if desired, with some loss in final output. The importance of \( C_4 \) previously has been stressed. Neutralization is not necessary as the output tube is always a frequency doubler as well as an amplifier of input power from the crystal oscillator.

The plate current of the tubes is indicated simultaneously on the same millimeter. The crystal tube current has been mentioned as 60 ma. in resonance, but with the amplifier grid and plate coils removed. Introduction of the amplifier grid circuit plug-in coil and tuning \( C_2 \) to resonance loads the crystal oscillator plate current to 70 ma. When the plate tank coil is also plugged in the total meter reading will be around 110 ma. or an amplifier current of 40 ma. out of resonance.

When the amplifier plate tank is swung to resonance the total current drops to about 90 ma. or approximately 6.5 watts input to the amplifier, antenna not connected. The tube runs cool with this treatment and when the antenna is introduced the total current loads up to about 120 ma., which corresponds to an amplifier input of 16.25 watts (50 ma. \( \times 325 \) volts).

The transmitter is built into an 8¼ by 12 by 6½-inch chassis with large ventilating louvers at each side, and several half-inch holes are punched at the rear and in the cover for air circulation. A protective metal cover is placed over the crystal for mobile or portable use.

---

Talking about brass, read this one from VE3BBE: "A guy bootlegged my call and then sent me an anonymous letter saying he had at last clicked with his first contact and would I be so kind as to QSL as he didn't have one and did not wish to go back on his promise to QSL." Nice feller!
Amateur radio operators and car owners with auto radio installations—here is the answer to those additional current requirements for your radio and extra equipment. The new Delco-Remy Model 961-N Generator is a low-cost unit that makes available a 26-28 ampere output, when needed.

This new Special Service Generator is complete with Current and Voltage Regulator, wiring and all necessary attaching parts. The Delco-Remy regulator controls the voltage at the battery, preventing battery overcharging and excessive voltage within the electrical system—and it does not cause radio interference.

Delco-Remy Model 961-N Generators may be installed on most cars. Any Branch or Electrical Service Station of United Motors can supply them.

FOR POLICE CAR SERVICE: Delco-Remy heavy-duty generators of the 934 type are available for installation on most cars, in either City Police or State Police Service.

Delco-Remy products are sold and serviced by United Motors Service everywhere... wherever you see this sign.
THE Grass STOCK
of Transmitting and Receiving Radio Equipment is one of the Largest in the World

Test Equipment Carried in Stock
Oscillographs—Oscillators—Tube Testers—Voltmeters—Modulation Monitors

<table>
<thead>
<tr>
<th>Equipment Description</th>
<th>Price</th>
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<tbody>
<tr>
<td>RCA Supreme (*)</td>
<td>$14.70</td>
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<tr>
<td>Triplet (*)</td>
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<td>DuMont (*)</td>
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<td>Webster Precision (*)</td>
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<td>Clough-Brenge (*)</td>
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<td>Headrite Burt (*)</td>
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<table>
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<tr>
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<tbody>
<tr>
<td>Brush Crystal Phones</td>
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<td>Trimm Featherweight Phones</td>
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<tr>
<td>Single Button Mikes</td>
<td>$2.25</td>
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</table>

PREMIER MOUNTED CRYSTALS
40-80 Meter Bands ........................................... $4.35
UNMOUNTED CRYSTALS ......................................... 2.25

KEYING RELAY
will operate on one dry cell. Can be used as Single Pole Single Throw or Single Pole Double Throw. Sturdy construction, has 1/4" diameter Solid Silver Contacts.
Compares favorably with expen­sive types. Special .................................... 59c

Gross Value on U.T.C. Transformers

<table>
<thead>
<tr>
<th>Type</th>
<th>Delivers 2000 volts A.C. at 500 M.A.</th>
<th>$5.20</th>
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<td>Delivers 1000/1500/2000 volts A.C. at 300 M.A.</td>
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<tr>
<td>Type B</td>
<td>Delivers 1500/2000/3000 volts A.C. at 500 M.A.</td>
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<tr>
<td>Type C</td>
<td>Delivers 1000/1500/2000 volts A.C. at 300 M.A.</td>
<td>$10.95</td>
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</table>

THORDARSON CASED TRANSFORMER
600 volts each side of C.T. 200 MA 250 V. 10 amps. C.T. 5 V. 3 amps. 250 V. 300 M.A. .......... $2.45
THORD. CHOKE 12 H 250 MA ................................ $1.95
THORD. 15 H 250 MA CHOKE ................................ 2.95

MAC-KEY Semi-Automatic and Straight Oscillator ............... $3.95

HEAVY DUTY ANTENNA KNIFE SWITCH
Single Pole. Double Throw 100 Amperes, 5" Break ... $1.45

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PORCELAIN BASE 50-WATT SOCKETS
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3/4", Across Flange. Mounts through 21/2" hole. Scale Length 1/4", Ranges: 0/15 Amps. ........ $3.20

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W3FAR Wins 28-Mc. Contest
(Continued from page 80)

conditions were poorest, a half-wave vertical radiator exactly a half wavelength above ground proved itself capable of working short-skip stations (within 1000 miles) when they could never be raised with the horizontal flat top. Experimentation at W3FAR is being continued and records kept during 1937 to compare with the complete '36 data.

We regret that space is inadequate to detail the experimentation at the other leading stations, but each participant built considerable new equipment. W8JFC used several arrays successfully. W3BRZ found a 133-foot flat-top, one of the most practical of many antenna combinations for 28 Mc. W9HUV did 80 per cent of his work with a similar antenna. A half-wave vertical, with matching stub and 500-ohm line was nearly as consistent, but gave lower S-ratings. Two half-wave antennas with reversing stubs between, stacked vertically, and a half-wave vertical doublet were also tried. To all entrants our congratulations on the very successful work performed and the outstanding entries submitted.

—F. E. H.

Oklahoma State Convention
Tulsa, Okla., July 17th-18th
The director and executive committee of the A.R.R.L. have formally approved the Oklahoma State Convention to be held at the Hotel Alvin, Tulsa, Okla., July 17th and 18th.

The Tulsa Amateur Radio Club sponsoring the affair cordially extends to all amateurs a cordial invitation to be present at this convention. Plenty of entertainment, prizes, stag party and all for the low registration fee of $1.98. All registrations received prior to July 1st will be eligible for special pre-registration prize.

Send registrations to Ronnie Durham, c/o Radio, Inc., Tulsa, Okla.

Silent Keys
It is with deep regret that we record the passing of these amateurs:
Fred E. Bayer, VE1AG, Musquodoboit Harbor, N. S.
William Gibbons, W9TAK, Hazle Crest, Ill.
Leroy K. Gilbert, W0GIIII, Maplewood, Mo.
Raymond M. Rebbecc, W9EGD, Bartonville, Ill.
T. V. E. Seeley, VE2IQ, Shawinigan Falls, Que.
J. J. Ryan, VE3AI, Hampstead, Que.
EIMAC presents practical ZERO BIAS class "B" audio tubes capable of modulating 100% class "C" input powers of from 200 to 2000 watts.

Audio Output Maximum

<table>
<thead>
<tr>
<th>TUBES</th>
<th>Audio Output (Zero Bias)</th>
<th>Maximum Audio Output (With Bias)</th>
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<tbody>
<tr>
<td>35T</td>
<td>100 watts</td>
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<td>100TH</td>
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<tr>
<td>450TH</td>
<td>1000 &quot;</td>
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ADVANTAGES OF EIMAC TUBES AS MODULATORS

1. Practical zero bias operation with audio outputs up to 1 KW.
2. Extended power capabilities with higher plate voltages and a minimum of bias.
3. Tubes are designed to operate with maximum possible "static" input. Such practice tends to approximate push-pull class "A" operation.
   (a) High static plate currents minimize power supply regulation requirements.
4. Low interelectrode capacities prevent loss of the higher audio frequencies.
5. Uniform characteristics make unnecessary "special matching" of tubes.
6. Grid characteristics free from "kinks" caused by secondary emission and gas currents which minimize possibilities of "self-oscillation" and "fuzz."
7. "Cheapest" possible audio watts. Tube cost vs. power capabilities is probably the lowest in the industry today.
   See these tubes at your dealer’s today.

EITEL-MCCULLOUGH, INC.
San Bruno, California, U. S. A.

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

(Continued from page 45)

A score exceeding 20,000 in the VE/W contest. UD has
rigged his new suppressor-modulated rig—RK-23. JN has new 56-Mc.
from Sackville. WARNING! KEEP THESE DATES
for the passing of one of the old-timers and best known ama­
ters of this Section. Fred E. Bayer, VE1AG of Masquod­
boit Harbor, has joined the ranks of “Silent Keys.” AG, though operating under many handicaps, without power
mains, and maintaining a gas engine to keep batteries charged,
became one of the most popular 3.9-Mc. ‘phones. His cheery voice will indeed be missed by all of us, and the writer of this column is one of the old-timers as far as years. Our sincere
condolences to family and relatives. St. John—“CE” was heard talking on 5.6-Mc. ‘phone. EL is talking about 14-Mc.
‘phone. JZ is getting 56-Mc. rig ready for car. FI is exper­
imenting on a 56-Mc. mobile transceiver. GP has a new 60-W.
rig, GQ with Kiwanis Boys K Club and is bringing on a fine
receiver has a 172.5-kc. bar mounted in a vacuum tube, LC
has FB 14-Mc. ‘phone. BV wants to put his ‘phone on 3.9
Mc. New calls in Fort William: ANG and AOD, in Port
Arthur: ANP, UA threw out ‘42’s for 6L6’s. FY is trans­
ferrred from Ignace to Fort William; during day he is Ca­
adian Pacific op. ZU is rebuilding for 14 Mc. AND is
now in Smithwater. ANY is new in Toronto. PH is
back home in Ottawa from McGill University; he is re­
buiding to a pair of 851’s. AGO (ex-ZLR) is now in Ottawa.
ABW is new in Lynedoch and is rebuilding for 14 Mc. AM is
in 3.9 MC. AMP is in new comer in Toronto on 1.75-Mc. ‘phone. The Toronto Short-Wave
Club executive for the 97/38 season is: Pres., R. L. Law;
Secy., H. Robertson; Treas., L. Rerswell; Activities
Chief, R Bain. PL is going to Alberta again this summer after
“Dinny” bones, and while there will use VE4TA on; at
return east his QTH will be ‘Toronto, as he is joining the staff
of the Ontario Forestry Branch. ABY builds boats by day
to be able to “ham” at night. ABM burned up his rig. UF
reports for the Timmins gang; he placed third VE
in the 1936 VE/W contest. VO4V is new in the.
EJ is getting 56-Mc. rig ready for car. PL is experi­
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in the 1936 VE/W contest. VO4V is new in the.
NEW ENGLAND DIVISION

CONNECTICUT—SCM, Frederick E., Jr., WICTI—The Nutmeggers put this Section on top of the heap in traffic handling during the '37-'38 season and you S.C.M. wishes to thank all the members for their efforts. HX5 moved to 14 Mc. Hal, at AW, had a chance to get in some rag chewing. JTD will have a new sky-wire for 14 Mc. XJF will operate in a 56-Mc. net. UW made a field trip. IMX and JX2E on 176 Mc. You folks are scheduled with VES2U is still perking three mornings a week. BDI is busy studying possible locations for WIAW memorial station. ITI says KQX moved in three doors away. JFY made a field trip to Atlantic Division. He has promised to JXP that they start a Conn. shore-line 56-Mc. net to be known as the "Crab Net." KJP is rebuiding and working in a radio store. BHM worked 50 foreigners in a week on 14 Mc. JCF says Unit 2 U.S.N.R. is going full blast this month. Visitors are welcome at the airport, especially N.C.R. members. JUD is working on 14 Mc. TD turned in a good score in O.R.S. party. BQS reports that EWD put on a kw. rig. JHK was the only station to report by radio this month. DWO enjoyed O.P.S. party. ITIS moved. KMM came on the air with a 61.6 crystal oset, pushing a '10. CUB is on 7002 kc. The Nutmeg Net gang held a get-together May 2nd at Trinity College. BDI had a get-together May 2nd at Trinity College. BDI had a "G" man!}

Traffic: W1BSX 574 AW 340 JXP 312 UE 103 JYE 85 IMV 61 GMK 54 KEN 47 BDI 44 JQ 38 ITI- GME 20 JFN 17 KIP 16 BHM 9 HTF-EZW 6 JUD-TD 4 BND-BQS 3 JHK 2 DWP 1 157 DMP 138 KV 73 (WLGJ 44) FAJ 15 JMY 83 AJS 172 (WLGQ 66).

MAINE—SCM, John W. Singleton, WICD—Well, gang, this is my last report as your S.C.M. I want to take this opportunity to thank all of you who have done good by and helped to put Maine on the map. I hereby offer the new S.C.M. my whole-hearted support. Let's get behind the new S.C.M. and put Maine over this season.


EASTERN MASSACHUSETTS—SCM, Albert N. Giddings, W1AB1—W1H shows the boys how A1S is busy on 7-Mc. net. JCK inquires about O.R.S. A1B worked in fun in W1/VE Contest. AGX is moving to 14 Mc. for the summer. HWE is on 7 Mc. with 25 watts. DMP is getting ready to put up a couple of masts. JMY is thinking of link-coupling all bands. JZN is new O.B.S. HIL is interested in O.P.S. work. HGV have applied for O.R.S. APK has completed a new 56-Mc. transceiver in his club's new airplane. KIN and BFT has a new transmitter under construction for use on 1.7 to 4 Mc. KKQ has built a new YL operator in Nashua.}

Traffic: W1IP 289 FBI, 188 (W1GB 79) BFT 131 GMT 89 FOR 30).

NEW ENGLAND DIVISION

Traffic: W1UNU 643 IEG 85 (W1G1 154) GTN 88 HRC 7.

VERMONT—SCM, Alvin H. Battison, W1NFG—C.R.M.: W1, R.M.: 1EZ, P.A.M.: 1AVP, KJG and JNI visited AHN. C.R.M. had a gathering party and built a new trans­mitter. ATM is marking time until "Rural Electrification" reaches his home. KJG and I1Q visited at GNF. BVP has rebuilt for 14-Mc. "phone. JAH hald another visit prior to the Convention. JAX built an experimental electric organ to demonstrate at the Convention. IQP has moved to W1FKC. DAIJ and FAH joined the landed gen­try—having acquired the use of a large tract out in Scituate somewhere to operate with. I1Q has a new gas-buggy. I1N now holds W15GW call, and when tried to use new tube won in A.A.R.S. contest rig went all to heck. BVR seems to have made a hit with the Rhode Island gang by the way he conducted himself at the Board Meeting. HEH built a s/c "sillyscope" with all the facts. I1Q is now O.R.S.

Traffic: W1UNI 614 A1S 375 (W1G1 167) JCK 367 ABG 288 AGX 226 WHE 208 I1IA 188 INA 150 FBO 158 EM1 125 DMP 143 JNU 126 FAR 123 BMW 108 JFS 109 HJL 106 KJK 102 KEJ-IGU 81 BRF 73 JX2E 78 JMS 57 I1N 40 JTM 375 26 IC 25 FC 22 19K 21 QW 17 (CCIC 40) RE 17 JSK 11 IVX 5 8 ECF 6 JID 4 JTY 3 JHN 2 HII-1FR 1 (Mar.-Apr.) W1JNF 89 FC 39. W1UNL/D8TSCC—SCM, William E. Barrett, W1AH1—10R made the B.P.L. for last time before Barrett moved to Pittsfield. IRO is incorporating some new ideas in a 1-kw. instantaneous QSY transmitter. DZ1 is hitting the bright spots. A1N served on the Grand Jury. HX5 moved to new QTH. KID is employed at W1W1J. IQG has a new truck. HX5 visited GFP by land wire. RSW and GAZ visited GAE.

Traffic: W1F85V 126 GAI 14 GNF 3 KJG 2 AHN 1.

ATLANTIC DIVISION

EASTERN PENNSYLVANIA—SCM, James M. Bruning, W3EZ, R.M.: 3AKB, 3AQN, 3EOII, 3A1S, P.A.M.: 3E0Z. B8Q is a former S.C.M. returning to Section activities as an Official Observer. 3FRY made W.A.C. in 24 hours last month, and this month reports a new W.A.C. on 36 hours. Some C.R.M. are putting up the full 1-kw. on the experimental work. 3SI has had a new S.C.M. and put Maine over this season.


NEW HAMPSHIRE—SCM, Carl E. Evans, W1BF7—The M. V.A.R.A. made plans to operate portable in the Field Day from EAW's summer camp on the side of Mt. Kear­ny. KJP is a new proud father. Congrats, O.M. ITP is active on 56 Mc. until next fall. IDY has his new outfit working. DJK is working on a flood-control project at Allenstown and operating on 3.5-Mc. portable in Pembroke. HJI is busy DXing on 14 Mc. and has worked a lot of new countries. HJN graduated from radio school and is now working for W1EBB. C1A reports the Farmers' Net still going strong. IDQ returned from Florida and may be heard on 3.5 Mc. ITF is now a Class A Emergency Corps station.

Traffic: W1IP 289 FBI, 188 (W1GB 79) BFT 131 GMT 89 FOR 30. W1H is working on 14 Mc. BKG is moving to 14 Mc. for the summer. BJD has a new outfit and is planning to move portable in September. OKE has a new V-8 convertible coupé. JDP is increasing power on 56 Mc. TA is thinking of installing a 56-Mc. transceiver in his club's new airplane. KIN and HGV have applied for O.R.S. A1K has completed a new emergency transmitter. JUD is building a power supply for an RK-20 amplifier. BJH is rebuilding his 56-Mc. beam so that he can control it from the operating table. BJI is back on 56 Mc. BFT has a new transmitter under construction for use on 1.7 to 4 Mc. KKQ is a new YL operator in Nashua.

Traffic: W1IP 289 FBI, 188 (W1GB 79) BFT 131 GMT 89 FOR 30.)
If you're getting the equivalent of pink slips in your present position, why not train yourself, as so many other amateurs have done, for responsible jobs in the Radio Engineering field? New advancements in broadcast and aviation radio offer new opportunities for men with technical training.

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Standard Frequency Transmissions

<table>
<thead>
<tr>
<th>Date</th>
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<th>Station</th>
<th>Date</th>
<th>Schedule</th>
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STANDARD FREQUENCY SCHEDULES

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The time specified in the schedules is local standard time at the transmitting station. W9XAN uses Central Standard Time, and W6XK, Pacific Standard Time.

TRANSMITTING PROCEDURE

The time allotted to each transmission is 8 minutes divided as follows:
2 minutes—QST QST QST de (station call letters).
3 minutes—Characteristic letter and station followed by call letters and statement of frequency. The characteristic letter of W9XAN is "O"; and that of W6XK is "M."
1 minute—Statement of frequency in kilocycles and announcement of next frequency.
2 minutes—Time allowed to change to next frequency.

Schedules for WWV

For transmissions and schedules of standard time intervals and ionosphere bulletins see "WWV Services Again Expanded," June, 1937, QST.

Each Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station WWV will transmit on three frequencies as follows: 10:00 to 11:30 A.M., E.S.T., 5000 kc., noon to 1:30 P.M., E.S.T., 10,000 kc., 2:00 to 3:30 P.M., E.S.T., 20,000 kc. On each Tuesday and Friday the emissions are continuous unmodulated waves (c.w.); and on each Wednesday they are modulated by an audio frequency. The audio frequency is 1000 cycles per second.

---

Heard on the 14-Mc. 'phone band (by W2IXY): "Well, if you are 4 kc. lower in frequency than I am you must be way out of the band, as I am on 14,149 myself."

---

WSQHJ, 119 Forest St., Wellington, Ohio, is interested in hearing from amateurs who like to play checkers by radio. He has his station equipped with break-in and is ready to take on all comers. His frequencies: 3735-kc. c.w., 1817-kc. 'phone.

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Say You Saw It in QST — It Identifies You and Helps QST
sisted by the new RME69. 3BUI made W.A.C. in the DX moved to Williamsport. 3GUD is part, v. 3EZ bought a new SW3-d.c. model for portable and emergency use. 3CHI worked a W4 in Alabama while using 10 watts 'phone on 28 Mc. SASW enjoyed the Williamsport Hamfest. 3IU is settled in his new location and threatens his home with some real competition. 3FPW is new editor of Beacon Radio Amateur Club paper, "Parasitics." Ed suggests: GO and 3EBR for O.R.S. 8FLA is having his help toward learning East Penna. traffic. 3BRZ enjoyed his brother O.P.S. with some real competition. 3FPW is new with a new VM-4. 3EFH rebuilt his rig and bought a new NC-100X receiver. 3EDC had lots of fun during O.R.S. parties. 3FCXE broke down his Class B transformer and replaced it a couple more R.C.C. members. AADE mentions that and is all set to explore 7 and 56 Mc. SPCL made over 3000 28-Mc. activity continues brisk in Harrisburg Section. The Main Line Radio Club has started its summer series of 1.75-Mc. 'phone and 3.5-Mc. c.w. with the call QVO. NCJ has been doing some FB DX work hooking OA. HA, G, CM, EG, JB and ANU have started rebuilding. Salisbury-Southern New Jersey-SOM, Carroll D. Kent-Maria Thorden, XOH3NG. GHT is experimenting with antennas. JST/4 at Miami, Fla. (with Eastern Airlines), manages to get in some 14-Mc. operating. NNZ, rebuilding, will be signing EL2? for the next few years. ROANOKE DIVISION

NORTH CAROLINA—SCM, H. S. Carter, W4OG—CYB and CPT have been appointed P.A.M. to assist your S.C.M. in getting the 'phone dope each month. Your cooperation would be greatly appreciated by these men and myself. DGV's daughter had an emergency operation at Gastonia, and CXV kept schedule with DGV every night and kept him informed of her condition. Congratulations, O.M. Raleigh: COL's new rig is capable of from 750 to 800 watts input. DGV still holds the title of Champion Message Handler, because he has man's ability to occupy his time. EG, JB and ANU have started rebuilding. Salisbury-Spencer: The Salisbury Radio Club has a building and station of its own now. EAM is rebuilding. Lattimore: DQU thoroughly enjoyed the last moved to The Falls. HIR is building a new rig using the "Bi-Path" excitior with an 805 final. EIO moved from Kentucky to Warrenton, and is in charge of the Weather Station at the Chapel Hill: COL's new rig is the new SWX-2A. HIR has made contacts during his first year on the air; he and FBM have been operating 7 and 14 Mc. FBM is going strong on 28-Mc. 'phone; he relayed a message to Hawaii from BRK. EG is using a pair of TR's on 28 Mc. BRK has a new W4 and 28-Mc. rig going. QRX has been a trouble to EG. QVO has been a trouble to EA. BBM and QVO have had a lot of fun during the summer. QAN is secretary of the S.H.B.P. & M. R.S. 160-watt 'phone. KOB has a new Royal portable using all capital letters. YA received a 'J' QSL which qualifies them for W.A.C. To celebrate the occasion, Crosley threw a feed; there are twenty-one operators on the YA staff at present. DUL received his W4N New Hampshire QSO. G. 77FA has moved to Bellevue and will operate 7 and 14 Mc. FIP reports that the Penna. Assn. for the Blind is operating 1.75-Mc. 'phone and 3.5-Mc. c.w. with the call QVO. NCJ has been doing some PB DX work hooking OA. D4, VK, TI, PQ, OZ, etc.; he reports working the Finnish CQ. Vacations: DUL is now in charge of the Weather Station at the airport. Chapel Hill: COL's new rig is the new SWX-2A. HIR has made contacts during his first year on the air; he and FBM have been operating 7 and 14 Mc. FBM is going strong on 28-Mc. 'phone; he relayed a message to Hawaii from BRK. EG is using a pair of TR's on 28 Mc. BRK has a new W4 and 28-Mc. rig going. QRX has been a trouble to EG. QVO has been a trouble to EA. BBM and QVO have had a lot of fun during the summer. QAN is secretary of the S.H.B.P. & M. R.S. 160-watt 'phone. KOB has a new Royal portable using all capital letters. YA received a 'J' QSL which qualifies them for W.A.C. To celebrate the occasion, Crosley threw a feed; there are twenty-one operators on the YA staff at present. DUL received his W4N New Hampshire QSO. G. 77FA has moved to Bellevue and will operate 7 and 14 Mc. FIP reports that the Penna. Assn. for the Blind is operating 1.75-Mc. 'phone and 3.5-Mc. c.w. with the call QVO. NCJ has been doing some PB DX work hooking OA. D4, VK, TI, PQ, OZ, etc.; he reports working the Finish QST for a successful winter season. Traffic: W3DQO 14 DNU 48 AEJ 11 ZJ 76 BEI 5 B9 0 CES 12 BYR 27 FPA 16 XZ 5. W3DQO is now in charge of the local club. ZL 608 has a new ham (16 years old) and is all set to explore 7 and 56 Mc. 8PCL made over 3000 points in the last O.R.S. party. 27TX 5 is ready for summer vacations. 3MUF moved to Williamsport. 3HJF is all set to explore 7 and 56 Mc. 3CCE is building a new rig and looking without success for W10XG and W10RG. 3RFQ moved to Williamsport. 3GUD is now a ham (16 years old) and is all set to explore 7 and 56 Mc. 8PCL made over 3000 points in the last O.R.S. party. 27TX 5 is ready for summer vacations. 3MUF moved to Williamsport. 3HJF is all set to explore 7 and 56 Mc. 3CCE is building a new rig and looking without success for W10XG and W10RG.
is rebuilding his rig for crystal-control. East Flat Rock: EKM sends code practice each Sunday night at 9:00 p.m. Winston-Salem: BYA on 28 Mc. is dividing his time 50-50, rag-chewing and DX. DGV is doing 3×267 14-Mc. 2 phone mostly. DBW is active in the Army Net, 4NO. is planning for Field Day. CFR is active on 7 and 14 Mc.


NCJ is chewing and experimenting. DG V is working 3.9- and a new ham in Richmond on 7 Mc. AIJ spends his operating time mostly on 7032 kc. using '47 crystal oscillator, 5 watts input and a pair of tens; he can be heard working break-in with KLE on 28 Mc. AZV's new coltux shack is beginning to take shape. HXY is hard at work on the power pending the construction of the high-power rig. HSW is graduating in the fall and is going to college next fall. KGN is on 3.5 Mc. with 2A5 c.e. oscillator and a 1500-watt final. IVY has his antenna problems, KAJ is on 1.7-Mc. 'phone using a ten in the final. DQW schedules K5AA, BGO schedules 8FJN. The Tu-Horo Radio Club publishes an FB bulletin for its members. ADW is now with R.C.A. at Riverhead after doing a long stretch with the mailboat service.

Traffic: W6GTS 160 (W1QJR 73) CSY 70 ELM 58 UVA 18 FBL 11 FGJ 8 GPC 4 J3P 3.

WEST VIRGINIA—SCM, Dr. Wm. H. Riheldaffer, W3KKG—CDY has been going places on 14 Mc., having hauled his rig back to WVA for a couple of days. He worked an I for his number 52, K5J on 3645 kc. MBS is tied up to new 1.75-Mc. outfit, OFO is experimenting on 28 Mc. QBS is now on a farm. NTW likes F.P. 656 kc. for local DX. Q0W is on 7 Mc. mostly. Q5G is on 1.7-Mc. for the most part. QBQ has a new final with a pair of 354's. JD is on Transits "A" and "E". "H" and National Trunk at 11 p.m. ZW attended I.R.E. Convention. EWZ is building up his code practice, starts 14-Mc. schedules 0874 at the University of Florida. AVR is getting out well on 28 Mc. The Virginia Floating Radio Club meets next in Danville, Va., on July 18th. This will be a joint meeting with the North Carolina Club, so BE THERE!

Traffic: W6GTS 160 (W1QJR 73) CSY 70 ELM 58 UVA 18 FBL 11 FGJ 8 GPC 4 J3P 3.

RIVERSIDE—SCM, Robert E. Haight, W2LU—EGF is back in the traffic lead. JWT reports a new 354C is being put in his rig for crystal-control. KIP is looking over a new final with a pair of tens; he can be heard working break-in with KLE on 28 Mc. AZV's new coltux shack is beginning to take shape. HXY is hard at work on the power pending the construction of the high-power rig. KHN is graduating in the fall and is going to college next fall. KGN is on 3.5 Mc. with 2A5 c.e. oscillator and a 1500-watt final. IVY has his antenna problems, KAJ is on 1.7-Mc. 'phone using a ten in the final. DQW schedules K5AA, BGO schedules 8FJN. The Tu-Horo Radio Club publishes an FB bulletin for its members. ADW is now with R.C.A. at Riverhead after doing a long stretch with the mailboat service.

Traffic: W6GTS 160 (W1QJR 73) CSY 70 ELM 58 UVA 18 FBL 11 FGJ 8 GPC 4 J3P 3.

HUDSON DIVISION

EASTERN NEW YORK—SCM, Robert E. Haight, W2LU—EGF is back in the traffic lead. JWT reports a new 354C is being put in his rig for crystal-control. KIP is looking over a new final with a pair of tens; he can be heard working break-in with KLE on 28 Mc. AZV's new coltux shack is beginning to take shape. HXY is hard at work on the power pending the construction of the high-power rig. KHN is graduating in the fall and is going to college next fall. KGN is on 3.5 Mc. with 2A5 c.e. oscillator and a 1500-watt final. IVY has his antenna problems, KAJ is on 1.7-Mc. 'phone using a ten in the final. DQW schedules K5AA, BGO schedules 8FJN. The Tu-Horo Radio Club publishes an FB bulletin for its members. ADW is now with R.C.A. at Riverhead after doing a long stretch with the mailboat service.

Traffic: W6GTS 160 (W1QJR 73) CSY 70 ELM 58 UVA 18 FBL 11 FGJ 8 GPC 4 J3P 3.
**License or Chart Holder**

A HANDY gadget which will dress up the station has recently been brought out for hams. It is a rectangular metal frame, 4½ by 3 inches, provided with pyroline windows between which a combined station-operator license just fits nicely so that both sides can be seen. The frame is swivel-mounted in a small mike-stand type base for desk use, or in a bracket arm for fastening to a transmitter panel. The finish of the metal parts is black crackle.

The holder comes furnished with graph paper so that calibration curves can be mounted in it, if desired. The holder is made by Gordon Specialties Company, Chicago.

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**New Tuning Indicator Tubes**

TUBE manufacturers seem to be having a lot of fun with electron-ray tubes, judging by the way they vary this and that to get new varieties of tubes with differing characteristics. Two more of them have been announced recently: the 6T5 and 6AB5 (the latter, we think, marking the first advance into “two-letter” tube designations).

The 6T5 operates under conditions similar to those of the 6G5 at 250 volts; that is, the triode section is of the remote cut-off type. The target pattern, however, instead of being pie-shaped is like a doughnut. At zero grid bias the bright portion is a narrow ring around the outside of the target; as the grid voltage increases negatively the bright ring expands inwardly and at maximum grid voltage covers very nearly the whole target. It’s supposed to be easier to “read” than the wedge-shaped pattern. The bulb is tubular.

The 6AB5 is a “low-power” tuning indicator for auto sets and the like, working at a maximum plate voltage of 135. The filament takes 0.15 amp. at 6.3 volts. It has the conventional wedge-shaped pattern. Also tubular bulb.

If you want a cathode-ray tuning indicator in your set, you now have your choice of the 6AB5, 6E5, 6G5, 6H5, 6N5, 6T5 and 6U5. Certainly no one can complain about lack of variety!
NEUTRALIZING CONDENSERS

National pioneered the unusual design of these neutralizing condensers. Widespread use has proved the soundness of their principle and the honest quality of their construction. All sizes have both plates insulated by Isolanite, and have heavy aluminum plates machined to a smooth rounded edge.

Three sizes are offered. The smallest (Type NC-800, Net Price $1.80) is suitable for the RCA-800, EIMAC 35T, 50T and similar tubes. The next larger size (Type NC-150, Net Price $3.90) is for tubes like the HK-345, RK-36, 150-T, 300-T and 852. The largest size (Type NC-500, Net Price $7.50) is suitable for the WE 251A and similar tubes.

The chart at the left shows the capacity in mmf. for various settings of the spacing between the plates.

NATIONAL COMPANY, INC.

Radio Operator's Course
Complete in Telegraphy—Telephony

Practical Experience
Studio—Transmitter—Announcing

AVIATION RADIO A new complete training embracing advanced work for amateurs, or operators—twelve months' study required for the average amateur to graduate—excellent opportunity for men interested in commercial airlines. Applicant for enrollment must be high school graduate, or college student. We confer degree—Science of Radio—to graduates of this course. If interested, write for aviation radio details.

P. A. C. is an endowed, educational institution—not privately owned, not operated for profit, college rank maintained. Course consists of maximum knowledge necessary to secure Commercial Telegraph Second-class, and Radio-telephone First-class government licenses. Course includes Wireless Code, Radiophone, Announcing, Microphone-Studio Technique, Service, Television, Police, and Aeronautical Radio. We are authorized to teach RCA texts. At the completion of course you receive practical studio technique experience in our commercial broadcast studios located in the administration building, and experience as an operator on K P A C (500-Watt Commercial transmitter located on the campus, owned and operated by the college), and inter-departmental marine communication experience.

If interested, write for Bulletin R

PORT ARTHUR COLLEGE PORT ARTHUR (World-known port) TEXAS

$100 for a RADIO KEY!!?

WORTH IT—but I only charge $4.50

This semi-automatic key makes it easy to send! Dot stabilizer equipped. Selected mainspring, Marbleite finish base stays put. Chromium metal parts. Proper height for fast, rhythmic sending. New 1938 Mac Key only $6.50. Order Today! Also New Mac Straight Key—best ever—only $2.50. Write for complete dope on other Mac items of tremendous help to radio ops.

T. R. McELROY—175 Congress St., Boston, Mass.
WORLD'S CHAMPION TELEGRAPHER

QUARTZ CRYSTALS


BELLEFONTE, PA.

Say You Saw It in QST — It Identifies You and Helps QST
VACATION TIME means "FIVE" will be HOT!

DUPLEX TRANSMITTER-RECEIVER UNIT
RADIO TRANSCEIVER LABS.
TYPE TR-6A6
- Non-radiating receiver
- 7 tubes — Jensen dynamic speaker
- 6E6 unity coupled oscillator
- 10 watt carrier
- 100% modulation

DUPLEX OPERATION — PHONE • MCW
For five meter operation. Also supplied for 30-41 experimental frequencies. Special bands to order. Radio Transceiver Laboratories TR-6A6 ........................................... $39.75
Complete set of tested sylvania tubes ........................................... 4.50
Electronic vibrator power supply — input 6 volts @ 9
amps., output — 300 volts @ 100 masts. ........................................... 13.30
Stromberg-Carlson single-button hand mike .................................... 4.95
Complete for mobile operation ......................................................... $62.70

OTHER POPULAR HI-FREQ. TRANSMITTER
HARVEY UHX-10
- 1,500-60,000 kc.
- PORTABLE
- MOBILE
- PHONE — MCW — CW
- 10 watts output

SEE US FIRST — WE CARRY A COMPLETE LINE OF 5 METER EQUIPMENT
- NEW Hallicrafters in STOCK
- BASSETT CONCENTRIC FEEDER — 100% flexible
50-foot length, net ......................................................... $9.75
75-foot length, net ......................................................... 12.75
100-foot length, net ......................................................... 16.75

TERMINAL RADIO CORP.
80 CORTLANDT STREET, NEW YORK, N. Y.
BILL FILLER * ADOLPH GROSS

W8DPY Wins Paley Award
(Continued from page 9)

Sleepless for two nights previously, Stiles stayed on the job handling relief traffic continuously for more than 24 hours. When two relief operators arrived from State College, Pa., on Saturday night, he was in a state of nervous collapse bordering on absolute breakdown. In all, he spent 130 hours on continuous duty — without sleep, sustained only by "shots" administered by the doctor who had accompanied the relief party — supplying the citizens and relief agencies of Renova with their sole direct means of communication.

To evaluate Walter Stiles' entire performance is impossible in limited space. That through his efforts the 4000 citizens of Renova were saved untold misery and suffering is only a part of his accomplishment. Through his efforts they were fed, clothed, and protected from the dangers of disease and exposure. It can be said that he was prepared for the emergency; he recognized the need; he demonstrated incredible degrees of perseverance and technical ingenuity, as well as fortitude and courage, in fulfilling his duty as he saw it.

But let's not allow this "hero" stuff to go too far. W8DPY is far from the typical self-seeking "hero" of bad repute; he is, in fact, a real around ham of the finest type, as the A.R.R.L. Hq. gang discovered when we had the pleasure of entertaining him in Hartford for an afternoon and an evening following the magnificent Columbia luncheon.

Now 24, he has been a licensed ham for 10 years. He started in radio at the age of 10, when he sold garden seeds to provide the money for a crystal receiver. Four years later he passed the exam and got on the air with a '45 and 4 watts output. By 1933, at 20, he had worked 72 countries and laid the foundation for a real ham lay-out. Now he is Pennsylvania Net Control station in the A.A.R.S. and technical editor of the "Mason Dixon Straddler," 3rd C.A. publication.

His ham shack is located on an extension built on the rear of his home at Coudersport. Some time ago he acquired a hundred acres of mountain-top land for antenna experimentation, and now has, among other little trifles, an 8-wave-length 14-Mc. diamond with an 1800-foot feeder! He has a well-equipped layout operating on all bands, and as for the new portable set-up — but that's another story. Besides amateur radio, his hobbies include a miniature railroad — he is employed as electrician on the Pennsylvania Railroad — complete with passenger and freight engines, modeled after full-size P.R.R. originals. He also had a stamp collection and is a bug on photography.

In other words, he's a thoroughgoing ham and a right guy, and we can be proud that he has been chosen to typify the best in amateur radio for the year 1936.

—C.B.D.
CONGRATULATIONS TO EARL ANDERSON FOR DESIGNING SUCH A FB 3 STAGE ALL BAND TRANSMITTER

We predict that this rig will soon become one of the most popular on the Ham Bands. We have prepared the parts for this rig exactly as specified and pictured on page 22. June QST. The price is amazingly low for a fine transmitter like this since we furnish the specified Cardwell Condensers, complete coil kit as shown, drilled and punched chassis, Sansamo and Cornell-Dubilier Condensers, IRC resistors, National Isolantite sockets, etc. Each circuit is equipped for metering and unit is adaptable to relay rack mounting.

Price Complete, Less Tubes...........$39.95 Complete Kit of Tubes...........$11.80

Power Supply Kit for Type 42-T

Power Supply Kit for Type 55

Dumont Oscilloscope and Tubes

Famous Harvey Twin 15 RF Kit

with "Up to The Minute" Improvements, Increased Power, Greater Flexibility, Phone Operation, Antenna Matching Network, etc. A few of the features are listed below.

Twenty Watts Output on CW-10 Phone

Built in Resonance Indicator

Fused against overload

Crystal Control Regenerative Circuit

Class A Modulation

New Beam Tubes in Audio and RF

Multi-Band Operation from One Crystal

Full Break-in for CW or Phone

Highest Quality Parts Thru-out (CD, RCA, BUD)

Simplified Collins Network — Matches Any Antenna

Just the Thing for Summer Vacation Work

can be used off Mobile with a Generator or batteries. Every amateur should have one for an emergency transmitter in case of disaster, or as an auxiliary transmitter. May be used to drive a higher power amplifier such as pair of 150's or 155's. All parts supplied with drilled and punched chassis. Priceless Crystal.

CW............$15.95. PHONE, complete with tubes...........$19.95

ANNOUNCING OUR NEW FULLY EQUIPPED CAMERA DEPT.
FINES STOCK — BEST PRICES
Recording Ultra-High-Frequency Signals over Long Indirect Paths

(Continued from page 12)

used. The only other likely source of trouble is in the r.f. amplifier stage which, by the way, is mounted on the chassis with the tube underneath and its plate circuit above the chassis enclosed in a National shield can. The important adjustments here are the location of the grid taps on the coils $L_2$ and $L_3$. These taps should be adjusted until there is no sign of regeneration in the r.f. stage. Of course, if bypassing has not been done effectively in the immediately-associated circuit, the taps will have to be carried so far down in order to realize this condition that the gain of the stage will be seriously impaired. The usual fiddling with bypass condensers in power supply leads will be necessary in order to stabilize the i.f. amplifier. The two condensers $C_10$ were found to be essential in this particular set-up.

A refinement which will be found almost essential if the receiver is to be calibrated for quantitative work is a Faraday shield between the antenna coil and the grid circuit of the first tube. Such a shield may be simply made by winding a coil of about No. 24 d.c. wire on a celluloid form, doping it well, then splitting the coil, baring the severed wires at one end and soldering them to a grounding strip. The antenna coil in this case should be made in the form of a thin pie.

Another essential accessory is a voltage regulator for the power supply. We use the Delta voltage regulators and find them eminently satisfactory. Yet another essential with any but very low-drift crystals is an effective constant-temperature oven. The Billey BC6 type oven has solved the problem for us.

THE RECORD ANALYZER

In any recording work it is one thing to pile up a mass of recordings and to study them superficially. It is quite another thing to work up the records into some form suitable for correlation work. With the early photographic records of hourly tone signals this merely involved measuring off the magnitude of each "pulse," then getting means for each day or part of a day and the means for each hour of the day each month. The advance to continuous recording meant that a reduction of the records to give mean values, done in the conventional graphical manner, would take almost as much time as was consumed in the making of the original records. The need for some short-cut method led to a three-way rag-chew between Harner Selvidge, of Harvard University, Ed Sanders of WTIC and the writer. The outcome was a plan to use a bunch of clocks arranged as a primitive electro-mechanical integrator and operated by a series of thyratrons from the output of the receiver. This weird concept was christened at the time "unoctagirlcomptometuntimer" because it would probably do the work of eight girls, at the same time failing completely to tell the time in spite of its nine perfectly good electric...
The activity of a quartz crystal is a relative measure of the ease by which it can be excited and its ability to start oscillating. Maximum activity is obtained only by properly cutting the crystal from the raw quartz and then by carefully lapping the faces to an extremely high degree of planeness and parallelism.

To meet these rigid requirements, Bliley Engineers found it necessary to develop specialized machinery for precision lapping. As a final check each crystal is examined by means of a sensitive electrical micrometer gauge and the faces must be within very close limits of being plane and parallel before receiving the inspector’s approval.

When you buy Bliley, you are getting the result of the finest possible engineering and production skill and workmanship. When you buy a Bliley LD2 Crystal Unit (40-80-160 meters) at $4.80, you are getting the best all-round mounted crystal for amateur use. Bliley Electric Co., Erie, Pa.
Many secrets remain on 5, but it's no secret that the JOHNSON 5Q is extremely effective on 56-Mc. Compact, easily set up and taken down, it provides nearly 100% transfer from transmitter to antenna. May be mounted on set or fed with conventional transmission line, yet this highly efficient antenna is very inexpensive.

Available at leading Jobbers everywhere

E-F-JOHNSON COMPANY

Export Office: 25 Warren St., New York. Cable: "SIMONTRCE"

NEW HOLDER DESIGN

15 SECONDS TO INSTALL CRYSTAL

For All Bands
GREATER STABILITY
Plugs in 5 prong tube socket
Beautiful Appearance

MODEL AH HOLDER $1.00 At your dealer or direct

HIPOWER LOW DRIFT CRYSTALS:
within 10 kc., or Choice of stock
AH-10, 1700-3500 Kc. bands $2.35
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WRITE FOR NEW LITERATURE

Hipower "Low Drift" Broadcast and Commercial Crystals Are Approved by F.C.C.

Hipower Crystal Co., 2033 Charleston St., Chicago

clocks. The idea was later reduced to practical terms and applied to the more urgent problem of analyzing the seven months of continuous records that had already been made. The final equipment is shown in Fig. 5. It consists of a simple frame made of 2-inch by 1-inch pine supporting a drive roll similar to that used in the recorder. This roll is driven by a phonograph motor at a speed of sixty or more times the speed at which the original record was made. Mounted above this drive roll is a sliding contactor similar to the slider used in the dark ages on single-slide tuners. This slider makes contact with a strip of copper segments cut according to the receiver calibration in 5 db steps. When the pointer on the slider is located anywhere in the region up to 5 db above zero level the contact with the first of these segments closes one of a bank of relays and starts the first clock. With each progressive 5 db in the setting of the slider an additional clock is started until the maximum-signal position is reached. At this time all clocks are running. In operation the record is run through and the pointer on the slider is held manually on the trace on the recording. At the end of any period the drive motor is switched off, the slider set to zero and the new settings of the clocks read off. Comparison of these readings with that of a master clock which runs all the time enables the operator, with a simple computation, to determine the percentage of time for which the signal had been riding at any level. These data are then ordinarily plotted to give a curve of signal level versus percentage of time.

For convenience in taking curves of the diurnal variation in signal level additional dials having one hundred divisions were made up photographically and cemented to the clock faces. For this work the analyzer was run for one-minute periods (corresponding to one-hour periods on the recording) and the percentage of time for each level read off directly from the one-hundred-degree dials.

The actual mechanical and electrical arrangements of the device may, of course, be varied to suit the individual worker. The limitations of space forbid us to offer more than the basic idea.

In order to allow simultaneous recording and analysis of the record the contact strip is mounted on the frame of the Leeds and Northrup recorder, the contactor being attached to the pen assembly. The same relays and clocks are, of course, put to work. The only disadvantage of this set-up is that it requires hourly reading of the clocks if diurnal characteristics are to be plotted. At the moment we are engaged in designing a crude camera, operated from a time switch and arranged to take a picture of the clocks every hour. With this gadget installed it will be possible for us to engage without interruption in our ordinary ham work, happy in the knowledge that when the time comes for an analysis of a few months records we will only need to read off a couple of thousand clock photographs and compute the percentages of time.
We are now delivering the 1937 Patterson

**PR-15**

One of the finest amateur and communications receivers ever built.

The PR-15 contains the essential elements found in other receivers plus a long list of exclusive PR-15 features including:

- Radically Different 100% Noise Silencer
- Automatic threshold control silencer that greatly reduces noise interference from autos, power leaks, heating pads, key clicks, motors, etc.
- Crystal Filter, Series and Parallel Exclusive shielded design — absolute single signal — calibrated. Perfect usability on phone.
- Five Bands — 8 to 550 meters — .55 to 40 Mc.
- Equal gain over entire range — no dead spots. 2 r.f. stages on all bands. Quiet 10 meter reception.
- No Decrease in Signal Strength when Using Crystal Filter and Noise Silencer

Complete with 12" Heavy Duty Dynamic Speaker and 12 Matched Tubes (11 Metal and 1 Meta-Glas). List price, $182.50 — Amateur net price, $109.50

Down Payments and Monthly Payments as low as $12.50

SEND 3c IN STAMPS FOR COMPLETE INFORMATION

DELAWARE RADIO SALES COMPANY
WILLARD S. WILSON — W3DQ
405 DELAWARE AVENUE
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WILMINGTON, DELAWARE

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"And Now We Have Full-Range Superhet Selectivity**"

Stability of a superhet is dependent upon the quality of the condensers and coils used in the circuit! SICKLES coils and condensers are known world-wide for their quality and performance.

We are in a position to supply coils and condensers necessary to construct the "Transfer Circuit" described in QST, June '37, pages 16-21, by Mr. James J. Lamb.

Air Trimmers used are our own design — compact, dependable, and efficient. Fixed condensers are the new Sickles SILVER-CAPS, the condenser having less than 0.002% per degree drift.

The coils — the highly efficient "Diamond Weave..."

Sickles QST Type Price
No. 54401 No. T-1 Input $4.25
This unit includes the coils T-1 Air Trimmer C-1 and 2 SILVER-CAPS C-3 Unit complete in shield.

Sickles QST Type Price
No. 54402 No. T-2 Output $3.75
Unit includes coils T-2 Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54433 No. T-3 Input $4.00
Unit includes special coils T-3 Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54404 No. T-4 Output $3.75
Unit includes T-4 and Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54405 No. T-5 Input $4.00
Unit includes Luft C-4 and Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54406 No. T-6 Output $3.75
Unit includes Coils T-6 and Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54407 No. T-7 Input $4.00
Unit includes Luft C-4 and Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54408 No. T-8 Output $3.75
Unit includes Coils T-8 and Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54409 No. T-9 Input $4.00
Unit includes Luft C-4 and Air Trimmer C-3 complete in shield.

Sickles QST Type Price
No. 54410 No. T-10 Output $3.75
Unit includes Coils T-10 and Air Trimmer C-3 complete in shield.

All above items carried in stock. Order shipped same day as received.

THE F. W. SICKLES CO.
300 Main Street
Springfield, Mass.

* See QST, June '37, p. 16.

---

KENYON

EFFICIENT
RELIABLE
MODERN

KEN-O-TAP

The Practical Solution to the Modulation Problem

KEN-O-DRIVE

The Modern Answer to Critical Driver Operation

KEN-O-DYNE

The Precision Method of Matching Output Tubes to Speakers

Ask Your Dealer for Our 16 Page "T" Line Catalog Which Contains a Large Selection of Modern Audio Circuits.

Kenyon Transformer Co., Inc.
840 Barry Street, New York, N.Y.

Export Dept.: 25 Wamen Street, New York, N.Y.

Say You Saw It in QST — It Identifies You and Helps QST
GOOD TUBES have SPEER GRAPHITE ANODES

Graphite anodes will not melt or warp at any temperature, no matter how much above the melting point of nickel, molybdenum, tantalum. Speer *processed graphite anodes produce better, more uniform tubes with increased useful power and life.

Write for list of tubes using Speer Anodes and booklet.

SPEER CARBON COMPANY
ST. MARYS, PA.

TRIPLE TUNED 1-F TRANSFORMER

High adjacent channel rejection 30 kc. wide at 20 times down

Broad flat top — 8 kc. wide

Easy alignment; no cathode ray oscilloscope necessary

All trimming condensers tuned from top of shield

Compact Size

N 101 I-f Transformer, 465 kc. conv. $3.50 List
N 200 I-f Transformer, 465 kc. diode 3.50 List

ALADDIN RADIO INDUSTRIES, INC.
466 W. Superior Street, Chicago, Ill.

Licensee of Johnson Laboratories, Inc.

Fundamental-Reinforced Harmonic-Generating Circuit

(Continued from page 15)

is carried through any of these harmonics, and power output can be taken from each harmonic. Because the plate circuit of the harmonic generator is coupled back to the crystal oscillator, it is not desirable to couple the load directly to the tank circuit of the harmonic generator, and a coupling condenser is therefore recommended. This coupling condenser is made variable to control output and loading.

Other coupling arrangements than that indicated in Fig. 1 are possible; for instance, the two coils might be link-coupled. This would offer the possibility, with plug-in coils in the harmonic-amplifier plate circuit, of having an individually-adjusted link on each so that the proper coupling would be established when the coil was plugged in.

Regeneration or a tendency to self-oscillation is prevented in the harmonic generator tube because of the by-passing effect of the tuning condenser across the plate coil of the crystal oscillator, and no trouble will be experienced on that account. The circuit is so stable that grid-leak or cathode bias may be used in the harmonic generator; however, battery bias is preferred since it protects the tube in case the oscillator stops. The tube is to all intents and purposes a Class-C amplifier and the same protection should be afforded it as any other tube used for that class of service.

Because the circuit will generate all orders of harmonics, care must be used to tune to the proper frequency. The third, fifth, sixth, seventh and eleventh harmonics just won’t do in amateur circles, and some means for determining the fact that the fourth or eighth harmonic is being generated must be at hand. A simple way to make sure is to build an old-fashioned absorption wave meter with a small lamp in series with the coil and condenser. With such a means for determining frequency bands, even if only roughly, the amateur is pretty sure just where he is and there will be no danger of a ticket for out-of-band operation. The likelihood of picking the wrong harmonic is of course much greater on the higher frequencies than on the lower, and this should be kept in mind.

The crystal oscillator circuit is one that has been in use here at W1QP for a number of years, primarily because it is easy on the crystal and because full output may be obtained from the tube used. A plate efficiency of 64 per cent for the crystal oscillator is usual, and r.f. crystal current is of the order of one milliampere for every milliampere of plate current. The circuit in the cathode lead of the oscillator is tuned roughly to half the crystal frequency; i.e., for an 80-meter crystal, the cathode circuit is on 160 meters. The cathode coil, which may be a 100-microhenry coil for our purposes, is shunted with a 100-µµfd. fixed condenser. The grid resistor should be of the wire-wound type, and is connected between the grid
HAVE YOU A LOG

for your Portable and Mobile operation?

35c each
3 for $1

A.R.R.L.
West Hartford, Conn.

ORIGINAL UNIVERSAL CLASS B
TRANSFORMERS — NOW IMPROVED
MATCH ALL TUBES
50 Watts Audio, Per Pair......................... $4.95 POST
100 Watts Audio, Per Pair......................... 7.75 PAID
ONE YEAR GUARANTEE
Write Today for Big Free Data Sheet
DOUGLAS RADIO PRODUCTS
BOX A2 DOUGLAS, MICHIGAN
Earl I. Anderson, WBUD

SPECIAL TO AMATEURS
Piezo-Electric Crystals — $2.50 EACH POSTPAID
Until supply is exhausted... we offer small 80 meter band crystals unmounted; accurate calibration, excellent oscillators. Limited quantity.

SCIENTIFIC RADIO SERVICE
"The Crystal Specialists Since 1925." University Park, Hyattsville, Md.

5500 R. R. JOBS FOR CW MEN
WHO PREPARE THEMSELVES
AVAILABLE SOON
No license required. Eight hours per day. Year around. 65 to 80 cents per hour. If you can copy 15 words per minute, write

CODE-CRAFT
Q 6703 Dunham Ave.
CLEVELAND, OHIO

GULF RADIO SCHOOL
Radiotelegraphy Radiotelephony
Radio Servicing
SECOND PORT 1007 Carondelet Street
U. S. A. NEW ORLEANS, LA.

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

83
A NEW Service
TO UP-TO-DATE AMATEURS

FREE!

THESE MONTHLY BULLETINS BRING YOU PRE-PUBLICATION RADIO DEVELOPMENTS

SUN RADIO COMPANY
227 Fulton Street, New York, N. Y.
Cable Address: SUNRADIO NEW YORK

SUN RADIO COMPANY
227 Fulton St., Dept. B7
New York, N. Y.

You bet I want the latest dope on new items as they appear. Put me down for a FREE copy every month.

Name: ...........................................
Address: ...........................................
City: ................................... State: ..........................

and the cathode end of the tuned circuit. The constants of the plate circuit of the crystal oscillator should be proportioned to give a Q of 12. To determine the proper constants for this Q, reference may be made to the March issue of QST, in which a detailed explanation is given for determining the value of any tuning condenser in terms of the plate input to a tube.\(^1\) On the average, one \(\mu\)fd. per meter is a good value for crystal oscillators.

In the harmonic generator circuit, normal values of grid voltage and grid coupling are used. The grid coupling condenser need not have more than 50 \(\mu\)fd. maximum capacity and it certainly should be variable. The amount of coupling used is determined then by the grid excitation needed for the particular tube being used. For the 807 3 to 5 milliamperes grid current is plenty. As in the case of the crystal oscillator tube, the plate circuit of the harmonic generator should be so designed that it will have a Q of 12 if possible. Should the circuit be built so that it will tune to several high-order harmonics with one condenser and coil arrangement, the highest harmonic should tune where the condenser capacity is at a minimum.

The action of this harmonic generator depends upon decrement; that is, there must be a falling off of the voltage amplitude of the output power before the next kick is obtained from the fundamental frequency. To determine just what order of decrement exists, work is going forward to see if it can be shown on the cathode-ray oscillograph. Some progress has already been made in that direction and some interesting results should be obtained. There exists even the possibility that an 80-meter crystal-controlled circuit may allow us to operate on 160 meters with this new device.

Improving DX
(Continued from page 80)

is a well-thought-out one and at the present writing is being voted upon by the member-societies of the Union. It provides, among other things, that all the member-societies agree to the following subdivision of the 7-Mc. band:

7000-7200 kc.-C.w. or 'phone. On every continent, to be used for all communications within the interior of that continent. To be the only frequencies in this band used by W/VE amateurs.

7200-7250 kc.-C.w. only. To be used by the amateurs of all continents except Europe and North America, when they desire to work with European and North American amateurs.

7250-7300 kc.-C.w. only. To be used by the amateurs of Europe when they desire to work with the amateurs of other continents.

How would you like it? Think it over. Would it not facilitate your DX work? In return for these benefits, would you be willing to give up your rights to work in the frequencies not therein specified as available for North American amateurs? Both the Editor and the Communications Manager invite reactions.

\(^1\) Reinhart, "How Much CT?," QST, March, 1937.
GAMMATRON!
SCORES AGAIN!
3 NEW TUBES

354-D Amplification Factor 22
354-E Amplification Factor 35
354-F Amplification Factor 50

SEND for operating data and curves on these new Gammatrons. All types are 150 watts RATED plate dissipation.

AT YOUR DEALER

THE 1938 SUPERSKYRIDER

Just look at these features. Range from 5-550 meters! Variable selectivity control! 1000° of band spread on 20 meters alone! Net price complete, less speaker and crystal, $99.00; extra for 12" pm speaker in cabinet, $12.00; extra for crystal, $12.00.

TIME PAYMENTS ON ALL HALLICRAFTER SETS

JOHNSON "Q" ANTENNAS FOR BETTER DX

5Q. Five meter antenna system
10Q. Ten meter antenna system
20Q. Twenty meter antenna system

SPECIAL JOHNSON TRANSMITTING CONDENSERS

Type 50 CD 105 split stator 50 mmfd. per section, 550°, 11,000 V. spacing
Type 100 CD 110 same as above but 100 mmfd. per section
Type 50 CD 130 split stator 50 mmfd. per section, 300°, 13,000 V. spacing

KENYON SPECIALS

POWER TRANSFORMERS AND CHOKES AT UNHEARD OF PRICES!!! ALL CASED

POWER TRANSFORMERS
D200. 750-1000 V. each side at 300 mils
D201. 1000-1350-1500 V. each side at 300 mils
D202. 1500-2000-2500 V. each side at 400 mils
D203. 1000-1250-1500 V. each side at 500 mils

SMOOTHING CHOKES
O100. 20 Henries-200 mils. 2500 V. insulation
O102. 20 Henries-300 mils. 2500 V. insulation
O104. 20 Henries-400 mils. 5000 V. insulation
O106. 20 Henries-500 mils. 6000 V. insulation

SWINGING CHOKES
D101. 5-25 Henries-200 mils. 2500 V. insulation
D103. 5-25 Henries-300 mils. 2500 V. insulation
D105. 5-25 Henries-400 mils. 5000 V. insulation
D107. 5-25 Henries-500 mils. 6000 V. insulation

Heavy Duty 2½ V. 12 amp. 8650 ftl. trans., 7500 V. insulation

Special ........................................... $1.18

Triplett 0-1 mill. D.C. 2½" Bakelite case meters ............ $3.75
Triplett R.F. Thermo couple ammeters, 0-2½ amps. or 0-5 amps., 3½" Bakelite case ......... $6.53
All Other Triplett Meters In Stock at Regular Prices

W3AHR MAIL ORDERS PROMPTLY FILLED W3BMS

CONSOLIDATED RADIO CORP., 612 Arch St., Philadelphia, Pa.

Say You Saw It in QST — It Identifies You and Helps QST
A crystal microphone designed for voice transmission and general purpose P.A. installations. Output level -54 DB (conservatively rated). Equipped with interchangeable plug and socket and cable protector. List price $22.50

Wildrange, non-directional crystal microphone. Interior assembly two dual diaphragm high fidelity units. Equipped also with interchangeable plug and socket and cable protector. New low list price $27.50

Licensed under Brush Development Co. Patents

ASTATIC MICROPHONE LABORATORY, INC.
DEPT. O, YOUNGSTOWN, OHIO, U. S. A.
Pioneer Manufacturers of Quality Crystal Devices

RADIO ENGINEERING, broadcasting, aviation and police radio, serving, marine radio telegraphy and telephony. Morse telegraphy and railway accounting taught thoroughly. Engineering course of nine months duration equivalent to three years of college radio work. School established 1874. All expenses low. Catalog free.

DODGE'S INSTITUTE, Day Street, Valparaiso, Indiana

Unconditionally Guaranteed

Powerful Reliable

X cut 7000 KC ± 5 KC... $1.85 3500 or 1750....$1.65
Low Drift ± SKC 40-80-160.....2.20

PETERSEN RADIO CO.
COUNCIL BLUFFS, IOWA
Formerly Omaha Crystal Labs.

PROGRESSIVE III
built with

Stream-Line TRANSFORMERS AND CHOSES gives you highest performance at lowest cost.
Send for FREE Bulletin 44

GENERAL TRANSFORMER CORP.
518 S. Throop St., Chicago

How Would You Do It?

(Continued from page 80)

I—panel for switches controlling 110 v. a.c. power.
J—key.
K—tools, QSL's, neon bulb, plug-in coils, etc.
The shelf at L is mainly a support for the bottom of the structure. It can be used for the speech amplifier and its power unit, and also to accommodate magazines, books and the miscellaneous boxes of screws which, I believe, is standard equipment in every amateur station.

The space H may be made as a sort of pedestal inside the space for the receiver, and the receiver rests upon it. The writing desk is hinged at the bottom and folds up to hide the receiver, etc.

Panels may be used on the shelves that slide out, if so desired. The top and bottom shelves are put in permanently while the ones in between slide out in case repairs to the apparatus become necessary.

I think this rack would be inexpensive as the whole thing is made of ½ inch by 12 inch lumber and enough lumber can be purchased for about four dollars.

Honorable mention, for designs which were still on the list at the final judging, goes to the following:
W1EZV, H2K, IMV, JJZ, 2FQK, JSL, 3AYS, GBC, GJT, 4BDE, 6DBF, 9GBM, 80MM, 9FKO, VE44MU, 4QP, J. L. Pratt, Roland Abell, E. A. Krampert, H. R. Wahlin, Keith Henderson, Chas. Zrinsky and N. F. Van Gelder.

Here are the rules governing this contest series:
1. Solutions must be mailed to reach West Hartford before the 20th of the publication month of the issue in which the problem has appeared. (For instance, solutions of problem given in the March issue must arrive at QST before March 20th.) They must be addressed to the Problem Contest Editor, QST, West Hartford, Conn.
2. Manuscripts must not be longer than 1000 words, written in ink or typewritten, with double (Continued on page 90)
The Type CRM Oscilloscope employs the little RCA-913 tube having a one-inch screen. In spite of its small size, this new equipment is thoroughly practical and is quite satisfactory for routine measurements in the amateur station. The circuit includes a power supply with controls for brilliance and focus, a potentiometer for controlling the amplitude of the horizontal deflection, and a built-in 60-cycle sweep. This latter is particularly convenient as it permits checking transmitter operation with no connection other than a pick-up coil.

**NET PRICE $11.10**

Without Tubes

**Some Value!**

Genuine oil-impregnated oil-filled high-voltage condensers in round cans.

- Hermetically sealed, High-tension pillar insulator terminals. Positively seepage proof.

- 1000, 1500 and 2000 V. 1 to 4 mfd. Mass produced for lowest prices and genuine quality.

**DATA . . .**

Where to buy it

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

Baltimore, Md.
Radio Electric Service Company
3 North Howard St.

Boston, Mass.
H. Jappe Company
46 Cornhill

Boston, Mass.
Radio Shack
46 Brattle Street

Burlington, Vermont
Vermont Hardware Co., Inc.

Camden, New Jersey
Radio Electric Service Company
811 Federal Street

Greenwich, Conn.
Mead Stationery Company
252 Greenwich Ave.

Hartford, Conn.
Radio Inspection Service Co.
227 Asylum Street

Montreal, Canada
Canadian Electrical Supply Co., Ltd.
925 Craig Street, West

Newark, N. J.
Wholesale Radio Service Co.
219 Central Avenue

New York, N. Y.
Bruno-New York, Inc.
460 W. 34th St.

New York, N. Y.
Sanford Samuel Corp.
136 Liberty St.

New York, N. Y.
Wholesale Radio Service Co.
100 Sixth Avenue

New York, N. Y.
Grand Central Radio, Inc.
124 E. 44th Street

Eustace G. Wile
10 S. 10th Street

Raymond Rosen & Company
117 North 7th St.

M & H Sporting Goods Company
512 Market Street

Radio Electric Service Company
3145 N. Broad Street

Radio Electric Service Company
N. E. Corner 7th & Arch Streets

Pottsville, Pa.
Sylvester Radio & Supply Co., Inc.

Reading, Pa.
Bright & Company
8th & Elm Streets

Reading, Pa.
Sylvester Radio & Supply Co., Inc.
104 North Ninth Street

Albany, N. Y.
Uncle Dave’s Radio Shack
356 Broadway

88 Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them.
WHERE TO BUY IT

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

SPRINGFIELD, MASS.
1. F. Cashons
349 Worthington Street

SPRINGFIELD, MASS.
S. S. Kresse Radio Department
1540 Main Street

WASHINGTON, D. C.
Sun Radio & Service Supply Co.
928 F Street, N. W.

SPRINGFIELD, MASS.
T. F. Cushings
349 Worthington Street

BUFFALO, NEW YORK
Radio Equipment Corp.
326 Elm Street

WASHINGTON, D. C.
Sun Radio & Service Supply Co.
928 F Street, N. W.

BOSTON, MASS.
Selden Radio Company
28 Brattle Street

CONCORD, NEW HAMPSHIRE
Carl B. Evans
80 N. State Street

NEW YORK, N. Y.
Harrison Radio Company
12 West Broadway

NEWARK, NEW JERSEY
Wholesale Radio Service Co.
919 Central Street

NEW YORK, N. Y.
Wholesale Radio Service Co.
100 Sixth Avenue

WASHINGTON, D. C.
Sun Radio & Service Supply Co.
928 F Street, N. W.

RAYTHEON

AMATEUR TUBES

ALBANY, NEW YORK
Uncle Dave's Radio Shack
356 Broadway

BUFFALO, NEW YORK
Rymac Radio
216 E. Genessee Street

HARTFORD, CONNECTICUT
Stern Wholesale Parts Company
210 Chapel Street

NEW YORK, N. Y.
Harrison Radio Company
12 West Broadway

NEW YORK, N. Y.
Terminal Radio Corp.
80 Cortlandt Street

ROCHESTER, NEW YORK
Radio Service Shop
244 Clinton Ave., N.

WASHINGTON, D. C.
Upshur Radio Company
1837 Vernon St., N.W.

BOSTON, MASS.
The Radio Shack
46 Brattle Street

WASHINGTON, D. C.
Sun Radio & Service Supply Co.
928 F Street, N. W.

Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them.
4 BAND • Type HFM

Portable Crystal Control
7000—60,000 Kc.
PHONE—CW—MCW

- Single 40 Meter Crystal for All Bands
- A.C. or Battery Operation
- Complete With Coils for 5-10-20 and 40 Meters
- Duplex Operation—PHONE—MCW

$48.00

"Type TR-6A6"
- Non-glareding Race
- 7 Tubes—Jensen Dynamic Speaker
- 50% Unity Coupled Oscillator
- 10 Watt Carrier
- 100% Modulation
- Duplex Operation—PHONE—MCW

$39.75

RADIO TRANSCEIVER LABORATORIES
8627—115 Street, Richmond Hill, New York

Improves Your 'Fist'
Cuts Effort in Half
Simply press lever—machine does the rest

JUNIOR
ONLY $12.50

VIBROPLEX
SEMI-AUTOMATIC KEY

Vibroplex's machine speed, superior signal and effortless operation assures the user the fastest, best and easiest way to send. Experienced operators know this—that's why over 100,000 of them use only the Vibroplex key. Accept no substitute. Liberal allowances on old Vibroplex. Money order or registered mail. Write to FREE illustrated catalog just off the press.

THE VIBROPLEX CO. Inc.
832 Broadway
New York, N. Y.

NEW YORK YMCA SCHOOLS
4 West 63rd Street, New York City

(Continued from page 86)

spacing, on one side of the sheet. Diagrams and sketches may be in pencil, but must be neat and legible.

3. All solutions submitted become the property of QST, available for publication in the magazine.

4. The editors of QST will serve as judges. Their decision will be final.

Prizes of $5 worth of A.R.R.L. station supplies or publications will be given to the author of the solution considered best each month, $2.50 worth of supplies to the author of the solution adjudged second best. The winners have the privilege, of course, of stating the supplies preferred.

—D. H. M.

Our hero, who is getting along so well these days because of the help received from this series of problem contests, is fast running out of problems. We can see that our readers will have to step forward with some of their own troubles if this department is to be kept going. The quantity of solutions received is excellent. We need some suggestions for problems—we need 'em badly. Can it be that we amateurs have the ham game licked?—Enron.

New Beam Power Tubes
(Continued from page 18)

The RK-48 is the beam counterpart of the RK-28. The ratings of the two tubes are approximately the same, although the RK-48 will give somewhat higher plate efficiency. Tentative ratings and characteristics are:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RK-48</th>
<th>RK-28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament voltage</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Filament current</td>
<td>8 amp</td>
<td>8 amp</td>
</tr>
<tr>
<td>Plate voltage, max.</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>Screen voltage, max.</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>Plate dissipation, max.</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Screen dissipation, max.</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>D.c. grid current, max.</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>R.f. grid current, max.</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

As a Class-C amplifier, the bias should be —100 volts at the maximum plate and screen voltages. In operation, with the plate load adjusted for maximum efficiency, the following data are typical:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Plate voltage</th>
<th>Screen voltage</th>
<th>Grid voltage</th>
<th>Plate current</th>
<th>Screen current</th>
<th>Plate dissipation</th>
<th>Driving power</th>
<th>Grid current</th>
<th>Power output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2000 volts</td>
<td>400 volts</td>
<td>—100 volts</td>
<td>100 ma.</td>
<td>75 ma.</td>
<td>93 watts</td>
<td>1.95 watts</td>
<td>10 ma.</td>
<td>122 watts</td>
</tr>
</tbody>
</table>

The RK-48 and RK-28 are identical in appearance and basing. As with the RK-47, the beam-forming plates are connected to the suppressor pin, and this connection should be grounded.

Incidentally, there is no benefit to be gained by operating either of the new beam tubes with positive potential on the beam-forming plates. Doing so does not increase the output, and probably has no effect except to use up some electron emission which might otherwise be usefully employed by the plate.
HAM-ADS

Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.

(1) No display of any character will be accepted, nor can any special typographical arrangement, such as all or part capitolization, be used which would tend to make one advertisement stand out from the others.

(2) No special rate is 75c per word, except as noted in paragraph (6) below.

(3) Resumation in full must accompany copy. No cash or credit will be allowed in the event of cancellation will be allowed.

(4) Closing date for Ham-Ads is the 25th of the second month preceding publication date.

(5) A rate of 70c per word will apply to advertising which is not non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Advertising of bona fide surplus equipment owned, used, and sold by an individual apparatus offered for exchange or advertising inquiring for special equipment. When a member of the American Radio Relay League takes the 70c rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and takes the 80c rate.

(6) A special rate of 70c per word will apply to advertising which is not non-commercial in nature and is placed and signed by a member of the American Radio Relay League. Advertising of bona fide surplus equipment owned, used, and sold by an individual apparatus offered for exchange or advertising inquiring for special equipment. When a member of the American Radio Relay League takes the 70c rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial and takes the 80c rate.

Having made no investigation of the advertisers in the classified columns, the publishers of QST are unable to vouch for their integrity or for the grade of character of the products advertised.

QUARTZ—Direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Data, 719 World Bldg., New York City.

RADIO equipment—New and revised police radio servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Byrd St., Valparaiso, Ind.

NATIONAL—Hammarlund, RCA-RME used sets, 90% off list. W3DQ, 405 Delaware Ave., Wilmington, Del.

QSL's, W8SN, Helmietta, N. J.

CALLBOOK—new DX calls, new prefixes, thousands of new W's and VE's. The American Radio Relay League. Send postpaid $1.25, or a whole year (four issues) for $4. (In foreign countries $1.35 and 44.35.) Your call and QTH printed in large type $1 per year. Amateur Radio Call Book, 610 S Dearborn, Chicago.


QSL's, all colors, cartoons, snappy service. Write for free samples today. W1BEF, 16 Stockbridge Ave., Lowell, Mass.

QSL's, special introductory offer extended. Radio Headquarters, Ft. Wayne, Ind.


WASHINGTON: Eastern Electric amplifiers and equipment: 8A, $25; 8B, $35; 17B, $35; volume indicators, $20; 10A, $35; rectifier panels 1B, $35; 600A, $75; 754A meter panels, $17.50; 75FA condensers 2 mfd., .05¢ .01 mfd. 75c. Assorted transformers, commercial and takes the 70c rate. Provisions of paragraphs (1), (4) and (5) apply to all advertising in this column regardless of which rate may apply.

QUICK TRANSFORMERS—custom-built. Write for list. Troy Electric Transformer Co., Troy, N. Y.


SELL—Quartz crystals 75c each postpaid. Faber4, 4023 Davis Ave., Cheviot, Ohio.

SELL—New and revised police radio servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Byrd St., Valparaiso, Ind.

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

SELF-trade Mac Key and 1200 volt supply 40 meter crystal 3W135, WDLZ.

QSL's, SWL's, reply getters. Samples (stamps). W4ESN, 1827 Cone, Toledo, Ohio.

WANTED: gasoline motor generator or generator alone, 110 A.C. volts, 200-1000 watts. WSDX.


CHICAGO and vicinity: sell 34 k.w. CW transmitter. Want wood 8 MM projector, T. A. Hansen, 8105 Osceola Ave., Niles, III.

FOOT sale: 1000 volt 1 amp. Fasco generator 3500 R.P.M. Field separately excited. Best offer. W1CKF, Middle Haddam, Conn.

SHELL—National R.F.A. complete. SX10 Super Skyrder, Jesse Jones, 901 National, Vicksburg, Miss.

MUST sell complete 200 watt fone and CW xmitter; de luxe steel enclosed 6 ft. cabinet. 100% Thoradorn and Hammarlund equipped. Make of (W8SS), 931 W. Madison St., Chicago, Ill.

5 meter Hams. Sure fire results for receiving and transmitting. Any power. Using this new type coil to match feed line to antenna. This has been tried against every known system with superior results. Complete with instructions. $1.50, Bates Lab., N. Harwich, Mass.


SELL or trade for good camera—Paterson PR16C, W. P. Coll, Norco, La.

QSL's, 300 one-color cards, 1$. Samples, 2143 Indiana Ave., Columbus, 0.

TURNERS—custom-built. Write for list. July specials 2.5 volt A.C. tubes for $1.25. Tubing from 70c to $3.00. Send for complete list. Blum, 895 Ebner St., Columbus, Ohio.

QSL's, Beautiful designs, Free samples. Maleco, 1512 Eastern Parkway, Brooklyn, N. Y.


QSL's printed. Samples. W2AEG.

COLLINS 32B, extras $100. W2ETD.

TELEPLEXES, vibroplexes bought, sold, traded. Ryan Radio, Rm 109, Monroe City, Ill.

SELL: Hallcraft'er Skybuddy, $24. W3FWY, Armdone, Penn.

SW3, power supply, tubes, coil cabinet, 8 sets coils, perfect condition. Make offer. Lorenson, Southern Pine, N. C.

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PAK-1XM—Same as PAK-1M but with VARI-MATCH modulation output transformer. Impedances available are 220, 408, 1180, 2350, 2400, 3000, 4000, 4670, 4750, 5560, 7000, 9150, 9470 ohms. Net price $48

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