For the amateur who is interested in a means of consistent radio communication there is the Collins 250A Transmitter, one of the 200 Series so widely used in various commercial services. The cost of this transmitter is low because automatic tuning is not used and expensive control circuits are eliminated, but it has the same general design and excellence of construction of the larger and more complicated 200 Series Transmitters. All parts in the 250A are easily accessible through the use of Collins demountable deck construction.

The appearance and finish of the equipment is commercial in every respect and the transmitter is free of unnecessary gadgets.

Convenient frequency change is accomplished by the use of pretuned tank circuits in the low level stages and simple plug-in coils in the output circuit. Frequency range is 1500-30,000 kc. The tube complement is low in cost, consisting of 1—C-100D Oscillator; 1—6L6 First Amplifier-Doubler; 1—6L6 Second Amplifier-Doubler; 1—6L6 Third Amplifier-Doubler; 1—CK70 Intermediate Amplifier; 2—805 Final Amplifiers; 2—C305 Modulators; 2—872 High voltage Rectifiers; 2—5Z3 Low voltage Rectifiers.

Power output of 300 watts phone and CW makes the 250A a dependable DX getter and at the same time is easy on the light bill. Very moderately priced, the Collins 250A has everything you need to do a real job.
Already hundreds of amateurs are using the New 1938 Super Sky Rider. They are testing its low sensitivity, its wide range variable selectivity; its revolutionary New Spiral Band Spread on the air under all conditions of service. On their verdict we rest our case, so ask the amateur who owns one what he thinks of the New 1938 Super Sky Rider.

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- 6 Tubes
- 11 Tubes
- Wide Range Variable
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- Better Than One Microvolt
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<table>
<thead>
<tr>
<th>Model of Receiver</th>
<th>Cash Price</th>
<th>Down Payment 12 Monthly Payments</th>
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<tr>
<td>Sky Buddy</td>
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<td>17.90, 6.28</td>
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<tr>
<td>Ultra Skyrider</td>
<td>99.50</td>
<td>19.90, 7.03</td>
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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 worthwhile 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.

Hiram Percy Maxim, First President

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Address all general correspondence to the administrative headquarters at West Hartford, Connecticut.
IT strikes us that the 30-Mc. band isn’t so entirely dead this summer as amateurs commonly believe. On several occasions recently, when no signals at all were to be heard on the tuner, we have sent out a CQ and received answers from two or three fellows. It seems that they were just sitting there, waiting for someone to call!

We suspect that too many of us have the habit of just listening briefly on the band and, hearing nothing, concluding that it is “dead to-day.” Of course if we all did that, all our listening would always disclose a silent band. Moral: give 28-30 a whirl; you’ll be surprised. Or, as some of our friends put it, “Ya gotta make calls if ya wanta get results.”

The telegraph code is commonly said to be made of two elements, the dot and the dash. We would like to observe that that is only two-thirds of the story. There are three elements: the dot, the dash, and the space. Of these, we sometimes think the space is the most important. The relative length of dots and dashes can vary over wide limits without disturbing the readability of the signals, if only the spacing is correct.

The most common sending error is bad spacing within letters, the thing that makes CQ sound too often like NNMA or NNMET. Again it is the spacing that is at fault when TEST becomes NST.

But of all the spacing errors, the one whose correction would confer the greatest boon upon us is the failure to leave a space between words or between the repetitions of a call. Particularly when calls are run together, there is nothing to do but reduce the hogwash to paper and see where the dividing lines ought to be drawn. It takes a mind-reader to hear CIMARICIMARIC on the air and realize without writing it down that somebody is calling CIMAR in Ecuador and forgetting all about the third element of the telegraphic code, the space.

The R scale for expressing signal strength is supposed to be dead in amateur radio. Long live the S scale!

We used to talk R1 to R9, but the time was reached when amateur radio, or at least the telegraphic portion of it, almost universally adopted the RST system of reporting signals. Under that system, R refers to readability, expressed as QSA1 to QSA5, and so we no longer want to use R to refer to signal strength. It is the S element in RST which reports the signal strength. That is why articles in QST refer to strength of S5 or S9, instead of the old designations of R5, R9, etc. Of course the definitions in the two systems are not precisely the same, but they’re so close that the difference can be neglected in practice.

So it’s bad form now to say “R9.” If that’s what you mean, you should say “S9.” And that goes for ‘phone as well as c.w. How about it, gang?

We seem to be unloading some operating thoughts this month. While we are at it, there is one more we might as well get off the hook:

The Q abbreviations were got up originally to permit the interchange of necessary information between operators who might not understand a single word of the other’s language, and they therefore have extremely precise meanings. All too frequently these meanings are not observed in amateur radio with sufficient rigidity. We’ll illustrate:

Recently we were QSO a European amateur who was using an electron-coupled oscillator. He observed that there was strong interference on us. In response we stated that, as far as that went, there was plenty of interference on him too. Then, addressing ourselves to the point, we said that we were proud possessors of a new rubber crystal and could QSY slightly if he wished. In fact, we definitely asked him “QSY?” a couple of times, complete with the question mark each time. Now “QSY?” has just one meaning, and a very definite one: it refers to whether I, the inquirer, should shift frequency. But what did this galoot do but come back and say OK OK, he would QSY. And durned if he didn’t do it, too! A twist of the wrist on his good old E.C.O. and he whisked away to other parts of the band, and we never did hear him again. Again a moral: when you are talking with a foreign amateur, and there are language handicaps, observe carefully the exact assigned meanings of the international abbreviations. He probably means exactly what the Madrid bible says a particular Q combination means.

The Army and the Navy in this country do a sterling job of supporting amateur radio when it needs support. We owe something to both
services for their backing of us. One of the things we can do to repay them is to take part in the work of the A.A.R.S. and N.C.R., according to our preferences and qualifications. It is part of the "serious" side of the game that has built amateur radio to its present strength. To spread the news of what these services are doing, we are pleased to inaugurate in this issue of QST two new departments, one devoted to the Army-Amateur Radio System and the other to the Naval Communications Reserve. The departments are written in the head offices of these services and we hope that each month they may tell our readers something of the interesting story that is going on behind the scenes for those amateurs who are participating.

Chowpy-chowpy,
Chow-chow-pee-chow.
Something's the matter
With my radio.
K. B. W.

Our Cover

THE shot this month comes from Elmira, N. Y., where the annual National Soaring Contest is being held. Grant Meeker, W8ADV, is shown installing an ultra-high-frequency trans­mitter-receiver in a Ross-Stephens sailplane. The fellow with all the parachute trappings is Har­land Ross, the designer and pilot of the ship. Incidentally, the Elmira Radio Association gang did a bang-up job again this year with their communication networks between the adminis­tration buildings, the various launching sites, control points and the soaring planes. The Elmira organization is a sweetly running set-up if ever there was one.

Central Division Convention

Detroit, Mich., September 4th-5th-6th

THE Greater Detroit Amateur Radio Council is sponsoring the official Central Division Convention to be held at the Hotel Tuller, Detroit, Mich., on September 4th, 5th and 6th. It is the pleasure of the Convention Committee to extend a cordial invitation to all A.R.R.L. members and radio amateurs to attend this affair in Detroit.

Those amateurs who have attended former conventions and hamfests know that Detroit has always put on a good show.

A program has been prepared which will surpass all previous efforts, and if more information is desired write E. G. Canuelle, Secretary, Greater Detroit Amateur Radio Council, Hotel Tuller, Detroit, Mich.

South Dakota State Convention

Sioux Falls, S. Dak., September 4th-5th

IT IS a number of years since the last convention was held in this city, but it is the intention of the Sioux Falls Amateur Radio Club to make up for the intervening years. So, take note Ye Hams that you are all invited to attend the South Dakota State Convention, at the Hotel Cataract Sioux Falls, S. Dak., September 4th and 5th.

The registration will begin at 10:00 A.M. on Saturday the 4th, and the fee will be kept under $2.00 if possible. Plenty of entertainment will be in order and a feature skit by four talented members of the club will be presented during the convention.

Come early, fellows, and write Lloyd Angle, Secretary, 317 So. Menlo Ave., Sioux Falls, S. Dak.

Strays

W6JVG claims the distinction of being the first mobile radio station to cross the new Golden Gate Bridge.

Add to unusual requests from the uninitiated: A chap wanted to know if WSPLR could spare one of his license plates. Inquiry developed that what the friend wanted was a QSL card!

Suggestions still come in on that slippery bug problem. Several have suggested the old stunt of moistening the feet (one fellow recommends wine!) but here's one which is supposed not to smear or scratch the surface of the table. Take the glaze off the feet with fine sandpaper, apply some glycerin and then wipe off with a cloth. W9MTC guarantees she'll stick.
Back in 1930, when Ross Hull was returning from Australia to this country, the cargo ship on which he was one of half a dozen passengers, passed close enough to Pitcairn Island to allow a glimpse of that Pacific paradise. Hull was in the radio room when the open background of static was broken by a raspy spark signal, sending blind and asking that the boat stop at the island to swap shirts, medicines, etc., for fruit. As a result, the boat turned about and waited a couple of miles offshore while the islanders rowed out en masse in two large multi-oared boats bringing with them quantities of the most luscious fruit anyone ever heard about. The story of Andrew Young and his unique radio rig intrigued us all and several exchanges of letters were made with Pitcairn in the attempt to get the full story. Now we have it from a ham who actually lived there for a week and served time as assistant op. It isn’t exactly our brand of ham radio but it is as interesting a true story as has come down the pike in many a moon.—EDITOR

WHAT old timer doesn’t remember the buzzing sound of the old spark transmitter? What memories would come back to anyone who had heard this sound if he caught that same familiar note in this modern day and age! Down in the South Pacific there is just such a signal on the air. On a high island of steep, rocky cliffs, halfway between Panama and New Zealand, miles from anywhere PITC is the only active radio station. This is the now famous Pitcairn Island, a British possession, to which so much attention was attracted by the motion picture, “Mutiny on the Bounty.” For it was to this island that Fletcher Christian and his little band of mutineers with their Polynesian wives came back in 1790 to found what they hoped would be a home, though in exile. The island was ideal to further their ends as it was isolated from the rest of civilization, it was abundant in all kinds of fruit such as oranges, limes, mangoes, bananas, coconuts and guavas, and the climate, because of its mildness, favored an easy South Sea existence. The inhabitants of Pitcairn to-day are descendants of these mutineers and their Polynesian wives and still live the simple life of their forefathers.

It was to this island the Yacht Yankee on her second world cruise came on January 31st. As radio operator on the Yankee, WCFT, I was interested in any radio that I met in the course of the cruise. Since the Yankee remained—or at least part of her crew did—for the better part of a week on Pitcairn, I had ample opportunity to become well acquainted with such radio as was there, for during my stay I was the guest of Andrew Young, chief radio operator for Pitcairn radio or PITC.

Those who have pounded brass in the run between Panama and New Zealand, particularly for the New Zealand Shipping Company or Shaw Savill, may have heard this station, as occasionally the ships of these lines call here. However, as the high cliffs do not permit an easy landing—the islanders are noted for their skill and daring in coming out through the breaking surf in open boats—these operators would have no chance to get ashore during the time that their ship was hove to offshore.

PITC is situated in a small one-room shack adjacent to the home of Andrew Young in Adamstown, the only village on the island. The shack overlooks the sea on one side and the island towers up over it on the other. Around it are palms, frangipani, and other tropical plants. While Andrew Young is chief operator and has charge of the station, he has a number of assistants who

* Aboard Schooner Yankee, WCFT, on a world cruise.

ANDREW YOUNG AT PITC

PHOTO BY EDMUND ZACHER

PITCAIRN ISLAND FROM THE “YANKEE”
help him stand the long hours of watch kept by this station, for even though PITC is in this isolated part of the world, it is regularly open around noon and again from 4 p.m. until midnight.

In the early 1920's several of the islanders started to learn the code with the aid of flashlights on the understanding that the Marconi Company would shortly send them a receiver. As their proficiency increased they graduated to a buzzer and started to study the technical side of radio. They had very few books, mainly such as "A Layman's Introduction to Radio." By this time the receiver promised to them by the Marconi Company had arrived and been installed. Necessarily it was the simple crystal receiver of its day.

In 1928 a young man came from New Zealand and installed a small spark transmitter, inevitably of low power as there was no electrical power system on the island. Who this person was is unknown, but from what I have heard of him he very likely was one of New Zealand's amateurs at that time. As the only stations within range of this small spark transmitter were ships, all operation was limited to 600 meters. The transmitter received its power from a 12-volt storage battery, or accumulator as it is known locally. Originally this was charged by a gasoline-driven generator. At that time a supply of petrol was obtained from a cache left on Pitcairn by an Italian company that had proposed to establish an air route from South America to Easter Island, Pitcairn, Manga Reva and Tahiti. When this scheme fell through, the islanders bought up the gasoline for their own use. However when this fuel was exhausted, they were unable to obtain more because of shipping regulations. To-day PITC's one battery has to be sent to New Zealand for charging. For this reason there are long periods when the transmitter is silent, but even during these periods the operators continue to keep watch.

PITC is of great importance to the Pitcairners because it brings them the information of when ships expect to call and what their needs are. These ships are their only communication with the outside world and their only source of income. To-day the equipment is very much the same as when it was first installed. The transmitter is the same old 12-volt spark coil; the receiver a Marconi 16-crystal set and a Marconi 34-crystal set, but the 16 is much preferred by the operators.

During my stay on the island I pinch hit as second operator because several of Andrew's assistants were away for a few days on board the Yankee. I was introduced to some rather unusual customs connected with the Pitcairn radio. Days go by with hardly a sound, but even under these discouraging conditions, watch is kept when a ship is suspected of being within 1,000 miles. One day while hoping to hear GLYQ (S.S. Rotorua) Andrew heard GLYQ and GSXW (S.S. Rangatiki) working about noon. Around 5 o'clock I relieved him and about half an hour later, was startled to hear out of dead silence a station start up calling PITC. This station quickly proved to be GLYQ. Though he was unable to hear us, he sent blind the message that Norris Young, a Pitcairner who had been to Panama for medical aid, was aboard and in good health and to please bring fruit for the ship and honey for Captain Lamb. Expected arrival time 6 a.m. the next morning.

I immediately called Andrew and gave him the message. Being strange to the procedure at Pitcairn, I had no idea to whom it should be delivered as there was no address. He told me that in true Pitcairn style, I should have to call "Call ho!" at the top of my lungs. When I did so the call was taken up all over the island. Very quickly a crowd gathered around the station and after the proper authorities had been informed, a community meeting was held to arrange for gathering the fruit and loading it into the open boats.

At dawn the next morning we went out in the open boats through the breakers to meet the Rotorua, GLYQ, about two miles at sea. During my short visit with the operator on board, I was surprised to learn how little he knew of PITC and he was very much interested to hear what I had to tell him of my experiences ashore. He realized that Andrew would not tell him of all the difficulties that were encountered on Pitcairn.

Andrew Young's achievements at Pitcairn are very unusual. Though the equipment he has to work with would be considered impossible in most people's eyes, he has made it perform quite creditably. With his simple crystal receiver he can hear ships within 1,000 miles of the island and has

(Continued on page 70)
1936 Hiram Percy Maxim Award
Goes to W6KFC

The February, 1937, issue of QST bore an announcement of the creation of a permanent annual Hiram Percy Maxim Memorial Award, established in honor of their father by his daughter and son, Mrs. John G. Lee and Mr. Hiram Hamilton Maxim. This award is to be given annually to that member of the League under twenty-one years of age who is believed to have made the greatest individual contribution to amateur radio, or who has the best all-round record, during a given year.

It was stated that, in future, arrangements will be made late each year for choosing the winner so that he may be announced early in the new year. For 1936, however, owing to the fact that the award was not announced until the year had ended, this procedure was not possible, and it was not until June 23rd that the winner for the past year was announced.

The 1936 Hiram Percy Maxim Memorial Award winner is Victor H. Clark, W6KFC, of Phoenix, Ariz. He was chosen as the year’s most outstanding young amateur from a sizeable group of nominations made by the S.C.M.’s of various A.R.R.L. Sections, by a board of judges consisting of the amateur members of the League’s headquarters staff. In accordance with the announced terms of the Award, he will receive a bronze replica of the original “Wouff Hong” and the sum of one hundred dollars in cash.

W6KFC’s selection was based on an exceptional all-round record, rather than on any single remarkable achievement. His career demonstrates an intensive, aggressive application to amateur radio, with a high degree of useful accomplishment, especially in communications and traffic-handling activities. Combined with a splendid radio record is one of courage and spirit in overcoming heavy obstacles in life’s pathway.

W6KFC was born in Falmouth, Mass., on Cape Cod, August 23, 1917. Five years thereafter his family moved to Phoenix, Ariz., where they have remained ever since.

His schooling has, of necessity, been taken in a succession of spurts and pauses. At the conclusion of his third grade work he became ill and was forced to lose a year—regained two years later, however. When he was nine years old his father died, and he was forced to assume a share of the family responsibility. After graduating from grade school in 1931 he was forced to miss three years more because of illness, not entering high school until the autumn of 1934.

It was during this period of illness, while in a weakened condition, that he took up radio. Prior to that, from the time he was ten years old, model airplane building had been his favorite hobby, and he worked part time in a model airplane shop; some of his happiest memories are of those days.

Started in radio, however, he progressed rapidly through the b.c.l. DX and s.w.l. stages, and in October, 1933, received his first operator’s ticket. During the latter part of the following January he received his call. In the period between then and middle June of this year he has had approximately 5600 QSO’s, handled over 10,000 messages (A.R.R.L. count), made the B.P.L. ten times, and operated 1210 days out of 1235!

To list all the individual accomplishments of his amateur career in tabular form would occupy several pages of QST. To mention just a few: In
any West Coast operator ever topped the list. The remarkable thing about this last feat—and, indeed, almost all his radio accomplishments—is that he was not only going to school but holding down a job copying press for KOY at the same time. He works there in the mornings from 7:00 until 11:15 A.M., attends high school in the afternoons, and hams the rest of the time. To win the April Party he had to sleep Sunday and then go to work and school the next day without having slept that night.

In addition to traffic-handling, W6KFC's radio activities include some 56-Mc. work (he and W6GZU took first place in the hidden five-meter transmitter hunt at the Third Arizona Hamfest) and a certain amount of DXing. The latter includes an 80-meter QSO with JZLO, who gave him an S6 report.

Going over to the personal side, W6KFC, not yet twenty, is six feet, four inches tall, and weighs 205 pounds. He guesses that it was just a case of too much radio that wore him down to what he is now!

He lives alone with his mother—"whose generosity and patience made my 5000 QSO's possible"—and the two cats. One of them—Niggie, the favorite station mascot—is black as sin. Vic's other interests include playing at tennis and the take. He enjoys swimming, softball and other sports. He likes the movies, but would sooner handle traffic. Then, of course, he is interested in his px job, and likes that a lot. He plans to begin study on Radiophone 1st and Radiotelegraph 2nd tickets as soon as he hears from Washington on the outcome of his Class A exam, recently taken.

Well, there he is—a fine, upstanding kind of young amateur, just the type that T.O.M. most approved. His is a fitting first name to engrave on the scroll of those who typify the everlasting heritage of honor and achievement left by our founder-president.

—C. B. D.
A.R.R.L. Announces August Low Power Contest

25 Watt Power Limit—Multipliers for Self-Powered Equipment—Stations Home or Field Operated—For All W/VE Stations; August 21st–22nd

The purpose behind this activity, as the case with our June Field Day, is to encourage the building and testing of economical self-powered equipment suitable for work in possible future emergencies. Equally important is the conversion of existing stations for continued reliable operation as soon as power fails. The name of the low power man is legion, and we believe it is time we dedicated an activity to this whole group of operators, with a fair limit that does not invite competition from high-power stations. High power has its place in club emergency community plans. The more widespread availability of portables, economical in first cost and operation, but highly practical equipment in this power class, throughout the entire fraternity is the immediate objective. Entries of all amateurs using not more than 25 watts are most cordially invited, whatever your present power supply.

The contest set up especially focuses attention on plans for quick conversion of exciter units and receiver power supplies so that existing superlative amateur station equipment can be quickly made self-powered in any time of need, ready for any call to serve the community welfare. Experience with one temporary receiver in a crisis causes us to recommend plans to keep the regular good receiver (with which the operator is familiar, and performance superlative) going if at all possible in one's station. Emergency power is sometimes required at a home location, so home locations are permissible this time. Field installations (like June) are of course equally welcome. All such will be identified in our report of results, listings of home and field stations being kept separate, but while the June “F.D.” is designed for groups, and many units may be used at one station, this August work is limited to use of one receiver and one transmitter at a time, by one or several individual operators. Power from commercial mains can be used, but of course will not justify application of the multiplier designed to credit the extra effort or expense entailed in setting up self-powered stations. Advance entry is not required. No transmitter may be entered or contacts reported that utilized more than 25 watts input to the final amplifier.

The object of the contest is to work as many other stations as possible in the allotted time. Each station worked between Saturday, August 21st (4 P.M. local time) and Sunday, August 22nd (7 P.M. local time) will count one point. An extra credit of 10 points, before multiplier, may be claimed for sending not more than one message, addressed to A.R.R.L., reporting your transmitter tube line-up and power supply equipment. The sum of claimed points may be multiplied by 1.5 if either the receiver or transmitter is self-powered, or by 2 if both transmitter and receiver are supplied from an independent local source. Any frequency bands may be used, and voice or c.w. telegraph.

The log of operation, claimed score, and data on power, frequency band, and time of each contact must be listed with the computed total score, and sent in promptly at the end of the tests with information on both transmitter and receiver power sources. For any credit for the message, copy must be submitted showing complete handling data, and the word count (CK) must be right and preamble in correct order.

The modern amateur station is one that is prepared, where recognition has been given to some means of operation to continue useful communication performance in spite of commercial power failures. Get emergency power now, if you haven't any. This is the opportunity to give a real operating test to the low power rig and see if it and the power supply stand up. The popular June Field Day emphasizes group preparedness, cooperation and planning in making group installations, and operator training. This August activity again invites Field Day boosters to go afield but to decentralize activities to individual stations within the group. The whole amateur fraternity is invited to participate with individual stations (25 watts or less) and any power source desired, while finding out just what can be done with this power. A pleasant surprise is in store for some! All amateurs are requested to put station units under the microscope, investigating ways and means of going self-powered economically and practically. New plans for A.R.R.L. Emergency Coordinators will be announced in the future. The League's Emergency Corps is open to any amateur. Registration of your self-powered facilities is invited. Try the August Low Power Contest at home or afield. It's a brand-new kind of fun. When reporting, ask us to send you the registration form for A.E.C. membership.

—F. E. H.
Battery Performance from the R.A.C. Power Supply

Voltage-Regulated Power Packs for Receivers, Speech Amplifiers and Small Oscillators

By George Grammer*

THE a.v.c. principle is proving to have an ever-widening circle of uses in radio equipment, as its application to speech-amplifier systems will attest. Another highly-practical use to which it has been put in recent months is that of regulating the output voltage of power supplies, where, by giving well-nigh perfect performance from the standpoint of maintaining constant voltage under varying loads and line voltages, rectifier-type power supplies can be designed to duplicate battery performance—but without the life factor. To the amateur, this means the elimination of the principal cause of the instability which afflicts most high-frequency receivers operating from line power. It is a real pleasure to operate a receiver whose high-frequency oscillator will "stay put" on the peak of a crystal filter regardless of the setting of the r.f. gain control and which will ignore entirely the swooping line voltage caused by switching on refrigerators, oil burners or the like. The usefulness of a constant-voltage supply for frequency meters, low-power oscillators and similar devices is likewise obvious.

OPERATING PRINCIPLES

The principle upon which the voltage-regulator operates is fairly simple, and can be explained by reference to Fig. 1. A high-gain voltage amplifier tube (usually a sharp-cutoff pentode or tetrode) is connected in such a way that a small change in the output voltage of the power supply causes a change in grid bias and thereby a corresponding change in plate current. The plate current flows through a resistor (R₂) the voltage drop across which is used to bias a second tube—the "regulator" tube—whose plate-cathode circuit is connected in series with the d.c. line. The regulator tube, therefore, functions as an automatically-variable series resistor in the power supply. Should the output voltage increase slightly, the bias on the control tube becomes more positive, causing the control-tube's plate current to increase and the drop across the plate resistor to increase correspondingly. The bias on the regulator tube, therefore, becomes more negative and the effective resistance of the regulator tube increases, causing the terminal voltage to drop. A decrease in output voltage causes the reverse action. The time lag in the action of the system is negligible and, given proper constants, the output voltage can be held within a fraction of a per cent throughout the useful range of load currents and over a wide range of line voltages.

An essential in the system is the use of a constant-voltage bias source for the control tube. The voltage change which appears at the grid of the tube is the difference between a fixed negative bias and a positive voltage which is taken from the voltage divider across the output. To get the most effective control, the negative bias must not vary with plate current; furthermore, it is des-
sirable to use as much negative bias as possible so that the variations will be large. For example, let us assume that the fixed negative bias on the control tube is 40 volts, and that the voltage between grid and ground (negative of power supply) is 37 volts. The net bias between grid and cathode is then $-40 + 37$ volts, or $-3$ volts.

Now suppose the output voltage drops 10 per cent with an increase in load. The drop will be 10 per cent at any point along the divider, assuming constant conditions, so that the voltage between grid and ground is now $37 - 3.7$ volts, or $33.3$ volts, leaving the net grid voltage equal to $-40 + 33.3$, or $-6.7$ volts, a change of $3.7$ volts from the original value. If, initially, the fixed bias had been 10 volts and the drop between grid and ground $-7$ volts to give the same -a-volt bias figure, a 10 per cent change in output voltage would drop the grid-to-ground voltage to $6.3$ volts and the net grid voltage change would have been only $0.7$ volts. Obviously, therefore, to get the most effective control it is desirable to use a relatively large value of fixed bias so that the percentage changes in output voltage will cause relatively large differences between the fixed bias and “bucking” bias.

**A PRACTICAL SYSTEM**

The circuit diagram of Fig. 1 is an adaptation of a regulating system used in a commercial power supply manufactured by RCA for speech amplifiers. This circuit and the performance curves of Figs. 2 and 3 were furnished by an experimenter who prefers to remain anonymous. The chief departure from the RCA circuit is in the use of a battery to bias the control tube, which is a 57, instead of an 874 gas tube. For low-voltage supplies, where only a 22.5-volt battery is required, the battery is cheaper than the 874 and its voltage is probably more constant. The life should be long, since no current is taken from the battery.

In Fig. 1, the output voltage from a regular power pack is applied to the left-hand terminals, the regulated voltage being taken at the right. Resistors $R_1$ and $R_2$ constitute a voltage divider for the screen of the 57 control tube; $R_3$ is the 57 plate resistor which biases the grid of the 2A3 regulator tube. The bias battery, $E_b$, is in the position usually occupied by the cathode resistor. $R_4$, $R_5$, and $R_6$ form a voltage divider across the output circuit, with $R_6$ variable so that the operating bias on the 57 can be set manually. This control has no effect on the automatic operation of the circuit; its function is to set the output voltage at any desired value within the operating range as determined by the circuit constants and the tubes used.

The curves of Figs. 2 and 3 are typical of the regulation to be expected. In Fig. 2, the output voltage was set at 75.5 volts and the input voltage, $E_a$, varied. Over a 2-to-1 range of $E_a$, the output voltage variation was less than 1 per cent, which by practically any standards is excellent voltage regulation. Under the conditions shown graphically in Fig. 3, the voltage regulation over the current range considered was approximately $\frac{1}{2}$ of 1 per cent, too small to show on the curve.

For any particular operating conditions, satisfactory resistor values can be found through the use of the following equations:

**FIG. 3—OUTPUT AND INPUT VOLTAGE VS. LOAD CURRENT**
In all cases, maximum contemplated values of $E_a$ and $E_c$ should be used. $E_c$ cannot exceed 70 per cent of $E_a$. The equations give ratios for the resistances; the values used should be such that at least 2 milliamperes will flow through $R_1-R_3$, and more than 0.1 milliampere through $R_4-R_5-R_9$. Also, $E_b$, the bias battery voltage, should be more than 10 per cent of the maximum output voltage expected, for good regulation.

**The W.E. Regulated Power Supply**

The circuit of a voltage-regulated power supply recently developed by the Bell Laboratories is shown in Fig. 4. The circuit arrangement is somewhat different, although the operation and results attained are similar. Plate and screen voltage for the control tube are taken from the output side instead of the input side, as in Fig. 1, while the bias battery is placed in series with the lead to the grid of the control tube, a 2A3. A single-section choke-input filter is connected to the output of the rectifier; this amount of filter is adequate to smooth out ripple as well as slower voltage variations. $R_5$ is the output voltage control; in the Bell supply the output voltage can be varied between 130 and 250 volts by means of this control.

One important characteristic of a voltage-regulated supply is that it has a very low effective output impedance, being similar to an inverse feed-back amplifier in this respect. It is, therefore, unlikely to give undesirable back-coupling in high-gain amplifiers, a common trouble with ordinary power supplies. A voltage-regulated supply is consequently a good thing to have on low-level speech amplifiers.

**A Ham Version**

To most amateurs, the idea of using batteries in a line-operated power supply is a bit incongruous. To get something which would be free from the bulk and necessity for renewal that batteries entail, therefore, we hatched out the circuit of Fig. 5, which is a combination of the two foregoing, and gave it a trial. This one is built around the well-known constant-voltage properties of the ordinary neon lamp, which is a cheap replacement for the 874. A trial of the circuit in a haywire set-up convinced us that the idea was practical enough, so, after the most suitable circuit constants had been determined experimentally, the complete supply shown in the photograph was constructed.

In all these systems the fundamental principle is that of "lossing"; that is, the power supply without regulation must be capable of furnishing more voltage than is wanted at the output, under any and all conditions. The regulator cannot add anything to the output; it can only hold down excess input. In this it is similar to all a.v.c. systems. Therefore, the first requisite is a power transformer which will give, under full load conditions, at the lowest line voltage likely to be encountered, the desired output voltage plus the minimum drop through the regulator tube. The most suitable regulator tubes are triodes having low plate resistance, and of those available the 2A3 comes nearest to being the ideal. Allowing 60 or 70 milliamperes per 2A3, the lowest possible tube drop is at zero bias. The grid of the tube cannot be swung positive in this application, because the voltage drop across the control tube's plate resistor, $R_4$ in Fig. 5, cannot reverse in polarity. The limiting condition is zero bias, attained when the plate current of the control tube, a 6J7, is completely cut off. At zero bias, the drop between plate and cathode of a 2A3 at 70 milliamperes is approximately 70 volts. It is best to figure on a minimum drop of about 100 volts through the regulator tube; however, because at very low control-tube plate currents the neon tube is likely to extinguish, thereby destroying the control. While the neon is conducting, the voltage drop across the lamp is approximately constant at 65 volts.

Since a considerable voltage drop has to be tolerated, and since we wanted to get as much output as possible from a standard h.o.r. type transformer, a condenser-input filter was used in the unit pictured. Further to increase the output voltage, an 83-V low-drop rectifier was used in place of the customary 80. The net result is that at the full-load rating of the transformer, 70 milliamperes, a regulated output of 250 volts can

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1 Trucksess, "Regulated Plate Supply," Bell Laboratories Record, May, 1937.
be secured. The output control, $R_5$, gives a range from 160 to 365 volts; the output current is limited at the higher voltages, but at 200 and below considerably more than the rated current can be taken without losing control.

A transformer with two filament windings in addition to the rectifier winding is a requisite unless one wants to install a separate filament transformer for either the regulator tube or the control tube. In this case the transformer used has a 2.5-volt winding and a 6.3-volt winding; the former supplies the 2A3, while the latter handles the control tube and the receiver device is used in conjunction with the supply. Transformers with two 2.5-volt windings are also generally available, in case the receiver uses 2.5-volt tubes. In such case a 57 can be substituted for the 6J7.

The neon lamp is the 1-watt G-10 type, the 1-watt size being used simply because the common half-watt size is not recommended, according to the manufacturers, for d.c. For good regulation, it is essential that the resistor be taken out of the base, or else that one of the lamps without a base resistor be secured. The cement holding the base to the bulb may be softened with boiling water or a gas flame. If the resistor is left in, the regulation is considerably better than that of the power supply alone, but not nearly as good as when the resistorless lamp is used.

There are no particular "tricks" to be observed in getting the thing to work. As we have already said, the values given in Fig. 5 are the ones we found best in practice. $R_5$ may be made as low as 0.1 megohm; lowering the resistance will increase the range of control with varying loads, but does not give quite as good regulation as a half megohm. With the latter, the variation in output voltage from zero output current to 70 milliamperes is of the order of a volt or two -- scarcely perceptible on a 500-volt meter, while the lower value of $R_5$ shows a change of 7 to 10 volts under the same conditions. Most of the change takes place between 0 and 25 milliamperes, however, so that there is very little practical difference when used with the ordinary receiver which has a fairly high minimum current.

The regulating capabilities of the supply depend to a considerable extent upon the output voltage selected. With constant line voltage (115 volts) the output will stay under control from zero output current up to the maximum limits:

<table>
<thead>
<tr>
<th>Output Voltage</th>
<th>Max. Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>35 ma.</td>
</tr>
<tr>
<td>300</td>
<td>50 ma.</td>
</tr>
<tr>
<td>250</td>
<td>75 ma.</td>
</tr>
<tr>
<td>200</td>
<td>95 ma.</td>
</tr>
<tr>
<td>160</td>
<td>over 100 ma.</td>
</tr>
</tbody>
</table>

Line voltage variations, as well as output current variations, are compensated for to the extent to which the transformer is capable of supplying the excess voltage required. At 250 volts output, the voltage will stay constant over a range from 108 to 135 volts (the maximum available from the Variac used for this test). At 200 volts output, the same thing is true over a range of 100 to 135 volts on the primary, and at 180 volts, over 90 to 135 volts. Momentary variations (such as caused by switching on a motor or similar operation which causes a current surge and a resultant dip in the line voltage) can occur over a much wider range without affecting the output voltage because enough energy is stored in the filter condensers to bridge such a short gap.

The neon tube is a visual indication of control, since the voltage is regulated so long as the tube glows. If the supply is used on a receiver and the load current increased or line voltage dropped to the point where the bulb goes out, there will be a click and a perceptible hum, indicating that control has been lost and that the filtering action of the regulator likewise has disappeared. With the regulator working, it is extremely difficult to detect any hum. The additional filtering makes it possible to dispense with the second filter section ordinarily required, so that a voltage-regulated supply actually costs very little more than an unregulated supply having equivalent filtering.

All in all, a well-regulated power supply should find many uses in the station.

August, 1937

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**FIG 5—WIRING DIAGRAM OF A PRACTICAL VOLTAGE-REGULATED SUPPLY SUITABLE FOR RECEIVERS, SPEECH AMPLIFIER OR DEVICES HAVING COMPARABLE VOLTAGE AND CURRENT REQUIREMENTS**

- $C$—Double 8-µfd. dry electrolytic, 450-volt working (Aerovox).
- $L$—12 henrys, 75 ma. (Thordarson T-4707).
- $R_1$—10,000 ohms, 1 watt.
- $R_2$—25,000 ohms, 1 watt.
- $R_3$—10,000-ohm potentiometer (Yaxley Y10MP)
- $R_4$—5000 ohms, 1 watt.
- $R_5$—0.5 megohm, 1 watt.
- $N$—1-watt G-10 neon bulb with base resistor removed.
- $T$—Power transformer, 350 volts each side c.a., 70 ma; 6.3 volts at 3 amp.; 2.5 volts at 4 amp.; 5 volts at 2 amp.

A 6C6 may be substituted for the 6J7 if desired. 

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**CURRENT REQUIREMENTS**

- $T$-7021.
- $Y$-Lomp.
- $V$-Yaxley (Y10MP).
THREE operators tied for first place in the third A.R.R.L. Copying Bee (December, 1936): L. R. Clements, W2HHG, J. Y. Bowman, W5FCQ, and H. G. Martin, W6GVT, each made a rating of 98%, copying correctly forty-nine of the fifty groups transmitted. They have been awarded engraved medallions in recognition of their proficiency. Congratulations, OM’s!

There were 150 amateurs competing in the “Bee.” Stations W1INF, W2AYN, W9BAZ, W9UZ, W6AM and W6CIS, using frequencies in the 3.5- and 7-Mc. bands, transmitted at about 25 words per minute fifty words and jumbled groups totalling 367 characters (letters and numerals). Each word or group copied correctly counted 2%. No operator made 100%, due to the difficult nature of the texts. Different texts were sent from the east coast, central and west coast stations. It was necessary to submit a copy of one station only, although many operators copied more than one station and submitted best copy.

Corrected copies have been returned to all contestants together with copies of the texts transmitted by the various stations so that each operator may see where he slipped up. It was an unusually stiff test and no operator need feel too badly about his rating.

It was a strictly amateur contest. Each contestant had to certify that he had not been employed as a commercial or government radio, Morse or cable operator within the year preceding the Copying Bee. The following exceptions, however, were eligible: (a) Holders of commercial licenses without experience under same. (b) Such holders (‘phone licensees or technical attendants) whose duties had not been telegraph operating within one year.

Final Ratings

W9BAZ was logged by 88 participants, W1INF by 62, W2AYN by 39, W9UZ by 26, W6CIS by 29 and W6AM by 21. All three operators made best copy from W9BAZ, 17% from W1INF, 12.4% from W6CIS, 10.4% from W9UZ, 6% from W6AM and 2.6% from W2AYN.

Participating operators are here listed according to accuracy of copy, ratings of 50% or higher being indicated:

- 98%: W2HHG W5FCQ W6GVT 94%: W8AEH W9WRK 92%: W2BJY W3EEN W3GKN W5BMI W5ENI W9ESA 90%: W11GB W2DUP W7CZX W8BEN W9KJY W9RLB 88%: W1GBY W11OE W6DVD W6FZL W8KM W8CDK W8PSM J. R. Thorburn 86%: W3CMV W2JFY W3FQS W4DYZ W5BIL W9VKF 84%: W2JEQ W3EZ W4ASK W5CPT 82%: W3QM W4AGI W6CSC W6EYR W7BXP W9HCC VE5OK 80%: W9AMR W6OGJ W8KUN 78%: W1CHF W1GUA W2CCZ W2KIH W4DVO W7ELF 76%: W3AKB W4BET W6MTP 74%: W2CGW W4CRZ W7EOH W9CWR W9QR W8SGP 72%: W5FSJ W9ANV W9DOP VE3SS 70%: W1ABG W1IYC W3EHW W4CEI W9DOU W8PNG 68%: W2IVR W3GBK W6IDW W8EKC W8JT W8PGI W9LQ 66%: W2QO W3ADE W3BWT W4BVD W6NGA W8CVS (L. W. Krute) 64%: W6LRN W9KUI VE5LA 62%: W5QD 60%: W1BET W1IHW W2AJL W6LUO W9DI 58%: W1JID W3FXV W5EJT

H. G. MARTIN, W6GVT, ONE OF THE THREE COPYING BEE WINNERS

W6NEN 56%: W8GUN 54%: W9OTR W9UEG VE5II 52%: W2GES W3GHW 50%: W2IVU W2HYC W2ELK Below 50%, in order: W3FBM W9AHA W9MFH W9PTU W3EAP W4DQO W6MUR W7EBQ W8OR M W3COK W7FBZ W8AFE W2BJX W2JKT W2JRS W8EU W9OVD W2LH W4BK W7ESM W8ISK W9MWU VE2FD W5DCE W8NWZ W4EFM W8QGD W2CEN W7CWN W8CVS (S. W. Krute) W9NFT W1JY VE4CQ W4DOV W5FCI W6SDC VE1EX W2GTA W2HGO W3DXX W9KIK W9SSL W6OJW W8KHY W7FZR W2HOL W3BQD.
Pan-American Traffic

At the request of the A.R.R.L. Board of Directors, the Federal Communications Commission concurring, the Department of State is proposing to the American regional conference to be held in Habana in November the question of a uniform arrangement between all of the American countries, permitting amateurs to handle third-party messages of a type that would not normally go by paid commercial service. As most amateurs know, we already have such arrangements between this country and Canada, Chile and Peru; and to us there seems a good chance that there can now be general agreement on a uniform practice between all of the American countries. It would, of course, aid materially in advancing the common destiny of the peoples of the Americas.

F.C.C. Notes

So many of the important administrative officials of the F.C.C. have been absent from the country this summer attending international conferences that amateur affairs in the Telegraph Division have moved with great slowness. It was not until June 29th that the Commission took up the Board’s request for a change in the “phone allocations in the 28-30-Mc. band, and then just to put it on record until July 31st, to afford opportunity for any objections to be filed with the Commission. All of the other League matters pending before the Commission have been similarly stalemated during the early summer, with no possibility of action during the absence of the people who have to pass upon these matters. However, with a lull now between conferences, we hope that we can soon report some action.

B.C.L.

At its annual meeting the Board of Directors expressed concern over the extent to which cheap midget superheterodyne receivers experienced interference from amateur stations, through no fault of the latter but because of insufficient design features of the former. Resolutions were transmitted to the Radio Manufacturers Association concerning possible improvement in the design of these receivers to preclude this pickup. The R.M.A. now advise us that the matter has been considered by their Board of Directors and the question referred to their engineering division with a request to report back, as soon as possible, the remedial measures possible. They state that “it is hoped that effective steps will be taken which will reduce and possibly entirely remove the cause of complaint from amateur operators of experimental stations, through future improvement in the design of commercial sets of the midget type.”

Class-A Code Exams

Members write in to ask us whether a Class-C amateur, going up for the Class-A exam, needs to take another code test. There seems to be considerable diversity of practice in the field offices of the F.C.C. Most of the time a Class-C man is not given another code examination, but we know of quite a few cases within the past year when it did occur. We even have heard of one Class-C man who went up for Class A and was obliged to take two code examinations the same day, one for Class B and one for Class A. Hi! Anyway, we asked the F.C.C. about it and here is the dope:

An applicant with a valid Class-B license does not need to take another code examination. If his Class-B license has expired, he must take the code test. And if he has only a Class-C license, of course he must take the code test.

Operator Rules

Extensive amendments to the Communications Act of 1934 were adopted on May 20th to make effective the provisions of the International Convention for the Safety of Life at Sea. A new section has been at work in the F.C.C. for many months drafting ship safety rules, and the whole question of marine radio has been overhauled. The great bulk of the material is of no concern to amateur radio but we notice a few items of amateur interest:

Amongst the offenses for which the Commission may suspend an operator license are now definitely listed the intentional transmission of “false or deceptive signals or communications, or a call signal or letter which has not been assigned by proper authority to the station he is operating.”

It is also stipulated that F.C.C. may suspend the license of an operator who “has obtained or attempted to obtain, or has assisted another to obtain or attempt to obtain, an operator’s license by fraudulent means.” Amongst other things, this is a warning to hams who give code examinations for Class-C applicants.

Amongst extensive alterations in the rules governing the necessary operators on shipboard is one which now requires a marine radio officer to have (Continued on page 78)
PORTABLE radio equipment ordinarily finds application in three general uses: on field days, vacation trips, and in emergencies. Ideally, each of these uses requires equipment of special qualifications; yet the average amateur is lucky if he can assemble just one complete outfit of portable gear and keep it in operating condition.

With the approach of the 1937 Field Day, our thoughts naturally turned to the assembly of suitable equipment for the occasion. Last year W1JPE put a 6L6 and some miscellaneous components in a wooden box, convinced himself that he had a portable, and went out and had a lot of fun in the 1936 Field Day. Even the most casual observer couldn't take a portable into the field, operate a number of hours, and not return with a few ideas. When his glib tongue convinced other members of the secretarial staff that they had missed themselves a time by not taking part, and would be created on a broader perspective than just this one Field Day. All-around utility, for all kinds of trips and other applications, and in particular for emergency work, was made the objective. The equipment to be described represents an attempt to reduce a certain amount of practical experience with various portable applications to literal apparatus forms.

Fundamentally, the equipment consists of four units: power supply; transmitter, modulator and receiver. The individual unit style of construction was adopted because it lends desirable versatility to the layout as well as ease in transportation. Experience a couple of years ago in manhandling a heavy portable built into a suitcase on a 7500-mile swing around the country emphasized the latter point.

THE COMPLETE PORTABLE STATION—ADD A 6-VOLT BATTERY AND IT'S READY TO GO

In the rear is the dual Genemotor assembly, with switchboard and cable sockets. In the foreground, left to right, are the Class-B modulator, 4-tube superhet receiver, and 35-watt input crystal-controlled transmitter. All are built in 5 by 6 by 9-inch metal cabinets.

enlisted them in the 1937 venture, these ideas were naturally incorporated in the new layout.

At the same time it was decided that, in view of the varied qualifications and requirements of all-around portable equipment, the complete design

*Asst. Secretaries, A.R.R.L.
cable plugs are mounted on a front panel. This makes setting up the equipment a speedy and easy matter; while operating, once the switch order is memorized, is flexible and straightforward.

Two words of warning in connection with the Genemotor supply: First; elimination of radiation from the various power supply leads is no simple task, especially when a sensitive superheterodyne receiver is used, and it is strongly recommended that the special filter unit supplied by the manufacturer be used. For those who get a kick out of trouble, filter circuits and constants are shown in the power supply diagram. Second; be sure to use short, heavy battery leads. The ordinary cable used for this purpose on automobile receivers is far from adequate, showing a tremendous IR drop under the heavy total current conditions (17 amperes or more). Regular car-battery cable and lugs are advised.

THE TRANSMITTER

Last year a single 6L6 was used in the portable rig. Since that time Jim Lamb found out a few more things about the tube in the Tri-tet circuit, and a few ideas of our own had been added. In the first place, while tuning to two bands with a single condenser had been satisfactory in the

other rig, we hardly thought we could get away with it in this one, which was going to use two 6L6's in parallel, because the doubled plate current would require a larger tank condenser.

FIG. 1—THE POWER SUPPLY CONNECTIONS

L1—R.f. choke (20 turns) L5—8-henry 30-ma. plate C8—0.1-pfd. 600-v. paper.
L2, L4—6-henry “A” L6—10-henry 100-ma. C1, C6—8-pfd. 500-volt (200-v. turns).
L3—R.f. choke C2—0.1 µfd. 600-v. paper.

Bottom views of sockets are shown. Left to right, they take receiver, modulator (or key or tuning milliammeter across “K-K” terminals) and transmitter plugs. Switches turn on either or both Genemotors, connect heaters in each or all of the three units, and change 250-volt supply from receiver to modulator.


The transmitter is built on a piece of ½-inch aluminum which is fastened to the back of the metal housing can. This allows the transmitter unit to be taken out and serviced if necessary. All of the construction is straightforward except possibly the socket for the crystals, which was made from a piece of bakelite strip with contacts taken from a broken socket. The
The problem of designing a portable receiver these days has, it seems, reached a state where the only question is to decide what to leave out. Recent results from progress in research and manufacturing techniques have provided such a profusion of circuits and components that almost any desired result can be achieved. All that is left is to pick those that will accomplish that result in the smallest space and with the least complexity.

The receiver constructed for use in this portable assembly is a four-tube superhet. It represents a mid-point between the home-station super with a standard tube complement and the ancient and honorable superhet circuit using a regenerative converter and detector with no i.f. amplification. The latter is, as a matter of fact, hardly a super at all, but a variation of the autodyne in which the regenerative or oscillating quite legal, a point that was not brought out last year and which resulted in several inquiries.

THE RECEIVER

The problem of designing a portable receiver these days has, it seems, reached a state where the only question is to decide what to leave out. Recent results from progress in research and manufacturing techniques have provided such a profusion of circuits and components that almost any desired result can be achieved. All that is left is to pick those that will accomplish that result in the smallest space and with the least complexity.

The receiver constructed for use in this portable assembly is a four-tube superhet. It represents a mid-point between the home-station super with a standard tube complement and the ancient and honorable superhet circuit using a regenerative converter and detector with no i.f. amplification. The latter is, as a matter of fact, hardly a super at all, but a variation of the autodyne in which the regenerative or oscillating

contacts were drilled out and riveted to the bakelite strip. This was done simply to conserve space, and the strip could of course be replaced by the conventional wafer sockets in an installation where space was not at a premium. The tuning condenser and antenna coupling condenser are mounted on the Cardwell bracket furnished with them, thus serving as support and insulating the condenser from the metal chassis at the same time.

Keying is done by plugging across the modulator socket terminals on the power supply, marked "K-K" (see diagram). The transmitter is tuned like any other Tri-tet oscillator. An end-fed antenna is coupled on to the antenna post, and the antenna coupling condenser run in until the neon bulb on the antenna post looks right and the keying sounds decent in the receiver. Incidentally, this type of capacity coupling to an antenna is

![Diagram 2: The Transmitter Diagram](image)

### COIL TABLE

<table>
<thead>
<tr>
<th>Coil</th>
<th>Number of Turns</th>
<th>Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>La</td>
<td>11 turns</td>
<td>1⅜ inches</td>
</tr>
<tr>
<td>Lb</td>
<td>18 turns</td>
<td>1⅝ inches</td>
</tr>
<tr>
<td>Lc</td>
<td>15 turns</td>
<td>1½ inches</td>
</tr>
<tr>
<td>Ld</td>
<td>20 turns</td>
<td>1½ inches</td>
</tr>
<tr>
<td>Le</td>
<td>25 turns</td>
<td>1½ inches</td>
</tr>
</tbody>
</table>

All coils wound on National XR-1 1-inch diameter forms, and are heavily doped to withstand rough handling.
detector is operated under conditions of constant stability, improving the performance over a number of bands and especially on the higher frequencies. In this receiver a much higher order of selectivity can be achieved, especially on c.w., than with such an arrangement.

The four tubes are, in order: 6A8 mixer; 6K7 regenerative i.f.; 6A8 second detector and b.f.o., and 6F6 output. For descriptive purposes, it will probably be simpler to work from the audio end backwards.

The 6F6 is operated with high bias, reducing the maximum output but saving on plate current. It drives the tiny 3½-inch Premier speaker at adequate volume for listeners grouped around the operating position, although ordinary "room level" is not attained without blasting. As a matter of fact, in most applications the speaker is dispensed with, headphones being used in preference. The speaker is incorporated in the present design simply to meet individual preferences where they exist. For applications in which more space is available a full-size speaker with a proper input transformer and standard audio stage are recommended.

The use of a pentagrid tube for combined second detector and b.f.o. is not common in ham practice, although it has been done. In this arrangement it proves very satisfactory indeed.

The only complication comes in lowered gain when the b.f.o. is turned off, for modulated reception. This might be attributed to lowered conductance due to the removal of potential from the anode grid, although the application of...
static (non-oscillating) potential did not noticeably improve performance. In any event this complication is not serious, for the reduction in gain is less than 2 to 1 and is hardly noticeable in operation.

A glance at the circuit diagram will show that

the switch which disconnects the anode grid voltage also, by removing a shunt, increases the value of the bias resistor in the 6A8 cathode circuit. This is done to compensate for the lowered cathode current.

The b.f.o. coil assembly is a Sickles 800-ke. unit with two modifications. First, the 4½-inch can in which the assembly is supplied is cut down to a length of 3 inches to enable mounting horizontally above the speaker, with the tuning condenser shaft projecting through the front panel. Second, the rotor of this small parallel tuning condenser is disconnected from the plate end of the coil (the grounded end in the conventional e.c. oscillator) and is instead connected to the cathode tap, which is the grounded terminal in this circuit. This is done to eliminate body capacity effects.

No, that 800 ke. at the beginning of the last paragraph isn't a typographical error. The i.f. used in this receiver is 1600 ke., and the second harmonic of the b.f.o. is used, to prevent pulling. The high i.f. was chosen in order to eliminate the necessity for pre-selection—objectionable both from the standpoint of space requirements and the necessity for an additional set of plug-in coils.

Full-size air-tuned i.f. transformers are used; here is one place where skimping to save an extra half-inch of space or dollar of cost is not worthwhile. While not equal to good 450-ke. i.f.t.'s, these 1600-ke. iron-core units have adequate gain and selectivity, and what they lack is made up by the regenerative circuit.

The use of controllable regeneration in i.f. amplifiers is an asset only too rarely utilized in amateur receivers not equipped with piezoelectric filters. This condition is unfortunate. Such receivers as have been described 4 employing regeneration for added selectivity and gain have been individually highly successful. The principle as applied to this receiver works out equally well on the bench and in preliminary trials; how it will stand the rigors of outdoor work is, of course, something still to be seen.

Construction of the regenerative circuit is relatively simple. The first requirement is to disassemble one of the standard Sickles 1600-ke. i.f.t.'s. The grid and plate leads are then reversed, as are the B+ and ground returns; this makes the bottom coil the grid coil, simplifying mounting and adjustment of the tickler. The tickler itself consists of 10 turns of No. 28 d.c.c. wound over a ½-inch form and doped to make a self-supporting coil. It is slipped over the protruding end of the dowel in the i.f. assembly, which projects below the terminal lug plate.

In lining up the i.f., the regeneration control is set so that all resistance in the cathode circuit is shorted out. Alignment is then carried on as usual, with the test oscillator connected first to the 6K7 grid and then to the 6A8 mixer grid. The output meter can conveniently be connected to the headphone jack.


![FIG. 4—THE MODULATOR SECTION](image)

- \(R_1\)-50-ohm, ½-watt carbon.
- \(C_1\)-100-ohm potentiometer (IRC).
- \(R_3\)-0.5-megohm potentiometer (IRC).
- \(R_4\)-5-µfd. 25-volt electrolytic.
- \(T_1\)—Double-button microphone input transformer (UTC CS-104).
- \(T_2\)—Class-B input transformer (UTC CS-29).
- \(T_3\)—Class-B output transformer (UTC CS-33).
- \(C_2\)-Double-button microphone input transformer (UTC CS-104).
is turned wide open, whereupon the tickler is moved up and down until the point is reached where the circuit just edges into oscillation. At this point the tickler is firmly fastened with Duco cement or some similar fastener. The regeneration control will then provide selectivity ranging from quite broad to single-signal, with the characteristic sharp ringing or "pinging" characteristic at the latter end of the scale.

The mixer utilizes a pentagrid converter with self-contained oscillator. Such an arrangement is not ordinarily regarded with favor in amateur superhets, but in the present case, with the high i.f. and good circuit components, its stability and general performance are reasonably satisfactory. Certainly it is as good or better than the average all-wave broadcast receiver, and the latter in turn are usually better than the average portable job, so the comparison seems favorable.

A self-aligning-tracking system is employed that works out quite effectively. After many headaches trying to adjust variable series pads in oscillator circuits in the past, it was resolved to avoid that bother in this set. Standard values of fixed mica condensers were selected for the series pads, therefore, and the coils calculated to fit. The use of mica condensers in an oscillator circuit is not ordinarily the wisest procedure, but in this case the capacity values are many times that of the tuning condenser and percentage variations with humidity or thermal changes are small.

In order to eliminate the necessity for trimmers on each coil the usual procedure was again reversed and a single fixed trimmer was used in the oscillator circuit. This trimmer is adjusted once, and each coil wound to fit that setting. Standard values of fixed mica condensers were selected for the series pads, therefore, and the coils calculated to fit. The use of mica condensers in an oscillator circuit is not ordinarily the wisest procedure, but in this case the capacity values are many times that of the tuning condenser and percentage variations with humidity or thermal changes are small.

In order to eliminate the necessity for trimmers on each coil the usual procedure was again reversed and a single fixed trimmer was used in the oscillator circuit. This trimmer is adjusted once, and each coil wound to fit that setting. Naturally the minimum capacities in the r.f. circuit for different bands will change; this is taken care of by the inclusion of an externally-controlled variable trimmer in the mixer grid circuit. Tracking on each band is compensated for by the simple procedure of adjusting this trimmer knob for maximum signal strength.

The antenna primaries are much smaller than usual in sets of this type. The reason for this is to improve the image rejection ratio; it was found that doubling the size of the antenna coil on 80 meters (with 400-ohm input) improved the overall gain only 25 per cent but boosted the strength of the image by 1400 per cent. With the specified values the image ratio is 40 db or more on all bands.

The construction of the set is straightforward, but it must be approached in a logical manner. After all, there are a lot of parts to be jammed into a space 5 x 6 x 9 inches! The photographs adequately show the general layout and placement of parts; a few constructional hints may be helpful.

The sub-base, made of 1/4-inch aluminum, is mounted 1 1/2 inches from the bottom—just room enough to accommodate the variable resistors. It is fastened to the front and back walls by two pairs of small angle brackets, into which 6/32 screws are threaded. Before the final assembly a "dress rehearsal" in which all parts are mounted, all holes drilled, and all fitting accomplished, is held. The parts on the sub-base and front panel are first assembled and then the rear wall is added and the plug-in coil shield assembly installed. Following this the end walls with their supplementary components can readily be added. While serviceability is not, inevitably, a paramount feature of so constricted a design, almost every part except the b.f.o. assembly can be removed or replaced with surprising ease.

THE MODULATOR

Basically, this portable gear was designed for c.w. operation, and both transmitter and receiver perform to their fullest capacity only when handling code. This is as it should be, for the limited capabilities of low-power portable equipment must necessarily be permitted a maximum of efficiency, and this implies c.w. operation.

However, 'phone can often be employed to advantage even in portable work when conditions are suitable. It is often especially useful in connection with emergency work, and one of the prime objects of this equipment was its adaptability to emergency needs. Therefore a modulating unit

(Continued on page 81)
THE Board of Directors of the A.R.R.L. at their last meeting offered the use of one page of each issue of QST to the Army-Amateur Radio System. This offer is greatly appreciated and is accepted by the Chief Signal Officer. It is hoped that this page will be of interest to all readers of QST, as well as to members of the A.A.R.S. For the information of those who may not be well acquainted with the A.A.R.S., the following brief description will explain:

The Army-Amateur Radio System was first organized in 1925 with the assistance of the American Radio Relay League. It is an organization of radio amateurs voluntarily affiliated with the Signal Corps of the U.S. Army. Its primary method of training is the handling of messages in accordance with Army procedure. The system is operated under the direction of the Chief Signal Officer in Washington, who appoints a Liaison Officer, A.A.R.S., to handle amateur matters. Control is divided into nine areas within the continental limits of the United States under the Signal Officer of each corps area.

The A.A.R.S. is organized to assist the Red Cross and military commanders in times of disaster or national emergency by providing additional channels of communication throughout the United States to augment or replace land lines that might be damaged or destroyed.

Radio nets are organized to operate on spot frequencies and consist of the Army Net, Corps Area Nets, State and District Nets. The net control station of the Army Net is WLM/W3CXL, located in Washington, D.C. This station maintains schedules with corps-area net control stations and also with Panama and Hawaii. Each corps area has a net control station which also works with various state net control stations within the corps area. The Army Net and Corps Area Nets normally operate on special frequencies using call letters assigned by the Chief Signal Officer. Other nets operate in the amateur bands.

Operation is normally from September 1st to May 31st each year. However, nets continue to operate with reduced numbers during the summer months, though operation is not required to maintain active status.

A ZCB (QSO) contest was held from 6 P.M. E.S.T. May 30th to 12:00 midnight E.S.T. May 31st. Each contact counted one point and additional credit of ten points was allowed for contact with all nine corps areas. Complete reports have not reached this office as yet but some members have reported working all corps areas on eighty meters. The largest score to date is 131 points. Complete results will be given later.

A questionnaire was recently sent all A.A.R.S. members. From these reports we observed several estimates of copying speed of thirty to thirty-five w.p.m. in five-letter code groups. On Monday, June 7th, WLM broadcast for five minutes five-letter code groups at 25 w.p.m. and requested those listening to copy with a pencil.

PDC, the monthly bulletin of the Chief Signal Officer which has formerly been published on the first of each month will hereafter be published on the 15th of each month. The monthly report from Corps Area Signals formerly due on the 22d of each month will hereafter be due on or before the last day of each month. All members should, however, get their traffic reports in as soon after the 15th of each month as possible.

DIXIE JONES’ OWLJUICE

THIS column of juice wishes to assure Mr. Garcia, of CM2AO, whose letter follows, that he ain’t the only one that can’t make no sense outta the hifalutin’ langwidge in QST. The trouble is the writers are so doggone edjicated that the main idea gits sidetracked behind a coupla verbs or sumpn and if ya ain’t plenty good ya miss it. This “Message From Garcia” points a moral even as did the “Message To Garcia” of forty years ago.

“Habana, April 17, 1937

“Dear Mr. Dixie:

“You and QST has gave me big surprise. For the long time since I have trying to learn the English. I had the teachers and the teacheresess but was not never available to read the tongue. Then one day I was looking in QST the diagrams I could descifer but the words were more worser I could not descifer until all at the once I consciously understood what I was looking into over the page. It was your juice even the rhinnerhosses and other byrds. I am sorry about the picture and you hanging into the mike as I keep always hanging myself by the key forever. But I liked it all as I could get the meaness of it. Please do more so es pse where can one get diccionary of yours and subscripcion to Squinch Owl? 73 excuse dx adios QRU, AK, SK.

“Yours truly,

“S. E. GARCIA, CM2AO,
Calle 13, No. 97 Vedado, Habana, Cuba.”

—W 4/R of the “Dixie Squinch Owl”
Details of the Emergency Communication Plan

By Lieut.-Commander Wm. Justice Lee, C-V(S), U. S. N. R.

A NUMBER of years ago, seven to be exact, the Navy worked out a plan for emergency communication for its Naval Reserve stations in connection with Red Cross relief.

This plan was based upon the fact that in almost every city of the United States there is a chapter of the Red Cross and likewise in a great many cities in the United States there are one or more members of the Naval Communication Reserve who own and operate their own amateur radio stations. After a number of conferences with the Red Cross it was decided that a member of the Naval Communication Reserve should be appointed on each local chapter Subcommittee of Transportation & Communication and that this Naval Reservist would act as the liaison representative of the Communication Reserve with the Red Cross in that particular locality.

The entire plan is based upon the knowledge acquired during past emergencies or disasters when normal channels of communication have failed and under these conditions the Communication Reserve-amateur radio stations stepped to the fore and established communication with the outside world. The plan is divided into two major classifications, (a) predictable disasters, (b) unpredictable disasters. Under the former classification come general floods and hurricanes and under the second classification come fire, earthquake, tornado, sleet storm, bursting dam, landslide, volcanic eruption, cloudburst, explosion and possibly some others.

In case of any disaster the local Naval Reservist at the scene of the disaster will attempt to forward his report to his Commandant at his Naval District Headquarters, routing the dispatch according to methods which will be described later on, and bearing in mind that when a real emergency occurs which involves the possibility of injury and loss of life, every means may be considered allowable when attempting to establish communication with the outside world.

The American Red Cross maintains area headquarters in three cities. When a disaster occurs the Naval Reservist originating the report will send his report to his District Commandant. The Commandant will take such action as he deems necessary and will immediately file a priority dispatch by Navy radio or commercial line to the area office of the American Red Cross which has jurisdiction over the state in which the disaster has occurred. These offices and the states which are included in their area are shown below:


(b) American Red Cross, Midwestern Branch Office, 1709 Washington Avenue, St. Louis, Missouri, for disasters in the following states: Wisconsin, Illinois, Minnesota, Iowa, Missouri, Arkansas, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Montana, Wyoming, Colorado, New Mexico and Michigan.

(c) American Red Cross, Pacific Branch Office, Civic Auditorium, San Francisco, California, for disasters in the following states: Idaho, Utah, Arizona, Nevada, Washington, Oregon and California.

In order to insure as far as possible that a successful contact may be made, four different methods of communication have been worked out known as Methods (A), (B), (C) and (D). Assuming that the first word of a disaster is originated at a Reserve-amateur station, the station of origin has the opportunity of sending it over any one of the following channels:

**Method (A)**

<table>
<thead>
<tr>
<th>Channel 1</th>
<th>Channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Originator</td>
<td>Navy shore station</td>
</tr>
<tr>
<td>Section control station</td>
<td>Navy Department</td>
</tr>
<tr>
<td>Master or alternate control station</td>
<td>Red Cross Area Headquarters</td>
</tr>
<tr>
<td>Naval District shore station</td>
<td>Navy Department</td>
</tr>
<tr>
<td>Red Cross Area Headquarters</td>
<td>Red Cross Area Headquarters</td>
</tr>
</tbody>
</table>

**Method (B)**

<table>
<thead>
<tr>
<th>Channel 1</th>
<th>Channel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any amateur radio station</td>
<td>Commercial high-frequency radio station</td>
</tr>
<tr>
<td>Commercial wire or h.f.</td>
<td>Naval radio station</td>
</tr>
<tr>
<td>Commercial radio station</td>
<td>Red Cross Area Headquarters</td>
</tr>
<tr>
<td>Naval radio station</td>
<td>Red Cross Area Headquarters</td>
</tr>
<tr>
<td>Navy Department</td>
<td>Red Cross Area Headquarters</td>
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</tbody>
</table>

**Method (C)**

<table>
<thead>
<tr>
<th>Channel 1</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Army-Amateur station</td>
<td>Army Corps Area station</td>
</tr>
<tr>
<td>Army net control or Corps Area station</td>
<td>Army Corps Area station</td>
</tr>
<tr>
<td>Army Message Center, Washington</td>
<td>Army Message Center, Washington</td>
</tr>
<tr>
<td>Red Cross Area Headquarters</td>
<td>Red Cross Area Headquarters</td>
</tr>
</tbody>
</table>
All dispatches reporting a local disaster are to be actually addressed to and for action of the Commandant of the Naval District in which the disaster has occurred. In cases of very serious and wide-spread disasters, reports are to be sent to the national headquarters of the American Red Cross, Washington, D. C., in addition to the dispatch sent the Commandant, Twelfth Naval District, and to the local Red Cross Area Headquarters.

The American Red Cross has been very particular to describe the information which it requires when the first and second messages are filed, which is as follows:

First message—Report type of disaster, location and as much additional information as is immediately available.

Second message—Report (1) area covered by disaster; (2) number of persons dead; (3) number of persons injured; (4) number of persons temporarily homeless; (5) number of homes destroyed; (6) number of homes damaged; (7) number of families affected.

The frequencies guarded by Naval Shore Radio Stations at the time of writing of this article are shown below:

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<th>Eastern</th>
<th>Stations</th>
<th>4040</th>
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<th>7995</th>
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<th>4225(S)</th>
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<tr>
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Notes: Stations listed above transmit and receive on the above frequencies.
N—Indicates night only.
D—Indicates day only.
S—Harmonic series—appropriate frequency for day or night.
4235 kc. series is CinC, ship-to-shore frequency on both coasts.
12225 kc. is used during day by NSS, NAR, NAS, NAO.
13305 kc. is used during day by NSS, NAU, NBS, NAW.

This table of frequencies was effective 1 June, 1937, but is susceptible to changes from time to time that the requirements of the Service make necessary. It will be noted there are one or more stations that can be contacted on the east or west coast at almost any time of day or night in case of emergency, as these stations continuously guard some high frequency. The important thing to do is to pick out the proper frequency for the distance and time of day and then make sure that the transmitter is properly tuned so that the Navy operator at the receiving station will be able to hear the call on the frequency which he is guarding.

No attempt has been made to list the commercial high frequencies guarded by commercial shore radio stations, nor has any attempt been made to give frequencies guarded by Army-Amateur and Army Corps Area Headquarters stations. These frequencies may be changed from time to time, but it is usually possible for amateurs or Naval Reservists to identify certain of these stations at the time that they require their assistance. The Coast Guard operates a point-to-point circuit between Washington and its section base stations on 4050 and 8100 kc., the lower frequency being used at night and the higher frequency in the daytime.

Now let us suppose that you are a Naval Reservist, for example in Louisiana, and it appears that a hurricane is liable to strike the coast town in which you live, during the next twelve hours. Just what would you do? You would contact the local chapter of the Red Cross, and further ascertain that the nearest Naval Radio Station continuously guarding a high frequency is located at Pensacola, Florida (NAS). If you had not already done so you would calibrate your transmitter and receiver to as close to 4075 kc. as possible and would attempt to establish advance contact with Pensacola so as to be ready in case of serious damage when the hurricane struck. If for any reason you were unable to raise Pensacola you could call Norfolk, Virginia, (NAM) on 7995 kc. and send a dispatch to Pensacola requesting them to listen for you on 4075. As soon as communication had been established, the Naval Radio Station would inform you on what frequencies they would listen for you and what schedules they would keep. The Commandant of the District would, in the meantime, in all probability have advised you by wire to be ready in case of emergency and instructed the Naval Radio Station to establish communication. That is what would happen in case of a predictable disaster.

In case of an unpredictable disaster such as an earthquake which might occur in Utah, there might be no commercial wire lines in operation after the shock and consequently no one would know what had happened. In this case your amateur station would attempt to raise any Naval
Radio Station on the west coast, preferably your own District Headquarters in San Francisco (NPG). If the earthquake had occurred during daylight hours you would call on 8150 kcs. or on 8470 kcs., whereas if the emergency occurred at night you would call on 4010 or 4235 kcs. Having once made contact with a Naval Radio Station, that station would take charge of the situation and instruct you what to do with regards to frequencies and maintenance of schedules.

Because the Section Control and the Master and Alternate Control Reserve stations are usually manned only on drill nights, except by special orders, these stations cannot be contacted in the case of an unpredictable emergency. However, in the case of a predictable emergency, the probability is that the Commandant of the District which expected a disaster would already have notified the personnel of these stations to man the stations and have them on the air, in which case you would be able to contact your Section or Master and Alternate Control Station on one of the Reserve frequencies, namely 8475 or 4045 kcs.

Some people have had the opinion that the Naval Communication Reserve was organized primarily for emergency operation in case of floods, hurricanes or other disasters, but this is actually not the case. The Communication Reserve is now made up of about 900 officers and 4300 men who have been enrolled in the Naval Reserve and are being trained for purposes of national defense. They are given regular instruction by means of drills and in other ways, in order to fit them to take their place with the Navy in case the need should arise. In order to provide this training, the Navy has developed this system of radio circuits by which naval procedure and methods are taught through practical radio operation. Naturally when a disaster occurs, the Naval Reserve personnel and their equipment are temporarily available to the Red Cross for relief purposes until regular channels of communication are again open. It is neither the desire nor the intention of the Navy Department to supersede commercial communication when such communication is available, nor is the Communication Reserve expected to operate after the regular Army, Navy, Coast Guard, National Guard or Naval Militia is prepared to handle emergency communication.

The purpose of the Red Cross Plan is primarily to bridge the gap of time which elapses between the time that the disaster occurs and the time that regular federal or state relief agencies can take charge and furnish necessary communication.

It might be interesting to readers of QST to know that, during the Ohio River and Mississippi Valley floods during the spring of this year, the Naval Communication Reserve control stations in Chicago, Cincinnati, Wheeling and Memphis handled a very large amount of relief traffic for the Red Cross and for a time actually acted as the key stations for U. S. Coast Guard relief operations. This service continued in some cases for upwards of two weeks, although such long service was not contemplated by the original Red Cross Plan. It proved necessary because other channels of communication had not been reestablished. The vital usefulness, however, of the Red Cross Plan, comes in the first one or two hours of disaster when every minute is of importance in getting the word of the disaster to the Commandant and the Area Red Cross.

This plan has been given very wide distribution through the Red Cross, the Army, the Coast Guard and other branches of the government. Any amateur who is interested in helping out in case of emergency will do well to look up the nearest member of the Naval Communication Reserve and secure from him information with regards to identity of Navy and Naval Reserve stations in his locality, with the idea that this information may prove of great value in case of emergency.

**Northwestern Division Convention**

*August 28th and 29th*

RAINIER NATIONAL PARK! Sunrise Park, on the East Side of Mount Rainier, has been chosen for the 12th Annual Northwestern Division Convention to be held on August 28th and 29th, under the direct supervision of Director Ralph Gibbons and assisted by Harold W. Johnson. Cabins are $2.00 and up, with or without blankets. A Cafeteria is also on the grounds. The registration fee is $1.00. It will be necessary to register not later than August 15th, and this should be done by writing Harold W. Johnson, W7DXF, Box 527, Pendleton, Oregon; further information will also be furnished by him.

**Pacific Division Convention**

*Stockton, Calif., September 4th—5th—6th*

SEE you all in Stockton” is the heading which appeared in the Special Edition of the *Stockton Record* when the first publicity was released recently. The Stockton Amateur Radio Club joins in with the newspaper in extending a cordial invitation to all radio amateurs to attend the annual Pacific Division Convention to be held at the Hotel Wolf, Stockton, Calif., September 4th, 5th and 6th. A big program is being prepared and many features will appeal to all who come to the affair. One of the features which promises well, will be an initiation of the Royal Order of the Wouff Hong by members of the Manteca Radio Club. Watch for publicity, but if you want more information drop a card to George R. Scott, W6IKG, Hotel Wolf, Stockton, Calif.
A 56-Mc. Converter of High Stability
High-C Oscillator and High-Frequency I.F. for Reception of Crystal-Controlled Five-Meter Signals

By Byron Goodman,* WIJPE

Major problem of 56-Mc. c.w. reception is that of obtaining a high-frequency oscillator that doesn't flutter and burble. One way is to use the harmonic of a lower-frequency oscillator, but this always leaves the gate wide open for reception of signals on another band, unless the signal circuits are quite selective—usually a very improbable condition at this frequency. Also, with ordinary methods of tracking, one ends up with an oscillator that is too low-C for good stability.

One angle of attack is so relatively simple that it is surprising that it has not been described before. The obvious solution to the image problem is to use a higher intermediate frequency. At the same time, if we put the oscillator on the low side of the signal frequency it will be on a much lower frequency, where the chances of its being stable are much better. And then it can be made real high C to increase the stability. The only problem left is that of ganging the high-C oscillator circuit and the low-C signal circuit or circuits. It is here that a very fortunate property of tuning capacities steps in and saves the day. A straight-line capacity condenser near the high-capacity end of its scale tunes practically straight-line frequency, so if we already have sufficient capacity in a circuit, a straight-line-capacity condenser will tune straight-line-frequency (or very nearly so) throughout its whole range. This holds true at any total capacity, of course, so long as the variable capacity is small compared to the fixed capacity. It is therefore a simple matter to design a low-C signal circuit that will track with a high-C oscillator circuit. This holds true for any intermediate frequency, but a high one was used in the setup to be described to eliminate the possibility of images and to allow a lower oscillator frequency to be used.

A little scratching around on a pad of paper disclosed that with an intermediate frequency of 20.5 Mc. and a tuning range of 55.7 to 60.3 Mc. one should run into no image trouble. True, images might creep in from the range 14.7-19.3 Mc., but this would include no amateur signals (with the improbable exception of harmonics from the 80-meter band) and so any amateur signals heard actually would be received on the 5-meter band. The simplest sort of 20.5-Mc. i.f. amplifier is an old t.r.f. receiver covering that range. A superhet could be used, but there would be too good a chance of running into oscillator harmonics from the receiver used as the L.F. An SW-3 served as the i.f. with the converter to be described, but any stable t.r.f. set will work quite well. If you don't mind dodging a few harmonics you can use your regular superhet.

Still more juggling, this time with condenser catalogs and the Lightning Calculator, gave the proper tuning condensers to be used. In the signal circuit, a range of 10.5 to 9.0 µfd. covers the

*Assistant Sec'y, A.R.R.L.
range and gives nice low C; and for the oscillator, 113-90 µfd. does the trick in covering the oscillator range of 35.2-39.8 Mc. These values were worked out backwards; the tuning ranges of various available condensers were listed and then the proper lumped capacity found. No regular condenser small enough to cover the signal circuit range was found, so two plates were removed from a Cardwell ZS-4-SS, bringing its capacity range from 4-1.5 µfd. down to 2.4-0.9 µfd. Since the lumped capacity in the signal circuit was to be only 8.5 µfd., the use of an acorn tube was indicated. It fits into the scheme well, since by mounting the tube under the socket taking the coil, the grid lead is cut down to about three-eighths of an inch. The 6J5G has been suggested as a stable high-frequency oscillator, and its use justified its reputation.

In order to squeeze the last microvolt of signal out of the detector stage, it was made regenerative. Also, because of the high intermediate frequency, cathode oscillator-coupling was used, and has shown absolutely no "pulling" effect. By using the coil that couples the oscillator to the detector as the cathode impedance for the regenerative detector, a simple and effective method of oscillator-coupling and obtaining regeneration is secured. Regeneration is controlled in the usual manner, by varying the screen voltage.

Finally, a tuned antenna circuit was used, more efficiently to transfer energy from the antenna to the grid circuit. The tuned antenna circuit was link-coupled to the grid circuit, and the only necessary precaution to take is to see that the link is not made of twisted pair. An improvement in signal was apparent when wires separated about a half-inch were substituted for the twisted pair used at first.

The performance of the converter might well be improved by the addition of an r.f. range and gives nice low C; and for the oscillator, 113-90 µfd. does the trick in covering the oscillator range of 35.2-39.8 Mc. These values were worked out backwards; the tuning ranges of various available condensers were listed and then the proper lumped capacity found. No regular condenser small enough to cover the signal circuit range was found, so two plates were removed from a Cardwell ZS-4-SS, bringing its capacity range from 4-1.5 µfd. down to 2.4-0.9 µfd. Since the lumped capacity in the signal circuit was to be only 8.5 µfd., the use of an acorn tube was indicated. It fits into the scheme well, since by mounting the tube under the socket taking the coil, the grid lead is cut down to about three-eighths of an inch. The 6J5G has been suggested as a stable high-frequency oscillator, and its use justified its reputation.

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The performance of the converter might well be improved by the addition of an r.f.
input coupling transformer is made by bending coil socket by tapping two 1-inch lengths of brass ground low.

The detector tube, a 954, has its socket mounted directly under the detector oil socket. It will be necessary to make two mounting pillars for the coil socket by tapping two 1-inch lengths of brass rod, since the acorn-tube socket partially covers the mounting holes for the pillars. Flat-head screws must be used. An acorn-tube socket similar to the one shown must be used, because it is necessary to keep the capacity between cathode and ground low.

The wiring is simple and straightforward, the only precaution being the usual one of making leads short and solid in the r.f. circuits. It will be noted in the diagram that the oscillator coil socket has two ground leads running from it, one to the oscillator tuning condenser and one to the detector tuning condenser. This was done so that the chassis would not have to be depended upon for the ground return. It is advisable to make the leads to the acorn tube grid and plate clips of fine wire, about No. 28, to eliminate the danger of breaking the tube when making connections.

The dial is an ordinary National Type "B" with a larger knob added. With the variable vernier ratio set all the way over towards "Slow," the dial gives smooth tuning and with a little care you will find that you won't miss any signals. You aren't tuning across four or five hundred kilocycles, but over 4½ megacycles and the tuning is fairly sharp.

The "on-off" switch is so wired into the circuits that it turns off both the converter and the receiver used as the i.f. amplifier.

**TRIMMING THE COILS**

Probably the most difficult task in the construction of the receiver is trimming the coils to their proper inductance. The first thing to do is to couple the output transformer to the receiver to be used as the i.f. amplifier. Couple the output of a modulated oscillator set at 20.5 Mc. to the 954 grid and tune in the signal on the receiver. Then tune the trimming condenser on the output transformer for maximum response. The i.f. amplifier is now lined up.

Set the test oscillator at 28 Mc. and set the tuning dial at 90. Rotating the oscillator padding condenser, the signal (second harmonic of the test oscillator) should be heard with the oscillator pader at almost exactly half scale. Then set the test oscillator at 30 Mc. and see where the signal comes in on the tuning dial. If it's at about 5 on the dial, you have been very lucky and hit the proper range right off. A little trimming of the oscillator coil, about a quarter turn at a time, will soon give you the proper range.

Loosely couple the test oscillator to the antenna circuit and trim the detector coil. The detector padding condenser should be set at about ½ scale to give exact tracking, but the antenna tuning will interlock slightly so it is not necessary to trim down to the last sixteenth of an inch of wire. If ear noises peak up with the detector pad set at half scale or so the coil is adjusted closely enough.

Running the regeneration control up, the detector should oscillate at about ½ scale. If it oscillates too soon, space the turns slightly on L3, the cathode impedance, until the regeneration works the way it should. It will be found that ¼ of a turn here will make the difference between "yes" and "no," so it is well to spend some time with the cathode coil.

With the set lined up properly, it will be possible to run across the band for c.w. signals with all of the ease and confidence customary on other bands. Any crystal-controlled signal will have the same stability that is obtained on 14 and 28 Mc., and you have the assurance that once found, it isn’t going to flutter out of audibility almost immediately. Using the SW-3 as the i.f. amplifier, the regeneration control of the SW-3 is set in the sensitive position normally used for weak-signal reception, and held there for c.w. reception. It is backed off slightly for ‘phone reception, in the usual manner.

When the rig is in operation, try changing the number of turns that link the output transformer to the receiver being used as the i.f. amplifier. Different receivers have different input impedances, and some adjustment of the coupling coil may be necessary if maximum sensitivity is to be secured.

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**Strays**

Bustand’s “Radio Instruments and Measurements”, Circular 74, is back in print again, now reprinted with various errors and omissions corrected. In other respects it is still the same book which was once the experimenter’s standby.

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Why get excited over 56-Mc. DX? says W2GFE, According to May QST W8MAH has worked 32MH on 914,310 kc.—with a T9X signal, too! If you don’t believe it, see page 61 of that issue.

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It seems that WOUVJ was taken to task by his neighbors for broadcasting on kilocycles instead of megacycles, where said neighbors claimed he belonged!
Operating Data on the New Beam Power Tubes

A Two-Stage Beam Transmitter Using the RK-47

By George Grammer*

ACTUAL experience with the new beam transmitting tubes announced in our last issue—the RK-47 and RK-481—proves them to have the characteristics that have been found so desirable in their smaller prototypes. In plate current behavior, they are more like triodes than conventional pentodes, which means that more loading, and consequently more output, is possible at a given plate voltage. Under proper operating conditions, the plate efficiency is somewhat higher than with a pentode at the same plate input, another indication of improved performance.

The operating curves of Figs. 1 and 2 are of interest in indicating typical performance with variable excitation. With both types a grid current of 10 milliamperes is sufficient for full output when the recommended grid bias is used. The driving power is very low, being less than two watts for either type, and the tubes actually do drive well from a low-power source. The overall performance indicated by the curves is borne out very well in practice. With the RK-47, for instance, it is quite easy to obtain an output of 150 watts without exceeding the rated input, and the fact that an elaborate exciter is not needed not only makes the construction of a compact transmitter relatively easy, but greatly facilitates band-changing. Such a set is shown in the accompanying photographs; a rig using RK-48's is to be described in a following article.

The outfit pictured is an “all-beam” affair suitable for working three bands, 7, 14 and 28 Mc., with one crystal, and switching from one band to the other is accomplished simply by changing the final tank coil. The driver is a 6L6 Tri-tet, working from a 7-Mc. crystal; the RK-47 is used as a straight amplifier on 7 and 14 Mc. and as a doubler on 28 Mc. The set-up is somewhat experimental in nature, because we were chiefly interested in getting some data on the performance of the tube under different operating conditions.

The conclusions can be stated briefly enough: The tube is well screened and shows no tendency to oscillate without neutralization, and it makes a good doubler, although requiring higher bias in this application and therefore more driving power for most efficient operation. It is rather difficult to get a good L-C ratio on 28 Mc. because the output capacity is high compared to that of a good high-frequency triode; the result is that, using the same tuning condenser that is suitable for 7 and 14 Mc., not all the power developed by the tube can be realized as useful output, since the relatively high circulating tank current on 28 Mc. raises the tank losses. The output on 28 Mc. using the tube as a doubler runs between 60 and 75 watts, the lower figure being obtained when the input is adjusted so that the plate shows no color and the higher at the recommended maximum plate input—150 ma. at 1250 volts.

From the convenience standpoint the transmitter illustrated is a quite desirable arrangement. Fig. 3 gives the circuit diagram. The 6L6 plate circuit is proportioned so that both 7 and 14 Mc. can be covered with a single coil at $L_0$, an arrangement which is not especially efficient but which is permissible in this case because the output of the 6L6 is far more than is needed to excite the RK-47. Changing $L_0$ is therefore unnecessary for operation on any of the three bands; $C_1$ is simply

\* Assistant Technical Editor.

The difficulty of securing a single choke which would work well on all three bands finally forced the use of series feed, but on installing the latter we ran into r.f. troubles in the plate-supply leads and on the supposedly "cold" chassis. The most effective cure was the installation of $C_7$ across the meter jack and $C_{10}$ from the cold end of the 6L6 plate choke to ground. After these condensers were put in there was no further trouble of this type.

The physical layout is quite simple. Viewed from the back, at the left is the socket for the crystal, followed by the 6L6 and the socket for the 6L6 plate coil. These are toward the rear of the chassis, leaving space in the front for mounting the plate meter on the panel. The RK-47 is set in a socket suspended below the chassis so that the grid leads are entirely "underground." A shield can with the top cut off surrounds the lower part of the tube to provide further shielding. The plate tank condenser and coil are at the right. The jacks for reading plate currents and RK-47 grid current are mounted on the rear edge of the chassis; the two at low voltage are insulated by fibre washers and the high-voltage one by a piece of bakelite mounted so that the jack projects through a hole of ample size in the chassis.

The crystal holder shown in the photograph is a new National multiple unit, with an internal switch, holding four crystals. The switch shaft is connected to a panel control by means of a flexible-cable coupling so that any of the crystals can be swung to give resonance at either 7 or 14 Mc. The 6L6 is biased by a cathode resistor and grid leak combination, the leak being adjusted to give optimum harmonic output. The screen is fed through a dropping resistor, and the plate is parallel-fed to avoid danger of flashing over the rather closely-spaced plates of $C_1$ and to avoid the necessity for insulating $C_1$ from the chassis. Series feed is used in the RK-47 grid circuit, a blocking condenser $C_6$ being inserted in the 6L6 plate tank to insulate the bias voltage from ground. Resistor $R_6$ is a grid leak used only when doubling in the final; it is shorted by switch $S$ when the tube is a straight amplifier. The 15,000-ohm value specified was found to be optimum in this particular circuit arrangement. The RK-47 plate circuit is conventional. The screen is supplied through $R_s$ from the oscillator plate supply.

Only one other point about the circuit needs comment. In the early experimental work, parallel feed to the RK-47 plate was used, and proved to be entirely satisfactory on 7 and 14 Mc. However, on 28 Mc. the plate choke ran hot and the efficiency was practically all wiring is underneath the chassis

The layout affords complete shielding without any special constructional work.

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be selected from the front. The holder fits a standard five-prong socket and can be pulled out in an instant should it be necessary to use an extra crystal provided with the customary mounting.

The 6L6 plate coil is an air-wound affair cemented on celluloid strips and mounted inside a shielded plug-in coil box. The shield is grounded through one of the five pins on the coil base.

The usual collection of r.f. chokes, by-pass condensers and resistors is to be found underneath the chassis. $C_1$ and $C_4$ are mounted upside down from the lower side of the chassis stop, with their shafts projecting through holes in the front. The oscillator cathode coil, $L_1$, is to the left of $C_1$; it is mounted simply by No. 14 wire leads, soldered through holes in the bakelite form, which go to convenient soldering lugs. A small baffle shield is placed between the two condensers. All r.f. leads are as short as possible, with grounds directly to the chassis. The final tank condenser is insulated from the chassis by means of small butt-in type insulators.

The chassis is electrolytic, 7 by 17 by 3 inches, and the panel 10½ by 19 by ¼ inches, the dimensions being suitable for relay-rack mounting.

For minimum crystal current it is essential that the dimensions of $L_1$ be duplicated and that $C_1$ be set as near minimum capacity as is consistent with the excitation required. Crystals of ordinary activity will work well with $C_1$ set right at minimum, and this control in nearly all cases may be left alone. The setting for 7-Mc. output will be found near maximum capacity on $C_2$, and for 14-Mc. output near minimum capacity. The 6L6 plate current at resonance will be about 60 milliamperes in either case, using the 400 volts specified in Fig. 3. A neon bulb touched to the crystal shows only a dim glow, and the crystal is only slightly warm after long periods of operation. Most of this heat is transmitted from the tubes through the chassis.

In the RK-47 stage, with $R_6$ shorted out, the unloaded minimum plate current on 7 Mc. should be about 15 ma. and on 14 Mc. about 25 ma., the difference being accounted for by the fact that the $L$-$C$ ratio is less favorable on 14 Mc. Doubling to 28 Mc., with $R_6$ in the circuit, the minimum plate current
grid current over 10 milliamperes does no good so far as output is concerned.

The fixed bias, approximately 70 volts, may be secured from batteries or from a power pack. This value is for Class-C operation, and is greater than cutoff so that no plate current flows when excitation is absent.

If 28-Mc. operation is not wanted, a 300-volt supply will be sufficient for the oscillator. The lower voltage gives the crystal even less work to do, and provides ample excitation for the RK-47 as a straight amplifier. With 300 volts, the 4000-ohm resistor in series with the RK-47 screen should be cut out.

An alternative method of operation is to use 3.5-Mc. crystals, driving the RK-47 as a straight amplifier from either the second or fourth harmonic of the oscillator. With 400 volts on the oscillator plate, the fourth harmonic is large enough to provide adequate excitation when one of the low-drift crystals is used. The older X cuts do not have as great activity—at least this was the ease with several samples tried—for good fourth-harmonic operation. The cathode coil for an 80-meter crystal should have 15 turns in the same space as the specified 40-meter coil occupies. Incidentally, the latter coil is sufficiently large so that 20-meter crystals of the "harmonic" type can be used in the transmitter for 14- and 28-Mc.

No antenna-coupling circuit is indicated in the diagram, since most amateurs have their own pet schemes. There is ample room on the forms for a link, or even for a coupling coil to be used with series or parallel tuning. The spacing between such coils can be adjusted, so the tank and antenna coil for a given band can be plugged in together.

The transmitter could be adapted for 3.5-Mc. operation by substituting suitable crystals and a larger coil at L2. One difficulty is that of securing a large enough final tank coil without resorting to another type of form; a second is that the $L_C$ ratio becomes unduly high on this band with the tank condenser specified. Unfortunately, however, we run up against the physical fact that a condenser suitable for 14 and 28 Mc. is invariably too small for the lowest frequencies, and that one large enough for 3.5 Mc. has too much residual capacity for 28 Mc. We hope some day that condenser manufacturers can be persuaded to make a fixed air condenser of reasonable voltage rating which can be incorporated in a regular plug-in coil assembly so that this business of $L_C$ ratios in wide-frequency-range transmitters will be less troublesome.
A DeLuxe 'Phone Transmitter With Grouped Controls and Cable Tuning

An Innovation in Transmitter Construction for Convenience and Protection of Controls

By S. L. Baraf* and Frank Edmonds,* W2DIY

IN THE past few years an abundance of ideas and equipment has been presented to amateurs who wish to occupy as many bands as possible with a minimum of time taken out for changing from one to another. There are, however, many in the amateur fraternity who derive their chief enjoyment from reliable daily contacts on the same band. These amateurs number among them some of the hardest workers and most unselfish operators in times of emergency; a large part of their value comes from the fact that they have built up stations which can be depended upon to be on the air at a definite frequency and to put out a high-quality signal. The speed and precision with which these fellows handle traffic during emergencies is well up to the standards of the best commercial services.

With these thoughts in mind, a transmitter was designed having features that should appeal greatly to those amateurs who confine themselves largely to single-band operation.

To begin with, a rather unusual design feature in the transmitter is the cable tuning. The tuning controls are grouped to facilitate tuning and to protect them from being disturbed, once set. Moreover, once the transmitter is tuned up the tuning controls are no longer of importance and in this particular arrangement they least distract the operator's eye when observing the operation of the transmitter. It will be noticed that all essential tuning controls are symmetrically arranged on an inclined panel. The controls ordinarily cannot be tampered with because of a glass door which in closed position protects them from accidental mis-adjustment. It will also be

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noticed that the meters are grouped at the top so that the operator does not have to search all over the panel while tuning up the transmitter. Now then, looking at the front of the transmitter, it can be realized that with the glass door closed the meters and the oscilloscope predominate, with the line voltage control on the front bottom also in view.

Having gone to such exacting design details it is only natural to state how it was possible to group all controls and meters symmetrically without the use of many name plates and dials. The writers found that it did not cost any more to anodize the front aluminum panels and then have them engraved with the necessary circuit designations and differently assigned dial divisions for the tuning controls. Mounting screws for the panels are hidden from view by trim strips so that a finished "professional" appearance is attained. To enhance the operating convenience of the transmitter, provision is also made for remote operation.

A glance at the rear-view photograph of the transmitter will show how it was possible to group the tuning controls. This was accomplished by introducing the use of flexible tuning cable of the type used in remote controls for auto radios. This cable will readily handle the larger transmitter tank condensers, provided the cable housing is clamped securely so that there is extremely little whip. A particular advantage in cable tuning is the fact that the tank condensers may be placed in any position necessary for maximum efficiency, without regard to panel layout.

To provide safety and convenience all controls and meters are at ground potential, and the transmitter is completely relay operated.

THE USUAL ARRAY OF DIALS AND CONTROLS ALL OVER THE TRANSMITTER PANEL IS CONSPICUOUS BY ITS ABSENCE

Remote tuning by means of flexible cables permits grouping all tuning controls at one easily-accessible spot. Once the transmitter is tuned, the drop panel, which has a glass insert, is closed so that the controls cannot be touched.

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C1, C2, C3—100-mfd., variable (Cardwell MT-100-
GS).
C4, C5—100-mfd. mica, 1200-volt (Cornell-Dubilier Type 9).
C6, C7—0.002-mfd. mica, 2200-volt (C-D Type 9).
C8—0.002-mfd. mica, 2200-volt (C-D Type 9).
C9—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C10—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C11—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C12—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C13—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C14—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C15—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C16—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C17—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C18—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C19—0.002-mfd. tubular, 2000-volt (C-D Type 9).
C20—0.002-mfd. tubular, 2000-volt (C-D Type 9).
R1—20,000 ohms, 20-watt.
R2—20,000 ohms, 20-watt.
R3—50,000 ohms, 20-watt.
R4—50,000 ohms, 20-watt.
R5—40,000 ohms, 20-watt.
R6—1500 ohms, 20-watt.
R7—20,000 ohms, 20-watt.
R8—500 ohms, 10-watt.

FIG. 1—CIRCUIT DIAGRAM OF THE EXCITER UNIT

R.F. SYSTEM

Electrically, the r.f. section of the transmitter consists of four stages, which provide adequate isolation of the crystal oscillator and ability to operate the transmitter on the 20-, 40- and 80-meter bands by the use of the proper crystals and plug-in type coils. The buffer and driver stages use pentodes because of the low driving power required and the freedom from neutralizing troubles. The output stage is the conventional push-pull triode arrangement, which gives maximum efficiency with high-level plate modulation and because of its balanced construction permits permanent neutralization. The crystal stage uses a pentode operating at low plate potential. This circuit was chosen because of the fact that the pentode requires a minimum of crystal current, and since no large power output was required to excite the following pentode, the crystal stage was designed for maximum frequency stability. The use of the pentode oscillator together with temperature crystal ovens and operation of the oscillator at low voltage makes possible an oscillator whose frequency stability is comparable to that of the better commercial stations.

The second stage is a straight pentode buffer. The driver stage, however, contains an interesting feature for those who have had difficulty in deciding how to obtain operating potentials for this type of tube. In order to obtain the maximum output from the RK-20 with the lowest plate potential it was decided to operate this tube with positive potential on the suppressor grid. A number of operators have been at a loss as to a method for obtaining this suppressor potential without taking taps from one of the low-voltage power supplies, which requires some fishing for the proper location of this tap and the use of an additional power lead to the tube. This difficulty was solved by the use of another dropping resistor from the screen to the suppressor. For an RK-20
FIG. 2—THE PUSH-PULL FINAL AMPLIFIER AND ANTENNA COUPLER

- R1, R4—30,000 ohm, 1-watt.
- R5—500 ohm, 20-watt.
- R6—250,000 ohm, 1-watt.
- R7, R8—50,000-ohm, 1-watt.
- R9—5000 ohm, 20-watt.
- R10—25,000-ohm, 1-watt.
- R12—25,000-ohm potentiometer.
- R13—500 ohm “T” pad, line gain control.
- R14—20,000-ohm, 20-watt.
- R15—5000 ohm, 20-watt.
- R16—500,000 ohm, 1-watt.
- R17—500,000-ohm, 1-watt.

- C1, C2—20-µfd., 450-volt electrolytic (Corning type 805). (Wound on Bud Type 376 ceramic forms.)
- C3—25-µfd., 450-volt electrolytic (C-D Type 9). (Wound on Bud Type 376 ceramic forms.)
- C4—250-µfd., transmitting type (Cardwell XG-110KD).
- C5—0.001-µfd. mica, 5000 volt (C-D Type 9).
- C6—0.001-µfd. tubular, 2000 volt (C-D Type 9).
- C7—8-µfd. paper, 400 volt (C-D Type 9808).
- C8—0.002-µfd. mica, 1200 volt (C-D Type 9).
- C9—0.002-µfd. mica, 1200 volt (C-D Type 9).
- C10—0.002-µfd. tubular, 2000 volt (C-D Type 9).
- M1—500 d.c. milliammeter (Triplett 421).
- M2—0-50 d.c. milliammeter (Triplett 421).
- M3, M4—500 d.c. milliammeter (Triplett 421).
- M5, M6—0-2.5 r.f. ammeters, external (Cardwell PE-C-4008).
- M7—0-100 µfd., 25 volt electrolytic (Corning type 805).
- M8—20 K ohm, 20-watt.
- M9, M10—20,000 ohm, 20-watt.
- M11—500-ohm, 20-watt.
- M12—500-ohm, 20-watt.
- M13—500-ohm, 20-watt.
- M60—2000 ohm, 20-watt.
- M64—2000 ohm, 20-watt.
- M81—2000 ohm, 20-watt.
- M100—2000 ohm, 20-watt.
Four power supplies are used in the transmitter proper, one for the speech amplifier and oscillator, a second for the buffer and driver stages, a third for the bias supplied to the final and driver stages, and a fourth for the power amplifier and modulator. There is also a fifth supply, for the oscilloscope. The power supply for the final r.f. and modulated amplifier is capable of delivering a full kilowatt at 1300 volts. Four 866A's are used in this supply, with a balance coil between the parallel tubes on each side to provide an equal division of current to the rectifiers. Without the use of the balance coil one of the tubes would take most of the current; moreover the use of the balance coils avoids the use of more expensive 872 rectifier tubes. A liberally designed Vari-Power autotransformer, 2000-watt rating, is used to compensate for line voltages from 95 to 130 volts. When this transformer is adjusted to provide the proper voltage at the power amplifier tube filaments, the proper operating voltage is also provided at the other transformers. The transmitter is completely protected by relays so connected that opening of the rear door or tampering with the auto-transformer while the transmitter is in operation will automatically shut down the transmitter. Overload of the power amplifier tubes will cause the high-voltage plate supply to be shut off but will leave the filaments and low-voltage supplies in operation. An eight-terminal connector at the rear of the transmitter provides for operation of the transmitter from a remote point.

The audio system in the transmitter proper consists of the modulator and driver stages. The a.f. input to the transmitter is to a two-connection plug terminal at the rear; this connector runs to a five-terminal strip at the rear of the amplifier deck with provision for input impedances of 50, 200 or 500 ohms. The input stage consists of push-pull 2A3's, which are still the best available tubes for use as Class-B drivers.

It has been noticed that there is an increasing tendency on the part of amateur constructors to resort to the use of new type tubes for this type of service merely, it is assumed, because of the desire to use the latest in tubes when constructing a new rig. If really high-quality transmission is desired it is highly advisable to use driver tubes with a low plate resistance. Tubes such as the 2A3, the 6A3, the new 6A5G or the 845 fall in this class. Tubes such as the 6L6 and the 6B5, while they make very good output amplifiers, have a plate resistance much too high to meet the requirements for Class-B drivers and should be avoided for this service. 1

The desirable effects of high plate resistance with tetrode and pentode tubes can be overcome by use of inverse feedback, which in effect lowers the plate resistance of the tube. See "Some Practical Inverse Feedback Circuits for Audio Power Amplifiers," QST, January, 1937. The use of inverse feedback requires a higher value of driving signal, however, so that the operating conditions are comparable to those of low-mu triodes.—Broxon.

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The modulator tubes selected for the transmitter were the familiar 838's. By increasing the input slightly over rated conditions these tubes are capable of 300 watts of high-quality audio. The multiple taps on the Varimatch modulation transformer proved to be very handy when the transmitter was first tested out. It was found that when tuned up the transmitter was capable of an output of 400 watts at eighty meters but that the wave form, as viewed on the oscilloscope, was slightly distorted at the high frequencies. Upon checking over the transmitter it was found that the plate voltage was slightly higher than had been anticipated and under this condition the matching of the modulator to the Class-C stage was not as close as it should be for high-quality transmission. It was a simple matter to correct this condition by reconnecting the taps on the modulation transformer to provide a closer impedance match.

THE OSCILLOSCOPE

The oscilloscope used in the transmitter uses a separate power supply and provides for both trapezoidal and envelope type patterns. The circuit is conventional, and needs no particular comment. A 60-cycle sweep is provided. Much has been written about the oscilloscope so the experienced operator does not have to be convinced to the advantages of incorporating the scope in a high-quality transmitter. As used in this transmitter the scope can be used for a complete check on the rig when tuning up. The 60-cycle sweep is useful in checking the neutralization of the Class-C stage, and with the aid of an external linear sweep oscillator and an audio-frequency generator the entire audio system may be checked over to determine gain, frequency response and quality of the audio amplifier system. When the transmitter is in operation the operator has his choice of either the envelope or trapezoidal pattern as a constant check on percentage of modulation. The writer prefers the envelope pattern as this enables one to observe both the percentage of modulation and the wave form at the same time.

THE REMOTE AMPLIFIER

The remote amplifier shown provides for remote control of the transmitter from the operating position and for either a crystal microphone or low impedance line input. Three stages are provided in the remote amplifier; all stages are used with the crystal microphone, but only one stage is used with the low-impedance line. Switches...
ing from one to the other is accomplished by a double-pole double-throw switch. Separate gain controls are provided for the microphone and for the low-impedance line. A db meter permits constant observation of the speech level to the transmitter. The dual input is obtained through the use of a dual-primary transformer between the second and third stages. It will be noted that the coupling condenser to the output transformer is 1 µfd, rather than the usual 0.25 condenser shown in most connections of this type, and a word of explanation may not be amiss. If the reactance of the coupling condenser and the impedance of the primary of the transformer are considered as a voltage divider it will readily be seen that the frequency response at, say, 30 cycles can be considerably improved by increasing the coupling condenser from 0.25 to 1 µfd.

The audio tubes used in the remote amplifier are 6C6's. The first is high-impedance input, pentode connected, and is resistance-coupled to a second 6C6 triode-connected. The plate of the second 6C6 is shunt-fed into a dual-primary coupling transformer. The second (low-impedance) primary winding is fed from a 500-ohm "T" pad which in turn is connected to a 500-ohm line transformer. The 500-ohm line transformer permits inputs from 50-, 200- or 500-ohm lines. The third 6C6 is shunt-fed and works into a plate-to-line transformer.

Construction Details

Looking at the front of the transmitter, the meters in the upper row, running from left to right, are as follows: Power amplifier filament, power amplifier grid, power amplifier plate and two r.f. antenna ammeters. In the row below are the oscillator plate, buffer plate, RK-20 plate and modulator plate.

The controls on the tuning panel are, reading from left to right, oscillator, buffer, driver, final p.a. grid, final p.a. plate, antenna, antenna. Below these controls are the controls for the 906 oscilloscope.

At the bottom of the panel is the Coto wheel control for the line voltage adjustment, by means of a seven-point switch connected to the auto-transformer.

Looking at the rear of the transmitter, mounted on the floor of the cabinet are the high voltage plate transformer, the 2-kw. auto-transformer, h.v. filter choke, condenser and bleeder. On the deck above are the filament transformers for the h.v. rectifier, and the 1000-volt rectifier, the bias supply and the oscilloscope supply.

Above the power supply deck at the rear of the chassis is the line-to-push-pull-grid transformer feeding the 2A3's, the 838 modulators and modulation transformers. Next to the driver and modulator and on the same deck is the low-voltage supply for the 2A3's and the RK-25 oscillator.

Above the modulator is the relay control panel containing overload, time-delay and starting relays. In front of the relay panel is the inclined tuning panel.

Directly above the relays is the deck containing the RK-25 oscillator, RK-25 buffer and RK-20 driver. It will be noted that the tank condensers on this deck are mounted on end for short leads to the coil sockets, which are elevated above the chassis. The RK-25 buffer is located behind the aluminum baffle seen at the right. All of these stages are shunt fed to permit the tank condensers to be mounted directly on the chassis. The RK-20 tank coil has a link winding connecting with the two isolantite stand-offs at the right rear of the chassis.

The oscilloscope extends over the chassis between the oscillator and buffer stages and is supported from the front panel by means of four tapped rods and a square socket plate which has curved slots for rotation of the tube to obtain a horizontal image.

The top deck contains the push-pull 805's. The grid and plate tank condensers on this deck are mounted with the shafts to the rear, for connection to the tuning cables.

Directly above this plate tank is the low-pass antenna network, suspended from the top of the cabinet. The condenser shafts extend downward to connect with the isolantite flexible couplings on the cables, which run down through holes in the amplifier chassis. All inter-chassis wiring is by means of cable running behind the false side of the cabinet and terminating at numbered terminal blocks just below each chassis on either side.
A REVIEW of the principles involved in Class-B operation seems to be in order because a knowledge of the fundamental principles is essential if proper operation is to be realized. This is particularly true if the voltages or tubes, or both, are not the ones specified in the operating data furnished with the transformers. The amateur is usually forced to use as much of the equipment as possible when changes are made. He can not always, for example, purchase new power supplies if the ones at hand deliver voltages slightly higher or lower than the optimum values, nor does he wish to purchase new Class-B transformers when he replaces his modulator tubes with other types, if it is at all possible to use the ones he has.

On the other hand, it is extremely important to have the audio equipment working properly. Harmonic content or distortion must be at the absolute minimum. Every one wishes flat frequency response, yet frequency response from an amateur standpoint should be a secondary consideration to low harmonic content. A signal with low harmonic content, whether it has wide-range frequency response or not, will occupy only the minimum amount of territory necessary for voice communication, but a station with high harmonic content will spread and splash into adjacent channels and unnecessarily interfere with other signals. Even if an amateur did not care particularly how good his quality might be, he would owe it to other amateurs to keep his signal as clean as possible—and any improvement in this respect will necessarily improve the quality.

In speaking of distortion, we do not refer to frequency discrimination but to distortion of the wave form. Such distortion results in the generation of frequencies which are harmonics or multiples of the input frequency. Harmonics may be kept at a minimum if all of the tubes in the speech equipment are operating under proper conditions. They may originate in the low-level speech equipment as well as in the modulator stage, but improperly-operated modulators—and this applies to Class-A as well as Class-B—are chiefly responsible in so great a proportion of the cases that the factors involved are worthy of the consideration of every amateur.

TRANSFORMER OPERATION

Except for overmodulation, the commonest source of distortion is an overloaded modulator or one where the reflected load impedance is incorrect. Many amateurs seem to have a mistaken conception of the operation of an audio transformer. Audio transformers act exactly as do power transformers. The principles are exactly the same although, of course, the requirements are different. Perhaps this fact has been overlooked because power transformers are rated in terms of voltage and current while audio transformers are spoken of in terms of impedance or impedance ratios. It is sometimes assumed that if the secondary of an output transformer is marked 2500, 5000, 10,000 ohms or some other value, that the secondary is of that definite value regardless of any other considerations; and that if that secondary is terminated in a load of any other resistance or impedance, there will be a loss in power or fidelity. In other words, there will be a mismatch between secondary and load. Such is not the case. There is never any mismatch between secondary and load nor without any other qualifications is the impedance of the secondary the value marked on the secondary. If the primary is open and the secondary impedance measured, it should theoretically be infinity, and in any event will be many times the value marked on it. What the transformer manufacturer is trying to say is that with the specified modulator tubes, operating at the specified plate voltage and for the output specified, the secondary should be terminated in a load whose resistance or impedance is the value stamped on the secondary. If the modulator plate voltage is higher or lower, or if more or less output is required, the value probably would be different.

The purpose of a Class-B output transformer is to take the power developed by the modulators, which has a certain ratio of voltage to current, and change it to the ratio of voltage and current required at the secondary. If this ratio is correct it is said that the impedances are properly matched, because the ratios are expressed in terms of impedance. Under these conditions the power efficiency of the modulator will be the maximum obtainable with low distortion. If the ratios are not correct, one or more undesirable effects which will be discussed later will be evident.

The primary reflected load impedance depends upon the turns ratio of the transformer and the value of the impedance or resistance in which the secondary is terminated. If we had a transformer with the same number of turns on both primary

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and secondary, the turns ratio would be 1 to 1 and the impedance ratio would also be 1 to 1. If we were to measure the impedance of either winding with the other winding open, the impedance would be some very high value; but if we connected a 5000-ohm resistor across the secondary and then measured the primary impedance we would find it to be 5000 ohms also. If the resistor across the secondary were changed to 2500 ohms, the primary impedance would also be 2500 ohms. If the transformer had twice as many turns on the secondary as on the primary, the turns ratio would be 2/1, or 2, and since the impedance ratio is the square of the turns ratio, the impedance ratio would be the square of 2, or 4. In this case, if we put a 5000-ohm resistor across the secondary and measured the primary impedance it would be one-fourth of 5000 or 1250 ohms. Similarly, if we put a 10,000-ohm resistor across the secondary, the primary impedance would be 2500 ohms. We are assuming that there are no losses in the transformer, a permissible assumption because in well-designed units the losses are small enough to be ignored.

THE CLASS-B PLATE CIRCUIT

The circuit of Fig. 1 is the circuit for all Class-B tubes. The components and operating potentials are varied to suit the tubes, but the circuit stays the same. The tubes are biased to cutoff, or nearly so. So far as audio is concerned, the centers of both input and output transformers are at ground potential. If a.c. is applied to the primary of the input transformer, at any given moment the phase of the voltage applied to tube A will be opposite to that applied to tube B. For instance, when tube A is being driven positive, tube B is being biased further negative and being cut off entirely. On the other half of the cycle, tube B is driven positive and tube A is cut off entirely. From this it may be seen that only one tube works at a time and for this reason only one tube need be considered when making the necessary calculations.

So far as the tube is concerned the primary of the output transformer is a resistance, so the circuit for one tube might be drawn as shown in Fig. 2. A certain proportion of the supply voltage may be developed across $R_p$. It is impossible to develop all of the supply voltage across $R_p$ because some voltage is required at the plate of the tube to attract enough electrons from the filament to permit the necessary plate current to flow. Also, the grid must never become positive with respect to the plate. In general, approximately 80 per cent of the applied voltage may be developed across $R_p$. The power developed will depend upon the current as well as the voltage and may be calculated by

$$\frac{(I_{p_{\text{max}}})^2 \times R}{2}$$

where $I_{p_{\text{max}}}$ = peak plate current to one tube.

$R_{\text{max}}$ = reflected load impedance to one tube (one-fourth plate-to-plate value)

We can also calculate according to the following expression, substituting $E_{R_p}$ (peak developed voltage) for $R$

$$\frac{(I_{p_{\text{max}}}) \times (E_{R_p})}{2}$$

Let us assume that the plate-supply voltage is 1000 and that the drop across the tube is 200 volts. This would permit us to develop 800 volts peak across $R_p$. Let us also assume that the maximum recommended peak plate current is 0.5 ampere. $800/0.5 = 1600$ ohms reflected load impedance for one tube. The correct plate-to-plate load would be four times that value, or 6400 ohms. The audio output would be

$$0.5 \times 1600 \times \frac{2}{2} = 200 \text{ watts}$$

Now let us assume that the wrong value of load impedance had been used, say 2500 ohms per tube instead of 1600. With 800 volts across 2500 ohms, the peak plate current would be $800/2500$ or 0.320 amp.

Power $= \frac{0.320^2 \times 2500}{2} = 128 \text{ watts}$ audio output.

From this it should be obvious that if the reflected load impedance is too high, the amount of power obtainable without distortion will be reduced.

On the other hand, suppose the reflected load impedance is lower than the optimum value of 1600 ohms—say 1200 ohms—and we require 200 watts of audio. Using the formula and solving for the unknown, we have

$$\frac{(I_{p_{\text{max}}})^2 \times 1200}{2} = 200 \text{ watts}$$

$$\frac{(I_{p_{\text{max}}})^2 \times 600}{2} = 200$$

$$\frac{(I_{p_{\text{max}}})^2 \times 333}{2} = 0.333$$

$$I_{p_{\text{max}}} = 0.577 \text{ amp.}$$
With the correct value of reflected load impedance the peak plate current was only 0.5 amp., but now 0.577 amp. is necessary for the same output. As we mentioned previously, the recommended maximum peak plate current for this hypothetical tube was 0.5. The extra 0.27 ms. of peak plate current may introduce distortion and shorten tube life. In addition, the plate dissipation will be increased. In the previous case, with 800 volts developed across the plate load and a peak current of 0.5 amp., the plate dissipation at peak plate current would be $200 \times 0.5 = 100$ watts. In the second case, we are developing $0.577 \times 1200 = 692$ volts and the plate dissipation at peak plate current would be $308 \times 0.577 = 178$ watts. If plate dissipation is one of the limiting factors the tube will be badly overloaded.

**THE IMPORTANCE OF IMPEDANCE MATCHING**

This should answer the often-asked question of how important it is to match impedances. The situation may be summarized by saying that if the reflected load impedance is too high, the maximum power output without distortion will be reduced, although the efficiency will be good and the harmonic content low. If an attempt is made to obtain more power with excessive drive to the grids, the distortion will increase tremendously. The peak output, which is the important consideration in modulation, will not increase greatly but the average power may be increased considerably because of alteration of the wave form. For this reason, even though it may be impossible to obtain enough peak power to modulate 100 per cent, it may appear from the action of the meters that the capabilities of the modulators exceed 100 per cent modulation if no facilities are available for examining the waveform. The spurious frequencies due to the distortion will also make it appear at a receiving point as though the signal were overmodulated when, in fact, the voltage output from the modulator is insufficient to swing the carrier from zero to twice its unmodulated value—the requirement for complete modulation.

When the reflected load impedance is too low the situation is about as bad. The power efficiency of the modulator stage is reduced and the plate dissipation increased. If, in attempting to develop the necessary power and voltage, it is necessary to drive the plate current of the tube to a point where the filament emission is exceeded, the distortion will be high and tube life will be shortened. The effects of the distortion will be the same as if the reflected load impedance were too high, and it may or may not be possible to modulate 100 per cent.

In general, a variation of approximately 10 per cent from the optimum value is about the maximum permissible if best performance in all respects is to be obtained.

It is important to remember that the optimum value of reflected load impedance varies with the output desired and the applied voltage. For example, for an audio output of 200 watts from a pair of 203-A's with 1000 volts on the plates, optimum performance would be secured with a plate-to-plate load of 6900 ohms. If only 100 watts of audio were required, the optimum plate-to-plate load would be twice that value or 13,800 ohms. If 200 watts were desired and the plate voltage were 1250, the optimum value of reflected load impedance would be 11,800 ohms. Because there are so many variables and because the consequences of improper operation are so serious in our crowded bands, it is extremely important that each amateur be able to make the necessary calculations. Fortunately these are easily made with the simplest of mathematics. Knowing the optimum value of reflected load impedance for the available plate voltage and desired output, as well as the impedance ratio of the output transformer, it becomes a matter of simple ratios. Assume the optimum value is 10,000 ohms and the transformer is marked 8000 ohms on the primary and 5000 on the secondary. The ratio would be $10,000/X = 8/5$.

Thus the load resistance of the modulated amplifier should be 6250 ohms. The plate input to the modulated amplifier should be twice the audio output of the modulator.

**DETERMINING OPERATING CONDITIONS**

At least one tube manufacturer is publishing complete Class-B data for various outputs at various plate voltages for each type of tube, but common practice is to provide only one or possibly two ratings for each tube, usually the maximum values. In the former case, all of the figuring has been done except that of calculating the load impedance of the modulated amplifier from the impedance ratio of the transformer, as previously explained. In the latter case, we may make our own calculations. Let us use the hypothetical tube which we previously used in examples. The manufacturer's ratings probably would look like this:

(Continued on page 98)
How Would You Do It?

Designs for 50-Foot Antenna Masts—Announcing the Eighth Problem

DX conditions have been rather poor lately and the traffic net has suspended operation for the summer months. Nevertheless, Our Hero has not been exactly idle for he has been mulling over the dozens of antenna mast and tower designs sent in by his ham friends in response to his request in June QST. The job of selecting the prize winners was not easy since all of them indicated plenty of thought on the subject. After weighing all factors such as cost, strength, availability of material, appearance, ease of erection, novelty, etc., he finally emerged from the heap with the selections which follow.

First Prize Design

By Corliss B. Gardner, W1ALJ

The mast used at W1ALJ should solve Our Hero’s mast problem. It can be made forty to sixty feet high, requires only two back guys forming a tripod with the antenna and is cheap to construct.

The material required is as follows:
1. 6 x 6 9 feet long
2. 4 x 4 14 feet long
3. 4 x 4 20 feet long
4. 2 pieces 20 feet long, 1” thick, 3” at bottom end, tapered to 2” at top

Design

- Top piece 2 x 1 6 feet long.
- Lapping bolts:
  1. 4 6x 14”
  2. 3 3/4” x 7”
  3. 3 3/4” x 3 1/2”

- Reinforcement bolts to prevent splitting at ends of sticks:
  1. 2 3/4” x 4 1/2”
  2. 1 3/4” x 7”
  3. 1 3/4” x 3 1/2”

Each bolt requires two washers. Large square washers may be used on the lapping bolts and regular round washers on the reinforcement bolts. The bolts and washers should preferably be galvanized.

The cost of all material for this mast in this locality (Southern Rhode Island) was only about $12.

Constructional Hints

1. Saw sides of bottom piece (6 x 6) to accommodate lapping of the two 4 x 4’s. See Figs. 1 and 2.
2. Shed the tops of all pieces to allow rain to run off.
3. Bore necessary bolt holes in all pieces.
4. Install the reinforcement bolts and washers.
bolts with washers in ends of all pieces where necessary and tighten.

5. Lay all pieces on level ground in mast formation and insert bolts. Tighten all bolts except those for lapping the first two parallel 4 x 4's with the second 4 x 4.

6. Cut and fit the intermediate reinforcement pieces used in the two parallel sections and nail them permanently in place. They should be about one foot long.

7. Get three or four soap boxes for horses and paint mast if you desire. Light gray makes a fine-looking mast.

8. Use at least ½" rope for raising any antenna and install a good pulley on top stick.

Guying of this type of mast is neither complicated nor costly. No. 14 or 12 steel wire will suffice for an ordinary single wire antenna. Small egg type strain insulators are best for breakers due to lapping of guy wire holes. They should be spaced about 12 feet.

As previously mentioned, only two back guys are necessary, each of these spaced 120 degrees from the antenna.

There are numerous methods of anchoring the guys but the most common are trees, fences and pipes driven in the ground. The latter method is shown in Fig. 3. The guy anchors should be installed at least 30 feet from the base of the mast.

**INSTALLATION**

Dig hole 5 feet deep for 6 x 6. This piece may be set in cement or reinforced by filling hole with rocks and tamping dirt around them. Use level to make sure base piece is vertical. Raise first two parallel 4 x 4's, and bolt in place to base piece. Raise remaining 40-foot section to vertical position hr side the parallel 4 x 4's. It is not heavy and one man can easily accomplish this. While a brother ham holds the 40-foot section in place, climb a stepladder and tie a piece of rugged rope or wire loosely around the whole assembly about 2 feet down from the top of the parallel 4 x 4's. Hold this in place with a staple driven into one of the parallel 4 x 4's. This will serve as a safety guide while raising the 40-foot section vertically.

Two men take one guy each and walk in opposite directions from base of pole to a distance of about 40 feet. Get a good hold under bottom of 40-foot section and raise vertically. Men on end of guys should allow plenty of freedom and yet not allow top to sway more than 12 inches or so. When bottom of this section reaches your waist, start walking up stepladder. If you are rugged, you can handle mast with one hand and hang on to stepladder with the other. However, if you are not rugged, someone should help you during this operation. When 40-foot section reaches the proper height, slide its base between the 4 x 4's and insert the two bolts for this lap. Tighten nuts and the mast is complete.

**FIG. 4—LIGHT BUT STRONG. A NOVEL MAST OF HOLLOW CONSTRUCTION**

**Second Prize Design**

By Nathaniel C. Smith, W2GZU-W9UJ

The writer believes that the attached drawings and description given below are the exact answer to a ham's wish for an ideal antenna stick. The pole was erected in 1921 when the writer was ADM of Illinois and is located in Hoopeston, Ill., where up to two years ago it was still standing, straight and true, though somewhat in need of paint. The cost of materials for the mast, white lead and guy wire is just about $10. It was sold for $5 when I left Hoopeston in 1924 and is still standing in 1937, to the best of my knowledge, in the yard of the ham who purchased it. Its appearance and life have been so remarkable that I believe I built better than I realized, so I feel that I am really passing along a good and worthwhile suggestion.

The principle of the thing is to create a square hollow pole, held together in the fashion of bamboo growth; that is, with a bracing and strengthening section spaced about every 2 feet. The essential details are shown in Fig. 4.

The lower section of the mast is naturally the larger. Its foundation is a good solid 6 x 6 timber about 6 feet long. The next step is to make a section about 14 or 16 or 18 feet long, depending...
upon the availability of the lumber which should be good, smooth finish, hard pine, cypress or spruce, depending upon the locality. Needless to say, good grain free from knots is desirable. Three pieces (assuming that 18-foot stock is available) are laid out. There will be two sides 6” wide by 18’ long of ¾’’ or ⅝’’ stock, and the third will overlap on the edges so that it will be 8’ wide x 18’ x ⅝’’ or ⅞’’. Insert the 6 x 6 about 2’ into the U formed by the three pieces above mentioned. After lining up so that all edges are flush, commence to fasten together with nails, or preferably iron screws with flat heads, not forgetting to paint thoroughly every edge with a nice thick mixture of white lead and linseed oil. Having completed this step we should have a “U” section of mast 8’ x 6’ x 18’ with a 4’ section of 6 x 6 as a base, which will be later embedded in concrete when we are finally erecting the mast. The next operation is to put in the braces every 2 feet. These are 6” x 6” x 1” thick. These should be put in with white lead between wood surfaces and thoroughly fastened with screws or finishing nails. At the open end of the “U” we leave 18’” for the insertion of the next section of the mast which telescopes into the base section. Give the inside a thorough coat of white lead and linseed oil about the consistency of glue and let dry for a week or so. The cover for this section of the "U" is another 8’ x 18’ x ¼” which is screwed down after the second coat of white lead and linseed oil is dry. Any irregularities in the lumber and joints should be smoothed down with a plane.

The second and third sections of the mast are constructed in a fashion similar to that of the base, except that they are progressively smaller and that there is no need for a solid inner base section in the upper sections of the mast. We can see that the second section should have outside dimensions of 6” x 6” to telescope inside the base section and that the third section will be 4” x 4” to telescope into the second and that the top section is a solid 2” x 2” of say 12 to 20 feet. Our sky hook will be easy to erect and in the vicinity of 50 to 60 feet, depending upon the length of lumber available.

If a 50-footer is all that is desired, an attempt should be made to obtain 18-foot lumber for all sections. The third section should be capped or plugged instead of being filled with a 2” x 2” x 20’ timber (hardwood imperative). For three sections, which just about approach 50’ altitude, the mast will be solid as a telephone pole and can be climbed with safety even if you are a 200-pounder. With the top section of 2” x 2”, it can be climbed by lighter men, but it is slightly "whippy" because only four guys are used, one in each of the points of the compass to take the strain off the antenna.

Let me add that the care in making the joints and keeping everything square and shipshape will pay when the sections are bolted together. Also it is very important to put white lead between the surfaces wherever wood joins wood. On top of this caution one should give it at least two coats of white lead and linseed oil. It will take a good deal of white lead but it will be money well spent.

Erection of this mast is child’s play for a fellow who can “tote” a man’s share. About three huskies are all that are needed for pure “pusha-push” under a pair of 2 x 4’s bolted together like a scissors. A hole is first dug for the base of the mast about 4’ deep and with enough space around it to pour some good “grout” concrete. In the direction in
Problem No. 8

Our Hero has another problem which has been bothering him for some time. Things came to a head around three o’clock the other morning in the middle of a QSO with a VK. The YF suddenly appeared on the scene with fire in her eye and demanded the cessation of “that awful racket.” The “awful racket” referred to was the incessant thumping and clacking of the homemade magnetic antenna changeover switch. Our Hero believes there should be a way to eliminate this noise either by proper switch design or by some satisfactory mounting. He would like suggestions with complete details.

The usual monthly prizes of $5 and $2.50 worth of A.R.R.L. Stationery supplies for first and second selections are offered.

which the mast lies, a slanting runway about the width of the mast and as deep as the bottom of the pit where it is finally to rest should be dug. The 6 x 6 butt is eased down this runway to the bottom of the pit which throws the top of the mast to about a 15 to 20 degree angle. Then the three huskies put the 2 x 4’s under the second section of the mast and “Heave ho! my hearts.” The hardest part about building this mast is waiting for the white lead and linseed to dry. After two coats inside and roundabout, you will find it in your coffee and your pajamas and other unexpected places but 15 years later it will have been about forgotten.

The complete list of material required is given below:

1st Section
1—4” x 6” x 6’
2—6” x 18” x 1/8”
2—8” x 18” x 1/8”
7—Spacers 6” x 6” x 1’

2nd Section
2—4” x 18” x 1/8”
2—6” x 18” x 1/8”
8—Spacers 4” x 4” x 1’

3rd Section
2—2” x 18” x 1/8”
2—4” x 18” x 1/8”
8—Spacers 2” x 2” x 1”

Top Section
1—2” x 2” x 20”—oak
1—Pulley (Brass or bronze)
1—(Necessary length) Manilla rope
4—Guys (necessary length) No. 8 iron galvanized wire
Strain insulators

Honorable Mention
By C. Falstrom, W9LM

For Problem No. 6 I will describe the mast in use here at W9LM. It was put up at a cost of no more than $8. Only four persons were needed to put it up and no guy wires were used. It has stood four years through some strong winds, too. The drawings of Fig. 5 will help to make the details clear.

A used telephone pole was purchased and delivered for $5. That wasn’t a special discount either. It was 38 feet long. A hole 6 feet deep was dug for it. This left about 32 feet above ground. About 2 feet from the top of the pole a half-inch hole was bored. The raising was done by hand until a ladder could be placed under it. Two ladders were used. After the pole was raised with a short ladder (about 12 foot long), another one about 20 feet was used to raise it up all the way.

The top section was assembled on the ground. Three 2 x 4’s were needed, two 18 feet long and one 10 feet long. The 10-foot section was placed between the two others and bolted in place so that the total length was 24 feet. The assembly also required a half-inch hole to receive the main bolt which is 3/8-inch diameter about 12 to 14 inches long. This half-inch hole was drilled about 5 feet from the ends of the two long pieces. The long pieces were spread so that the 2 x 4’s would go on each side of the telephone pole, and the long bolt inserted. Three or four nails were driven in one side of one long length to nail it on the telephone pole when it is up straight. In order to obtain leverage to swing this top part into an upright position, a temporary piece of 2 x 4 was nailed to the other long piece on one side.

A rope was fastened on the end so that someone on the ground could swing the whole top section up in the air. This temporary raising apparatus should be in good condition to prevent the thing from coming back down with a bang.

O. H. wishes to thank the following for submitting designs: W1FTB, KCQ; 2BEZ, JSL, KAZ; 5WN; 7AZX; 8OA, SOMM, SOKC; 9ASV, VTH, WLE, YWX; VE3QB; C. S. Fleming, Wm. Roberts, H. N. Schmidt.

Comes now a letter from Charles E. Bates, Jr., W6JWX, to say that he is not among Silent Keys as reported in our December issue. Naturally we regret the occurrence, and, having expressed ourselves on this subject on one or two previous occasions, only can add that while the business of reporting a live ham as having passed on may seem humorous to mentalities of four years, to normal people there’s nothing particularly funny about it.
**HINTS and KINKS for the Experimenter**

**An Inexpensive Time Delay Relay**  
**By Wilbert B. Smith*  

TIME delay relays, though almost a necessity in the up-to-date transmitter, are often avoided because of the cost. However, an ordinary power-remote control relay can be made to do the trick by the addition of a flasher and lamp bulb. The flasher may be of the small disc variety which may be obtained at any electrical store.

Fig. 1 shows one circuit arrangement using a double-pole double-throw relay. Initially the lamp and flasher are in series across the 110-volt line and the relay coil is across the flasher. When the flasher heats up sufficiently to open, the relay coil is energized, whereupon the lamp and flasher are disconnected, and the relay coil together with the load are connected directly across the line. It should be noted that this relay should be of the quick-acting type, with a fairly heavy armature, otherwise it will not hold in what the flasher opens.

Should the relay at hand not prove suitable for use as in Fig. 1, the circuit shown in Fig. 2 may be used. Here the relay is always connected in series with the lamp, but is shorted out by the flasher until the latter warms up sufficiently to open. Having the relay in series with the lamp is not a material disadvantage, providing it receives sufficient energy for correct operation. If the relay draws considerable current a larger bulb and flasher may be used.

For most purposes a flasher suitable for use with a 60-watt lamp will give good results, the time lag, of course, depending on the bulb used and any possible adjustment on the flasher itself. Time lags longer than about 20 seconds are inclined to be rather unstable, hence this type of relay is not altogether suitable for such service.

A suggested arrangement is to mount the lamp bulb and the flasher in a twin plug fuse receptacle, with a plug fuse to complete the circuit through the flasher. A refinement would be to substitute a resistor for the lamp bulb and a special mount for the flasher.

**Break-In Operation with a Dynamotor**  
**By Robert E. Valgren, W9ALO  

FOR those fortunate enough to have a.c. available, break-in is so simple there is no excuse, it seems, for not using it. But for the ham who must depend on a dynamotor, or a motor-generator set, it may not be such a simple matter. The dynamotor at this station made so much QRN that even an S9 signal was copied with difficulty. After making a number of inquiries as to possible remedies, I was none the wiser and about to give up. R.f. chokes and condensers up to 20 µfd. across the brushes did not improve matters much, if at all. The machine is put up in an iron casting so shielding it further did not hold much promise.

However, I decided to try something. With the aim of the soldering iron, a box with a tight-fitting cover was made from galvanized-iron sheet. It was made with two compartments. In one, the dynamotor was mounted on heavy felt padding to absorb vibration and thus eliminate much of the QRN coming through the air, and also to insulate the machine completely from the sheet-iron box. That may be of importance. Two 2-µfd. condensers were connected in series across the primary, or motor, brushes. The centertap, or the connection between the condensers, was
grounded to the dynamotor frame. Lead-covered cable was used to connect the primary to the storage battery. The sheath of this cable makes contact with nothing except the metal box. In the other compartment was placed the starting relay, a Ford generator cut-out, and three chokes, one in series with the lead to the starting relay, and one in each secondary or high-voltage lead. The chokes are "shuttle" type, and are wound with about 325 turns of No. 28 d.c.c. They are separated as far as possible in the box and the center one is wound in the opposite direction from the others. The dynamotor is a General Electric, 24/750-volt machine and has a 1-µfd. condenser in the base to filter the high voltage. Using crystal control, T9 reports effective. By habit I connect the inside terminal to the output or cold side of the circuit. Sometimes chokes are more effective if individually shielded in small tin boxes such as Kester solder boxes. Different size chokes may be tried. Grounding the metal box may help, but in my experience "floating" shields are more effective as a rule.

Measuring R.F. Power with an Exposure Meter

IN CALIBRATING a series of lamps for measuring r.f. power by means of a Weston exposure meter, I ran across the following kink which may be useful to others.

Choosing the more open portion of the exposure meter scale, and using only that portion between 10 and 200, the following is the method:

1. Connect the lamp or lamps of the desired power rating to the lighting circuit. Assume that the lamps are consuming their rated watts.
2. Mount the exposure meter at such a distance that meter reads 200, and fasten it firmly in place.
3. Disconnect from lighting power and send radio power into lamps.
4. The curve of Fig. 3 is a calibration of percentage of total watts vs. meter reading, and holds within a permissible 3 per cent or 5 per cent accuracy for all lamp sizes.

—G. M. Hannah, W3AFR

Keying a 53

IN RECENT experiments here I have come across an excellent method of break-in keying on the 53 oscillator-doubler. With this system not only are chirps at a minimum, but clicks are entirely absent. It was found to work satisfactorily with AT-, V- and Y-cut crystals.

At the first attempt to use this circuit, keying between crystal and ground, an annoying hiss was heard over the band, and chirps and clicks were pronounced. The clicks were suppressed by insertion of a 0.005-µfd. condenser, as shown in Fig. 4. This value is fairly critical, as less will not suppress the clicks, and more causes the condenser to unload its charge at intervals of about 10 seconds. This also reduced the chirp, and when a low-resistance bleeder was installed in the power supply, the chirp had completely disappeared. I had never accomplished this before in keying a
53. However, one more problem presented itself—the hiss made this system quite useless. Finally it was completely stopped by insertion of an r.f. choke in series with the key, on the side next to the crystal, and a 0.01-µfd. condenser across that on the key side. This value is not critical, and can be varied to give a bong to the note, at the discretion of the amateur.

---Edward J. Meehan, W3FPW

Grid-Modulator Coupling

The method shown in Fig. 5 for coupling a modulator to a final stage for grid modulation may prove of interest to the gang. No special coupling transformer is required and the parts will be found in the always present junk box. I am using this scheme here to modulate a 211 on 80 meters and find it works quite satisfactorily.

R. L. Hunt, VE3MX

Erron’s Note.—Although it is theoretically undesirable to introduce appreciable resistance into the grid circuit with grid-bias modulation, because of the change in effective bias resulting from the change in rectified grid current with voice excitation, quite satisfactory results can be secured provided the change in grid current under normal operating conditions is not large. Any distortion introduced from this cause can largely be eliminated by shunting the 7000-ohm resistor by a high-impedance choke or transformer winding having a d.c. resistance of not more than a few hundred ohms.

West Gulf Division Convention

Houston, Texas, August 20th—21st

The Hotel Rice will be the center of attraction for the 1937 official division convention to be held August 20th and 21st, at Houston, Texas, under the auspices of the Houston Amateur Radio Club. From the very beginning Hams will be kept on the go, because the motto of this convention is “Entertainment.” Of course other things are on the program. Come and see the big doings for hams, YLs and XYLs. Publicity has already been released but watch for more, and meanwhile if you want more information, write to L. P. Holland, Chairman, Box 707, Houston, Texas.

New Vibrator-Type Plate Supplies for Storage-Battery Operation

With growing interest in portable and emergency equipment which is independent of an a.c. source of power, there has been a definite need for a compact and relatively inexpensive plate supply capable of operating from a 6-volt storage battery; one which would give reasonably high output for the operation of a transmitter having sufficient power for practical communication. This need has now been met through the introduction of a new vibrator-type unit which is capable of supplying somewhat more than 10 watts for the transmitting-tube plates. The unit is known as the “Vibrapack,” and is made in four types, two of which have a maximum output of approximately 200 volts at 100 milliamperes, the others 300 volts at 100 milliamperes. In all types, the output is adjustable in four 15-volt steps. The Vibrapack carrying the type number VP-552 is of chief interest to amateurs looking for a portable transmitter power supply. It is of the self-rectifying type, no rectifier tube being required, and has a maximum output of slightly over 300 volts at 100 ma., using a condenser-input filter with an 8-µfd. input condenser. The Vibrapack contains the interrupter-rectifier, power

(Continued on page 88)
Calendar:

Although, at the time of writing, the June, 1937, issue of the I.A.R.U. Calendar has not yet been fully completed, it has enough of interest to the amateurs at large to be reviewed briefly. As you know, the Calendar is the bi-annual medium through which Union business is transacted and proposals formulated.

Proposal No. 28, on the question of sub-dividing the 7- and 14-Mc. bands (reproduced in the July issue of QST) was lost by a very close vote. The proposal aroused the widest conceivable differences of opinion, and the reasons for voting against it were in many cases mutually conflicting. This is due partly, of course, to the varying conditions and regulations in the member-countries. However, the response of the societies indicates that the subject is well worthy of discussion and the last of it has certainly not yet been heard.

The question of amendment of proposals after publication in the Calendar but before voting, Proposal No. 29, received but one dissenting vote, and was therefore adopted. This sets up the machinery for speeding up action in Union affairs.

The working code of “Miscellaneous Rules” was unanimously adopted, and a permanent appendix has been added to the Constitution incorporating those permanent policies other than constitutional amendments that have been adopted by the Union from time to time.

The Newfoundland Amateur Radio Association was unanimously admitted to the Union, making the total membership now twenty-nine. Speaking on behalf of the other member-societies, a number of whom expressed sentiments of congratulation, the Headquarters extends this new member a cordial welcome and hearty good wishes.

The recent enactment of a rule requiring that member-societies refrain from forwarding QSL cards to non-member societies in countries where there exists a regular member-society of the Union results in a condition whereby, if a society refuses to forward cards to non-members, amateurs in a given country may have no way of receiving cards. There would seem to be a definite obligation on the part of a society which accepts the QSL-handling responsibility for a country to handle all cards for amateurs within that country, irrespective of membership. At the same time, since the non-member does not aid in supporting the society, it is entirely reasonable to insist that he pay for such service. In view of this situation, the R.S.G.B. has proposed a modification of the Rule which would incorporate the above considerations, presumably through some machinery whereby non-members would keep stamped, self-addressed envelopes on file with the national QSL Bureau, or be able to collect their cards in person.

Two new societies have been proposed for membership, the Heseeau Luxembourgeois des Amateurs d’Ondes Courtes and the Experimental Radio Society of Egypt. The Reseau Belg, in which are grouped the French-speaking Belgian amateurs, has combined with the Flemish-speaking Belgian organization, the Vlaamse Radio Bond, to form the Federation des Emetteurs Belgas, and now requests that the F.E.B. be recognized as the member-society of the Union for Belgium.

The W.I.A. proposes that the major societies hold not more than six international DX contests

Conducted by Byron Goodman

August, 1937
a year, with the smaller societies co-operating to conduct smaller biennial contests. Worked in conjunction with the Contest Calendar to avoid conflict, it should result in an eventual system that will space the contests evenly throughout the year.

A list of the boundaries of the territory under the jurisdiction of each society was given, to facilitate the determination of qualifications for the issuance of WAC certificates, and an "N" system for designating types of notes when giving signal reports was suggested by the D.A.S.D.

56-Mc. Tests:

The Lausanne section of the U.S.K.A. will conduct 56-Mc. tests on August 14th-15th from the summit of Mont-Tendre at Jura, and asks that all interested amateurs listen for the signals. The call HB1AQ (HB1 is the new portable designation) will be used and, starting at 1800 GT, on August 14th modulated transmissions will be sent for 15 minutes, followed by a 15-minute listening period. The last half hour of each hour will be used for two-way work. This schedule will be maintained until 1600 GT on August 15th.

HB1AQ hopes that a number of amateurs will listen for the transmissions; a QSL card will be sent to all stations heard or worked.

General:

G2LK reports that the Manchester gang won the RSGB National Field Day held during June. . . . OZ7EU won the hidden transmitter hunt at an outing at Odense. About 30 amateurs participated. . . . A clipping from a London newspaper discloses that the English amateurs are becoming emergency-conscious, after a flood at Fen, where two amateurs served as a means of communication between two isolated points. The plan calls for amateur equipment capable of operation independently of the commercial power lines. . . . W2LG, visiting in England, is convinced that the United States is a paradise as far as easily-accessible and inexpensive radio gear goes. Lamb and Stadler tell the same story.

WAC:

The following WAC certificates were issued during 1936:

Madeline MacKenzie, VE4KX; W. G. Huppats, VK5GW; A. C. J. Pritchard, VE3CP; D. H. B. Duff, VK2EO; A. Guildford, VE4AF; Alberto Kirchner, EA4BF; Arthur David-Andersen, LA4NY; Knut Iversen, LA4P; H. F. Gales, ZBIE; P. Legrand, ON4FX; Juan Lobato y Lobo, XZIN; J. J. Cortes dos Dares, CT1DT; Reese O. Strock, W2GTZ; Joseph P. Jupp, W2GVZ; Fred Neal, VE2Q; John M. Wells, W2IZ; James C. Link, W8EQ; John S. Foggs, Jr., W1DEU; John P. Bloomer, W8EQ; Paul J. Moore, W9MV; William Adrian Robinson, W2EYY; William L. Reed, W3FEK; Charles W. Nicholson, W1BAU; William L. Young, Jr., W5DLC; Norman Ward, W9BWW; Fred Reid, Jr., W7EJD; James J. Fitzgerald, W1FBL; H. J. Seigl, W5EDP; Carl F. Mueller, W2GIZ; E. M. Austin, VK2RR; R. T. Manuel, VK5RT; H. N. Bowman, VK6FM; E. N. Arnold, VK2OJ; K. R. Rankin, VK3KR (phone); R. Y. Findlay, G6XV; Henry E. Clarke, W2BT; Robert Pettier, FS0V; B. Turner, G6ZT; H. N. Bailey, G8BP; Dr. Harald Dickmann, D4IPG; Wilhelm Bender, D4OQT; Rudolf Maushart, D4BQO; Vladimir Kott, OK1LF; Bohumír Fink, OK1L; Rudolf Stebb, HB9T; S. E. Meers, PA1ZA; Kurt Schubert, ZL1CC; O. J. Stevens, ZL2QM; K. Aksawa, JESN; J. N. Smith, O1SQX; Birger Larsen, LA2B; B. S. Watson, ZT8; A. E. Way, ZT8; T. A. Laxon, ZU6G; H. L. Howes, Z8AL; G. D. S. Underwood, G5UD; Don Julio Anglada, EAS0Y; Cetons M. Dunn, W9YIT; William M. Atkin, W6JF; R. A. Jubb, ZE1JN; Paul Hallingby, Jr., W6JHK; Mrs. Evelyn S. Sanford, W4DAI; E. F. Sanford, W4DPM; Henry E. Reilly, VK4ER; Charles W. Rogers, W2AIW; Hubert Ricek, Jr., W9YUZ; Richard M. Grove, W5EYK; Jack T. Woodruff, W2PK; Jack Pimlott, W6CGK; Paul B. Lovegren, W4AFN; Fernand Cause, W3EOI; Cécil M. Phillips, W7A1J; J. D. Ryder, W8Q; Richard V. Vonkroth, W8AYD; Raymond D. Stiles, VE2VY; W. C. Sahnow, W7AVY; James S. Moore, W9APZ; Allan Chessworth, VE4JY; Edward D. Schwartz, W6GUP; Fred Herdwick, W3C; Ronald W. Moran, W3Q; Ralph B. Ladd, W4KH; Robert G. Grub, VE4AP; Robert G. Haskins, W4DRZ; Rod Meany, W8JTW; Burton L. Fielding, W9SOT; Whitling and Owen E. Coyle, W2FCX; Frederic C. Shidell, W9CUD; Samuel E. Johnson, W2FBS; S. J. Bascomb, W4AAX; Guy Grossin, W4ATU (phone); Guy Grossin, F4RJ; Harry Loreta, W6GW; W. C. Z7F (phone); T. J. Bradford, ZT9AK; Mr. Dirnagel, D4TFP; Senor Alfredo Guito Puig, E3; G. A. Chapman, G2ILC; Gerhard Hansen, G2TO; Romano Alonso Eustaines, EA1AZ; Gabriel Brasco, EA3OI; W. H. Robertson, G6WR; V. de Robillard, VQ4AF; Tadashi Matabara, 4JCF; Dr. Ryoos Nakagaki, 8SCD; Herbert Alffe, D4CGQ; S. E. Martinelli G5MW; V. W. Harston, VK4AY; C. Hedley, W2KM; N. M. Cameron, VE3GP; G. Kenen, VQ4A; A. Woerner, D4QFT; P. F. van Cleenaputa, PA0XM; B. H. van der Hulst, PA9ST; M. Smit, PA0LR; N. van Overvoorde, PA0NO; T. Tsyau, PA0FF; C. Cohen, PA0JSD; D. Zaayer, PA0JU; Paul Gratza, F6JG; C. Rene Bertrand, F6SAA; T. O. Cadeil, VUBZ; Karl Heinrich, O8EHH; Byron Goodman, W1JPE; Ivar Westlund, SM5JW; Warren Mallory, W8PGS; Andre Ferry, F8VS; Howard L. Baumans, W2AZF; Alexander Maitland, W2DFP; W8EPI; W6EPI; W6EPI (phone); Kenneth Bishop, W1EWD; Reid G. Smythe, W2BLD; Craig Hare, W5BHD; D. Reginald Tittlebus, W0TH; William Benson, VE3W; Charles W. Knight, W5DYH; Leslie D. Gregg, W5WU; M. J. D. Storer, W5DSR; William J. Woerner, W5W; Richard Grove, W6BPD; Bruce W. Peterson, W6WJT; E. J. Knoll, Jr., W3OP; K. J. Cook, SU1A; Mario W. Simon, PY2G; George G. Glaire, W6G.
Amateur Radio STATIONS

W6CNE's Mobile Rig

WE SUPPOSE there are a few of the ten-meter 'phone gang who haven't heard W6CNE hamming away while bowling along over the Southern California highways. The many who have heard the rig have been mighty curious about it, so here are the pictures and dope.

This is not just a station installed in a car—it's a radio car throughout. Besides the radio apparatus the car, a '36 Willys panel delivery, is equipped for emergency operation, carrying four days' rations, a two-burner stove, 25-pound icebox, wash basin, five gallons of water, cooking utensils and dishes for four people, and bedding. The seats fold into a double bed, and a small folding table serves as a desk. Besides the above, an extra supply of heavy clothing, rubber boots and similar accessories also is carried. The inside of the car is well lighted and is provided with an electric fan, the lights and fan running from 110 volts taken from the portable power plant.

The cabinet occupying most of the space under the dash at the right-hand side contains the station. The transmitter is capable of working on 5, 10 and 20 meters, using plug-in coils. A 6A6 oscillator-frequency-multiplier, working from a 7-Mc. crystal, gives output on 28 Mc. to drive an 802 buffer which in turn drives a pair of 801's in the final stage. The modulator uses a pair of 46's in Class-B. A crystal microphone, equipped with a W.E. chest mounting, is used for voice pickup. The mounting leaves both hands free for driving—an absolute necessity in Los Angeles, Roy says!

Two receivers are mounted in the cabinet. A special job is used for five and ten meters—a super having acoms in the r.f., mixer and oscillator stages. An all-wave broadcast receiver takes

(Continued on page 80)
AUGUST A.R.R.L. ACTIVITIES are announced elsewhere in this issue. A Low Power Contest is an inviting innovation in its own right. When combined with the tried and true objectives of the Field Day, with either field or home operation possible, we have little doubt that a successful activity may be predicted. The Field Day was bigger and better than ever this June, according to early reports, and we trust it will continue to see enlarged participation in its own right. The new plan for August is a special activity to appeal to F.D. operators who want another, to bring new opportunity for any station of not more than 25 watts input to the final, to stress and encourage preparedness and self-powered capabilities for all stations.

It is impossible to devise any activity to suit all people, all groups, all objectives, and in spite of study and compromise we scarcely expect everyone to be satisfied equally. That is why different announcements are made to cover all fields. We invite all who can to enter and solicit constructive criticism and suggestions from all. When suggestions balance out, equal numbers for and against, we feel that activities are properly aimed. If a preponderance of thought is in a certain direction the plans are modified to follow this spontaneous indication, as experience in an ever changing world shows desirable. It is our aim to promote constructive activities within every amateur group where sufficient interest is shown.

This August test is a chance to try out self-powered equipment; and for the operator with modest power to compete with a station of single receiver and transmitter units in his own power class. Some members are low power enthusiasts; some are not. All should consider the emergency power supply problem which is of importance to the standing of the whole amateur service. Try your luck with 25 watts (or under) in the Low Power Contest (or F.D.) and let us hear from you.

Re the formula QSO: Brotherhood and the spirit of amateur radio, when reduced to a mechanical formula become as nothing. Real life and enjoyment are in the emotions, and happiness is not attained through sheer intelligence alone. Friendship, faith, and fraternalism require more of a person than inane adherence to a monotonous formula in sending and receiving. Amateur radio should be a means for self-expression as well as for receiving reports. Within organized groups of amateurs we find considerably greater breadth of fraternal relationships than in the mass exchange of rudimentary data which narrows the field of too many QSOs.

The longer we operate an amateur station the more we are convinced that the hams we meet, the friendships made, the contacts over the air and exchanges of real information are amateur radio. Let us not ignore the really great possibilities of communicating with our stations, then. Get into interesting constructive operating groups with a purpose. Let us never reduce our QSOs to the "mere formula" status, but strive to have something different for all comers. To do otherwise is a symptom of mental laziness. Quality is more to be desired than quantity. One really good contact is worth a dozen perfunctory formula exchanges. This is recognized by the eager support and interest in membership in the Rag Chewers’ Club.

To overcome the temptation to substitute a large number of contacts for a few very worthwhile ones, a list of questions or topics can be placed near the operating position, and used to draw out the taciturn or morose formula minded folk. There should be enough topics of the day and breadth of interest in amateur radio to make a good start for conversation possible on any occasion even without such helps. There are, of course, occasions when time is the essence and elaborations are improper. Conciseness with understandability is always desirable. But let us use our stations because we have something to communicate, not for mere trilling. Line up with O.R.S., O.P.S., N.C.R., A.A.R.S. or other constructive groups that give point to ham work. In general QSOs, as in life, have an objective. Let us use stations to get better acquainted, not only with equipment and operating technique, but with our brother amateurs. You will find that the operators worked can give you much interesting and helpful information if you will but draw them out.

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F. E. H.

O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 122): W1JZN.

56 QST
PRIZES FOR BEST ARTICLES
The article by Mr. L. R. Mitchell, W1H1L, wins the C.D. article contest prize this month. Each month we print the most interesting and valuable article received marked "for the C.D. contest." Contributions may be on any phase of amateur operating or communication activity (DX, phone, traffic, radio literature, etc.) which adds constructively to amateur organization work. Prize winners may select a 1937 bound Handbook, QST Binder and League Emblem, six logs, eight pads radiogram blanks, DX Map and three pads, or any other combination of A.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

"But It Never Could Happen To Me"
By L. R. Mitchell, W1H1L*

How many times we have read in QST of calls being bootlegged. And now often at club meetings, conventions and during QSO's brother hams have told us of their calling "borrowing" and "borrowed," of QSL cards received containing the QSO's call not bootlegged but frequencies never used by the rightful call owner. We even hear of lads who are no longer licensed, yet continually receive cards from all parts of the world. I have heard of these conditions and have thought "isn't that too bad," or "Why doesn't someone do something about it," always with the thought in my mind, "But it never could happen to me." I confess with shame that until recently I have never tried to do anything to help curb these "bootlegging" troubles. I never thought for one minute that any such thing would happen to me, and "thereby hangs a tale."

I have for the past year operated about 95% of the time on the 1.8 Mc. phone band. I use a crystal frequency of 1903 kc. and have not changed due to the fact that I have three wave traps on B.C.L. receivers tuned to eliminate troubles. I never thought for a minute that the signal would happen to me, and "thereby hangs a tale."

When I was returning home recently from a business trip I found another of these envelopes. Heck! I thought to myself, "I suppose I might as well go out to the shack and put a high quality signal on the air."

Upon picking up the green slip my blood pressure went up another 10 degrees. This slip said, "A-2 Emission does not comply with the requirements of Rules 375 and 382. 9:33-9:36 p.m. calling QL, 14,000-14,000 kc. Band." Not only was the signal 17 kc. out of the band, but it was A-2 emission!!

This was too much for me to take. Some law breaking, inconsiderate moron had used my call and violated at least two important regulations. "But it never could happen to me." Oh yeah!

I have had a lesson. It did "happen to me." May the fellow who operated the key of that transmitter boil in oil the rest of his days! From now on I am on the trail of any and all call bootleggers and I'll never rest until I help to give them what they are coming to them. Stop and think what this bootlegging means. Think of the number of cases you never even hear about. Let's do all we can to stop it.

Many of the hams who are members of the F.C.C. Upon returning home recently from a business trip I found another of these envelopes. Heck! I thought to myself, "I suppose I might as well go out to the shack and put a high quality signal on the air."

Surely my 80 watts couldn't be causing interference to the only way we can ever put our bands of these criminals. What say, gang? Are you with me?

1 Local amateur radio clubs have a definite responsibility to themselves and to the properly licensed amateurs of their communities in setting up control and establishing policies 1) to locate and do away with bootleg operations in any amateur frequency band any source of which may lead to the putting in the hands of newcomers in the game who have a correct and sincere interest in amateur communication. All hams who may read this should give any club information on the practices adopted and follow by sending affiliated clubs in control of unlicensed operation on request.

Briefs

WMEOW heard one ham say, in defense of rotten sending, "I send this way so that only a licensed ham can read my call. Then I am not bothered by listeners' cards." Well, that may be one way of looking at it!!

G10XS is interested in 56-Mc. schedules for transatlantic tests during the next six months. Help him by writing W1VR or VE who would care to cooperate should get in touch with him as soon as possible. Either write W. Sullivan, "Gillihan," Grosmont Road, Bangor, North Ireland, or watch for G10XS on 14 Mc. any evening starting at 1800 G.T.

W2FQ5 of Gloucester, Ohio, furnished communication from that town when outside telephone and telegraph lines were down following a storm in June. W2JCL and W6MPG handled one of W2FQ5's messages.

* 51-A North Ave., Melrose Highlands, Boston, Mass.
How's DX?

How:

About the time you get around to reading this, if any, you will probably be concentrating on how nice the water is down at the old swimming hole and other such summer thoughts. A soft seat on a shaded veranda with the musical accompaniment of ice tinkling in a tall thin glass will probably have much more lure than the stuffy shack and its squadrons of wasps and mosquitoes strafing any human without mercy. Your active radio work may be confined to contemplation of the new rig that will be built (or rebuilt) in early fall, and it is with this in mind that we'd like to make a suggestion. If you are going to make any claim of up-to-dateness, you can't overlook the business of quick frequency change. Not necessarily being able to go from 160 to 10 by the flick of a switch, but you should be able to jump around within the same band, and do it fast enough to get a fellow before he signs over. W6CUH set the standard with his splendid transmitter described a few months back, but everyone hasn't the money or facilities to do such a thorough job. But no modern oscillator stage should be built without provision for switching of several crystals, and you might give the idea of relays cutting in paddera in the following stages some consideration. Or you might have some other choice ones like VU2LJ (14,300 kc., T9), and PK6XH (14,270 kc., T7), U3QT (14,390 kc., T9), and W9VPG, says he is at Dakar, French West Africa.

When:

W8MAH reports Asians coming through in the early morning, with XU7Y (14,400 kc., T9x), JJ2J (14,270 kc., T9) and JJ2K (14,360 kc., T9) among the better ones. He adds that FJ7C is no phony, since W8PMQ had a letter acknowledged by the station at Miquelon. W6MX worked his Cuban, at last, and mentions some choice ones like VU2LIJ (14,300 kc., T9) FT4AG (14,400 kc., T9), HS1BJ (14,100, T9), FY8A (14,400 kc., T7) (VES2A 14,050 kc., T9), VK3AA (14,150 kc., T9) and HK4EA (14,400 kc., T9). W9TWC's contribution to the literature of the month includes PK6XH (14,270 kc., T7), USQT (14,390 kc., T9), FT4AK (14,395 kc., T9), V81AD (14,355 kc., T9), and between 14,265 and 14,300 kc., JJ2J, J5CI, J2LU, and J7CR. According to W1DIR, who worked him around 1130 p.m., EDST, VS2AB (14,360 kc., T9x) uses a directive antenna in this direction, and has a calling signal. Nice ones at W9VPG include PR6AR (14,270 kc.), HR2AC (14,440 kc.), and JJ2Q (14,330 kc.) . . . . While working with a 25-watt portable rig, W80IV snagged YV5AO (7160 kc., T9). The Spanish stations are nearly all on phone, if you have been looking for them.

What:

A tip to users of electron-coupled oscillators, from W1HOV: If you have trouble with your EC oscillator creeping, make sure that you have aluminum and not brass plates in the grid condenser. Brass expands a great deal more with temperature change than does aluminum and, in W1HOV's case, the substitution of an aluminum-plat condenser for a brass-plate one solved his problem of creeping.

Who:

We have it via the grapevine that Dave Evans, W4DBZ, is planning to move out west and go in with W6CUH on a combined station. If it turns out to be so, we can look for still more DX records to be busted by them, but their big problem will be trying to find stuff they haven't already
worked. Maybe they'll subscribe to the DX expedition .

This is not the "Missing Persons" department, but W2BSR received a batch of cards from FY8C including ones for W2BX and W2HX, but FY8C apparently copied (JSL Managers, and we've found that they are usually addressed stamped envelope, and if you have any DX cards W2BSR received a batch of cards from FY8C including rowing his station is no longer on the air and that someone worked. Maybe they'll subscribe to the DX expedition and finally cut the power down to 5 watts input to a doubler...}

"W1IEH worked all VE districts in his first five QSO's on 7 Me. the Friday night of the VE/W contest.

The Oklahoma Section Net is one of the few that keeps moving during the summer months. The following report in each morning on 3828 kcs: W5EMD, Bartlesville; W5ENN, Tahlequah; W5EGP, Muskogee; W5DTU, Oklahoma City; W5FSK, Ft. Sill; W5FT, Enid; and W5CEZ, S.C.M., Ponca City, the control. This net works into the A.A.R.S. net through a daily schedule between W5CEZ/ W5JC and W5OW/WLJ and a W5PEK-W5OW connection. An interesting field test of portable/emergency equipment equipment was made on the afternoon of April 4th by a group of Nebraska amateurs. The equipment, the property of W9EKK of Lincoln, consisted of an aspirating transmitter using an 89 crystal oscillator, 42 and a pair of 42's, with about 7 watts input from a dynamotor operating from two six volt storage batteries; modulation was accomplished with a single button mike (hand type), 77 speech amplifier working into a single 4th Class A modulator. Receiver was a rebuilt automobile super. Antenna consisted of an 8-foot vertical metal rod, mounted on the car and tuned by means of a Collins network. All transmissions were on 1.75 Mc. radio-phone, using a frequency of 1913 kc.

W9EKK and another operator left Lincoln at 2:00 P.M. and drove to Weeping Water, a distance of 34 miles, and back again. 100 percent contact was maintained with the car from both ends, Lincoln and Weeping Water, at all times. Brief stops (about 2 minutes) were made for each transmission, 16 stops being made, with the logs checked at each station receiving. W9TVS and W5HER operating W9EHW with two receivers made excellent three-way contact with the car and with the control station, W9RIE, in Lincoln. Contacts were maintained as a directed net, with W9RIE the key station in Lincoln, and W9EH and W9FVL, in Weeping Water. The outstanding part of this work is, of course, that it was accomplished on 1.75 Mc. 'phone. The following amateurs participated in the test: W9EKK W9L RIE SNI HAK W5K WBU JHR VFL EHW TVS.

Cross-Country Net

W9RWS, O.R.S., is Net Control Station of a new traffic net operating in the early mornings on a spot frequency of 7208 kc. during the summer months. 3804 kc. will also be used in the winter. The aim is to have at least one net station in each of the forty-eight states, Included in the present membership are: W9RWS, Farmington, Ill.; W9WFS, Chicago; W9VET, Minneapolis; W9ETH, Milwaukee; W9MAB, Cleveland; W9DGS, Anchorage, Ky.; W9BVV, Gainesville, Ga.; W9UQZ, Indianapolis; W9U1Q, Racine, Wis. If you are interested in joining this group, communicate with W9RWS, Max M. Bolon, Farmington, Ill.

At Fort Knox, Ky., the mechanized cavalry and artillery operate a large number of radio transmitters in armored cars and tanks. At present vacancies exist for enlistment of operators for these sets, and for qualified radio repairmen. Amateurs, unmarried and over 18 years of age, living in Kentucky, Indiana and Ohio, or neighboring states, should write for particulars to the Signal Officer (W9YHQ), Fort Knox, Ky.

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N. I. P. A.

Rho Epsilon, fraternal organization of college amateurs, is sponsor of the North-west Intercollegiate Press Association, an amateur radio news exchange service between college newspapers. At present there are three Rho Epsilon chapters, Alpha Chapter at Washington State College, Beta Chapter at the University of Washington and Gamma Chapter at the University of Idaho. The Beta Chapter has 20 members. W7LD at the U. of W. has schedules lined up with W7BVE, a student at the University of Montana, W7YL, station of the Alpha Chapter at W.S.C., and W7EZL at Oregon State College. Spot-frequency operation on 3585 kc. is contemplated. Amateurs attending colleges in the Northwest are invited to communicate with W7LD relative to joining the N.I.P.A. Address Nilo Koski, 5822 East Green Lake Way, Seattle, Wash.

Bill Stull, W5DHL, ex-K5IPT, WLM/W3CXL, WVE, W7J, WAF, is now in the Air Corps stationed at WYC, Langley Field, Va. He advises that Vance Murr, well known as W3BAI at Boiling Field, Washington, D. C., is now with Eastern Airlines, Miami, Fla.

W5DZY handled a message from W9WVB to W6FGU which resulted in locating a missing man whose daughter had died.
BRASS POUNDERS’ LEAGUE

(May 18th-June 15th)

Call Orig. Del. Rel. Credit Total
EC2MD 300 243 212 335 778
W5JTV 95 72 191 216 723
W61CH 152 127 197 197 749
W6DQ 22 22 209 22 73
W7DUE 58 49 266 49 850
W7LW 36 17 214 173 506
W6LLW 11 21 216 166 564
W7IVT 32 85 380 38 510
W7IVN 25 38 411 31 505

MORE-THAN-ONE-OPERATOR STATIONS

Call Orig. Del. Rel. Credit Total
W6GM, 314 W6SH, 140 W6KRO, 108
W81M, 209 W6WQ, 111 W6AT, 108

A.A.R.S.

Call Orig. Del. Rel. Credit Total
W6GM, 314 W6QW, 140 W6KRO, 108
W81M, 209 W6WQ, 111 W6AT, 108

MORE-THAN-ONE-OPERATOR STATIONS

Call Orig. Del. Rel. Credit Total
W6GM, 314 W6QW, 140 W6KRO, 108
W81M, 209 W6WQ, 111 W6AT, 108

A total of 500 or more, or 100 deliveries Ext. D.-C. will put you in line for a place in the B.P.L.

* Mar.-Apr.

Expedition Notes

MacMillan Arctic Expedition

The Schooner Gertrude L. Thelma, MacMillan Arctic Expedition, sailed from Gloucester, Mass., on June 24th to return in September after visiting Newfoundland, Baffin Land and Labrador. The ship is licensed under the call WHFN to transmit on the following frequencies: 468, 500, 4140, 5520, 8280, 11040, 16060 and 21080 kc. Relay broadcast channels at 5685 and 12882.5 kc. may be used with the call W10XH, Walter H. Ramsten, ex-9DFF, an A.R.R.L. member, is the operator. WHFN/W1OXH is Zenith-equipped. Schedules have been arranged with WHFN to transmit on the following frequencies: 14285, 3510, 3576, 3860, 3885, 3927, 3861, 3936.5. Both ‘phone and CW will be used. The operator is George R. Cadman, W2TFE, operator at W1OR (Bowdoin College) for several years. VE1IN will relay much of the traffic originating from the Macmillan expedition and anticipates a total of about 600 messages per month. Schedule will be maintained with various stations to clear this traffic. Tentative schedules have been arranged with W1AW, W1BDI, W1ES and W1UE. Thomas A. Gross, W1JGM, is manager of VE1IN and in charge of engineering.

From W6JTV, East Bay R.C.M., comes word that the Schooner Wander Bird, KMUP, has sailed for a two-months cruise to the islands and return. Her calling frequency is 6210 kc., working frequency 6230 kc. W6JTV and W6OBJ spent all of one Sunday afternoon working on KMUP’s transmitter, checking it for the trip.

Second Annual German DX-Contest

THE “DJDC,” Deutscher Jahres-DX-Contest, is to be an annual event. The DJDC consists of two parts – as it did in 1936, the DX-QSO between European and overseas stations, and the QTC-traflic between German and non-German amateurs. During the DX-QSO, serial numbers are again exchanged for verification.

Time and Frequencies: The contest takes place on all weekends of August 1937, starting on the 7th at 1200 GMT and lasting each weekend up to 2400 Sundays. All amateur bands may be used. German amateurs are prohibited to work on 1750 and 86,000 kc., bands, and the 3000 to 4000 kc. part of the 3500 kc. band. Stations frequently observed working outside the bands may be disqualified.

Contest QSO’s: The base of the contest is formed by the maximum possible number of contacts between European and overseas stations. For verification, six-character serial numbers are exchanged, if points are claimed for the QSO. The serial consists of two three-character numbers, the first meaning WRT or RST, the latter the running number of the QSO, thus starting with 001. The general call for contest QSO’s is CQ DJDC. QSO’s are permitted only once between the same stations each week-end, and on each frequency band. QSO’s between European and German stations do not count.

QTC-Reports: Contest QSO’s having taken place between non-German and overseas amateurs may be reported once each to Germany by each of the participants. Each QSO with European countries other than Germany creates a “QTC-report,” which consists of the call of the worked station, local time of the QSO in four-cipher number, and the serial number received. Example: ON4AU reports 0 1 2 3 4 5 6 7, ON4AU reports 0 1 2 3 4 5 6 7, ON4AU reports 0 1 2 3 4 5 6 7. This means ON4AU has worked W6CUH any day of the contest at 0515 his local time and received the serial 590012. The serial means with its first three characters that W6CUH heard ON4AU RST 589, the latter three characters mean the 59th QSO of W6CUH. At his end, W6CUH could be able to report this QSO in the following manner: ON4AU 2115/590012. That means, the QSO took place at 2115 W6-local time, ON4AU heard W6CUH RST 589, and it was the 59th DX-QSO of ON4AU.

You may send each German station a QTC-report for every non-German station worked. You may work the same D-station as many times as you like for the purpose of sending these reports. Schedules for sending your QTC-reports always to the same D-station are permitted. The German operator has to acknowledge the correct reception of the QTC-report (i.e., 5 QTC ok), before points may be claimed. QSO’s between overseas stations and Germany may be followed by QTC-reports to the same D-station. QTC-reports cannot include D. . . calls, and that QSO’s for sending QTC-reports are permitted only with Germany.

Scoring: The scoring is done by points.

QSO’s between Germany and overseas: 2 points each 1000 km, or part of it.
August 8: At Justice Park Gardens, Archer and Keen Avenues, Chicago, the Hamfesters Radio Club, Inc., will hold its fourth annual Picnic, Games, races, refreshments and dancing make up the program. There will be prizes to be judged as the grand prize. Prizes will be awarded to the holders of winning tickets whether or not they are present at the drawing. Out of town hams may secure tickets at 35¢ each from the club secretary, Clet H. Horton, 3752 South Laffin Street, Chicago.

August 8: The Annual Hamfest and Picnic of the Marin Radio Amateurs will be held at McNear’s Beach, out of San Rafael, California. A tri-club (Marin, Oakland, San Francisco) baseball game is scheduled with the Division Director and Alternate Director as umpires. The usual line-up of prizes will be raffled. There will also be an exhibition of manufactured equipment and other radio gear. Complete information is available from the club secretary, W6JZB.

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

(The list gives the Sections in which voting is to be held and the closing dates for receipt of nominating petitions for Section Manager. The names of the members of the planning committees for the elections to be held in each Section are also given.)

Section: Closing Date: Present Term: Present Candidate:
Eastern Pa. (resigned) July 15, 1937 James L. Manley
Maritime* Aug. 23, 1937 Arthur M. Cresswell June 14, 1937
Nevada Aug. 23, 1937 Edward W. Helm June 14, 1937
V. L. Aug. 23, 1937 William U. Shelton (re-elected)
Ohio Aug. 23, 1937 Harrison S. Smith July 12, 1937
Missouri Sept. 1, 1937 Albert N. Godfrey Sept. 16, 1937
Alaska Maritime Nov. 1, 1937 E. A. Helm Dec. 27, 1937
Nevada Nov. 1, 1937 Don E. Vaughn Nov. 1, 1937
Columbia Nov. 1, 1937 Don R. Vaughan-South

* In Canadian Sections nominating petitions for Section Managers must be received at Headquarters (345 Lynden Ave., Buffalo, N. Y., or 169 Logan Ave., St. Lambert, Quebec), to be valid. Petitions must be received no later than the closing dates specified above.

Practically every Section in the United States is now holding elections for its Section Manager, and it is suggested that a list of the names of all eligible candidates nominated for the position by A.R.R.L. members residing in the Sections concerned is forwarded to the planning committee for this Section.

Hamests Scheduled

July 5, 1937: The annual Jenny Lake Hamfest (WIMU) will be held at Jenny Lake, near Moose, Wyoming. It is an informal affair. All amateurs are invited and urged to bring along the wife and kiddies.

Entertainment will be provided for all. It is suggested that where possible those attending bring camping equipment as indications point to overcrowded cabins. Those desiring cabins should set in touch with W7AEC. Further details of the fest may be obtained from W7AEC, W7AMO or W7NH.

August 1: At Chatte’s Driving Range, Bowerhill Road, Mt. Lebanon, Pittsburgh, Pa., the fourth annual Hamfest of the South Hills Brass Pounders & Modulators. A golf program is planned with real prizes, good eats, plenty of fun and interesting speakers. It is an afternoon affair, registration 72¢, covering everything.

August 7: Radiomen of Cleveland, Ohio, announce an outing for their shut-in friends to be held at Puritas Springs Park, Cleveland, all day Sunday, August 7th. Everyone is invited: amateurs, their friends, shut-ins and their friends, SWL’s and the general public. WNLXY is a member of the planning committee. For complete details write John E. Garvey, 2114 W. 67th St., Cleveland, Ohio.

QSO’s between other Europeans and overseas: I point each 1000 km. or part of it.

For each QTC-report correctly acknowledged by a German station you may claim:

- 6 points each QTC-report by a European station.
- 3 points each QTC-report by an overseas station.

All points are totaled and multiplied by the number of German districts worked. The German districts are expressed by the last letter of the D... call. There are 19 German districts represented by the final letters of the calls: A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, R, T, U, V. Danzig, YM4 is considered as Germany and forms the 20th German district. Differences between cipher D3 or D4 are not regarded.

Prizes: There is no world winner, the participants of each country competing among themselves. Regardless of their score, all participants will receive from the D.A.S.D. a verification of their participation in the "DJDC 1937" and a list in which the results of the contest are published. The top scorer of each country will receive an artistic prize. If there are more than 5 participants, two prizes are awarded. In Germany, U.S.A., Canada and Australia, calls: A, B, C, D, F, G, H, I, J, K, L, M, N, 0, P, R, T, U, V. Mena7 and a list in which the results are received and sent, and the points claimed. Non-German stations must indicate to what German station QTC-qso is referred.

Each contest QSO (date, time, band, station worked, serial number, tuning notes, input and the type of receiver used. The final score must be remembrance token in the shape of a verification card for the contest. Every participant is urged to forward promptly his completed log. The log has to contain (for each contest QSO) date, time, band, station worked, serial number, tuning notes, input and the type of receiver used. The final score must be calculated. All logs must reach the D.A.S.D. not later than November 30th, 1937. Play safe, OM, and mail the log just after the end of the contest every participant is urged to send his log. In the 1936 DJDC about three hundred participants did not send any log, so that checking was very difficult. Therefore, send a log, OM, and you know you will get a nice remembrance token in the shape of a verification card for the 1937 DJDC. Mail log to Deutscher Amateur-Sender-Au. Empfangsdienst e.V., Berlin-Dahlem, Cecilienallee 14, Germany.

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the petition will likewise be conditional. The complete name, address and station call of the candidate should be included. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon of the closing date given for receipt of nominating petitions. It is not necessary to file the number of petitions that may be filed, but no member shall sign more than one.

Members are urged to take initiative immediately, filing petitions for each candidate listed above. This is your opportunity to put the man of your choice in office to carry on the work of the organization in your Section. This is your opportunity to put the man of your choice in office to carry on the work of the organization in your Section.

---E. E. Hendricks, Communications Manager

ELECTION RESULTS

Valid petitions nominating a single candidate as Section Manager were filed in a number of Sections, as provided in our Constitution and By-Laws, electing the following officials, the term of office starting on the date given.

- North Dakota: Ernest Blech, W9RIZ, June 14, 1937
- Minnesota: Edna L. Wiegand, W9GIZ, June 16, 1937
- Idaho: Carl Eichelberger, W7ETR, June 15, 1937
- Southern New Jersey: W. W. Finson, W3CEI, June 15, 1937
- Northern California: J. M. Whittaker, Jr., W6SG, and Mr. Henri J. Ballros, W6LMD, were nominated. Mr. Whittaker received 71 votes and Mr. Ballros received 47 votes. Mr. Tamsdell's term of office ended June 7, 1937.

A.R.R.L. Headquarters Operators

Hal Bubb, "Hal," Chief Opr. W1AW

The following calls and personal sines belong to members of the A.R.R.L. Headquarters gang:
- W1BI, J. E. Lamb, "Jim"
- W1AW, A.R.R.L. Headquarters Operators Club
- W1BRA, R. B. Beaudin, "rb"
- W1BD, F. E. Handy, "fh"
- W1CDB, C. B. DeSoto, "des"
- W1DF, George Grimmer, "gg"
- W1E, K. B. Warner, "ken"
- W1ES, A. A. Hebert, "ah"
- W1GQ, C. C. Beeley, "beck"
- W1HJ, Thomas W. York, "tom"
- W1JFQ, Vernon Chambers, "vo"
- W1JFN, A. L. Budlong, "bud"
- W1JPE, Byron Goodman, "by"
- W1JTD, Hal Bubb, "hal"
- W1M, C. C. Redlson, "rod"
- W1TS, Don Mix, "don"
- W1UE, E. L. Hattev, "ev"

STATION ACTIVITIES

Canada

Maritime Division

Maritime—SCM, A. M. Crowell, VE2IDQ—Nova Scotia: FQ has the rig going nicely on 14 Mc. 'phone. IJ is going strong on 3000 kc. with the 03A. IE was heard at the old bug on 14 Mc. DQ is testing out the new rig in new shack. Interesting information furnished by EE and KZ on the St. John gang and Loyalist City Amateur Radio Club: BF landed a commercial job. EE blew another transformer. EL has some new bottles. GP worked EGG on 14 Mc. 'phone. IZ boosted his power on 56 Mc. by using a single '19. IF finally got his 6L6 neutralised on 56 Mc. BM has a new 60 Mc. rig. KZ has gone in for experimenting. EV is off for the fall season. GB reports that the Montron boys and now sports an RME69 receiver. CX is building a new rig. JU moved to a new QTH and has a 6L6 c.c. osc. doing business. CI is putting up a new mast. RS schedules KS on 1.75 Mc. DQ and SR are both ready for business. EL announced a new power transformer. KO had a visit from KS of Sackville. IJ's landlord built him a new ham shack. FF returned to 3.5 Mc. HY is a new ham in Moncton with a pair of '46's final. JP, another new man, is going with a '45 Hartley.

Traffic: VE1J6 4 EV 5

Ontario Division

Ontario—SCM, Fred H. B. Saxon, VE3SSG—R.M. of the week: VE2HDI-D, 076, 0MG, 0KG, 0LU, 0JL, 0LH, 0KU. Three Ontario Section managers in the VE/W contest were presented with their prizes at a meeting of the Queen City Club, which was sponsored by the contest. CT and 0R each received '03A's. JT received a pair of '04A's. A New New has a HRD receiver. FC put up 50 foot towers for a 267 foot flat top, running East and West and in half an hour on 14 Mc. 'phone had worked E2LZ, VE5DX and 07UAC. ALU has new QTH. AIT is back home in Kirkland Lake after a series of operations in hospital in Toronto. We are glad to hear that he is like his old self again. AGM has new rig going PB with 585 watts input to a pair of '100TH's. AJF is at summer school. BY has '47 crystal. RK2S and T3G on 3850 and 14200 km. OQ is newcomer at Newmarket. YQ is fighting 14 Mc. 'phone. QM, AW is proficient at cracking rocks in a 6L6 circuit. PB is building a home instead of a transmitter. ABW is on 14 Mc. with a single '45. AMP is infected with 56 Mc. OF is getting a spot on 14 Mc. 'phone. WC is on 14 Mc. VY and AJF are sailing the Great Lakes for the summer. YN is changing over to 'phone. CA is rebuilding to p.p. T55's and is looking forward to O.P.S. CG reports from Winnipeg. WK has new QTVI. TM is rebuilding to high power. DH reports via radio. GT runs low power in early mornings. AG reports good going. GT, SQ, JI, WK, ZE, IX and ADG got tuned up for Field Day with 6L6 oce. and 38T final with power from a 300 watt generator driven from brake drum of car. 69 stations were worked for a total of 298 points. SG supplied a pair of portable masts of which the gang like the appearance. QK has an ATR219 transmitter on 56 Mc. and reports a lot of fun so far. The Frontier Radio Club and the Southern Ontario Radio Association, both of Windsor, were out for the Field Day, as separate units, and located about seven miles apart.

Traffic: VE3SSG 21 DH 17 CA 8 AGM-EM 6 SS 2. (April-May: VE3HDI 30)

Quebec Division

Quebec—SCM, Stan Comach, VE2EE—We apologize for stating that the 'phone W.A.C. honors were confined to this district. VE5OT would have us know that he also has achieved this. HE has practically recovered from his slight accident, but we regret to learn that AR is now confined to bed with a broken ankle. AP will soon be back with us after a trip to Budapest; John did a fine job and his District is proud of him. BW recently joined the ranks of the Benedictis. Correction . . . the pole on the roof at EX is 40 feet long, not 10 feet, as stated in last issue. LC and LV went out with a portable on Field Day; results: one receiver could not be warped, numerous mosquito bites and two temperas sadly ruffled. HH is at last putting his rig on 14 Mc. AA purchased a new receiver. We understand that Gordy, ex-ZOE, is returning to our District. BK returned from an extended vacation among the W's. GH, an old timer with a new call, operates 3.5 Mc. 'phone. CT is rebuilding. EE has completed the new rig. DU bought an FBXLA from HP. ID spent his vacation in New York City. IE built a portable to take with him to his summer home. SCOT is engaged to a Canuck; congrats to both. IJ is working in Montreal and vicinity for B. T. Co. GA is doing great work on 14 Mc.; Joe has been W.A.C. four times.

Traffic: VE3HII 4 KF 4 ITT 44

Van Alta Division

Alberta—SCM, Alfred D. Kettenbach, VE4LX—EO is using a T45 on 5.5 and 14 Mc. 'phone. GM is active in local civic affairs. HH visited SW, and made a tour of the District as R.I. LA rebuilt. HK and XYL visited LA and assisted in putting LA's tower back in place. GE is working 'phone regularly. TB, ex-Vegreville, is now located in the Northwest Territories. CAK is visiting Indians and visiting bands to look over the new QTH. ACF is rebuilding rig and receiver. CT is active again. IZ discovered a means of filter— (Continued on page 84)
Commercial QRM

RCA Bldg., 30 Rockefeller Plaza, New York
Editor, QST:

We received to-day a postal card from an amateur who evidently prefers to remain anonymous. The postal card is postmarked Detroit, Michigan, and carries the following correspondence:

"Have you got a pull June 1, 1937
wid Inspectors?"

Howdy Ham WEA R.P. 5:15 P.M.
Hog WEN New Brunswick

"Sa OM since when did you get permission to get into our band? Ur RST 589 hr OM
fb How about making sked wid
1 got a pink ticket one time for being just 3 kc. outside of band."

WEA, located at Rocky Point, operates on 10610 kc. with excellent frequency stability and, so far as we are able to determine, quite free from spurious emission. WEN, at New Brunswick, N. J., operates on 7407.5 kc. with excellent frequency stability and, so far as we have been able to ascertain since receipt of this amateur's report, free from spurious radiation in the 80-meter amateur band. Our frequency records show that WEN has in the past radiated sufficient half-frequency energy from an intermediate amplifier stage to be audible at our Riverhead, N. Y., receiving station. Whenever thus observed, the fault, demeasurement, was immediately corrected.

My purpose in sending you copy of this communication is a desire that, through the columns of QST, you might be able, editorially, to invite amateurs to advise us in each instance where they find spurious emission by any of the RCA transmitters. We receive such reports occasionally and appreciate the service rendered by these amateurs, for it enables us to correct a transmitter defect which might otherwise go undetected in the transmitter or even at our own receiving stations.

--C. E. Pfautz, Manager
RCA Frequency Bureau

What Good's a Kilowatt?

2068 Escarpa Dr., Los Angeles, Calif.
Editor, QST:

Recently I had a QSO with W7FHW, who said my signals were "S9 chirpy." I took off the 250-watt final and used only the 40-watt buffer. He noticed no difference in strength: still "S9 and chirpy." I took it off and used the 25-watt 6L6G doubler. The signal was still a chirpy S9, only slightly weaker.

Now why should we run a ‘California kilowatt' when half the soup brings the same S reports. A power limit of 100 watts would have saved me lots of $$ The only thing I’ve got against the 100-watt limit is that it would take away one of our rights.

--John T. Chambers, W6NLZ

No DX? Nuts!

311 Boulevard East, Weehawken, N. J.
Editor, QST:

It appears that a great many c.w. hams consider 7-Mc. as a glorified 5-meter band. W2's are the worst offenders in this respect, I believe, though I may be biased. It is just a bit discouraging to try to operate on the one-time “snappy” band when two W2's are using full input to QSO across New York City; a good five miles, perhaps. This letter was stimulated by a just finished QSO with CM2BK during the better part of which two of these rather foolish birds jawed at 8 w.p.m. about “no DX on 40 these days, don’t even work W9,” and more of this aggravating drivel, including “input here 250 watts.” Now why in the name of the holy Wouff-Hong use 250 watts to QSO a few thousand yards, QRM fair-to-middling DX, and lob a good sized chunk out of the band —all of which may be done on 160 c.w. or on 5 meters with only a few watts?

The receiver here is an old electron-coupled detector and two—step, yet PY2CW, K5AC, HA4H, etc., are regulars at R3-5, S4–7. Occasionally F3-8, CE3, YV1, SP2, O6E1, HK1, HA8, G's all roll in better than S3 and before ten o'clock at night. Now maybe I have the wrong ideas on what “DX” means to these men, but—

To hear all these W's crying “no DX on my new s.s.” is beginning to burn me up. Do none of them know how to turn the tuning dial?

--Maynard B. Chenoweth, W2GCC

International Good-Will

430 Baker St., San Francisco, Calif.
Editor, QST:

Just finished hearing W9—working VE5—.
What a soap box orator and authority on English, Canadian and United States politics! He was on a 20-meter 'phone with an email call out here, conditions being poor at the time. If certain foreign and domestic diplomats could have heard him, ham radio would lose no time in hitting the skids. This would-be reformer of Governments certainly did amateur-radio no good by his ravings. Maybe he was slightly inebriated; he certainly sounded like it. Political opinions are necessary in forming the course of any Government, but ham radio is no place for such expressions and comments as done in W9— a rabid style.

In working ham friends, diplomacy and tact are as necessary, in many cases, as in personal conversations. There is no need to QRM the much crowded bands with such inexcusable and offensive trash as he was putting out. He had the audacity to mention the good will between nations due to amateur radio right after he slapped VEo— s British Government right in the face!

I can't say how it all started (only heard W9— a side), but be sure finished in fine style. What amateur spirit he must have! I think this sort of thing should stop. If his temper got the best of him to some remark by W8MEE or anyone else, I am at his full disposal to exchange experience. Thanking you in advance, and wishing the best to old friend QST.

—F. O. Rowe, W6FK

He Makes Tubes

72 Avenue Prudent Bola, Brussels (2), Belgium

Editor, QST:

In QST for May, 1937, page 122, there was published an article telling that W8MEE would like to get in touch with any hams who make their own transmitting tubes. While I have not yet turned out triodes or such like, I have manufactured with some success rectifiers, mercury and high vacuum, with a special kind of heated cathode, and if it is of any help to W8MEE or anyone else, I am at his full disposal to exchange experience.

Thanking you in advance, and wishing the best to old friend QST.

—A. Stannier

About 14-Mc 'Phone

F. de Oimoa 17 sur., Apartado (P. O. Box) 815, Tampico, Tamao, Mexico

Editor, QST:

It was with a great deal of interest that I read the letter published in the June issue of QST under the title of "Foreign Fones." I am one of those "Foreign Fones" who operate outside of the American 'phone band on 20 meters, and most likely I have or some day am going to spoil a 100 per cent c.w. QSO for the writer of that interesting letter, Mr. Charles W. Finnigan, W3AJQ.

Mr. Finnigan points out the Mexican and South American countries as being particularly guilty of operating outside of the American 'phone band and causing 'phone QRM to the c.w. stations, but he forgets to mention (purposely, perhaps) that the VEs, VKs, PKs, A's, some of the Ks and most all of the European hams also operate 'phone outside of the 20-meter American 'phone band. Why then, I ask, does he point out especially the Mexicans and South Americans?

W3AJQ probably ignores the fact that we the Mexicans and South Americans also live in a free country like his, in accordance with the international treaty regulations; each country is allowed to assign the use of frequencies within the limits of the amateur bands, so he is entirely mistaken when he states that we deliberately operate outside of the American 'phone band. Yes, we operate there but within the frequencies that have been assigned to us by our own Governments.

Of course we could operate inside of the American band, too, but who wants to go in there with the big "American kludgowers"? Even Mr. Finnigan himself would feel sorry for us with the low power that we use. Why chance in the world would we have of ever making a QSO?

Most of the American 'phones that I listen to are very efficient and sound wonderful. They are very powerful and I admire them, so you can imagine what would happen to my low power sign inside of their band. They would be an easy bite for the "big sharks." If I guess the rest of the "Foreign Fones" feel that way too.

The 'American 'phone band is overcrowded as it is, and just suppose all of the 'phone stations in the world were thrown in there too. What would happen then? What chance would anyone have of ever working a DX station?

I am very sorry indeed that we, the "Foreign Fones," spoil Mr. Finnigan's c.w. QSO's, I sympathize with him: we all feel the same way. Where is the "white dove" that does not grunt and swear when the other guy QRM's his QSO? I would like to find him to send him a nice Mexican souvenir.

The amateur bands are very limited and we hams are too many, so the only thing we can do is to learn and practice the right definition of the word 'tolerance'.

—R. Villasenor, X82FG

Radio Poker

4315 Florida St., San Diego, Calif.

Editor, QST:

Probably every ham has heard of playing checkers and chess via radio, but I daresay no one has yet attempted poker over the air.

After several hours of over-taxing my brain (?) in deep concentration, I thought up a practical and simple method by which a nice poker game could be staged via radio, either c.w. or 'phone. With the latter it is easier, but just as much fun can be had with c.w. This system requires a great deal of honesty on each operator's part, but we don't have to worry about that, do we, boys?

Anyone interested in this brainstorm may drop me a line, and I will gladly send the explanation. Perhaps, if the response is great enough, a "Poker Net" may be organized, who knows? It will give the beginners something to do besides sending QC, test, v.vv., "incidentally," "hi hi," and the like. What say, fellers?

—A. Wilson, W6NIP

Harmonic Radiation

Blountstown, Fla.

Editor, QST:

I just been a sittin' back reading the Correspondence Section of QST (no apologies to WA1RE on language), knocking on occasional mead, and out of the hum that's QRMing me tryin' to get in the garage, when up pops this here W9VZL with his warning against the use of various impedance matching networks for the antenna.

Maybe it's the section of the cigarette I bit off an' swallowed that makes me feel like I do, but I don't think so, as I've felt that name way several times, specially when I hear one of them Latin American fellers trying to modulate a carrier he can't ketch. Sounds like ole peas caught in the fly paper an' a-wakin' a dyn-in-effect to git loose. Nope, I think it's here harmonic bizness.

The F.C.C. see harmonic radiation must be as low as the state of the art permits and since W9VZL has touched on impedance matching networks I'm going to yank out the next rack in line and see how much harmonics I'm generatin'. Naturally we have to generate 'em fore they get into the antenna, so unless we are going to operate the damn thing as a doubler Jet's get the harmonic generation down and the fundamental up where it belongs.

Here's a coil just as long as will go in the rack, and condensers as small as we can arrange for without payin' extra for them. They're 'bittin' the band' with the plates 99 and 98/100 per cent out. The tube voltage is somewhat overtaxin... (Continued on page 69)
When we first offered a complete line of low-loss dielectrics some years ago, we introduced the use of the word "steatite" to describe a certain group of high quality ceramic materials. At that time the word was used, particularly in Europe, to refer to the best of ceramic dielectrics. In its own field the word had come to have almost the same meaning as "Sterling." Since we first used it, we regret to say that the word has been so abused that it has lost most of its original meaning.

Many people incorrectly suppose that "steatite" is a brand. Actually it is the common name for a certain variety of natural talc used in making the best of electrical ceramics. It is a very expensive material to use because of the difficulties in manufacture. For one thing it is difficult to mold or compact into shape preparatory to firing. Further, it is very fragile at this stage so that breakage is high even when the pieces are handled with the greatest of care. In addition it requires such a high firing temperature that a special kiln is necessary. Only a few such kilns exist in this country.

Because of the difficulties in handling steatite, it is often mixed with other materials to make the product cheaper to manufacture, though inferior electrically. Up to a certain point such adulteration is not objectionable, because for many purposes the loss of electrical characteristics is not serious. However, the practice has been carried to such extremes by some American companies that materials are advertised as made of steatite that actually contain only a trace of that material, the bulk being cheap porcelain. Apparently there is no way to stop this, for as long as there is any steatite in the product at all it is legal to refer to it as "made of steatite."

This applies mostly to this country. In Europe, where most of the pioneer work was done, "steatite" still means quality. In fact they think so highly of the word that in France the principal manufacturer of high-grade ceramics, L'Isolantite S. A., uses **Isolant-Steatite** as the trade name of their product, while in Germany the premier company is known as **Steatit-Magnesia Aktiengesellschaft.** If these companies should test some of the material sold in this country as steatite, they would be quite embarrassed.

So, what? There is no way to tell what the losses in an insulator are except by testing. At the higher-frequencies — 56 MC, 112 MC and up — dielectric losses become quite appreciable, and a poor insulator is quite capable of stalling a low-powered oscillator. If the oscillator is high-powered enough it will cause very obvious heating of the insulator. Sometimes the heating is so violent that the dielectric practically explodes. In cases like these, of course, there is no mistaking the quality of the material, and one of the easiest ways of testing a piece of doubtful insulation is to expose it to the field of an ultra-high-frequency oscillator.

Barring such a test, the best suggestion we can make is to purchase only from a reliable source, and to be willing to pay a fair price. There is enough competition to insure that you will get exactly what you pay for.

*James Millen*
YAXLEY

Cable Connectors

Don't spend minutes of valuable time tracing wiring to find "which wire goes to what" when connecting your receiver to its power supply.

Don't take chances on burning out valuable equipment by making incorrect connections between the chassis of your rack and panel transmitter or P. A. system. Save time and effort when hooking-up your portable equipment.

Use Yaxley Cable Connectors for the instant connecting or disconnecting of any apparatus. The receptacles and plugs are polarized to prevent incorrect insertion.

Available in both 7-wire and 12-wire types, complete with cable or separately as desired. The prices are reasonable. Ask your distributor to show you Yaxley Cable Connectors—or write for details.

P. R. MALLORY & CO., Inc.
INDIANAPOLIS INDIANA
Cable Address—PELMALLO
FILAMENT TRANSFORMERS
Open style sub or top panel mounting - 115 volt, 60 cycle primaries.

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<th>Style</th>
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<th>Current (A)</th>
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<tr>
<td>T-16F08</td>
<td>2.5 volts C. T.</td>
<td>5.25 volts C. T.</td>
<td>10</td>
<td>2,000</td>
<td>90c</td>
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<td>T-16F09</td>
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<td>T-16F10</td>
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<td>T-16F11</td>
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<td>4</td>
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<td>T-16F12</td>
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<td>T-16F13</td>
<td>6.3 volts C. T.</td>
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<tr>
<td>T-16F14</td>
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<td>4.5 volts C. T.</td>
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<tr>
<td>T-16F15</td>
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<td>4.5 volts C. T.</td>
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<td>T-16F17</td>
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<td>4.5 volts C. T.</td>
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<td>$2.10</td>
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DESIGNED FOR AMATEUR USE

PLATE TRANSFORMERS
Shielded cases - Tapped Primaries

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<th>Style</th>
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<td>T-16P00</td>
<td>650 or 500</td>
<td>200 ma</td>
<td>200</td>
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<td>T-16P01</td>
<td>1250 or 1000</td>
<td>300 ma</td>
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<td>3,000</td>
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<td>T-16P02</td>
<td>1800 or 1450</td>
<td>500 ma</td>
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<td>3,000</td>
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<td>T-16P03</td>
<td>2500 or 2000</td>
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<td>T-16P04</td>
<td>1800 or 1450</td>
<td>500 ma</td>
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CHASES
INPUT

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<td>5-20h - 200 ma</td>
<td>2000 v ins.</td>
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<tr>
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<td>5-20h - 300 ma</td>
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<td>T-16C22</td>
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<td>T-16C23</td>
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<td>T-16C24</td>
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<td>12h - 500 ma</td>
<td>5000 v ins.</td>
<td>$5.40</td>
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</table>

Your parts distributor is now stocking Thordarson Amateur Specials. Investigate these stupendous values backed by the Thordarson guarantee of satisfaction. Bulletin SD-293 now at your parts distributor or direct from factory.

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THORDARSON GUARANTEED

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The Radio Handbook

SPECIAL JULY AND AUGUST

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NEW PRICES!
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Say You Saw It in QST — It Identifies You and Helps QST

heard KFI in Los Angeles on the broadcast band. Pitcairn is some 3,500 miles from the United States. With his 12-volt spark coil, aged as it is, he has held two-way communication with ships over distances of 400 miles. While these achievements are not unheard of, still many with modern equipment would be glad to do as well.

One morning when Andrew was aboard the Yankee, I was working schedules with the United States and the Canal Zone on high frequency. He had no trouble at all following what was being said even when copying a crack Army operator of the Canal Zone. Also, even though he had never used a tube receiver, he had no difficulty in operating ours (a Sargent Model 12 with plenty of controls). I discovered later that the growth of his surprising knowledge is due to the fact that he absorbs any little hints or remarks dropped by the ship operators he visits when they call at the island.

Many people on Pitcairn understand code; even the young children practice it with reed whistles. I was surprised one day when examining one of these whistles and blowing some code on it to have one of the native women translate it perfectly for me. Because of their ability to operate, any of the islanders have access to the station. While the other operators do not have the technical knowledge or quite the proficiency of Andrew Young, they are all quite capable of holding down PitC. There is another transmitter on the island, a privately-owned, 1/4-kilowatt spark station, but this is seldom operated.

In the last few years there have been several stations heard in the amateur bands which have claimed to be on Pitcairn Island. One of these, VR6M, was contacted by G6NJ and heard at WSIGQ. A similar station, VR6AA, was reported in January. Without a doubt these stations are fakes, but who or where I don't know. I hate to deprive any DX hound of the claim to have worked Pitcairn Island, but unless he has contacted one of the few expeditions which have called there, such as WCFT, he is out of luck.

It has often been a dream of mine to find a true Ham's Paradise. Here is the place—no automobile or electrical interference within 1,000 miles, a private prefix, and one of the most remote locations in the world. What ham doesn't dream of setting up a station in just such a place? However, some of the difficulties encountered in PITC would have to be overcome if such a dream station were to come true. Equipment would have to be brought in from the outside and some sort of independent power supply would be necessary. For low power this might be achieved by a wind-driven generator or possibly by a pedal generator such as is used by portable Army outfits. There is no water power available on the island and there is great difficulty in obtaining gasoline. In fact PITC itself in a few years will have to change or go out of existence, because the present equipment is so antiquated that it will be impossible
ANNOUNCING!
MODEL "B" TURRET
PAT. APPLIED FOR

FOR
Quick, Efficient
Band Switching

Rapid selection of any three bands by positive action wipping contact switch.

The plug-in feature provides a means of selecting any three band combination of coils most desirable at the time of operation.

The Model "B" Turret is equipped with a five section switch, permitting the use of single ended, center tapped, end linked, and center linked AIR INDUCTORS.

MODEL "B" TURRET, less coils...........$7.50

The Model "B" Turret is not a device forced on the market by competition with similar devices, but is rather the result of two years experimentation and study of the problems involved in efficient, quick band-changing. This Barker & Williamson development overcomes the inefficiencies and pitfalls found in the usual turn shorting and tapped coil systems.

Pretuning of the two lower frequency coils in use by means of small air-padding condensers permits spot frequency operation without retuning on all three bands. Standard Type B AIR INDUCTORS are available for the Model "B" Turret in single ended, center tapped, end linked, or center linked types. Every B & W AIR INDUCTOR now comes equipped with genuine Alsimag 196 steatite plug bar.

The Model "B" Turret is designed for operation in exciter stages and final amplifiers where plate voltage does not exceed 1000 volts and with inputs up to 100 watts.

If your local Jobber does not already carry Barker & Williamson AIR INDUCTORS have him place your order or write direct to factory for descriptive literature

W3DGP  BARKER & WILLIAMSON  W3GC
RADIO MANUFACTURING ENGINEERS
ARDMORE, PENNSYLVANIA
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HANDBY SIZE COMPLETE A.C.-D.C.

POCKET VOLT-OHM-MILLIAMMETER


A complete instrument for all servicing and other needs. Can be used for all AC-DC voltage, current and resistance analyses.

SEE YOUR JOBBER WRITE FOR CATALOG

What the League Is Doing
(Continued from page 19)

at least six months’ experience as a qualified operator on a ship of the United States before he is permitted to be employed as an operator on cargo vessels or tankers upon which only one radio man is required.

Strays *

"For many months Ross Hull of the headquarters staff, A.R.R.L., has been recording signals from UHF transmitters trying to unfathom some of the peculiar properties of these frequencies which are not acting according to Hoyle. Remember, theory said waves much below 200 meters wouldn’t go very far, but the amateurs discovered they did.

"Now they say that line-of-sight is all you can get out of waves shorter than approximately 10 meters. And yet Ross Hull shows that they, too, bend, and that they show other variations, which theory doesn’t account for.

"There is a growing realization that the A.R.R.L. is not only a bunch of brass pounders and potential war-time key punchers. The work of Jim Lamb and of Ross Hull and of many other hams will always stand in the way of those who say the amateurs serve no purpose and that it would be better to turn the ham bands over to cold hard cash uses. And as for the theorists and their deprecating manner toward amateur measurements, let the hams ‘smile as we smile now at the old forsaken bough where we cling’.”

—An editorial in "Electronics" for June, 1937.

The tube-base pin-numbering system recommended by the Radio Manufacturers Association recently has been changed, thereby making the information given in the receiving chapter in the Handbook disagree with the present "RMA Standard." Under the new system the pins are numbered in order in the clockwise direction from the left-hand filament or heater pin, looking at the bottom of the tube base or socket. The heater pins are readily identified on all but the five-prong bases because they are heavier than the others. On five-prong bases the heater pins are the middle two of the four grouped around
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The plus values in Burgess Batteries will give you, as an amateur or a professional, more than your money's worth — the plus values of consistent, faithful, accurate service.

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for Radio Transmitters
P. A. Systems
Scientific Apparatus

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Mallory has solved an age old problem for Radio Amateurs and P. A. men—how to obtain economically plate voltage for portable and mobile equipment. The answer is the new Mallory Vibrapack!

The Mallory Vibrapack is compact and dependable. It operates from a 6 volt storage battery—provides outputs of up to 300 volts at 100 m. a. of easily filtered DC. In addition, the low voltage models of the Vibrapacks are ideal for converting 110 volt receivers for 6 volt battery operation.

Made in the following models—

<table>
<thead>
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<th>Type</th>
<th>Nominal Output Voltage</th>
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<td>125-150-175-200</td>
</tr>
<tr>
<td>554</td>
<td>225-250-275-300</td>
</tr>
</tbody>
</table>

Supplied complete with special design Mallory Long-Life Rectifier tube included with interrupter 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!

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A.R.R.L. QSL Bureau

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

W1—J. T. Steiger, W1BGY, 35 Call Street, Willimansett, Mass.
W2—H. W. Yahnel, W2SN, Lake Ave., Hellen, N. J.
W3—R. E. Macomber, W3CZE, 418 10th St., N. W., Washington, D. C.
W4—B. W. Benning, W4QBY, 520 Whiteford Ave., Atlanta, Ga.
W6—D. Carson Mast, W6KHB, 423 East St., Ontario, Calif.
W7—Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio
VE1—J. E. Roue, VE1FB, 84 Spring Garden Rd., Halifax, N. S.
VE2—C. W. Skarstedt, VE2DR, 236 Elm Ave., Westmount, P. Q.
VE3—Bert Knowles, VE3QG, Lanark, Ont.
VE4—George Behrends, VE4RO, 186 Oakden Blvd., St. James, Winnipeg, Manitoba.
VE5—E. H. Cooper, VE5EC, 2024 Carnarvon St., Victoria, B. C.
K4—F. McCown, K4RJ, Family Court 7, San- turce, Puerto Rico.
K5—John J. Carr, K5AV, 78th Pursuit Squadron, Albrook Field, Canal Zone.
K6—James F. Pa, K6LBH, 1416D Lunalilo St., Honolulu, T. H.
K7—Leo E. Osterman, K7ENA, Customhouse, Wrangell, Alaska.
KA—George L. Rickard, KA1GR, P. O. Box 849, Manila, P. I.
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CONDENSERS
IN THE NEW
PROGRESSIVE III

GERRY COLE'S BUFFER-FINAL

Six of the ten CARDWELLS specified in the complete transmitter are efficiently placed to make the most of 450 watts input to the final amplifier.

CARDWELL CONDENSERS USED AND SPECIFIED IN BUFFER-AMPLIFIER

(1) XE-240-KD (shown) ... Net price each $12.60
(1) XT-210-PD (shown) ... Net price each 5.22
(3) NA-6-NS (under chassis) Net price each 2.16
(1) XT-210-PD (under chassis) Net price each 5.22

IN OSCILLATOR-BUFFER

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And... set your NEW CARDWELL CATALOG No. 40 for latest dope on the new GE Mycalex or Isolantite Insulated MIDWAY and STANDARD condensers... NOW.

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These A.C. solenoid relays are ideal for remote control of transmitters, for control of crystal ovens, and for any general remote control application except for keying. THESE RELAYS WILL NOT OPERATE IN KEYING SERVICE. Silver-to-silver double-break contacts are used throughout.

The maximum contact rating is 10 amp. at 220 v. or 3 amp. at 550 v. The relay coils are wound for 115 volts 60 cycle alternating current. Relays for other voltages can be supplied on special order. Use coupon below.

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**Radiostat**—A stepless graphite compression rheostat for primary of 550 watt filament or plate supply transformer. Range 4 to 150 ohms. Price $6.50

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Enclosed find money order for $.....................for which please send me, shipping charges prepaid, the following items:

______________________________ for______ Volts______ Cycles

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

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STATE.............................................

CODE SPEED (if any).............................. wpm

Robert W. Banders, W9LKI; Stephen R. Townsend, W1JLE; W. L. Turner, Jr., W3BEK; Louis E. DeAleur, W8AU; F. Broderman, W4CBZ; E. M. H. C. Mink, W6MB; Robert H. Moms, W5BBd; Norman Moberg, W7CMO; Walter J. Manning, W7ERA; H. E. Holmberg, W9UBB; Harry M. Matthews, W9UQT; Myron E. Gunn, W8NL; Edward M. Percy, W9F2T; Paul A. Pearson, W7DOX; Lee Baird, W6KNF; Philip B. Williams, W6EIP; George C. Gannascoli, W4CFD; Daniel C. Blake, W6EZA; Ernest E. Kohler, W7BQX; S. C. Austin, VK6A; Glenn Rosenberger, W9FFU; James B. Richardson, W1JLE; William G. Leyland, ZELKM; Lyle Smithers, W1IW; William A. Preston P. Nibley, W6JVB; Charles P. Zimmerman, W6ERS; Bruce E. Montgomery, W9AHH; Richard H. Karl, W9DHT; Leon Bergen, W9AIW; John J. Stenerton, W6CLS (phone); Francis J. Curley, W9BLL; H. R. Gogoln, H70 (phone); W. J. Heathcoat, Z7EX (phone); A. G. Lopeyorth, G6DL (phone); Antonio J. Bistrepou, HK1Z (phone); H. G. Mustermann, W2TP; Hans Eissmann, SM6W; Karl G. Smith, W6PRF; F. M. Graczy, V6S6 (phone); C. H. Castle, VK6K; J. H. Lawrence, VK6KM; E. A. Barber, VK6MD; R. W. Rose, VK2IG; A. H. Heath, VK6XZ; D. H. Fisher, VK7AB; L. A. Dean, VK5LD; H. Scholz, VK4HR; J. L. Bates, VK4UR; Harold F. Peterson, VK2EP; James L. Young, W7JL; Leslie C. Evans, ZL2AB; Sig. Fortunato Grossi, IREN; Sig. Ernico Mazetti, IIT; Ernest Mitchell, G5MV; Karl Emden, H90A; G. P. Anderson, G2QY; J. H. Cant, G6FU; G. Maciejewski, D4SIS; Franz Herrmann, D4JY; Herbert Salabrunn, D4WY; H. W. Dally, OZVJ; J. Corbly, ON4C; Roger Van Hee, ONUV; Ing. C. de Cartaja, JX20; Alan A. Ramey, W7A00; Charles E. Matthews, W4CYC; Otit Hill, K6AJA; Charles E. Wallace, W111B; Rose Hanisch, W9R85; Julius K. Mitchell, W6MPK; William G. Weidner, W1AL; Henry H. Homer, W9ID; Mark H. Upchurch, W2DNG; Stanley M. Keeler, W3DGC; Stanley McKeight, W9PNG; William Fletcher, W8AF; Norman H. Young, WX1H; Mort R. Miller, W6BEW; N. C. Baumam, W8XEO; Y. S. Maya, W6YED; Thomas E. G. Abbot, WSD7J; Eugene W. Hipple, W8M7W; A. Rebo, V1EAE; Robert M., W8JF; Oscar H. Baker, W9VBQ; R. W. Ellsworth, W6JT; Lawrence C. Cox, W5BWA; Alex H. Knight, W2DEA; James Jones, W8NUT; Mario Cera W21YR; Theodore D. Hais, WIPPO; Henry M. Harris, W6LLQ; (phone); Allie L. Hege, W4AHT; Everett H. Gibbs, WSAQ; Kenneth W. Christiansen, W6LCO; Ernest B. Vordermark, W4A2B; Charles H. Thomson, W6ARO; Arnold N. Dancomba, ZL2GN; W. D. Barnes, ZL2OD; Shigeo Okaya, JSFI; John F. Isaac, G5J; Oskar Becker, D4AI1; Hans Wottrich, D4DBA; Will Schuble, D4YLI; H. B. Gota, PA0GN; H. N. v. Dongen, PA6BD; Jr., W. Keesman, PAOZ6E; A. de Jongh, PA0YQ; Antonin Rakous, W2NNU; Milos Jurcica, OK1BM; John V. Conner, OK2MV; John D. Berg, OZ2B; S. B. D. Young, Q2YY; Robert H. Stoner, W8EVP; Manfred Assen, B8SD; Irving E. Cutting, W1FQ; Juan lobo y Lobo, X2BN (phone); Charles N. Delitos, W1G0RD ('phone); M. Esteva; Juan M. O Polaeeek, OEF1F; W. Fouhy, ZL2LB; Willy Blaschek, OZ3WB; H. Gutaon, G6GH; W. A. Mead, G6YY; H. Jones, G6Z7; H. A. Dorre, Jr., PK2HD; C. Grundy, G6Z3; P. C. Via, PA6MG; N. O. A. Nielsen, OZ7ON; Harold L. Hobler, VK4DO; Kenneth B. Bowman, W6DBQ; A. E. Howard, W3BET; Samuel E. Fieley, Jr., W1JW; Ernest B. Adahaha, W1GOU; Millard M. Walker, W6AHK ('phone); Frank B. Speer, KAI1AV ('phone); Edward Sawyer, Jr., W6PGD; Bob D. Ploof, W8NBP; Walter H. Mannin, W1GLF; Edwin C. Hutter, W2EEXW; J. Gray McAllister, Jr., W4PEY; C. E. Dewell, W9MRE; Myrl V. Hovia, W6GDH; Carl A. Ramsey, W9HLE; Arthur Grant, V6IDP; W. B. White, W6E; Arbie Wilis, W9WEQ; George N. Dugonis, W3C02; C. S. Jamieson, V6MGE; James J. Valentine, W9UEE; Charles O. Sylfied, W6WQ; Keith C. Daulton, W6EFQ; William T. Gerson, W3CUB; A. B. Unruh, W9AWP; E. Ohrom, V650G ('phone); W. I. D. Nightingale, G6GN ('phone); Edwards Sinclair, W6GAL ('phone); Sven Lindnas, G3OBB; T. Inoue, JZLW; Shigebori Matunagga, JSCA; Fritz Peuckert, D3SC; Hans Moer, D4NRV; K. G. v. Staveren, PA6KG; Ernest Bussmann, D4LDM; W. E. Dunn, G2LR; L. E. Crabbe, G6VF; Asbury P. Walker, W2BMM; Lawrence A. Laser, W6CJO; John McAndrew, W1BLO; Elden U. Benner, WIQH; Ralph Summers, W8GOQ; Donald McMenlon (Univ.

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These tubes have been operated with 3000 watts input in a privately owned regularly operated telegraphic transmitter for the past six months. The tubes are still perfect in every respect.

3000 volts at 1 ampere is the input power. Plate dissipation approximates 500 watts per tube or 5 times its rated value. Plate current is 2.2 times maximum ratings. A "brute force" method of obtaining 2 KW of antenna power.

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Enamelled

No. 14 , 17c, 20c, No. 17c, 25c, No. 20c, 30c, No. 16c, 40c, No. 14, 40c, No. 12, 75c. Phosphor Bronze, hard drawn—stretches and kinkless; high tensile strength, No. 12, 1.25. Seven strands No. 20, phosphor bronze. .......................... $1.40

Prices quoted above are for 100-foot lengths. Larger quantities in one piece are available.

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For use in complete circuit, or sub-circuits dividing the power line in equal proportions. Other sizes—Price on request.

LEEDS type A.L. ceramic holder, as illustrated above, fits standard A.L. socket .......................... 89c

Pyrex strain insulators 3/4" .................. 17c

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Complete line of Johnson 1-phonograph products in stock.

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677-U coil forms, 21 turns, 2 1/2" dia. resonant on 3.5 mc, 100 mfd. cap. .......................... 50c

677-Y -30 turns 4" dia. resonant 1.7 mc, 100 mfd. cap. .......................... 75c

NEW G.R. 8-prong socket: Heavy contacts separated by a bakelite wall. The ideal socket for radio receivers. Each 40c, or 10 for 1.00.

A Unit Style Portable Station

(Continued from page 82)

has been incorporated in the general layout.

The modulator, built up in the same size cabinet as the transmitter and receiver units, is entirely conventional in layout. It uses a 6N7 twin triode in Class-B, delivering 8 to 10 watts at reasonable distortion levels. This is not sufficient to fully modulate the 6L6’s at 35 watts input, of course, but the resulting signal seems more effective than the average 20-watt input portable when the latter is properly modulated. This is presumably due to the heavier carrier, an asset in reducing adjacent-channel interference on receivers with a.v.c. Too, the use of a low percentage of modulation with consequent minimization of r.f. distortion seems to permit higher levels of audio distortion without serious maltreatment of the voice quality. Total harmonic distortion of 10 or 15 per cent is not noticeable on the ordinary receiver of limited frequency-response with this arrangement. Despite the fact that an oscillator is being modulated, there is no detectable frequency modulation at the available percentage.

One control enables adjustment of the voltage applied across the microphone, while another sets gain. If a.c. operation of the modulator is contemplated provision can be made for plugging in a couple of flashlight cells for mike supply.

Vibrator-Type Plate Supplies

(Continued from page 84)

transformer, and r.f. filter for the elimination of "hash," but does not include the conventional smoothing filter. This leaves the way open for the builder to use as much or as little filter as may be necessary for transmitting purposes. Ordinarily a single pi-section filter, with the usual double-section electrolytic and small choke, will be ample. The efficiency of the unit is quite high; for a power output (at the filter input) of 32.5 watts the power taken from the battery is about 46 watts, or an efficiency of approximately 70%. The battery drain at full output is slightly over 7 amperes, and is almost directly proportional to the plate current drawn plus an "idling" battery current of about 3 1/2 amperes.

Two models are supplied for applications where the -B lead cannot be grounded, which is the case when the power pack is used with certain types of receivers; these use rectifier tubes. In other respects, the ratings are the same as those of the self-rectifying types.

With the amount of filter ordinarily used with the conventional line-operated power supplies, the Vibrapack is applicable to receivers as well as transmitters. Vibrapacks are manufactured by P. R. Mallory & Co., Inc., Indianapolis, Ind.
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ing his 700 watt, 110 volt a.e. rewound Dodge generator. W2 and JZ are to be congratulated on their success in re-winding 2,000 volt, one amp. D.C. job into 110 volt, 60 cycle a.e. plant. ADY is rewinding a 220 volt, d.c. 10 kw. generator, GD and KK made their W.A.C. on 75 Mc. W3N is putting '03A on 1.75 Mc. ZW is grid modulating a 211E. UX keeps in regular contact with Winnipe-gpeg and by all indications it will be bigger and better than ever. A.P.T. operated portable on A.R.R.L. Field Day. ADY is improving his 700 watt, 110 volt a.e. rewound Dodge generator. (Continued from page 68)

**FRAIRIE DIVISION**

**MANITOBA—SCM,- A. J. R. Simpson, VE4BG—** Along with AAW on 3.5 Mc. we have NW and KY working c.w. and AG with his Class B. 'phone, EK added a new bulletin microphone to his rig, IC expects to leave Winnipe-gpeg for Vancouver and thence will probably go to England to take up new work in the radio field. IP is vacationing in the Alberta Hamfest and by all indications it will be bigger than ever. A.P.T. operated portable on A.R.R.L. Field Day. IC expects to leave Winnipe-gpeg for Vancouver and thence will probably go to England to take up new work in the radio field. IP is vacationing in the Alberta Hamfest and by all indications it will be bigger than ever. A.P.T. operated portable on A.R.R.L. Field Day. IC expects to leave Winnipe-gpeg for Vancouver and thence will probably go to England to take up new work in the radio field.

**SASKATCHEWAN—SCM, Wilfred Shaffer, VE4EL—** Another Hamfest has come and gone, We had a big crowd, a nice banquet and a general good time all round. Each Club in the Section should study each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. There is much to be learned as each Field Day's members attend. 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There is much to be learned as each Field Day's members attend.
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NEW HAMPSHIRE—SCM, Carl B. Evans, W1BET—
The N.Y.V.A. enjoyed an FB outing on the A.R.R.L. official June Field Day with a portable location on Silver Lake in Belmont, N. H. Two receivers and transmitters were set up on the air exclusively by BET, FAB, IFY, YCA and JBA. GKE, HOY, GHU, GIO, HUN, ITA, and JMF helped keep things humming. The club wishes to thank AVJ, FTJ, HOU and JGC for the loan of equipment that helped make the field day a success. A total of 80 contacts were worked on 56 Mc. page 802.

BYJ—GKE, HOV, J.TD and JKH visited at times and Stratham Hill Fire Tower on 56 Mc.

JNO are on 56 Mc., with JFF getting rating from JNO as R.I.'s best 56-Mc. 'phone portable. JNO took 1st Class in Boscawen for the summer. IP is active on 56 Mo. for the Lake in Belmont, N. H. Two receivers and transmitters Mc. with 200 watts input from Barrington. HGV and KIN helped make the field day a success. A total of 80 contacts helped keep things humming. The club wishes to thank equipment at DAH-F Ali's "estate" in Scituate for location.

IJO is going to Nantucket for the summer. BVI, JH, HPE, JFF and GAN are going to take their commercial examinations, The Providence Radio Association participated with a score of 1070 points was the result. 6KNO is staying long enough.

Congratulations, boys. HXS has his 56-Mc. rig working at long last, but is well on his way. HXS is going to Nantucket for the summer. BVI, JH, HPE, JFF and GAN are going to take their commercial examinations.

Traffic: W1OR 45 IOT 30 BYR 20 (WLI 132) A13 JAH 11 INS 8 IZW 1 1ZD 128.

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THEY ARE TALKING ABOUT
GROSS CP-55 and CB-55
TRANSMITTERS
• Full 95 Watts input • New Taylor T20 tubes
• Ten Meter operation • Built-in power supply
• For operation on 10-20-40-80-160 meters
• 3 stages, 42 Osc, 6L6 buffer, 2-T20's in final

KIT $42.70

Less tubes, meters, crystal — One set coils included in price

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Two full size surface type meters...

6L6 (shell & rounded)...
6L6G (close-fitting)
6L6G (unshielded)...

The CP-55 is a Sensational Low Price Sensation.

GROSS RADIO, INC.
51 VESEY STREET NEW YORK

I. A. R. U. News
(Continued from page 80)

Hodges, W5MYH; Richard J. Buchan, W2TJF; Gene R. Bussey, W5EKK; Lee Hughes, W5DXXA; Roy L. Knight, W5RT; Edwin C. Shaw, W6SH; Harry E. Garvin, VE5JZ; Leland W. Smith, W4AEI; Earl G. Kraunik, W5BYE; Carl B. Evans, W1BFT; Tadeusz Chmielewski, SP1P; Joe F. Curless, W1NYN; G. S. Pool, W6BCO; Leander J. Smith, W5EBZ; Carl W. Brown, W9ARR; Robert M. Loomis, W2BZC; W. Geo. Mitchell-Dwelly, VE6FU; H. E. Royer, W3CDG; James B. Ricks, W9TO; Larry LeKashman, W2IOF; D. W. Heightman, G9DH (80-Mc. phone).

W6CNE
(Continued from page 55)
care of 20, when the station is operated portable on that band, as well as the b.c. entertainment when wanted.

The antenna is shown in the photograph of the car. It is a simple end-feed arrangement, using tubing, and its length is adjustable for the three bands used. It has given very satisfactory results on both transmitting and receiving.

The a.c. for the outfit is supplied by a 350-watt, 110-volt gasoline-engine driven generator made by Kato. This unit is mounted on the front bumper, as shown in the photograph. Ignition noise has been very successfully suppressed, but so far the noise from the generator itself has resisted all attempts at filtering, and information on how to cut out this type of noise would be appreciated by CNE.

On 28 Mc. while working mobile, contacts have been made with G5NI, G6LX, VK2GU, with the Argentine, Canada and all parts of the U.S. One of the best contacts was with W9BIID, when 100 per cent communication was maintained for the whole of a 27-mile trip from W6CNE's home in San-Fernando Valley to the heart of Los Angeles. The group picture was taken during a lunch-hour QSO with W5GAU. The movie atmosphere is accounted for by the fact that W6CNE (by way of introduction, J. Roy Hunt, Canoga Park, Calif.) is Chief Cinematographer at RKO.

Strays

Speaking of call-book coincidences, W1GKM discovers that W8OMA, W8OMB and W8OMC are all held by Smiths, all in different towns!

VR2FF writes that he hasn't seen mention in QST of the method of wiring up the customary five-prong crystal socket so the oscillator will perk no matter how the crystal is put in the socket. A simple stunt, so obvious it never occurred to us!

Through the courtesy of Raytheon, we have the following data on interelectrode capacities of the 6L6 and 6L6G types:

\[
\begin{array}{lcc}
\text{C_{66}} & \text{C_{67}} & \text{C_{67}} \\
6L6 (shell grounded) & 0.48 & 12.84 & 14.34 & \mu\text{fd}
6L6G (unshielded) & 1.40 & 11.82 & 9.96 & \mu\text{fd}
6L6G (close-fitting shield) & 0.85 & 12.88 & 14.74 & \mu\text{fd}
\end{array}
\]
GAMMATRON

**Compare—**
**BEFORE YOU BUILD YOUR RIG**—

<table>
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<tr>
<td>Grid Modulated Carrier Watts</td>
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<tr>
<td>PRICE</td>
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<tr>
<td>Carrier Watts Per Dollar</td>
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**AND GET THE MOST FOR YOUR MONEY!**

The Type 154 GAMMATRON is ideally suited to grid modulation. Because of its high overload capacity, conservative plate rating and its low amplification factor, the H.K. 154 far outranks its competitors in the same price class for this purpose.

Because of its characteristics and because a release of plate supply power takes place during peaks, linear grid modulation is possible at efficiencies in the order of 50% with the H.K. 154; with other tubes of higher mu, efficiencies greater than 30 to 40% are unattainable. Complete information on just how this can be done is yours for the asking.

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500 WATTS C. W.  500 WATTS PHONE

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**UTAH RADIO PRODUCTS COMPANY**

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Toronto, Ont., Canada

Buenos Aires (Ucosa Radio Products Co.)
28-Mo. o.w. activity this fall. R.C.A.'s u.h.f. survey car
heard on still looking for more stations for the L. I. net which operates operating frequencies: JHB 3580, DW 3695, EYS 3710. We are keeps DOG traveling around the country. l;,'x-K6DV is now soon. HLX sticks to 1.7- and 3.9-Mc. 'phone. JOU and JDO favorite, 3.9-Mc. 'phone GZG will appear on 14 and 28 Mc.
IHT 40 OQ 37 FF 27 DW 26 IOP 22 AZV 20 JGC 15 HXT QTH in Scotch Plains. FSQ, GBY, GFG and JOQ spent vicinity of Cleveland, Ohio, and will soon be a W8 on his old former. one to
tendance contest, BYD won a crystal microphone, IBR a the day lost. From reports published on the society page, two weeks at National Guard Camp at Indiantown Gap, Pa. 3BGD blew up a 211 amplifier and has been running 15 watts with 7 pounds 9 ounces of Junior Op. Congratulations!

Traffic: WSDQ 153 (WLM 97) JBF 69 PF 51 JHH 44 H7T 40 QG 37 FF 27 DW 28 IOP 22 ATL 14 GY 10 AV 67 EYS-A-A-CHT GBO-BKP-BLY-HM-5 CHK-FDL 3 BFA-EQJ 2 DOG 1 NORTHERN NEW JERSEY—SCM, Fred C. Reid, W2GMN—FPY, formerly of Plainfield and president of the Plainfield Radio Club's, has changed QTH to the vicinity of Cleveland, Ohio, and will soon be on his old favorite. 8.9-Mc. 'phone CGZ will appear on 14 and 28 Mc. soon. HLX sticks to 1.7- and 3.9-Mc. 'phone. JOI and JDO are on 1.7-Mc. 'phone. EKU is on 14-Mc. 'phone new QTH in Scotch Plains. FSQ, GBY, GFG and JOQ spent

Traffic: WICXL 178 (WLM 174) BWT 510 DQ 88 (WLM 92) SN 277 CIZ 49 BE 67 FSP 10 KE 43 W3EZ--R.M.'s: 3AKB, 3AQN, 3EOP, SASW. Among those there were 8CMP; Milton Grinnel, the R.I.; John Reinhart, 1Q; and 8CPC. Some of those there were 3CGM wins the first transmitter hunt of the Main Line for each hunt within a 75 square mile area. 3EZ came in two


ATLANTIC DIVISION

EASTERN PENNSYLVANIA—SCM, James M. Bruning, W3E2—R.M.'s: 3AKB, 3AQN, 3EQP, SAPW, P.A.M.: 3EOZ. 3GRS is a new ham in Reading and has started a 60-watt 6L6 rig. 3CGM is looking for new A.A.R.S. members. 3CGM is looking for new A.A.R.S. members. 3CGM received his R.C.C. certificate, 3GDI has had sickness and death in his family. The gang sends sympathy. 3AKB is rebuilding. SASS last saw 9.9's and one appendix. Wonder which he misses more? 3GDI is a member of the L.C.C. and has been having trouble with his final amplifier, 3GXE sends a report that Jimmy Gants (the Picture Snatcher) is now 3GXX, also that 3FSD is now Class A and is using 14 of 30 watts. 3GQ has been doing a little construction work. 3GJY worked four VK's in eighty minutes with 33 watts and a new Marconi aerial. 3DXC is building a portable transmitter and receiver. 3EOZ entertained G5NI for about a week. FLASH Mrs. BES presented the Old Man with 9 pounds 9 ounces of Junior Op. Congratulations! 3BGB blew up a 211 amplifier and has been running 15 watts with excellent results. 3QP is now fully equipped for Portable or Emergency work with a Chas-driven katolite Jr. 3CPS is a new ham in Reading and has started a 60-watt 6L6 rig. 3CGM is looking for new A.A.R.S. members. 3CGM received his R.C.C. certificate, 3GDI has had sickness and death in his family. The gang sends sympathy. 3AKB is rebuilding. SASS last saw 9.9's and one appendix. Wonder which he misses more? 3GDI is a member of the L.C.C. and has been having trouble with his final amplifier, 3GXE sends a report that Jimmy Gants (the Picture Snatcher) is now 3GXX, also that 3FSD is now Class A and is using 14 of 30 watts. 3GQ has been doing a little construction work. 3GJY worked four VK's in eighty minutes with 33 watts and a new Marconi aerial. 3DXC is building a portable transmitter and receiver. 3EOZ entertained G5NI for about a week. FLASH Mrs. BES presented the Old Man with 9 pounds 9 ounces of Junior Op. Congratulations! 3BGB blew up a 211 amplifier and has been running 15 watts with excellent results. 3QP is now fully equipped for Portable or Emergency work with a Chas-driven katolite Jr. The Beacon Radio Amateurs made extensive plans for Field Day, 3PAJ is another recent member of the R.C.C. 3FPA has another RX-20 tri-tet and thinks very highly of its usefulness. 3BRZ had a slight relapse to

Traffic: W8CSE 88 FCC 45 FUG 38 PLA 34 DHU 29 KVR 20 GWT 9 CGU 8 QHX 2. WHWT-8 35.
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Jensen 8-inch speaker.

Model KV Reproducer — Three sizes for 8, 10 or 12 inch
speakers, designed for really understandable speech reinforce-
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duction are eliminated. These models are relatively smaller than
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Also available in Carbon Models—List Price from $15 to $91.50.

The New England Division Convention

CONVENTIONS in New England are an institution and the response of the amateurs to this year's convention held in Providence, R. I., on May 21st–22nd, was most gratifying to The Associated Radio Amateurs of Southern New England who sponsored the affair. With a registration of nearly 400 the attendance was a pleasant surprise to everyone. As the committee had prepared a good program, there was not an idle moment, and the trips planned were conducive to making everyone feel congenial. Those with a sporting inclination found it possible to attend the races at Narragansett Park.

The best of speakers addressed the meetings during the two days of the convention. It is needless to go into the detail of the addresses, but the mentioning of such names as John L. Reinartz, W1QP, representing R.C.A.; L. S. Fox, of National Carbon Co.; Samuel Stiness, W1HXS, New England Tel. & Tel.; Dr. Howard L. Andrews, of Brown University, will show the variety of subjects covered. The Army and Navy were well represented by Captain Morris and Lieutenant Noble, respectively. Director Percy Noble and F. E. Handy, Communications Manager, were busy men during the convention. Mark MacAdam, WIZK, in his efficient manner had charge of the Code Speed contest, the winners of which were: Kenneth Bishop, W1EWD, perfect hand sending; W. J. Barrett, W1JAH, receiving and J. F. Lamont, semi-automatic key transmission, for which they each received a beautiful Silver Cup. That well-known speed champion, T. R. McElroy, gave another of his demonstrations and copied, unofficially, 82 words per minute.

At the banquet the convention was honored by the presence of Attorney-General Hartigan, representing His Excellency, Robert E. Quinn, Governor of Rhode Island, who extended the greetings of the state.

All in all it was a first-class convention and everyone seemed to be enjoying every part of it. Our thanks to Vincent O'Neill and his committee.

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Brief

W60LN and W6LHT, Los Angeles, working portable-mobile on 56 Mc., dropped into a drive-in eating place. From there they were working portable-mobile W9LHS-6, who was located in the hills above the city. W9LHS asked them to order him a couple of hot dogs and bring them up when they drove up to see him. Just as the waitress came up to the car with the "dogs," W9LHS' voice came out of the speaker and demanded to know why the waitress was so slow with his order. The boys then had a spellbound waitress on their hands and had to explain quite a bit. She was finally convinced it wasn't "spooks" when they let her talk two-way with 9LHS.

Standard Frequency Transmissions

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STANDARD FREQUENCY SCHEDULES

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<tr>
<td>8:32</td>
<td>7700</td>
<td>8:40</td>
<td>7800</td>
</tr>
</tbody>
</table>

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

TRANSMITTING PROCEDURE

The time allotted to each transmission is 8 minutes divided as follows:

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

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

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., 6000 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.
The National HRO
Complete Band Spread coverage, 1700 KC to 30,000 KC. Nine Tubes (not including rectifier). Two pre-selector stages. Strictly single-control tuning. Four-gang precision combiner with pre-loaded, worm-drive tuning, 20-1 ratio. Two I.F. stages with Litz-wound coils, air condenser tuned. Keat Frequency Oscillator for “offset” C.W. tuning. Single Signal (Crystal Filter) standard equipment. Direct reading micrometer dial spreads tuning over 500 divisions, numbered every 10 divisions. Complete with tubes and four sets of coils covering 1.7 me. to 10 me., less speaker and power supply. $1279.70

AND HERE'S WHY! 16,954 buyers of amateur radio supplies and service equipment who are on our active list of customers know from experience that Sun Radio Company is a most reliable place to buy. They know that even "hard to get" items are in stock here. They know, too, that they can depend upon our shop-by-mail service in cases where it is inconvenient to visit us in person. It took us over 15 years to build this reputation and because we guard it so jealously you can be assured of just that little extra measure of service.

The New 1938
Super Sky Rider
Complete coverage 5-550 meters. More than 1000° Electrical Band Spread. Wide range variable selectivity. Dozens of other quality features. Write for details of our Time Payment Plan. Liberal allowance on your present receiver. Price less speaker and crystal. $99.00

AUGUST HIGHLIGHTS from SUN RADIO

1 The new Hailscrapers 1938 model Super Sky rider. Write for our time payment plan. Other models in stock. Liberal allowance on your old receiver.
2 We have a complete stock of National parts and accessories. Write for Bulletin No. 261. It's Free!
3 National Receivers in stock: HRO, HRO Jr., NC-100, NC-101-X.
4 We are the largest Distributer for Stanco Transformers in New York City and have a complete stock. Write for Free X'mas manual.
5 Bilikey Crystals. HC3 @ $3.95; LD2 @ $4.80; H+L @ $6.50; VP1 @ $6.00. A large selection of frequencies in stock.
6 New Coto-Coil with variable link. All inductances in stock.
7 Stanco Plate Transformer, 1000v. at 300 M.A. $5.75
8 The New Mackey $9.50
9 The new C. H. T. Series by Chaptzarian. A large variety of plate, filament, modulation, audio chokes and transformers. Free catalog shows prices and various types.
10 Here, new, improved Western Electric phones $8.30
11 We have a complete stock of EIMAC, AMPEREX, RAYTHEON and RCA X-mititng Tubes.
12 RME, DB20 Prese­lector $43.60
13 We are proud to announce our appointment as distributors for Western Electric Amateur Equipment. Write for Free Literature and catalog.
14 $4.90
15 Before purchasing any test equipment, regardless of make, consult us. We can help you select the right equipment and save you money. Time payments and trade-ins considered. We stock: Superean, Weston, Irizet, Demount, Hickok, Simpson, Clough-Streng.
16 All Taylor Tubes in stock: 860 Jr. @ $1.00, 865 @ $1.65, T20 @ $2.45, T7-32 @ $2.75, 7T5 @ $8.50, 7T15 @ $19.50, 514 @ $18.50, 285B @ $7.50, 281D @ $17.50, 756 @ $4.95, T200 @ $21.50, T242 @ $8.50
17 Electronic Converter for powering Portable Equipment. Output: 6 V.D.C. to 300 v. @ 100 M.A. Very rugged. $13.25 net.
18 Complete stock of Hammond Parts. Just Free.
19 New Du Mont 5" model No. 168 oscillo­scope $116.50
20 Oyuvnia 316C. Full guarantee. While they last $6.75 net.
21 RME69 in stock. $131.25 complete. Liberal allowance on old receiver.
22 Corwin Dubilfer type JJ X-mitting condensers in stock.
23 U.T.C. transformers in stock.

MONTHLY BULLETIN SERVICE
Get on our mailing list. Get "The Sun" every month. a tabloid news-magazine that lists money-saving specials, contains articles by Jack Granis, Ed Berlant and other members of our staff. Simply send postcard with name and address to Dept. U-8.

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

Say You Saw It in QST — It Identifies You and Helps QST
The BRUSH Transfilter
FILLS THE GAP

The transfilter fills the selectivity gap between the electrically tuned circuit and the quartz filter. A transfilter can be employed in any superheterodyne whose intermediate frequency amplifier can be tuned to 465 kilocycles.

Technical data on request

The BRUSH Development Company
3320 PERKINS AVE., CLEVELAND, O.

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.

Amateur Equipment Cost of the Past

To old-timers as well as the newcomer, it is interesting to follow the cost of amateur equipment down through the years. Starting with the first issue of QST we find J. H. Bunnell advertising "the best and handsomest transmitter" which sold for $7.50. This was a straight key with the novel feature of renewable contacts "to eliminate fading due to varying resistance of the contacts."

At the beginning of 1916 loose couplers were widely advertised. One described as "handsome and will tune up to 1500 meters" sold for $15.

Not until September, 1916, were tubes advertised. The famous Moorhead valve, which had no internal grid and which would "cut static 50%," retailed for $6.50. The deForest audion tube also appeared in this issue and was listed at $5.50. Variable condensers, not in micro-microfarads but number of plates, ranged from $3 to $5. A. H. Grebe advertised a "short-wave regenerative receiver" for $32.50 which would tune to 1000 meters. This "receiver" consisted of a tapped coil and variable condenser mounted inside a beautifully finished box with a switch-point-studded panel with binding posts to go to the tube terminals or crystal detector, and 'phones.

By 1919 the cost of a variable condenser had come down to half its former price—providing you would assemble same yourself. The knocked-down condenser will be remembered by many.

Audio transformers came in packages of one for $7 and one special brand cost $20.

Headphones of this era were priced from $5 to $7 for domestic brands with an English firm advertising a pair for $18.

Two-stage amplifiers all nicely housed in cabinets were available at this time for $50. During 1919 the famous deForest unit construction receiver was advertised. The action unit was probably the most popular item for $10. The deForest wireless telephone transmitter to send voice 20 miles appeared in later 1919. This item sold for $200 and operated directly from the 110-volt lines.

The famous UV200 and 201 tubes first appeared in 1921; the former retailed for $5 and the latter $5.50. Power tubes followed soon after with the 202 rated at 5 watts for $8.

The "low-loss" era started in late 1923 and with it came an entirely new brand of advertisements—especially of low-loss condensers and coils. Late 1924 found the 1000-volt "S" tube rectifier on sale for $10. In 1925 finished oscillating crystals first came on the market for $25.

Certainly the amateur game of to-day doesn't tax the pocketbook in the manner it did twenty or even ten years ago.
Activity in a crystal is a relative measure of its ability to be easily excited, to snap into action quickly and to follow rapid keying. To be really good, a crystal must possess high activity.

Through correct design, the employment of special precision machinery and constant checking of every operation, high activity is assured in all Bliley Crystals. As a final positive check each unit must be able to follow rapid keying in a standard oscillator loaded to simulate actual operating conditions.

For the best in crystal control, use Bliley. For the 40-80-160 meter bands, get a Bliley LD2 Unit from your nearest distributor. He carries them in stock for $4.80.

**BLILEY ELECTRIC CO.**

ERIE, PA.

**BLILEY CRYSTAL UNITS**

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

**DODGE'S INSTITUTE, Day Street, Valparaiso, Indiana**

$100 for a RADIO KEY!!?

**WORTH IT — but I only charge $9.50**

This semi-automatic key makes it easy to send! Dot stabilizer equipped. Selected main-spring. Marbelite finish base stays put. Chromium metal parts. Proper height for tiresless, rhythmic sending. New 1938 Mac Key only $9.50. 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

**LEARN CODE RIGHT**

Tapes for Every Need — Even Airways

Send You Typical Messages by INSTRUCTOGRAPH

It’s easy and practical to learn or improve your Radio or Morse Code, any speed, Senior model with 10 tapes and Book of Instructions — $20.25.

Junior model with 5 tapes and Book of Instructions — $12.00.

(Not rented). Complete oscillator equipment, less battery, $6.50. Write for details today.

INSTRUCTOGRAPH CO., Dept. Q-8

912 Lakeside Place — Chicago, Ill.

Radio College of Canada

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**WORTH IT — but I only charge $9.50**

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T. R. McELROY—175 Congress St., Boston, Mass.

WORLD'S CHAMPION TELEGRAPHER
NOW THE UHF 6

At last that 5 and 10 meter superhet with low background and sensitivity—6 tubes, special IF’s, will bring in modulated oscillators but selectivity favors MOPA, punched chassis, and instructions and layout with each kit.

Complete Kit less tubes and cabinet $26.50
Tubes, $5.43
Cabinet, $9.25
Wired and Tested, $5.00

SPECIAL BUY—UTC
Plate Transformers & Chokes

20462A—1000-750-0-750-1000 AC at 300 MA, DC, 5.20
20462B—1500-1250-1000-0-1000 AC at 300 MA, DC, 6.75
20462C—2500-2000-1500-0-1500-2000-2500 AC at 300 MA, DC, 10.95
20462D—1500-1250-1000-0-1000-1250-1500 AC at 500 MA, DC, 10.95
20462E—575-525-0-525-75 AC at 500 MA, DC, 5.20
20462F—Smoothing Choke—25 Hy.-200 MA, 55 ohms DC Resistance, 2500 Volts Insulation $1.45
20462FS—Swinging Choke—5-25 Hy.-200MA, 55 ohms DC Resistance, 2500 Volts Insulation $1.45
20462G—Smoothing Choke—20 Hy.-300 MA, 95 ohms DC Resistance, 3500 Volts Insulation 2.85
20462GS—Smoothing Choke—20 Hy.-300 MA, 95 ohms DC Resistance, 3500 Volts Insulation 2.85
20462H—Smoothing Choke—300 MA, 95 ohms DC Resistance, 2000 Volts Insulation 1.95
20462HS—Swinging Choke—5-25 Hy.—300 MA, 95 ohms DC Resistance, 3500 Volts Insulation 2.85
20462I—Smoothing Choke—20 Hy.-300 MA, 95 ohms DC Resistance, 3500 Volts Insulation 2.85
20462IS—Swinging Choke—5-25 Hy.—300 MA, 95 ohms DC Resistance, 3500 Volts Insulation 2.85
20462J—Smoothing Choke—25 Hy.-400 MA, 85 ohms DC Resistance, 3500 Volts Insulation 3.45
20462JS—Swinging Choke—25 Hy.-400 MA, 85 ohms DC Resistance, 3500 Volts Insulation 3.45
20462K—Smoothing Choke—5-25 Hy.—400 MA, 85 ohms DC Resistance, 3500 Volts Insulation 3.45
20462KS—Swinging Choke—25 Hy.-400 MA, 85 ohms DC Resistance, 3500 Volts Insulation 3.45

TAYLOR TUBES
Complete Stock on Hand

T-20.... $2.45 — T-55.... $8.00 — 866.... $1.65

NEW UTC VARITRAN—VC

Compact, simple, rugged, inexpensive.... An ideal voltage control unit at the type employing a sliding contact riding over the transformer turns.

V-1—570 watts maximum rating; 115 volts, 50/60 cycles Input. Output 8 to 130 volts. Complete with cord plug and switch, net $10

The 1938 Super Skyrider

This amazing new communications receiver of Hallcrafters— to insure early delivery ORDER NOW.

Bassett Concentric Line

50 ft.... $9.75 75 ft.... $12.75 100 ft.... $16.75

MAIL ORDERS SHIPPED
KENYON SPECIALS

POWER TRANSFORMERS AND CHOKES AT UNHEARD OF PRICES | ALL CASED

**POWER TRANSFORMERS**

- D200. 750–1000 V, each side at 300 mils
  - Net $5.25
- D201. 1000–1250 V, each side at 600 mils
  - Net $8.50
- D202. 1500–2000 V, each side at 600 mils
  - Net $11.00
- D203. 1600–2500 V, each side at 600 mils
  - Net $11.00

**SMOOTHING CHOKES**

- D100. 20 Henries - 200 mils, 2500 V, insulation
  - Net $1.50
- D102. 20 Henries - 300 mils, 2500 V, insulation
  - Net $2.90
- D104. 20 Henries - 400 mils, 5000 V, insulation
  - Net $3.50
- D106. 20 Henries - 500 mils, 6000 V, insulation
  - Net $5.60

**SWINGING CHOKES**

- D101. 5-25 Henries - 500 mils, 2500 V, insulation
  - Net $1.50
- D103. 5-15 Henries - 300 mils, 2500 V, insulation
  - Net $2.50
- D105. 5-25 Henries - 500 mils, 5000 V, insulation
  - Net $2.50
- D107. 5-35 Henries - 500 mils, 6000 V, insulation
  - Net $5.60

**"X" CUT UNMOUNTED 40 METER CRYSTALS**

Made by nationally known manufacturer. Your choice from our stock, only $1.05. These are 1" square and have high output. Calibration is accurate to 1%. Special Bilev 30 meter crystal holders

**OHMITE POWER LINE CHOKES**

Keep your neighbors happy and eliminate complaints. Ohmite Power Line Chokes prevent high frequency currents from going out over the power line from your transmitter and causing annoying interference with your neighbor's receiver. Why make a nuisance of yourself when for the slight expense of an Ohmite Power Line Choke, you can stop all this trouble. Protect your own receiver the same way. See your dealer today. Built in three convenient sizes. Insist on OHMITE.

OHMITE MANUFACTURING CO. 4831 Fournoy Street Chicago, Ill. MANUFACTURERS OF RESISTORS AND RHEOSTATS OF ALL TYPES

**THE 1938 SUPERSKYRIDER**

Just look at these features. Range from 5–550 meters! Variable selectivity control! 1,000 of hand spread on 20 meters alone! Net price complete, less speaker and crystal, $19.95 extra for 12" pm speaker in cabinet, $12.00; extra for crystal, $12.00. Immediate Shipments

**RAYTHEON RK39 TUBES ARE ONLY $3.50, WHY PAY MORE?**

- EIMAC, 100th Tubes ................. $12.50
- EIMAC, 500th Tubes ................. $24.50
- WARD LEONARD – NEW! Antenna DPDT Changeover Relay, Mycalex insulation, 110 V.A.C. Field. ............... $8.85

**JOHNSON "Q" ANTENNAS FOR BETTER DX**

- 5Q. Five meter antenna system................. $3.83
- 10Q. Ten meter antenna system................ $12.00
- 20Q. Twenty meter antenna system.............. $12.00

Those new Brush Featherweight Crystal Fones are supersensitive and are only...

**LAST MINUTE FLASH!**

NEW THORDARSON SPECIAL POWER TRANSFORMERS

- T16PO-0. 640–810 V, each side at 200 MA, WT. 9 lbs
  - Net $3.96
- T16PO-1. 1220–1510 V, each side at 400 MA, WT. 28 lbs
  - Net $7.40
- T16PO-2. 1250–1540 V, each side at 600 MA, WT. 36 lbs
  - Net $11.60
- T16PO-3. 1740–2140 V, each side at 100 MA, WT. 31 lbs
  - Net $11.40
- T16PO-4. 2370–2950 V, each side at 300 MA, WT. 39 lbs
  - Net $13.95

Double Your Power!
At the Useful Voice Frequencies
Cut through QRM with a voice that can be understood. You don't need tricky high gain amplifiers with this tremendously efficient voice microphone. Eliminates all RF feedback troubles with its "airtight" shielding. Cuts out your hum problems too. You'll get more satisfaction out of the dollars spent on a VT-73.

LIST —
● MIKE
● STAND
● PLUG

$27.50

Write now for bulletin 10-C

THE TURNER COMPANY
CEDAR RAPIDS, IOWA
Licensed under patents of the Brush Development Company

WE OFFER —
SPECIALIZED PERSONAL SERVICE of genuine value that is not available from other jobbers.

TIME SALES of all receivers and transmitters with terms arranged to suit you and 6% finance charge. We finance our own paper. TRADE IN your equipment for the down payment.

TRADE IN YOUR RECEIVER
All receivers shipped on ten day trial. You need send but $5.00 with order, balance C.O.D. These receivers in stock:

RME-69a Complete...........$157.20
1937 Breitling 14s ............ 109.50
The new Patterson PR-15 ....... 109.50
The new RCA AGR-111 ....... 189.50
RCA AGR-155 ................ 74.50
RCA AGR-175 ................ 112.50
The new 1937 Super Pro ....... 238.14
The new Hallicrafters 1938 S-16 Super Skyrider 99.00
Hallicrafters Sky Challenger S-15 .... 69.50
Hallicrafters Sky Buddys ....... 29.50
Hallicrafters Sky Chieftains .... 44.50
Hallicrafters Ultra Skyriders S-10 .... 99.50

Every order and inquiry is personally attended to by Robert Henry, W9ARA, an active amateur for twelve years; graduate B.E. from M. I. T. and owner of Henry Radio Shop selling amateur supplies for eight years. You can reach me by letter, telegram, phone call, or visit 24 hours a day, 365 days a year. Write for any information.

HENRY RADIO SHOP
211-215 North Main Street BUTLER, MISSOURI

Class-B Audio Design
(Continued from page 46)

CLASS-B A.F. MODULATOR

D.c. plate voltage........ 1000 volts
Load resistance (plate-to-plate)........ 6400 ohms
Max. av. d.c. plate current (2 tubes) ......... 317 ma.
Power output (2 tubes) ........ 200 watts

From this information we wish to get two figures of vital importance which are not given. We want the recommended peak plate current and the drop across the tube at that current. With that information we can calculate the maximum output obtainable at the plate voltage available, together with the optimum reflected load impedance; or, if that output is greater than is necessary, the proper operating conditions for the required output may be obtained.

The peak plate current to one tube may be obtained by dividing the maximum average plate current (with sine wave input) to both tubes by 0.636. 317/0.636 = 0.5 ampere. This value should never be exceeded.

The drop across the tube is obtained indirectly by subtracting the voltage developed across R1 from the supply voltage. With a plate-to-plate load of 6400 ohms the reflected load impedance to one tube would be 6400/4 or 1600 ohms. With a peak plate current of 0.5 ampere, the peak developed voltage would be 0.5 X 1600, or 800 volts. With a supply voltage of 1000, the drop across the tube therefore must be 200 volts. The following formula should be used:

\[ \text{U.P.O.} = \frac{(I_{p_{max}} \times E_{R_p})}{2} \]

Suppose the power supply available for the modulators delivers only 900 volts.

(Case 1) \[ \text{U.P.O.} = \frac{0.5 \times (900-200)}{2} \]

\[ \text{U.P.O.} = \frac{0.5 \times 1700}{2} \]

\[ = 425 \text{ watts} \]

The optimum value of reflected load impedance would be 700/0.5 = 1400 ohms for one tube, or 5600 ohms plate-to-plate.

If the power supply delivered 1100 volts, the calculations would be

(Case 2) \[ \text{U.P.O.} = \frac{0.5 \times (1100-200)}{2} \]

\[ = \frac{0.5 \times 900}{2} \]

\[ = 225 \text{ watts} \]

The optimum value of reflected load impedance would be 900/0.5 = 1800 ohms for one tube, or 7200 ohms plate-to-plate.
The National Type O Dial is definitely a handsome piece of equipment. The circular-grained, solid nickel-silver dial is 3½ inches in diameter. Numerals and division lines are clean-cut and accurate. The large bakelite knob is well proportioned and comfortable to the hand. For safety, the dial is positively insulated from the hub by a large bakelite boss. Ask to see the National Type O Dial at your dealers.

NATIONAL COMPANY, INC., MALDEN, MASS.

LEARN RADIO — TELEVISION —

New Beginners' Class Sept. 13th. Send for 48-page catalogue, explains fully; 500 licensed graduates placed in last six years in broadcasting, shipping, police radio, aviation, etc. Oldest, largest and best equipped school in N. E. We teach all branches of radio. Tel. HAN. 8184. Ten operations placed with Pan-American Airways in one week. Radio Service Instructions Given. Open All Summer.

MASS. RADIO SCHOOL
18 Boylston Street, Boston

LITTELFUSE

Increase the efficiency of your equipment by using INSTRUMENT LITTELFUSES. All types of fuses and mountings from world-famous factory. HI-VOLT LITTELFUSES for transmitters; 1,000, 5,000 and 10,000 volt ranges, 1/16 amp. up. INSTRUMENT LITTELFUSES for meters 1/200 amp. up. RADIO FUSES, AUTO FUSES, etc. You should know about Littelfuses. See your dealer or write for catalog.

LITTELFUSE LABS. 4246 Lincoln Ave. Chicago, Ill.

QUARTZ CRYSTALS


BELLEFONTE, PA.

CORNELL-DUBILIER CORPORATION
SOUTH PLAINFIELD · NEW JERSEY
When in New York, visit our newly decorated and enlarged store... listen to all the new radio sets, see the latest developments... You are especially invited to inspect our new Camera Department. Should you have photographic equipment that you are anxious to trade in, we will offer liberal allowances on purchases of radio apparatus. Details can be furnished by mail.

**NEW SKY RIDER SUPER RECEIVER**

1938 model — 5 meter operation — minimum image trouble — R meter — variable selectivity... At the sensational low price (less crystal and speaker) of $99

Now you can own a real OSCILLOSCOPE with a large clear 3” tube (more than 7 square inches of screen). Completely equipped with amplifiers on horizontal and vertical plates... Perfect synchronization control at any frequency... A host of other features... $54.50

Famous nine feature Dunco Today’s leading low-priced, low-powered tube.

Brush Transformer for useful selectivity...

TAYLOR T-20

$2.45

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Suppose we had 250 watts input to the modulated amplifier, in which case we would require only 125 watts from the modulator. Assuming a modulator plate voltage of 1050

\[
\text{(Case 3)} \quad I_{\text{p max}} = \frac{125 \times (1050-200)}{2}
\]

\[
125 = \frac{125}{2} \times I_{\text{p max}}
\]

\[
I_{\text{p max}} = \frac{250}{850} = 0.294 \text{ amp. peak plate current}
\]

\[
850/0.294 = 2900 \text{ ohms } R_p \text{ or } 11,600 \text{ ohms plate-to-plate.}
\]

If the turns ratio of the transformer is known, the calculations need not be made in terms of impedance but may be made directly in terms of voltage ratios. The turns ratio may be taken directly from the impedance ratio and is the square root of the impedance ratio. A transformer with an impedance ratio from secondary to total primary of 5% would have a turns ratio of \( \sqrt{0.05} = 0.79 \). This ratio is for the whole primary; the ratio from secondary to one-half primary would be \( 2 \times 0.79 \) or 1.58.

In Case 1, we were able to develop 700 volts across \( R_p \), which is half the primary, so the peak voltage across the secondary will be 700 \times 1.58 = 1106 volts. The modulated amplifier plate voltage will always work out to be 1106 volts so long as the modulator plate voltage is 900 and the same transformer ratio and modulator tubes are used. The modulator will deliver 175 watts of audio so the input to the modulated amplifier could be a maximum of 350 watts. At 1106 volts, the plate current to the modulated amplifier should be 350/1106 = 316 ma.

In Case 2, we were able to develop 900 volts across \( R_p \), or one-half primary. 900 \times 1.58 = 1422 volts across the secondary. The audio output is 225 watts, so the input to the modulated amplifier may be a maximum of 450 watts. 450/1422 = 316 ma. modulated amplifier plate current.

In making the calculations only one precaution need be observed, namely that the input to the modulated amplifier must not exceed twice the audio output of the modulator. If more input is applied to the modulated amplifier, the plate voltage and current should be increased in proportion. Of course, 100 per cent modulation without distortion cannot be realized with appreciably greater inputs. If less input is desired the plate voltage should be maintained at the calculated value but the plate current may be decreased. This will increase the modulated-amplifier load impedance and also the reflected load impedance to the modulators. However, as the input to the amplifier is reduced less audio is required, and under these conditions the reflected load impedance should be increased, and it will increase in
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GENERAL CONSIDERATIONS

One of the commonest questions asked is “What should the meter read?” The question has no definite answer when voice input is used. The current value we have been dealing with in making calculations is a peak value which never shows up on any meter. In setting the ratings for Class-B audio, an average value is stated. This is the meter we would read with sine-wave input, and is determined by multiplying the peak value by 0.636. In other words, the average value with sine-wave input for two tubes is 0.636 of the peak value for one tube. However, with voice input, because of the difference in wave form the same peak output and peak plate current are realized at much lower average values of plate current. Usually the average plate current with voice input is approximately 50 per cent of the value for sine-wave input at the same peak output. Only an oscilloscope will give a correct answer to the question, “What should the meter read?”

In calculating operating conditions, the information presented herewith must be tempered with good judgment. From the figures only it might seem possible to take a pair of 10’s and transformers designed for use with them and by raising the plate voltage high enough modulate a kilowatt. However, it cannot be done.

The peak voltage from plate to filament will be the applied voltage plus the developed voltage. For instance, if the applied voltage is 1000 and the developed voltage 800, the peak voltage from plate to filament would be 1800 volts. The voltage from plate to grid would be greater by the amount of the peak grid voltage plus the bias, which would be approximately the drop across the tube, say 200 volts. Thus the peak voltage from plate to grid would be about twice the supply voltage. Consequently, the applied voltages should be in line with the maximum voltage ratings of the tubes or breakdown may be experienced.

Best transformer design involves the use of as small a core window as possible to accommodate the required amount of insulation and wire, and the minimum amount of insulation should be used to permit the tightest possible coupling between windings. For this reason, audio transformers use the least amount of insulation which will provide a reasonable safety factor. Consequently, if the voltages across the transformer are increased above the values for which it was designed, the

(Continued on page 108)
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Class B Audio Design
(Continued from page 102)
safety factor will be reduced. Increasing the voltage across the windings also adversely affects the low frequency response, though this is a less important consideration because the low-frequency cut off for most transformers is below the lowest frequencies obtained with voice input. The amount of d.c. through the secondary should not exceed the maximum rated value because it may result in core saturation, which necessarily must cause high harmonic content. In general, for safe operation, the voltages across and the currents through the windings of the transformer should be in line with those at which the transformer was intended to operate.

If the calculations are to be made for four tubes in push-pull parallel Class-B, the permissible peak plate current would be doubled. The drop across the tube or tubes would remain the same, as would the voltage developed across $R_p$. Twice the output may be obtained from four tubes as from two.

Rocky Mountain Division Convention
Colorado Springs, Colo., September 4th-5th

WHO will ever forget the Cave of the Winds? Yes, the Pike's Peak Amateur Radio Association is sponsoring the annual divisional convention which will be held at Colorado Springs, September 4th and 5th. Technical talks, equipment demonstrations, Army-Navy meetings, Novelty stunts, YL's theatre party, Picnic at Stratton Park, and of course a big banquet. Write C. E. Hathaway, Secretary, 1512 North Corona, Colorado Springs, Colo., for further information.

Roanoke Division Convention
Richmond, Va., September 4th-5th

ALL roads will be leading to Richmond and all hams will be trekking the highways for the 1937 official divisional convention if rumors are to be believed. Richmond Short Wave Club is sponsoring the convention to be held at the new John Marshall Hotel on September 4th and 5th. A program of special interest is being worked out—just watch for the publicity, President Woodruff, Major Hawthorne USMC and Commander Rogers USN will be present. There is a possibility that Secretary K. B. Warner will make the trip. A surprise will be sprung on the gang during the convention. R. N. (Bob) Eubank, 2817 Montrose Ave., Richmond, Va., is the chairman and will gladly give further information on request.
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<tbody>
<tr>
<td>Dymac Radio 216 E. Genesee Street</td>
<td>The Arnold Company 527 W. Broad Street</td>
</tr>
<tr>
<td>Complete Line Ham and BCL Equipment</td>
<td>W3EHL—“The Virginia Ham Headquarters”—W3FBL</td>
</tr>
<tr>
<td>Cl. 9080</td>
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<th>JAMAICA, L. I.</th>
<th>ROCHESTER, NEW YORK</th>
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<td>Wholesale Radio Service Company, Inc. 90-08 160th Street (Merrick Road)</td>
<td>Radio Service Shop 244 Clinton Avenue, North</td>
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<tr>
<td>&quot;Investigate Our Easy Payment Plan”</td>
<td>Complete stock amateur-BCL parts. Standard discounts, W8NUC</td>
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<th>MONTREAL, CANADA</th>
<th>SYRACUSE, NEW YORK</th>
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<td>Canadian Elec. Supply Co., Ltd. 285 Craig St., W.</td>
<td>Roy C. Stage, W81GF</td>
</tr>
<tr>
<td>Quality parts and equipment for discriminating buyers</td>
<td>Complete stock of standard Ham &amp; BCL parts</td>
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<td>Standard discounts. Free technical service</td>
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<th>NEWARK, N. J.</th>
<th>SPRINGFIELD, MASS.</th>
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<tr>
<td>Wholesale Radio Service Company, Inc. 219 Central Avenue</td>
<td>S. S. Kresge Company 1540 Main Street</td>
</tr>
<tr>
<td>&quot;Investigate Our Easy Payment Plan”</td>
<td>Standard discounts, standard lines. Advisory service: W1JO, W1FOF</td>
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<tr>
<th>NEW YORK, N. Y.</th>
<th>SPRINGFIELD, MASS.</th>
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<tr>
<td>Gross Radio, Inc. 51 Vesey Street</td>
<td>S. S. Kresge Company 1540 Main Street</td>
</tr>
<tr>
<td>&quot;Investigate Our Easy Payment Plan”</td>
<td>Standard discounts, standard lines. Advisory service: W1JO, W1FOF</td>
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<tr>
<th>NEW YORK, N. Y.</th>
<th>SYRACUSE, NEW YORK</th>
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<tr>
<td>Wholesale Radio Service Company, Inc. 100 Sixth Avenue</td>
<td>Roy C. Stage, W81GF</td>
</tr>
<tr>
<td>&quot;Investigate Our Easy Payment Plan”</td>
<td>Complete stock of standard Ham &amp; BCL parts</td>
</tr>
<tr>
<td></td>
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</tr>
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Despite the usual adverse weather conditions, RME-69 owners are able to maintain their DX contacts and work new ones. With so many stations "on vacation," you will find that Summer is the best time of year to log those hard-to-get countries.

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RADIO MFG. ENGINEERS
PEORIA, ILLINOIS

Say You Saw It in QST — It Identifies You and Helps QST
UTC’s leadership in transformer design is substantiated by the fact that some of the largest commercial organizations turn to UTC with their special transformer problems. Some of the more interesting units recently made by UTC for such organizations are almost in the “Believe It or Not” class.

One organization* required a 60,000 AMP transformer in a space approximately seven inch cube. Every other supplier contacted said “impossible.”

UTC MADE IT.

Hum pickup on portable amplifiers and pre-amplifiers was the bugaboo of one communications organization.†

They are now buying UTC because, as their Engineering Department stated, “We wouldn’t have believed it possible if we hadn’t actually made complete laboratory tests.” The input transformers supplied to this organization weigh only eighteen ounces. They have a frequency characteristic uniform from 30 to 14,000 cycles, and a hum pickup 90 DB lower than similar units of standard construction.

One of the important elements in the “U. S. Safety in the Air” program involved a special filter for use on planes. The excessive weight of this filter made the system impractical.

UTC, however, reduced the weight from over thirty pounds to 3¼ pounds.

One of America’s foremost radio comedians wanted to imitate the voice of America’s foremost news announcer on his program. The UTC 4 B sound effects filler made the job perfect.

A special carrier frequency problem encountered by one company,** required a high power, air-cooled, audio transformer with 30,000 VOLTS insulation and frequency response good up to 150,000 CYCLES.

UTC suggested the use of the LS-10X (tri-alloy shield) input transformer, which eliminated the problem completely.

A complete group of speech input and remote pickup amplifiers manufactured by one company,§ were not usable due to high hum level.

A special group of speech input and remote pickup amplifiers manufactured by one company,§ were not usable due to high hum level.

One of America’s foremost radio comedians wanted to imitate the voice of America’s foremost news announcer on his program.

The UTC 4 B sound effects filter made the job perfect.

The use of high carrier frequencies for special communication service made necessary high power amplifier equipment for test service.

UTC designed the amplifier equipment for one organization* and supplied the audio transformers for service up to 100,000 CYCLES.

### TO OUR KNOWLEDGE
- * The largest research organization in the world.
- † Largest radio receiver organization in the world.
- ** Largest radio communications company in the world.
- § Largest electrical manufacturer in the world.
Every detail of the NC-101X is expressly designed for amateur communication receiver use. Its high precision micrometer dial, calibrated like a fine instrument, is typical of the comprehensive specialization that makes the performance of the NC-101X so outstanding.
ACR-155—A moderately priced, 9-tube communications receiver covering from 520 to 22,000 kilocycles. Peak performance is assured by such RCA features as magnetite core i-f transformers and plunger-type air-dielectric trimmers. Price $74.50*

ACT-20—This new transmitter is winning widespread acclaim. Reports from owners prove its remarkable performance capabilities. Freedom from troubles, easy tuning, "broadcast quality" and assured performance are what owners like about the ACT-20. 20 watts C.W., 16 watts Phone output on all bands down to 10 meters at $129.50* (less accessories) make the ACT-20 a real buy.

ACR-111—Including every worthwhile feature for communication service, this new receiver represents the last word in modern design. Of particular importance are the constant-percentage electrical bandspread system, noise suppressor, two r-f and i-f stages, exceptional sensitivity and signal-to-noise ratio. ACR-111 complete at $189.50*

And don’t forget RCA V-cut amateur crystals—a better crystal for those applications where only the best is good enough. 20 meter crystals of outstanding performance at no extra price. $9.85* for amateur crystal and holder.