Certain applications of the 231C occasionally require that the transmitter be attended remotely.

Full provision has been made in the design of the 231C for a variety of remote control facilities.

The arrangement here illustrated employs a telephone dial for remote selection of the ten available frequencies and for selecting the type of emission, as well as for switching the transmitter on and off the air. Complete control and transmission is effected over a single telephone pair.

Four other basic remote control arrangements, each suited to different types of installation, are shown in the 231C Bulletin which is free for the asking.
DESIGNED TO
GOVERNMENT SPECIFICATIONS

This latest addition to the Hallicrafters family of communications receivers was mechanically and electrically designed by the twelve engineers in our own laboratories. But the specifications and performance characteristics were the result of exhaustive analysis of more than 600 requested reports and voluntary recommendations including specifications of government engineers.

Specific requirements for the best operation in the tropics and Sub-Arctic were included, as were military and marine requisites, broadcast monitoring necessities, professional communications requirements, DX needs and, of course, regional and general amateur requirements.

We sincerely believe the SUPER SKYRIDER has every performance characteristic accepted or demanded by leading engineers in each branch of radio communications. It could, we feel, easily sell for $250.00, but the Hallicrafters have only one way of arriving at the selling price of a model. It can be, and is, figured on a slide-rule. That method showed the SUPER SKYRIDER could sell, complete with crystal and 14 tubes, less only speaker, for $159.50 net.

THE NEW 341
SUPER Skyrider
THE NEW 1941 SUPER Skyrider

For the first time in communications history, the Halli- crafters present, as regulation accessories, reproducers of the famous Bass Reflex type. Especially designed by Halli- crafters-Jensen engineers, these are, we believe, the fin- est single-speaker enclosures made. Model R-8 (above) is 23½ x 17½ x 10½; complete with special PM Jensen speaker, $19.50 net. Model R-12 is 30 x 22½ x 16, with special PM Jensen speaker, $29.50. Both are handsome wooden cabinets finished in Gunmetal gray, providing a pleasing color match with the finish on the 1941 SUPER SKYRIDER.
JULY 1940
VOLUME XXIV
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NEW STANDARDS FOR RECEIVER PERFORMANCE

A few fundamentals of the new SUPER SKYRIDER are 6 bands covering 540kc to 43mc—2 stages of preselection—high fidelity, push pull audio—band pass audio filter—a new and highly efficient crystal filter circuit—an additional and completely effective noise limiter—cadmium plated steel chassis—standard relay rack panel \( \frac{3}{4} \) inch thick—machine tool, gray wrinkle, well ventilated steel cabinet.

THE NEW 541
SUPER
Skyrider
by Hallicrafters
Price was not a factor in the design of this model. It has details of construction as costly as skilled engineering necessitated. Nine features of construction are listed below. Additional features include provision for plugging in phonograph record player, also added facility for feeding recording heads through use of proper microphone.

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Section Communications Managers of the A.R.R.L. Communications Department

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THAT'S how Ruditchka Rubinski feels about it. A change in his power supply put nearly 2200 volts on his 2000-volt G-E Pyranol capacitors, but it doesn't phase Ruditchka. He knows Pyranol capacitors can take it—that they can be operated continuously at 10% above rated voltage with complete safety. Pyranol makes them extra compact, too, and they are available in either round or rectangular shapes for both upright and inverted mounting.

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

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

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“IT SEEMS TO US—”

In the few short weeks since we last addressed you on this page, the great European tragedy has flamed to new dimensions, has become a threat to all the world, and has made profound changes in the attitude of our own people and our own government. Inescapably this situation brings us new problems.

When we got up the A.R.R.L. Neutrality Code at the outbreak of the war, we did not include in it a self-imposed prohibition against working amateurs in belligerent countries and colonies, for the excellent reason that we did not for a moment expect that there would be any. From time to time there have been some, and it seems that the situation requires discussion. There are some foreign amateur stations that seem more than willing to give American amateurs information concerning the military situation, and one can only gather that they are being encouraged to do this for the purpose of cultivating us. It would be questionable neutrality for us to lend ourselves to such a situation. Our citizens and ships are obliged to keep out of belligerent territory, and no great extension of that thought would preclude our direct exchange of views with belligerents during these difficult days.

But the problem goes beyond that. The mad race in Europe unhappily seems likely to spread to still more countries so that there is no telling whether there will be any countries left untouched on that unfortunate continent. Moreover, in the few remaining countries not yet aflame, and where there are on the air at the most a few dozen amateurs, it seems probable that the stations are not operating with the full consent of their governments, which again is a hazardous condition for us.

League headquarters therefore has reluctantly come to the opinion that we ought not to work any European amateurs whomsoever, even for the barest routine exchange of signal reports. It just doesn’t any longer become us in anyone else’s eyes, regardless of our own knowledge of the utter unimportance of the contact. We are impelled to this conclusion by every broad-gauge consideration of the interests of our art. It is difficult to come to this decision. We are immensely sorry to have to make this recommendation because amateur radio on this side is truly neutral and is well capable of continuing to deal with the amateur of every nation, neutral or not, as a brother. By concerning ourselves strictly with technical matters, we could avoid entanglement and embarrassment. Yet we know that other people will not think so, and the safety of United States amateur radio compels us to give heed. After all, what is the value of the pleasure in a few fleeting DX contacts when these activities lay the individual amateur open to suspicion and prejudice the standing of our whole fraternity?

Put it down, then, as part of the A.R.R.L. Neutrality Code that we pledge ourselves to work no Europeans until the conflagration there subsides.

No law or regulation compels us to do this. No law or regulation is responsible for any part of our Neutrality Code. In fact, if such things had been dictated to us by the government at the outbreak of the war, we might well have been aroused to resentment at such a curb on traditional and constitutional rights. Our code is self-imposed. But, being voluntary, we are indeed the more strongly bound by it. It is another demonstration of the cooperative ability of the United States amateur to conduct himself in a temperate way and to police himself. Our position with our government is not the result of happenstance: we have earned their trust by demonstration down through the years of our sanity and foresight and our respect for the best interests of our country. We can take pride in this code of ours. It enabled us to demonstrate, in the early weeks of the trouble, that we could again be counted upon to take care of ourselves, and that the government need not worry about our violating neutrality or serving as dangerous channels of communication, even unwittingly. It was that showing alone that prevented the unnecessary closing down of ham radio during those weeks when everybody had the down-yonders and anything could happen. Official Washington was frankly amazed at the speed with which we amateurs ourselves spread this code around amongst our brethren, and our rigid

July 1940
observance of it tremendously enhanced our prestige. This demonstration of trustworthiness again stood us excellently when the war spread with amazing suddenness in May. We must be able to count upon its doing so as the situation grows more tense with every passing day.

It is therefore to this code of conduct that we owe our security to-day. It must continue to be absolutely respected by us all. The government cannot police 50,000 amateurs; if they believed we required constant monitoring, it would be easier to suspend us. Therefore nothing is of greater importance than that every last one of us conduct himself that his operations are above suspicion. This is not a job that headquarters can do for you; it depends upon what you fellows do in your individual shacks.

Let's summarize it: We do not work amateurs anywhere in Europe, belligerent or otherwise. We keep all our international contacts with other continents strictly on the basis of experiment and small talk. We relay no intelligence of any sort from one country to a third country. We talk only in plain language, and we always sign our call at the end of each transmission. Even amongst ourselves we do not discuss on the air anything about the war or any topic that might have a military significance for an interceptor. In other words, we make an absolutely rigid separation between this war and our interest in amateur radio, that the

**FLASH!**

*Foreign Communications Prohibited!*

Our printer had just got that much of our editorial set up in type when, about noon of June 5th, the F.C.C. issued an order, effective at once, suspending communication between amateurs licensed by F.C.C. and those in any foreign country. Thus a great deal of what we were talking about is removed from a discretionary basis, made mandatory. Let the Commission's order speak for itself:

**Order No. 72**

At a meeting of the Federal Communications Commission held at its office in Washington on the fourth day of June, 1940, Pursuant to authority contained in Sec. 303 of the Communications Act of 1934, and in accordance with Article 8, Sec. 1, of the General Radio Regulations (Cairo Revision, 1938) annexed to the International Telecommunications Convention (Madrid, 1934):

IT IS ORDERED, that amateur radio operators and amateur radio stations licensed by the Federal Communications Commission shall not exchange communications with operators or radio stations of any foreign government or located in any foreign country; provided, however, that this order is not intended to prohibit the exchange of communications between licensed amateur operators and licensed amateur stations in the continental United States and licensed amateur operators and licensed amateur stations in the several territories and possessions of the United States, or between licensed amateur operators and licensed amateur stations in the continental United States and United States citizens authorized to operate amateur radio stations in the Philippine Islands or the Canal Zone, or between licensed amateur operators and licensed amateur stations in the several territories and possessions of the United States.

IT IS FURTHER ORDERED, that all rules and regulations of the Commission inconsistent with this order be, and the same are hereby, suspended, pending the further order of the Commission.

This order shall become effective immediately.

By the Commission:

T. J. Slowie, Secretary

This order washes out all foreign DX. K4 (and KC4), all the varieties of K6, and K7 of course are still OK — these are U. S. K5 and NY are OK, as are all the KA stations operated at military or naval bases. Also approved is communication with any other KA station licensed to a United States citizen; otherwise it is not.

Inevitably there will be some hardships under these restrictions. If you are connected with any cases in which these requirements prevent communication with a distant United States citizen who desperately needs it, communicate the facts to your division director — it may be possible to do something about it.

A monthly magazine cannot keep up with this fast-moving international situation. The best possible service of information is being given over W1AW and the A.R.R.L. Official Broadcasting system. Further news, interpretations of this regulation, etc., will go out daily over W1AW. Keep yourself informed by making it a practice to listen daily for the fast developments that come between the issues of *QST*.

K. B. W.
A Stabilized Variable-Frequency Oscillator

Design Considerations for High-Stability Transmitter Frequency Control

BY G. M. BROWN,* W2CVV

Some two years ago, when the owner and operator of W2CVV got tired of trying to dodge the QRM on the 4-Mc. 'phone band with a few moth-eaten crystals, the obvious expedient was to build some sort of continuously variable oscillator for controlling the transmitter frequency.

After perusal of various articles on e.c.o.'s and inspection of some such oscillators in service, none of which seemed to be the entire answer to the problem, it was decided to start with fundamentals and see what could be done.

The stabilized variable-frequency oscillator which resulted, as well as others of essentially the same design built by W2ACB, W2HZL, W2VO, W2CFH, W1JLT and others, has been so uniformly successful on all bands from 10 to 160 that this article has been prepared. It is not intended to cover complete constructional details, although all components, constants, and circuits together with photographs of the original model are given, but rather is to be used as a guide in designing an oscillator to fit the needs of the individual builder. To this end the reasons for all design decisions of a major nature, and suggested design variations which may better fit individual needs, are included.

The Requirements

No design problem can be successfully attacked without a rather accurate outline of the desired features of the contemplated equipment. When boiled down, these features for a variable oscillator, in their approximate order of importance, are outlined below.

1. Frequency Stability

Although there is plenty of room for argument as to the relative importance of various requirements, there can be little doubt that a high order of frequency stability, under any and all conditions, belongs at the top of the list. We all like to get close to the edge of the band now and then, and Grand Island QSL's are uniformly unwelcome.

2. Reset Accuracy

Reset accuracy is very nearly as important as frequency stability — neither can be fully utilized without the other.

3. Convenience of Operation

Setting of the frequency must be accomplished by means of a single control.

The necessary switches must be provided to permit the oscillator to be turned on alone, without the rest of the transmitter being energized, thus avoiding the cardinal sin of e.c.o. operators of swishing carriers up and down the band.

Means must be provided for automatically energizing the oscillator with the transmitter during normal operation, without requiring manipulation of additional send-receive switches.

4. Economy

Inexpensive receiver-type components must be used wherever possible without sacrificing necessary operational requirements.

Frequency Stability

Since the achievement of exceptional frequency stability is of major importance, that problem was taken up first. An analysis of the various factors tending to cause frequency variations resulted in a list of the most important as follows:

1. Temperature variations.
2. Humidity variations.
3. Oscillator plate voltage variations.
4. Oscillator loading variations.
5. Mechanical shifting of parts.

Temperature variations affect frequency by

The stabilized variable-frequency oscillator built by W2CVV. The lower dial makes six revolutions for complete band coverage, the smaller dial above indicating the number of tuning dial revolutions.
Maybe you have an e.c.o. that satisfies you right down to the ground, or maybe you're just on the verge of making your first stab at variable-frequency control. In either case you'll do well to read this article with care, because it not only sets out the problems in clear-cut fashion, but also provides practical solutions to them. And perhaps some of the suggestions will make that good e.c.o. even better.

changing the mechanical size and thus the electrical characteristics of the frequency-determining circuits. With increasing temperature, coils become larger and have more inductance, and ordinary air condensers become larger and have more capacity. Both these effects tend to lower the resonant frequency. They may both be quite well compensated for over a reasonably small frequency range, such as a single amateur band, by a fixed condenser so constructed as to have a negative temperature coefficient. Fortunately the development of small, cheap titanium-dioxide capacitors having such a coefficient makes the use of a bulky bimetallic compensator unnecessary.

The final selection of the amount of temperature compensation required can best be determined by cut-and-try methods, since there will be considerable variation in individual circuit components and mechanical arrangements. A rough calculation, however, will at least provide a starting point. Since titanium dioxide compensators have a negative temperature coefficient of 0.06 per cent per degree C, approximately ten to twenty times the positive coefficient of the normal coil and condenser combination, the use of five to ten per cent titanium dioxide capacity in the total tank capacity will be a good place to start. If the completed oscillator has a tendency to drift down in frequency as it warms up, it means that more compensation is needed, and vice versa. The results of tests on the first model indicate that the 20-µfd. Erie Ceramicon compensator is about right with 240 to 340 µfd. total tuning capacity. Of course, it is entirely possible to obtain satisfactory compensation with compensators having coefficients lower than 0.06 per cent — in fact, if the proper negative coefficient is available, the entire fixed padder, \( C_2 \) (Fig. 1), may be used to compensate the coil and variable capacitor, and no other compensation used. Another possibility is to use a zero-coefficient capacitor for \( C_6 \), and make \( C_5 \) only large enough to compensate for the other circuit components.

Although such compensation is quite effective in compensating for frequency drift caused by ambient temperature changes and general heating of the oscillator unit during operation, changes from tube heating cannot be disposed of so easily. It was, therefore, deemed advisable not to make any attempt to compensate for tube changes, but rather to minimize their effect by using a small, low capacity, lightly loaded oscillator tube of the type ordinarily employed for the heterodyning oscillator of receivers, and a high-C oscillator tank circuit.

The effects of humidity on oscillator frequency are not entirely understood, and can be completely eliminated only by hermetically sealed compartments. The use of wax-sealed high-stability fixed padding condensers for a major portion of the tank circuit was found to provide adequate freedom from humidity effects under normal operating conditions.

The frequency of the conventional electron-coupled, or Dow, oscillator can be so designed and adjusted that its frequency is relatively independent of minor changes in supply voltage and output coupling. Careful measurements have shown, however, that the optimum adjustment of such things as screen to plate voltage ratio is dependent on \( L/C \) ratio, and consequently is not uniform over a frequency band.

To avoid the necessity for critical adjustments to obtain freedom from supply voltage and loading effects on the frequency, it was decided to eliminate the causes rather than to attempt to compensate for them. The supply voltage variations were easily disposed of by the use of a modification of the voltage-regulated power supply described in August, 1937, \( QST \). Variations in

---

Loading on the oscillator were eliminated by using an untuned buffer amplifier lightly coupled to the oscillator circuit. These two expedients, together with complete shielding of the oscillator circuit, have the additional advantage of almost entirely eliminating any effect on the frequency by tuning of subsequent transmitter circuits.

So long as no loading or supply voltage variations are to be permitted, there is no need for tolerating the complications of an electron-coupled oscillator. Accordingly, the 6J5 tube was selected, since it has the lowest inter-electrode capacities of any of the suitable conventional tubes. The metal variety was used, and so mounted that its base pins project into the oscillator compartment, thereby achieving very complete shielding.

Some oscillators are so sensitive to vibration that the family cat tiptoeing across a feather bed will sound like a hammer shop. This condition is caused by poor selection of components, or poor mechanical design. Contrary to popular belief, the answer is not to use large coils, massive condensers and copper tubing connections. Rather, the frequency-determining components should be small and light, and, of course, of good quality. They should be sturdily mounted as compactly as possible, with all leads as short as possible.
Inside view of W2ACB’s unit. Note the spring-loaded drive mechanism which controls the frequency-calibrated dial. The cables connect to a worm shaft below the chassis. No crystal oscillator is included in this unit.
A view of the chassis, with the cabinet removed. The power supply is along the rear edge, the regulator tube being beside the 80 rectifier. The tube near the far edge, in front of the power transformer, is the control tube for the regulated supply. The oscillator tube and 6V6 buffer are spaced on either side of the band-setting control, just in front of the power supply. The crystal oscillator and output amplifier are near the front panel.

bringing the oscillator back on calibration in case of ageing of components. It can consist of a two-plate double-spaced Hammarlund APC, or can be constructed as shown in Fig. 3.

The coil L1 must be tightly wound on any available low-loss form (preferably ceramic) of suitable size and must, of course, be mounted rigidly. The size given in the parts list was determined by the form available and was found to be about right.

These oscillator components, together with C1, C2, R1 and the bottom side of the socket for VT1, must be in a shielded compartment. This compartment should be no larger than required to provide space for the components with reasonable clearance, and must be sturdily constructed of at least \( \frac{1}{8} \) inch material.

The oscillator must be lightly loaded for high stability, and it was found that using the oscillator cathode tap as the loading tap provided adequate excitation without too much loading.

VT2, the buffer amplifier, should be so located that its excitation lead can be as short as possible after leaving the oscillator compartment.

There is nothing particularly critical about the remaining circuits. Good practice should of course be followed, but the stability has already been determined when the oscillator section is complete.

The tetrode buffer, VT2, is impedance coupled to the grid of VT4 by means of the untuned choke \( L_s \), the capacitor C11 and the grid leak Rs.

The Pierce crystal oscillator VT3 uses these same coupling components, and is provided with a switch \( S_i \) for selecting any one of three crystals.

A fourth position on the switch disconnects all crystals and grounds the grid. Normal operating cathode bias for the crystal oscillator tube is produced by the voltage drop in Rs. When the grid is grounded, the voltage drops in both Rs and Rs are applied as bias, reducing the plate current to a very low value.

The output tube VT4 receives its excitation from either the buffer VT2 or the crystal oscillator VT3, and can operate as an amplifier on 1750-2050 kc., or as a doubler with 3500-4000 kc. output. Since its tank circuit has negligible effect on frequency, plug-in coils are used for \( L_s \) to cover these two bands.

The 25-µfd. output tuning condenser \( C_{14} \) is ganged with the oscillator tuning condenser \( C_5 \) for single-dial control. Those who may have experienced trouble attempting to line up ganged condensers in a receiver may be reluctant to attempt ganging these condensers, but it will be found to be a much simpler proposition, mainly because of the heavy loading on the output tube and the fact that a relatively narrow band is to be covered. As a matter of fact, the coils for the original model were designed with a Lightning Calculator, and found to track adequately with no changes. In addition, the 100-µfd. padding condenser \( C_{15} \) is brought out to the front panel, making compensation convenient for any mistracking or output loading.

Note that the output tuning capacitor \( C_{14} \) has 25-µfd. maximum capacity, while the oscillator condenser, \( C_5 \), which is ganged with it, has 100 µfd. This does not complicate tracking, with the

(Continued on page 80)
Portable Kinks

Useful Circuit and Antenna Ideas

BY HARRY W. DREYER, W1WNC

The writer has lived—and operated ham rigs—in about seventeen different locations, principally in New England, Long Island and Chicago, in the past too many years, so that a change of QTH is no longer a thrill. The structures housing the ham equipment have varied from penthouses to one-room cabins in the Maine woods, with excursions into 12-foot row boats and the engine room, 100 feet underground, of a large hotel near Grand Central Station, New York (the antenna was down there, too). Ham radio worked at all these places—some better, some worse, but all better than no hamming at all. The following remarks are the story of a series of things learned in meeting unusual problems offered at various locations.

Probably the first thing that worries the average ham who moves into a new and unusual QTH is the antenna. He usually thinks of the antenna as the whole radiating system, and more often than not, if a c.w. man, does not even connect a wire to a “ground” because the rig works FB without it.

Actually the radiating system may be a far-flung network, including everything that has r.f. in it (said r.f. originating somewhere in the rig). We are all familiar with the weird and unwanted lighting up of lamp bulbs on the front porch or even as far removed as on the neighbor’s premises. These are examples of extended radiating systems where current maxima happen to come at or near lamps. That they put out our signals to other states, countries and even continents is not questioned, but obviously they are not the most efficient radiating systems that can be devised. And they are usually the finest producers of key clicks and ‘phone QRM. So what to do?

Every ham who has done b.c. service work knows that almost any 110-volt b.c. set will bring in husky signals if its “ANT” post is connected to the nearest “ground”—steam radiator, water pipe or sometimes a BX line or gas pipe. In the joy of discovering this cheap antenna it is usually not noticed that such a connection also is most efficient in bringing in all forms of man-made static, clicks, dial-phone QRM, etc. Look at Fig. 1 and you will see that the chassis is not grounded, and that reception is possible in a way that the designer never intended.

Now this may seem to have little bearing on a ham transmitter installation, but consider Willie Jones who has just moved his 40-watt rig into a new QTH and hitches it to an abandoned b.c.l. antenna about 50 feet long, loads up his final and proceeds to contact the 80-meter c.w. band with good average efficiency and better than good

Fig. 1 — The traced-out antenna system when the antenna post on a b.c. receiver is connected to a “ground.” C1 and C2 are capacities from the primary of the power transformer to core and chassis. Man-made static comes in through the power line and develops a voltage across the antenna coil between chassis and the pipe ground, G1.

Fig. 2 — Tuned ground lead for use where the set is located some distance from the actual ground.

*34 Prospect St., Terryville, Conn.
enthusiasm. Let us ask ourselves (but not Willie), what is his radiating system? Well, something less than a quarter wave of it may be on the 50-foot b.c. antenna. Where is the other quarter wave? You can find it if you go looking for it with a sensitive r.f. meter, and if Willie happens to have 400 watts instead of 40 you will find the current maxima lighting up lamps in curious places.

We do not pretend to have a cure-all for all of these troubles, especially those where the radiating portion of the antenna passes over and close to the house, but we have cured some bad ones. Generally the nearest thing to a good ground in any house is the cold water pipe, right where it comes through the e cellular wall from the street. As a ground for low frequencies, audio units, power packs and such, a wire run to it will generally be o.k. no matter what its length. But if your antenna feed system is such that the chassis of the final wants to be “hot,” a wire to this water pipe will not work if it is more than a couple of feet long. In most cases, just don’t ground the chassis, or else ground it through an r.f. choke so it will be an audio ground only. However, one or two cases we have found yielded to the treatment shown in Fig. 2. This is, in effect, a ground wire 1/2 wave long and it is a part of the radiating system, but it won’t light the neighbor’s Mazdas because both ends of it are at zero potential and it transfers no energy into 110-volt mains provided it does not run close to and parallel to an open wire. LC looks like a wave trap but is not. L and C are not the correct values to produce resonance for the signal frequency; they simply combine to form some value of reactance, either inductive or capacitive, which we select by varying them.

When the radiator is fed by a non-resonant transmission line or center-fed by a tuned line these troubles rarely occur. End-fed Zepp jobs often are bad offenders. Single-wire fed doublets also give some trouble. Or any sort of improperly-adjusted antenna and feeder system can do it. If the radiator is one-half wave or more long, an r.f. ground should not be needed. A good test is to observe whether connecting a ground wire to the chassis of the final changes the r.f. current or voltage materially at any point in the radiating or feeding system. If it does, all is not 100% perfect, though it may be near enough so that no serious trouble will occur. Few commercial rigs will pass this test.

We want to put the major portion of our r.f. into a radiating system as high and as clear of surrounding objects as possible. But compromises are a part of our daily life, and only experience teaches what violent compromises frequently will work quite well. Often the ham whose family leases a shore cottage for one or two months in the summer leaves all his gear home because the cottage is only one story high — 15 feet, maybe — with no trees near. So he says, “What’s the use?” This is an appalling mistake. A QTH near salt water is one where great height above ground is distinctly not needed. Look at Fig. 3, a sketch of W1ANC/1 on Long Island Sound, one of the best locations we have ever had. The antenna is unorthodox, being grounded at its far end in the waters of the Sound. In addition to working FB, it gave continuous lightning protection and didn’t spill any of our precious 20 watts around the surrounding 110-volt lines. With a rig consisting of a 42 e.c.o. and a single 6L6 final at 400 volts, we were able to contact Europe about a half hour before the high-power New York and Long Island boys on 40-meter c.w. On 80 c.w. our reports within sensible distances were 88 and 89. On asked to Norfolk, Va., at noon on 40-meter c.w. we were always 87.

A different sort of trouble was encountered in a one-room shack in the woods near Ellsworth, Maine. Both transmitter and receiver were operating from a Vibrapack and 6-volt battery, and it seemed impossible to get rid of the vibrator.
Converting a receiver using 6.3-volt tubes to 6-volt battery-vibrator pack operation.

Hash because no ground connection was available. You couldn't drive a pointed drill rod into the ground anywhere within shooting distance of the cabin; there was no well, no buried metal pipes, and it was winter so we couldn't bury anything if we had had it. Purely by accident it was found that about 200 feet of antenna wire laid at random on top of the ground, over brush and stumps, gave a ground that removed most of the hash from the pack and also reduced most of the ignition QRM from the gas-driven charger which was our only source of power and light.

The antenna at this location was hung high up in a spruce tree without climbing it. About 175 feet of mason's cord with a 2-pound fishing sinker was laid carefully out on a hard road so that it would not snarl. A couple of husky overhand swings and a heave put the sinker over a branch about 70 feet from the ground. Some judicious jiggling of the line was needed to get the sinker back down to the ground. Then a length of No. 16 enamelled copper-steel wire was pulled up over the branch, an insulator spliced in, and pulled up to a convenient height. The excess wire coming down from the branch was coiled and fastened at a height and concealed from the local small fry. Many antennas have been put up this way by the writer, who is at the half-century mark in years and not as active in climbing as formerly.

Receivers and Transmitters

A word now about receivers at portable locations may not be amiss. Many have been described in these pages — good ones all, no doubt — but the author has always wanted his own pet communications receiver to use. It is very easy to do if you have a good 6-volt battery and reliable means of charging it, also a vibrator powerpack — the same one you will use on the transmitter. We happen to have a Hammarlund HQ120, but believe the same remarks apply to all modern communication receivers using 6.3-volt tubes. As shown in Fig. 4, the wiring changes...
whose signal stayed at a constant $S_2$. At night, fading and heterodynes spoiled it badly. Signals on the 28-Mc. amateur band were present 24 hours a day, although after dark only the 4th and 5th districts were heard. Any signal $S_1$ or better was QSA5. No serious attempt was made to log extreme DX sigs because it was during the period of World War No. 2.

Reams have been written about portable transmitters, and ours were not worthy of additional description except as to the output circuit used. Just one transmitter was made, using a 6N7G tube as two triodes in a neutralized m.o.p.a. circuit, with a single 6L6 driven by a carbon mike for the modulator. It is thought that this circuit realizes nearly the maximum stable output on 160-meter 'phone that can be had from one 6-volt battery and vibrator pack. Its circuit is shown in Fig. 5. It will be noticed that the fixed capacity between the two 6N7G plates is used as a fixed neutralizing capacity, adjustment being made by varying the tap on the Hartley oscillator. It worked FB.

And a Flexible Output Circuit

Our only other contribution is a rather unusual and very flexible output circuit which really goes back to the days of spark. But like old Limberger, it is still good. A variation of it is still in use at permanent W1ANC in Terryville, Conn., and is a constant source of amazement to the many visiting hams who are more thoroughly grounded in the more conventional circuits. Fig. 6 is about it. The final is a TZ40 on 160, 80, 40 and as a doubler, weakly, on 20 (60 watts). The tuned circuit is $L_4$ and the combination of $C_1$ and $C_2$. Fig. 7 is a TZ40 on 160, 80, 40 and as a doubler, weakly, on 20 (60 watts). The tuned circuit is $L_4$ and the combination of $C_1$ and $C_2$.

Fig. 5 - Simplified output circuit connected to various types of antennas, mostly unorthodox arrangements used in portable work or where space is quite limited. The tank coil is described in the text. Sufficient tuning condenser capacity should be provided to give about $2 \mu\text{fd.}$ per meter, since there is no additional selectivity between tank and antenna to suppress harmonics. A 350-$\mu\text{fd.}$ condenser will serve for 160, 80 and 40 meters. The coil should be wound of bare wire so every turn can be tapped; the smallest Mueller phosphor-bronze test clips are quite satisfactory for the purpose. When the total length of wire in the loop arrangement, Fig. 7-C, is less than $1/4$ wavelength, the circuit at 7-D should be used. Fig. 7-E is for extremely short wires, such as a 10-foot antenna used on 1.75 Mc.

C2 is a large, wide-spaced 4-gang b.c. condenser which has been double spaced, ganged and their stators connected in parallel. This results in a good high-voltage condenser of about 400-$\mu\text{fd.}$ capacity. (Needless to say, this combination has seen service in almost as many other final stages as there are prongs in a rake.)

(Continued on page 88)
SPECIAL ELECTION NOTICE

To all A.R.R.L. members of the Southwestern Division:

You are hereby notified that a special election is about to be held in the Southwestern Division to elect a director to fill the vacancy left by the resignation of Chas. E. Blalack, W6GG, to become vice-president of the League. The election will be for the unexpired remainder of the 1939-1940 term, plus the next regular term of two years, 1941-1942, as provided in By-Law 24.

If more than one eligible candidate is named, voting will take place during the month of September, 1940, on ballots that will be mailed from the headquarters office in late August.

Nomination is by petition. Nominating petitions are hereby solicited. Your attention is invited to the pertinent portions of the Constitution and By-Laws of the League, a copy of which will be mailed any member upon request. Ten or more A.R.R.L. members residing in the Southwestern Division may join in nominating any eligible West Gulf member of the League as a candidate. The following form is suggested:

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

We the undersigned members of the Southwestern Division, hereby nominate ............., W6..., of ................., as a candidate for director from this division for the remainder of 1940 and for the next following full term of 1941-1942.

(Signatures and addresses)

The signers must be League members in good standing. The nominee must have been both a member of the League and a licensed radio amateur operator for a continuous term of at least four years immediately preceding receipt by the Secretary of his petition of nomination, except that a lapse of not to exceed ninety days in the renewal of the operator's license and a lapse of not to exceed thirty days in the renewal of membership in the League, at any expiration of either during the four-year period, will not disqualify the candidate. He must be without commercial radio connections: he may not be commercially engaged in the manufacture, selling or renting of radio apparatus normally capable of being used in radio communication or experimentation, nor commercially engaged in the publication of radio literature intended, in whole or part, for consumption by licensed radio amateurs. Further details concerning eligibility are given in By-Law 12. His complete name and address, and call, should be stated. All petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon E.S.T. of the 20th day of August, 1940. No member shall append his signature to more than one petition. To be valid, a petition must have the signatures of at least ten members in good standing. Petitioners are urged to have an ample number of signatures, since nominators are frequently found not to be members in good standing.

Balloting will close at noon, October 1, 1940, and the successful candidate will take office as soon as the result can be determined.

This election constitutes an important part of the machinery of self-government in A.R.R.L., and members are urged to take the initiative and file nominating petitions immediately.

For the Board of Directors:

K. B. WARNER,
Secretary

June 4, 1940

THE 1940 BOARD MEETING

The Board of Directors of the A.R.R.L. came back to Hartford for their 1940 two-day annual session at the end of May. Most of the directors coming in a day early on the Memorial Day holiday, there was time to inspect the headquarters station and the headquarters offices, to pound brass at W1AW, and to play with some of the new gadgets in the QST lab.

Then for two days the Board was in executive session, with every director present. Their reports showed continued growth in League membership and activity, a general feeling of satisfaction on the part of amateurs with the way the League has been handling their affairs, and a spirit of unity that we need for the trying days ahead. The minutes of the meeting are here reproduced for your information. A great many things of importance happened and you owe it to yourself to read the minutes carefully because we have space and time here to summarize them but briefly.

The sad state in which the world finds itself these days naturally was reflected in our affairs at this meeting by the Board. The full cooperation of amateur radio is being offered our Government in any way in which it may be needed. All through the Board meeting the feeling kept cropping out that amateur code proficiency was one of the most important things these days, and
the officers of the League were directed to take certain steps that will help amateurs to build up their code proficiency and make them conscious of its great importance. Realizing that things can move very fast at such a time as this, and that multi-men committees and boards might be too slow to deal with an emergency concerning our frequency bands, the Board made a very large grant of powers to the President to act as a committee of one in such a crisis, following a unanimous recommendation to this effect by the Committee on Amateur Frequency Assignments. We hope it will never come to that, but we are ready. Steps were also ordered taken to unite amateur opinion in the two Americas, in keeping with the fact that of major countries it is now only Latin America and ourselves who remain on the air. We need members, too, and every active amateur ought to be a member of the League, that we may move in concert — and so the Board appointed a new Membership Committee to build up League membership.

As usual at Board meetings, the question of phone allocation came in for a long consideration. At the end, it was decided to print a proposition in QST and take a poll of amateur sentiment on it. It will be printed next month. Briefly, the plan is to see whether you approve widening the phone allocation to 3800-4000 kc and also, separately, whether you approve widening and shifting the 20-meter allocation to 14,000-14,200 kc. If you do, and if the Commission is willing, the Board is disposed to go ahead with the proposals. If you turn them down they will die there — at least for another year.

On the business side, you will remember that the Board last year appointed a committee to engage a firm of business engineers to make a survey of the League headquarters establishment. This job was finished this spring and the report made to the directors. It is only natural that they should have found room for improvement, but in general they found the headquarters highly satisfying and so advised the Board in a report of 67 pages and many tables and charts. This report the Board examined in considerable detail. The pertinent portions of it will be published soon by the Board, probably next issue, for your information. Acting upon a major recommendation of the report, the Board formed a Finance Committee to advise in the establishment of budgets, in approving investments, etc. This committee consists of Mr. Reid, chairman, and Messrs. Blalack and Hill. . . . Also on the business side, the Board again examined proposals for setting up a social security or retirement plan for League employees, who are not covered by the Social Security Act, but again rejected all proposals. . . . Appropriations totaled $7825, being $3200 for the cost of the meeting, $3625 for director expenses in 1941, $500 for the Finance Committee and $500 available for sending SCM's and QSL Managers to their division conventions.

The only requests to be made immediately of the F.C.C. are for the repeal of the "nuisance regulation" about every mike-user having to sign the log, and a plea for more examining points, particularly with a view to having one in each state. . . . The Board shelved propositions to ask F.C.C. to open part of the five-meter band for television and part of the ten-meter band for f.m.

On the administrative side, the Board examined and rejected a proposal that two of the division directors be selected to double as president and vice-president, but did adopt a provision excluding the president and vice-president from voting on changes of by-laws. They similarly declined to relax eligibility requirements, to authorize official delegates to conventions, and to expand the Royal Order of the Wouff Hong. A few changes in by-laws were made for administrative convenience. For the particular information of our Canadian members we should like to explain that the changes in by-laws concerning Canada are purely for convenience and that they are absolutely without change of effect or intention; in fact, the important two last by-laws are repeated in precisely the former language.

Amateur radio's liaison with the Red Cross was improved by the adoption of an expression of League aims and policies toward the Red Cross, a mutual recognition of the needs and capabilities of both organizations in time of community distress.

In the officers' elections held at the close of its annual meeting, the Board elected George W. Bailey, W1KH, as president of the League, succeeding Dr. E. C. Woodruff, W8CMP. Charles A. Blalack, W6GG, was elected vice-president, as­suming the post relinquished by Mr. Bailey. W1KH, well-known throughout the country because of his frequent appearances at hamfests and conventions, brings to his new post a thorough familiarity with amateur problems resulting from a long and active career on the air, as well as a business background and a personality well­fitted for leadership. W6GG becomes the first Pacific Coast officer the League has had, and his election is expected to improve East-West liaison in A.R.R.L. affairs. He, too, has a long background of amateur experience and has been active in the Board as director of the Southwestern Division.

Dr. Woodruff, W8CMP, retiring as president after two terms in the chair, was elected to succeed the late Hiram Percy Maxim upon his death in 1938. The second president the League has had in all its quarter-century of existence, Dr. Wood-
ruff has held high the torch of lofty idealism, of unquenchable devotion to the principles of public service and national responsibility, bequeathed by his predecessor. Handled a hard job made harder by the stature of the man who came before him, he succeeded in it to a degree that only his will would be dominant. His wisdom and humility, his sincere love for amateur radio and his untiring labors in its behalf, have made him well-loved and long to be remembered.

The minutes follow:

MINUTES OF 1940 ANNUAL MEETING OF THE BOARD OF DIRECTORS AMERICAN RADIO RELAY LEAGUE

May 31-June 1, 1940

In compliance with the Constitution and responsive to due notice, the Board of Directors of the American Radio Relay League, Inc., convened in regular annual meeting at The Hartford Club, Hartford, Conn., on May 31, 1940, with Dr. Fugene O. E. Boyce in the chair. The meeting was called to order at 10:30 A.M., Eastern Daylight Saving Time, and the opening roll call showed the following directors present:

Eugene C. Woodruff, President
G. W. Bailey, W. Vice-President
Alexander Reid, Canadian General Manager
E. Ray Aridge, Delta Division
Charles E. Blalack, Southwestern Division
Hugh L. Cavness, Roanoke Division
Ralph J. Gibbons, Northwestern Division
Glen R. Glasscock, Rocky Mountain Division
William A. Green, West Gulf Division
Kenneth T. Hill, Hudson Division
W. Bradley Martin, Atlantic Division
J. L. McCargar, Pacific Division
Percy C. Noble, New England Division
Hugh L. Caveness, Roanoke Division
Floyd E. Norwine, Jr., Midwest Division
William C. Shelton, Southeastern Division
Fred W. Young, Dakota Division

Absent, R. H. G. Mathews, Central Division. There were also present Secretary K. B. Warner, Communications Manager F. E. Handly, Assistant Secretary A. L. Burdolf and, as technical advisor to the Board, J. J. Lamb, A.B.R.L. Research Engineer. At the invitation of the Board, there was also in attendance as a non-participating observer, Alternate Director Russell Bennett, New England Division. The Chairman received a letter from Treasurer A. A. Hebert, sending his greetings to the Board and regretting his inability to be present because of illness.

On motion of Mr. Cavness, unanimously VOTED that the minutes of the 1939 annual meeting of the Board of Directors are approved in the form in which they were issued by the Secretary.

On motion of Mr. Green, unanimously VOTED that the annual reports of the officers to the Board of Directors are accepted and the same placed on file.

On motion of Mr. Cavness, after discussion, VOTED that all acts performed and all things done by the Executive Committee since the last meeting of the Board, and by it reported to the Board, are ratified and confirmed by the Board as the actions of the Board.

On motion of Mr. Blalack, after discussion, VOTED that the Board, having considered its mail action in which it decided not to call for new elections in the Central, Roanoke and Southwestern Divisions, pursuant to the 1939 revision of By-Law 21, now ratifies the action taken and decides to take this position as of September 18, 1939. Mr. Young requested the Board to be notified of any action which it may take in this regard.

On motion of Mr. Green, unanimously VOTED that the Board, having considered its mail action in which it decided not to call for new elections in the Central, Roanoke and Southwestern Divisions, pursuant to the 1939 revision of By-Law 21, now ratifies the action taken and decides to take this position as of September 18, 1939.

On motion of Mr. McCargar, unanimously VOTED that
ascertain how the Federal Communications Commission would regard a formal request from the League on the said subjects. He shall then advise the Board the results both of the poll and of his solicitation of F.C.C. sentiment, and shall seek the further instructions of the Board. That the Secretary is instructed to print in the issue of QST carrying the poll an article showing the reasons and justifications for the poll. After further discussion, the yeas and nays being ordered, the said question was decided in the affirmative:
Whole number of votes cast, 14; necessary for adoption, 8; yeas, 13; nays, 1. Those who voted in the affirmative are Messrs. Arledge, Blalack, Caveness, Gibbons, Glasscock, Green, Hill, Martin, Mathews, McCargar, Norwine, Shelton and Young. Mr. Noble voted opposed. Messrs. Woodruff, Bailey and Reid abstained. So the motion was amended.

The question then being on the adoption of the amended motion, and the yeas and nays again being ordered, the said question was decided in the affirmative:
Whole number of votes cast, 14; necessary for adoption, 8; yeas, 8; nays, 6. Those who voted in the affirmative are Messrs. Arledge, Blalack, Hill, Mathews, McCargar, Norwine, Shelton and Young. Those who voted opposed are Messrs. Caveness, Gibbons, Glasscock, Green, Martin and Noble. Abstentions: Messrs. Woodruff, Bailey and Reid. So the poll was ordered in the language proposed.

At the instance of Mr. Gibbons, the Board proceeded to an examination of the report of the survey of the headquarters organization. On motion of Mr. Gibbons, ORDERED that Messrs. Handy, Budlong, and Lamb retire from the meeting. After discussion, on motion of Mr. Mathews, VOTED that the Board of Directors shall appoint a Finance Committee, in accordance with the recommendations of the survey, page 61, to act in an advisory capacity in the establishment of expense budgets and the results obtained in comparison to these budgets, and to approve investments and otherwise provide a check on the responsibilities of the Treasurer and of the Secretary; the committee to consist of three members elected by the directors from amongst their own number, and to serve for one year. On motion of Mr. Gibbons, the Board proceeded to the selection of a committee by ballot. Mr. Mathews nominated Messrs. Blalack, Caveness and Reid. Mr. Caveness withdrew his name. Mr. Noble nominated Mr. Bailey. Mr. McCargar nominated Mr. Hill. The Chairman appointed Mr. Segal as teller to canvass the ballot. The result was the selection of the following committee: Mr. Reid, chairman; Mr. Blalack; Mr. Hill.

On motion of Mr. Noble, after discussion, VOTED that A. A. Hebert having retired as office manager and manager of credit & collections on the Secretary's staff, his salary as Treasurer of the League is fixed at $2000 per year, effective June 1, 1940. Mr. Gibbons requested to be recorded as voting opposed.

The Board was in recess from 5:06 p.m. to 5:16 p.m. After further extended discussion of the survey report, on motion of Mr. Gibbons, unanimously VOTED that the members of the Board are authorized to make this report available to any member of the League upon request. At this point Messrs. Handy, Budlong and Lamb rejoined the meeting at the request of the Board.

Moved, by Mr. McCargar, to amend certain portions of the Constitution & By-Laws to read respectively as follows:

Section 2, Article III, Constitution: The President and Vice-President shall be elected by the Board of Directors from among their number and shall hold office for two years, or until their successors are elected and qualified, provided they continue to be members of the Board of Directors. The Secretary, the Communications Manager and the Treasurer shall be appointed by the Board of Directors.

Section 1, Article IV, Constitution: The affairs of the League shall be managed by a Board of Directors under the Constitution & By-Laws and the general provisions of the laws under which it is incorporated. The Board of Directors shall consist of one Director from
each of the several territorial divisions of the League in the United States and Possessions, elected by the members of the League thereof, and a Canadian General Manager.

By-Law 25: The President and Vice-President of the League shall be elected by the Board of Directors at their annual session in presidential election year.

By-Law 26: The President and Vice-President shall be elected at the annual session of the Board of Directors held in each even-numbered year. Their terms of office shall begin at the conclusion of the meeting at which they are elected and shall continue for two years, or until their successors are duly elected and qualified, provided they continue to be members of the Board of Directors.

After discussion, the yeas and nays being ordered, the said question was decided in the negative: Whole number of votes cast, 15; necessary for adoption, 12; yeas, 2; nays, 13. Messrs. McCargar and Reid voted in the affirmative. Those who voted in the negative were Messrs. Arledge, Blalock, Caveness, Gibbons, Glasscock, Green, Hill, Martin, Mathews, Noble, Norwine, Shelson and Young. Messrs. Woodruff and Bailey abstained. So the motion was lost.

Moved, by Mr. Glasscock, that each A.R.R.L. affiliated club and/or A.R.R.L. section be authorized to send to its division convention one delegate for each twenty-five club members or fraction thereof, such delegation to carry to the convention any resolutions or other matters for consideration by the convention, and to speak for the club during discussions on resolutions. But, after discussion, the said motion was rejected.

Moved, by Mr. McCargar, that By-Law 12 be amended to provide that, amongst those declared to be eligible for membership, employees of such servicing businesses, provided they do not service or handle amateur equipment. After discussion, the motion was rejected, 5 votes in favor to 9 opposed.

Moved, by Mr. Glasscock, that there be included in the By-Laws appearing under the heading "Canada" and now comprising Division VII of the Constitution similar language to the effect that, whenever Canadian amateurs shall petition for their own organization, and it is manifest to the majority of the entire Board of Directors that the success of a separate Dominion organization is assured, the Board of Directors, at any annual meeting of the Board, shall thereupon adopt a resolution to this effect.

On motion of Mr. Shelton, unanimously VOTED that the League, through its Secretary, shall work towards the establishment of a F.C.C. examining point in every state, the objective being the eliminating of the large numbers of Class C licenses now existing.

On motion of Mr. Shelton, unanimously VOTED that the Section Communications Manager be allowed to meet with the director in joint meeting at the expense of the League, in lieu of attendance at state or division conventions, this meeting to be held directly before the Board meeting. But, after discussion, the said motion was rejected. So the motion was lost.

On motion of Mr. Shelton, unanimously VOTED that the Communications Manager is directed to provide the League in the United States and Possessions shall be responsible to the Board of Directors for League welfare in all matters in Canada. He shall keep himself informed of all conditions and activities in Canada on the needs and desires of League members therein, that he may faithfully and intelligently represent them in the Board of Directors. He shall, so far as possible, attend all meetings of the Board of Directors. At each annual meeting of the Board, he shall present a written report to the entire Board of Directors that the success of a separate Dominion organization is assured, the Board of Directors, at any annual meeting of the Board, shall thereupon adopt a resolution to this effect.

On motion of Mr. Glasscock, unanimously VOTED that the Communications Manager is directed to provide the directors a summary of the results of the frequency-measuring tests of Official Observers after each test.

On motion of Mr. Glasscock, unanimously VOTED that the President is directed to appoint a committee of three members of the Board as a Membership Committee, to increase League membership.

By-Law 28: A Canadian General Manager and an alternate shall be elected in each odd-numbered year. All the provisions of these By-Laws affecting or governing directors and alternate directors from the divisions of the League in the United States and Possessions shall apply to the Canadian General Manager and his alternate; provided, however, that the holders of these offices, and their nominees, and any petitioners for a witness, shall be responsible to the Board of Directors that they may faithfully and intelligently represent them in the Board of Directors. He shall, so far as possible, attend all meeting of the Board of Directors. At each annual meeting of the Board, he shall present a written report to the entire Board of Directors that the success of a separate Dominion organization is assured, the Board of Directors, at any annual meeting of the Board, shall thereupon adopt a resolution to this effect.

The Canadian General Manager shall be a member of the Board of Directors. He shall be the liaison officer of the League between the Board of Directors and its Canadian members. He shall have general supervision of all League activities in Canada and shall be responsible to the Board of Directors for League welfare in all matters in Canada. He shall keep himself informed of all conditions and activities in Canada on the needs and desires of League members therein, that he may faithfully and intelligently represent them in the Board of Directors. He shall, so far as possible, attend all meetings of the Board of Directors. At each annual meeting of the Board, he shall present a written report to the entire Board of Directors that the success of a separate Dominion organization is assured, the Board of Directors, at any annual meeting of the Board, shall thereupon adopt a resolution to this effect.

The policy of the League in Canada shall be that of a friendly hand for the amateurs of a sister country, pending their growth to such numbers and strength that their ability to form and conduct a self-governing non-commercial amateur organization throughout the Dominion is evident. The activities of the League in Canada shall be regarded as a temporary stewardship undertaken at the request of Canadian amateurs. Whenever Canadian amateurs shall petition for their own organization, and it is manifest to a majority of the entire Board of Directors that the success of a separate Dominion organization is assured, the Board of Directors shall in establishing and proclaiming a separate all-Canadian organization to be known as the Canadian Radio Relay League, in which the League in the United States and Possessions shall have a constitution similar in tenor to that of this League; and this League shall thenceforth relinquish all direct activity in Canada.

The years and nays being ordered, the said question was decided in the affirmative: Whole number of votes cast, 15; necessary for adoption (in view of the amendment of By-Law 54), 10; yeas, 15; nays, 0. Only one director voted in the
affirmative, except the President and Vice-President. So the by-laws were amended as proposed.

Moved, by Mr. Blalack, that in the two places each in By-Laws 21 and 31 where there is reference to a period of five hundred dollars ($500) is hereby appropriated for the tryout under the terms and conditions set forth in the plan; that the Treasurer of the League be appointed by the Board, at the General Manager's discretion, to audit and approve the report of the Committee; and to draw up legislation to that effect and to propose such legislation to the United States Congress to represent the American people in carrying on emergency Coordinator to serve as a member of the Red Cross chapter to extend radio planning into chapter jurisdictions and to correlate radio amateur operations to assure the best possible amateur radio facilities. The cooperation with American Red Cross chapters may be furthered by individual chapters' designation of an American Radio Relay League Emergency Coordinator to serve as a member of the Red Cross Chapter Sub-Committee on Transportation & Communication as recommended in the Chapter Disaster Preparedness & Relief Manual, ARC 299.

On motion of Mr. Mathews, after discussion unanimously VOTED that the Secretary is instructed to recommend to the Federal Communications Commission the striking out of that part of paragraph b of F.C.C. Rule 122.45 which relates to the signing of the log of an amateur phone station by all persons using the microphone.

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Clayton Radio Club, Clayton, N. Y.
Kensington Amateur Radio Association, Elyria, Ohio
Kenosha Kilocycle Club, Kenosha, Wis.
The Amateur Radio Researchers Club, Los Angeles, Calif.
Young Ladies' Radio League, Bowbells, N. Dak.
Glendale Amateur Radio Society, Glendale, Calif.
Wall Street Radio Club, New York City.

Moved, by Mr. Arledge, that a permanent advertising committee of three members elected from members of the Board by the members of the Board be elected each year and to serve until the following Board meeting for the purpose of passing on the eligibility of advertisers to the columns of QST when and before any advertiser is rejected by the Secretary or advertising manager; a vote of one to one being fatal. Extended discussion ensued, after which, the yeas and nays being demanded, the said question was decided in the affirmative: Whole number of votes cast, 15; necessary for adoption, 10; yeas, 15; nays, 0. Every director voted in the affirmative, except the President and Vice-President. So the by-laws were amended as proposed.

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Wall Street Radio Club, New York City.
QSL Managers of the League, within the continental limits of the United States, to attend one official A.R.R.L. convention within the call areas for which they are the respective QSL Managers during the time between this date and the date of the holding of the next annual meeting of the Board, provided that such convention be within a radius of 300 miles from the QSL Manager's place of residence; reimbursement to be made at the rate of two cents per mile via the shortest commonly-traveled route, plus one night's hotel accommodation at $2.50, and an allowance of $2.00 for convention registration fee; allowance of these expenses to be subject to approval by the Communications Manager upon examination of detailed report of the activities of the Section Communications Manager or QSL Manager at each such convention, to be submitted with his expense account; and any unexpended remainder of this appropriation at the date of the holding of the next annual meeting of the Board to be restored to surplus. Moved, by Mr. Young, to amend the motion by striking out the provision for QSL Managers; but the said motion was rejected, 5 votes in favor to 9 opposed. On motion of Mr. Martin, unanimously VOTED to amend the motion to substitute the word "the" for the words "$2.00 for;" so that the full amount of the convention registration fee is allowed. Moved, by Mr. Martin, further to amend the motion to provide an allowance of the railroad coach fare instead of two cents per mile; but the said motion was rejected. The question then being upon the adoption of the motion as amended in respect of the convention registration fee, the same was thereupon ADOPTED.

Moved, by Mr. Gibbons, that there be hereby appropriated from the surplus of the League, as of this date, the sum of three thousand two hundred dollars ($3200) for the purpose of defraying the expenses of holding this meeting of the Board, any unexpended remainder of the sum to be restored to surplus. Moved, by Mr. Young, to amend the motion by striking out the provision for QSL Managers; but the said motion was rejected, 5 votes in favor to 9 opposed. On motion of Mr. Martin, unanimously VOTED to amend the motion to substitute the word "the" for the words "$2.00 for;" so that the full amount of the convention registration fee is allowed. Moved, by Mr. Martin, further to amend the motion to provide an allowance of the railroad coach fare instead of two cents per mile; but the said motion was rejected. The question then being upon the adoption of the motion as amended in respect of the convention registration fee, the same was thereupon ADOPTED.

On motion of Mr. Gibbons, that directors' annual reports be submitted to headquarters four weeks before the annual meeting; that headquarters make copies of same and mail to each director copies of all reports, so that the same shall be received by the individual directors at least two weeks before the annual meeting. But, after discussion, the motion was rejected, 7 votes in favor to 8 opposed.

The Board recessed for luncheon at 12:25 p.m., reconvening at 1:50 p.m. with all directors and other persons hereinbefore mentioned in attendance.

Mr. Noble presented a unanimous report of the Committee on Amateur Frequency Assignments. On motion of Mr. Norwine, unanimously VOTED to accept the report as read and place the same on file.

Pursuant to the foregoing report, on motion of Mr. Noble, after discussion of the problem of preserving amateur rights in the present situation, unanimously VOTED (1) that the Board of Directors makes an open authorization of ten thousand dollars ($10,000) for the defense of amateur frequencies; and (2) that the President of the League is appointed as a committee of one with full power to act at his own discretion and without supervision in the expenditure of this fund, without liability as to anything except misappropriation; and (3) that the President is requested, but not bound, to use the services of Means, Warner and Segal at any stage he may think necessary; and (4) if, in the judg-
OFFICERS’ REPORTS AVAILABLE TO MEMBERS

In April of each year the officers of the League make comprehensive written reports to the Board of Directors. The Board of Directors has made these reports available to the membership of the League. Interested members may obtain copies post-paid at the cost price of 50¢ per copy. Address the Secretary at West Hartford.

On motion of Mr. Young, unanimously VOTED that the Secretary is instructed to prepare a statement of the expenses of each person connected with the 1940 meeting of the Board and send it to all directors after the expenses are all determined.

Moved, by Mr. Noble, that one page of QST be devoted each month to emergency work — including rules for procedure and names of county and community coordinators. After discussion, with unanimous consent, Mr. Noble simplified the motion to provide that one page of QST be devoted each month to emergency work. But, after further discussion, the motion was rejected.

On motion of Mr. Caveness, after discussion, unanimously VOTED that the 1941 annual meeting of the Board shall be held in Hartford on Friday and Saturday, May 9th and 10th.

Proceeding to the election of president and vice-president, on motion of Mr. Mathews, two-thirds concurring, Special Rule A was suspended. The Chair appointed Alternate Director Bennett and General Counsel Segal as Tellers. By special order of the Board, secret written nominations were made.

Nominations for president being in order, the Tellers announced that those nominated were Mr. Woodruff, Mr. Bailey and Fred H. Schnell of Chicago. The vote was then taken and the result of the ballot was announced by the Tellers as follows:

Whole number of votes cast, 15
Necessary for election, 8
For Mr. Bailey, 11
For Mr. Schnell, 1
For Mr. Woodruff, 3

Mr. Bailey, having received a majority of the votes cast, was thereupon declared elected president of the League, for a term of two years.

Proceeding to the election of a vice-president, those nominated were Messrs. Black, Caveness, Reid, Schnell, Segal and Woodruff. The vote having been taken, the result of the first ballot was announced by the Tellers as follows:

Whole number of votes cast, 13
Necessary for election, 7
For Mr. Black, 5
For Mr. Caveness, 2
For Mr. Reid, 2
For Mr. Woodruff, 4

No candidate having received a majority, a second ballot was ordered, the result of which was announced as follows:

Whole number of votes cast, 13
Necessary for election, 7
For Mr. Black, 6
For Mr. Caveness, 1
For Mr. Reid, 1
For Mr. Woodruff, 5

No candidate having received a majority, a third ballot was ordered, the result of which was announced as follows:

Whole number of votes cast, 13
Necessary for election, 7
For Mr. Black, 7
For Mr. Woodruff, 6

Mr. Black, having received a majority of the votes cast, was thereupon declared by the Tellers to be elected vice-president of the League for a term of two years.

On motion of Mr. Gibbons, the Board rose in token of appreciation of the splendid services of Mr. Woodruff to the League. (Applause.) Mr. Bailey spoke briefly in appreciation of the honor shown him by his election.

On the joint motion of Messrs. Mathews and Gibbons, the Board adjourned, sine die, at 4:58 P.M.

(In the course of its deliberations the Board also discussed, without formal action, an appeal by K8NYD in the matter of the 1939 DX Contest, communication with the Byrd Antarctic Expedition, code tests from W1AW, F.C.C. monitoring work, headquarters movie, b.d.l image interference, emergency nets not devoted entirely to amateur activity, DX Contest rules, QST articles on home recording, the extension of Class A to the 105-meter band, automatic issuance of Class A after holding Class B three years, and the work of the Planning Committee. Total time in session, 14 hours, 13 minutes. Total appropriations, $7825.)

K. B. WARNER, Secretary.

Strays

W5ITX, who received his call on his fortieth birthday says, "Life begins at 40." — W5NW.

Silent Keys

It is with deep regret that we record the passing of these amateurs:
Robert A. Bradley, W8HB, Fleetwood, N. Y.
Thomas W. Burnett, W4FUR, Birmingham, Ala.
Frank V. Cantwell, Jr., W3FNN, Trenton, N. J.
William H. Glander, W2GCY, Newark, N. J.
William Hartwell Harrison, Jr., KB6SQ, Guam
Gerald W. Herrmann, W7DOR, Oregon City, Ore.
Jack R. Kean, VE3ADU, Windsor, Ontario
John J. Long, Jr., W8ABX, Brighton, N. Y.
William Lowry, VE5DG, Pouce Coupe, B. C.
Lt. Thomas H. Martin, W5IQS, ex-W9EQ, Ft. Worth, Texas
Col. L. Martin, ON4LM, Bruges, Belgium
Orison McCord, W2LBB, Jamaica, N. Y.
Charles W. McCracken, W9EUI, David City, Neb.
Paul C. Monroe, W8LPA, Mt. Vernon, Ohio
Wilbur Webb Ramage, W7EN, Salem, Ore.
Loren Willing Wood, ex-9EKF, Joliet, Ill.
Counting Words Per Minute Electrically

A Combination Audio Oscillator and Counter for Code Practice

BY M. J. LARSEN

The device described herein was built as an aid for code instruction. The average speed in words per minute is indicated by a meter to enable the sender to keep a continuous check on his rate. For convenience, a code oscillator and power supply are included on the same chassis.

Principle of Operation

The principle of operation of the counter may be explained with reference to the circuit diagram of Fig. 1. The key operates relay 1. One lever of this relay operates the oscillator. The other lever is connected to the grid of $V_2$, a 2A3, which operates relay 2. Between characters the key is open, levers of relay 1 released, and the grid of $V_2$ approaches the cathode potential as $C_1$ discharges through $R_1$. This activates relay 2. When the key is down condenser $C_1$ is charged very quickly through the lower resistance, $R_2$, the grid goes to ground potential and relay 2 releases, since the cathodes of the 2A3's are positive. By proper adjustment of $R_1$, relay 2 is activated only between characters and not between the dots and dashes of the character.

On the break of relay 2, the small condenser $C_2$ is charged by a 200- to 300-volt supply. On the make of relay 2 this charge is transferred to condenser $C_3$. The network composed of $C_3$, $C_4$, $C_5$ and $R_3$, $R_4$ acts as a low-pass filter so that the average charge and discharge current from $C_3$ flows through the grid resistors of the 6A6 with but very little pulsating component. Because of the values selected for the capacitances and resistances of the filter, $C_2$ does not rise to more than a few volts, say 6 volts, with a medium sending rate. Thus $C_2$ discharges from about 300 volts down to about 6 volts on each impulse of the relay. That is, $C_2$ transfers very nearly all of its charge to $C_3$ between each character. The charge transferred per second, then, which represents the average current flowing from $C_3$, is $Q_2 f$ where $f$ is the number of characters per second. The average current flowing through $R_3$ and $R_4$ is $Q_2 f$ or $C_2 E f$, where $E$ is the charging potential of $C_2$. The potential appearing between the two grids of the 6A6 is simply this current times the combined grid resistance or

$$2E_2 = C_2 f E f \left( \frac{R_2 (R_3 + R_4)}{R_3 + R_4 + R_7} \right). \text{(Approx.)}$$

The grid voltage, then, can be fixed roughly by adjustment of $C_2$ and $E$ for a given rate, while the finer adjustment can be taken care of by $R_7$.

The 6A6 operates the microammeter $M$ through a direct-current type of push-pull arrangement. The bias required for the 6A6, supplied by the 6H6, is not critical, although one particular bias for a given plate supply will produce the most linear relationship between $E_2$ and current through the meter. If the elements of the 6A6 are balanced, the meter will indicate zero with no signal on the grids. If the elements are not balanced, adjustment can be made by substituting a variable resistance for either $R_8$ or $R_9$.

Calibration

The counter was constructed to operate a 0-1 milliamper direct-current meter. Calibration was made on the basis of 5 characters per word. For 20 words per minute, therefore, the number of impulses per second, $f$, becomes 1.67. Adjustments of $C_3$, $E$, and $R_7$, as given in the above equation, were made so that full scale on the

A novel method of continuous measurement of sending speed. Possibly a bit elaborate for the average beginner, but a useful device for the radio club which conducts code classes.

meter represented 20 words per minute. Thus the rate could be read easily from the meter with no change in scale and without using a calibration curve. By further adjustment of \( R_7 \), full scale can be made to indicate 40 words per minute.

Departures from true reading are caused by \( C_2 \) not quite discharging the same amount because of some voltage variation across \( C_3 \) with change in rate, by a slight non-linearity between grid voltage and meter current, and line voltage fluctuations. By test, however, the total error has not exceeded 5 per cent.

Oscillator and Power Supply

The oscillator employed is a tuned-grid type with \( C_8 \) adjusted with respect to the reflected inductance of a high-impedance speaker to give a tone having about a 500-cycle frequency. Keying is accomplished by changing the grid of the 2A3 from ground to cathode potential through the outer lever of relay 1.

The main power supply from the 83 is conventional except that the extra bleeder is provided for the adjustment of the charging potential of \( C_2 \). Extensive filtering is not necessary, a single choke-input section being sufficient.

An assembled view of the apparatus is shown in the photograph. The only controls are the knobs for adjusting \( R_1 \) and \( R_7 \). Once calibrated, the only adjustment necessary is that of \( R_1 \), which each sender may have to adjust somewhat to suit his style and approximate speed. The requirement for correct indication of the rate is that the sending be reasonably well done. If there is little discrimination between character spacing and the spacing between dots and dashes, then the time delay will not function properly. But this is a helpful limitation in that it demands good sending.

![Circuit diagram of the code counter and oscillator.](image)

**Fig. 1** — Circuit diagram of the code counter and oscillator.

- \( R_1 \) — 0.5-megohm volume control.
- \( R_2 \) — 1000 ohms, 1-watt.
- \( R_3, R_4, R_5, R_6 \) — 0.5 megohm, ½-watt.
- \( R_7 \) — 2-megohm volume control.
- \( R_8, R_9 \) — 5000 ohms, 1-watt.
- \( R_{10} \) — 20,000 ohms, ½-watt.
- \( R_{11} \) — 15,000 ohms, 1-watt.
- \( R_{12} \) — 8000 ohms, 2-watt adjustable.
- \( R_{13} \) — 25,000 ohms, 1-watt.
- \( R_{14} \) — 50,000 ohms, 1-watt.
- \( R_{15} \) — 25,000 ohms, 10-watt adjustable.
- \( R_{16} \) — 15,000 ohms, 10-watt adjustable.
- \( R_{17} \) — 8000 ohms, 10-watt.
- \( C_1 \) — 0.5 µfd., 100-volt.
- \( C_2 \) — 0.02-µfd. paper, 600-volt.
- \( C_3, C_4, C_5 \) — 2-µfd. paper, 100-volt.
- \( C_6 \) — 16-µfd. electrolytic, 100-volt.
- \( C_7 \) — 8-µfd. electrolytic, 500-volt.
- \( C_9, C_10 \) — 0.02-µfd. paper, 400-volt.
- \( L_1 \) — 12 henrys, 150 ma. (Thordarson T-17C00-B).
- \( T_1 \) — Audio-output transformer, 1:1 ratio.
- \( T_2 \) — 440 volts each side c.t., 125 ma.; bias tap at 38 volts; with 5-, 2.5- and 6.3-volt windings (Thordarson T-74R28).
- \( M \) — 0-1 milliammeter.
- \( R_{y1}, R_{y2} \) — D.p.d.t. relays to operate on 20 ma. (Type used is W.E. E-165.)
An Efficient U.H.F. Unit for the Amateur Television Transmitter

Crystal-Controlled 112-Mc. Output for Video or Voice Modulation

BY L. C. WALLER,* W2BRO

The r.f. unit described in this article is particularly designed for amateur television transmission, in combination with the camera-modulator unit described by Mr. J. B. Sherman in May QST. Addition of the receiver described in the June issue completes the amateur television station.

At present there are three frequency bands available for amateur television transmissions.

* RCA Mfg. Co., Inc., Harrison, N. J.
1 "A New Electronic Television Transmitting System for the Amateur"; QST, May, 1940.
2 "A Receiver for the New Amateur Television System"; QST, June, 1940.

These are 112-116 Mc., 224-230 Mc., and all frequencies above 300 Mc. It is desirable, for technical reasons, to use the lowest frequency band available; hence, this transmitter is designed to operate in the present 112-116 Mc. (2½-meter) band.

At first thought, it might seem that a transmitter suitable for handling amateur television signals would have to be of very special design; however, such is not the case. The r.f. unit, shown in the circuit of Fig. 1 and the accompanying photographs, is of simple, straightforward, u.h.f. design. Only 4 r.f. stages are required, thanks to the Tri-tet crystal oscillator which quadruples the 7.119-Mc. crystal frequency. Any good 40-meter crystal can be used.

The 6L6 oscillator is followed by two 6L6 frequency doublers, as shown in Fig. 1. The new RCA-829 twin beam-power tube, especially designed for u.h.f. operation, is used as a straight 112-Mc. r.f. power amplifier. This tube is especially well adapted because of its low driving-power and low modulating-power requirements. The 829, in grid-modulated amplifier service, requires only 0.5 watt of r.f. driving power and negligible video modulating power. The necessary video modulating signal of only 17 volts peak value is easily supplied from the cathode circuit of the 6L6 modulator (located on the camera unit). The carrier output of the 829 operating at about 500 volts is approximately 23 watts.

The Tri-tet crystal oscillator stage is conventional. As usual with this highly efficient circuit, careful attention must be given to the design and adjustment of the cathode tank, $L_1$-$C_1$. Self-excited oscillations are practically certain to occur if the value of $L_1$ or $C_1$ is not correct. When the oscillator is operating with the plate tank $L_2$-$C_2$ tuned out of resonance, the d.c. plate current will be 45 or 50 ma. At no-load resonance (with $C_7$ disconnected), the oscillator plate current should make a fast, sharp dip of about 8 to 14 ma. Care must be taken that the 28-Mc. fourth harmonic is selected; a plate-current dip at the 21-Mc. third harmonic will also be within the tuning range of $L_2$-$C_5$. The crystal-current indicator bulb $B$ will glow just a little more than a dull red when the Tri-tet is working properly. When the oscillator plate tank is tuned to the
fourth harmonic of the crystal, the crystal current should make a noticeable dip.

The 56-Mc. doubler stage is also conventional. No trouble was experienced in its adjustment or operation. The 112-Mc. doubler is unusual only with respect to the "series-tuned" plate-tank circuit employed. An ordinary parallel-tuned circuit will not provide as good efficiency or power output at 112 Mc., because of the poor L-C ratio obtainable. In the circuit shown, the tube output capacitance is in series with C14. These capacitances tune L4 somewhat like a split-stator condenser, with the result that the total effective capacitance shunted across L4 is only one-half that of the tube capacitance alone. Thus, L4 can have almost as much inductance as the 56-Mc. doubler plate coil, L2. The inductance of L4 should be adjusted by squeezing or pulling the coil turns until C14 resonates when half meshed. In this manner, the r.f. voltage node on L4 can be made to fall very close to the center of the coil. The power output of the 112-Mc. doubler is almost as good as that of the 56-Mc. doubler; it is even adequate for plate modulation of the 829, where a final-amplifier d.c. grid current of 11 ma. is required.

The 829 stage uses a resonant-line (1/4-wave) plate circuit and a fixed-tuned grid circuit. The grid coil, L7, is tuned only by the tube input capacitance. Tuning is initially accomplished by adjusting the length of L7. The latter can be squeezed or elongated by means of two bakelite dowel rods; resonance is indicated by the 829 d.c. grid-current meter. A final-amplifier grid current of 2 ma., or slightly less, is adequate for grid-modulated television service. If the grid current is too high, it can be reduced by loosening the coupling of L5 or L6, by reducing the plate voltage on one or both of the doubler stages (the preferable method), or by slightly detuning the 112-Mc. doubler stage.

Really practical amateur television transmission has arrived, at last. And here is the evidence that there is nothing especially complicated about the r.f. end of a ham television transmitter. The job described by W2BRO in this article has been thoroughly proved in field tests, in combination with the camera-modulator and receiver units described by J. B. Sherman in May and June QST, and has clearly demonstrated the straightforward practicability of good quality amateur television communication with simplified, economical apparatus. This 112-Mc. rig has shown its worth as a high-grade 'phone transmitter, too. So look it over, u.h.f. 'phone gang.
ground end, so that under no condition of operation with the 829 screen voltage exceed 225 volts, measured to the cathode (not to ground). The amplifier plate-tank circuit is tuned to resonance by means of condenser C21, after the shorting bar at the cathode (not to ground). The amplifier plate-tank circuit is tuned to resonance by means of condenser C21, after the shorting bar at the upper end of the plate rods has been adjusted approximately to the proper position. The 829, like other beam types, should never be operated without a load. A 25-watt lamp clipped across the plate rods 4 or 5 inches from the plate-grid, 6.6 A1

Fig. 1 — Circuit of the 112-Mc. transmitter.

C1, C7, C10 — 3-30 μfd. mica trimmer (Hammarlund MEX).
C2, C3, C4, C5, C6 — 0.002 μfd. mica (Aerovox).
C9 — 75-μfd. variable (Cardwell Type ZU-75-AS).
C8, C9, C10, C11 — 500-μfd. midget mica.
C11, C12 — 25-μfd. variable (Cardwell Type ZR-25-AS).
C16 — 25- to 50-μfd. midget mica (May be omitted).
C17 — 25-μfd. electrolytic, 100-volt working.
C18 — 50-μfd. electrolytic, 25-volt working.
C19 — Special variable condenser (see text).
C22 — C23 — 500-μfd. mica.
R1 — 7,500 ohms, 0.5 watt.
R2 — 500 ohms, 2 watts.
R3 — 20,000 ohms, 2 watts.
R4, R5 — 5000 ohms, 25 watts, adjustable.
R6 — 150,000 ohms, 0.5 watt.
R7, R8, R9 — 5000 ohms, 5 watts.
R10, R11 — 10,000 ohms, 2 watts.
R12 — 25,000 ohms, 0.5 watt.
R13 — 2500 ohms, 25 watts.
R14 — 3000 ohms, 0.5 watt.
R15 — 20,000 ohms, 25 watts, adjustable (see text).
R17 — 290 ohms, 25 watts.

X — 40-meter crystal, 7018.7 to 7231.2 kc.
RFC — 2 1/2 mh, r.f. choke (National Type R-100).
B — Tan head pilot bulb, 63 v, 150 ma. (G. E. Mazda No. 40).
P — 5-pin wafer socket.
J1 to J3 — Single-closed-circuit meter jacks.
L1 — 10 turns No. 26 d.c. on 1/4" form, 3/8" long.
L2 — 7 turns No. 12 bare solid wire, 1/4" outside diameter, 1/2" long, air-wound.
L3 — 4 turns No. 12 bare solid wire, 3/8" outside diameter, 1/2" long, air-wound.
L4 — 3 1/2 turns No. 12 bare solid wire, 1/4" outside diameter, 3/8" long, air-wound, center-tapped.
L5, L6 — 1-turn link coils, No. 18 insulated push-back wire, diameter to fit around center of L4 and L7, respectively.
L7 — 4 turns No. 18 bare solid wire, 3/8" outside diameter, approx. 3/8" long (see text), center-tapped.
L8 — Two pieces 3/8" solid copper rod (or tubing) each 1 1/2" long, spaced 3/4" center-to-center (see text).
AA1 — To antenna feeders. An RCA Type UT-106 socket is used for the 829.

The chassis is 3" x 6" x 18", 1/4" aluminum.
amplifier grid circuit by means of $C'_{11}$ and $R_{13}$.

The resistance of $R_{13}$ should be low enough to avoid degeneration effects due to modulation of the d.c. grid current, and high enough so as not to load the video modulator output circuit too heavily. A value of 3000 ohms is satisfactory.

In order to grid-modulate the 829 properly, it is essential that the plate circuit be heavily loaded. In other words, when $C_{21}$ is detuned from resonance, the amplifier plate current should not rise more than a few milliamperes. This heavy-loading requirement is characteristic of "efficiency" modulating systems.

Because of the relatively large power input and plate dissipation which the 829 is rated to handle, and its small physical size, the bulb of this tube becomes very hot during operation. For this reason, forced-air cooling is essential. Any small, inexpensive electric fan placed 6 or 8 inches from the tube will provide the necessary cooling.

Table 1 gives the more important voltage and

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<tr>
<td><strong>D.C. Plate Voltage</strong></td>
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*Total current for both units.

Fig. 2 — Circuit of the Television Transmitter Power Supply.

L1 — 5-20-henry 300-ma. swinging choke (Thordarson T-19C36).
L2 — 12-henry 300-ma. smoothing choke (Thordarson T-19C43).
P1 — 5-pin ceramic socket.
P2, P3 — 115-volt male plugs, chassis type.
P4, P5 — 117-volt bull’s eye pilot lamps, candelabra base, color as indicated (Drake No. 75).
F — 3-amp. radio fuse (Littelfuse No. 3AG).
S1, S2 — S.p.s.t. toggle switch, 250-V, 6 A. (Cutler-Hammer).

Underneath the power pack with the base plate removed. Note the safety interlock female socket strip to the left of the 866 rectifier sockets. A male plug mounted on the base plate (not shown) closes the primary circuit when the bottom is covered. The output filter capacitance $C_a$ consisting of four 20-µfd, 450-volt electrolytic condensers connected in series-parallel was added after this photograph was taken. These condensers are readily mounted on terminal strips under the chassis.

Safety features include shielding of the 866’s and all high-voltage terminals, as well as an interlock in current readings of all four r.f. stages, under normal carrier conditions. The voltages are measured to chassis.

The power supply for the transmitter is shown in the circuit of Fig. 2. Constructional details can be seen in the illustrations. Two 866’s are employed in this unit, because the peak inverse voltage involved is considerably above the rating of tubes such as the 83 and 5Z3.

(Continued on page 96)
A Different Portable-Emergency Transmitter

Simplified Design With the Inverted Amplifier

BY R. P. AUSTIN,* W3EVA

Now that emergency amateur equipment has had its "baptism in fire" on many occasions during the past few years, the need for such gear in every ham station should be quite apparent. The argument that it might never find use in some localities is not a particularly good one — New England thought "it can't happen here," and was fooled.

Normally the starting point in the design of an auxiliary rig is the junk-box, and that's where I started on this one. A few odd condensers, coil forms and beam-power tubes turned up, and a small 5-by 6-by 9-inch metal cabinet that was slowly gathering dust crystallized the design.

The Circuit

With c.w. operation in mind, and break-in operation a "must," the need for good, clean keying at any speed was imperative. My personal favorite in this line is the regenerative pentode oscillator. I have two of them now, and either one keys beautifully, with any of 18 crystals, without chirps, blurs, or blooms at speeds up to 150 w.p.m. These keying tests have been conducted with a tape transmitter, tape recorder and an oscilloscope. No difficulty was encountered

* 113 Second Street, Laurel, Md.

with a key lead up to 50 feet in length, and no keying relays were used. So experience indicated the regenerative oscillator circuit, and the junk-box dictated a 6V6G tube. A 6V6, 6F6 and 6L6 all were tried later, with some differences in output but none in keying characteristics.

A very desirable form of amplifier to follow the oscillator would be one that is simple without sacrificing efficiency and requires no fixed bias or neutralization. Such an amplifier is readily obtained by connecting the two grids of a beam-power tube together (resulting in a high-µ triode) and then inverting it; i.e., the grid (control and screen) is grounded and the cathode is left up in the air. This greatly simplifies the amplifier, because the only parts required are tube, socket, plate coil and condenser, plate by-pass condenser and a low-impedance link to the oscillator stage. There isn't much to that, is there?

The wiring diagram shown in Fig. 1 will give a better idea of the inverted-amplifier connection as well as the rest of the circuit. Doubtless some of the boys are going to indulge in hoarse laughs at this idea, but if they try it they will soon change their tune. It enables us to obtain a cheap, simple and relatively foolproof rig that leaves nothing to be asked for. Of course, the transmitter can be operated on only one band with any one crystal, but crystals are not as scarce as they used to be. A Tritet oscillator could be used to give two-band operation from one crystal but, in my experience, I have yet to see an oscillator of that type that will give good keying at all speeds. And it takes more space.

Construction

No particular care need be taken in the construction of the rig other than that according to general good practice in amateur design. It is necessary to shield the two stages from each other, since there is a possibility that the amplifier will oscillate if its plate circuit is inductively coupled back to the oscillator plate circuit. However, a simple single shielding baffle was found to be all that is necessary. The link from the oscillator plate coil to the cathode-grid circuit of the amplifier is made by twisting together two pieces of flexible rubber-covered wire. A similar line leads from the amplifier output link to the antenna terminals.

The tube and coil sockets are mounted below

1 Romander, "The Inverted Ultraudion Amplifier," QST, Sept. 1933.

The inverted-amplifier portable emergency rig set up in the field ready to go. Antenna output terminals are at the extreme left; the left-hand dial tunes the amplifier and the dial under the plate meter tunes the oscillator. Key jack and crystal socket are available from the front of the panel.
the chassis. Wires to the tuning condensers are brought through the chassis by means of small porcelain feed-through insulators. The crystal socket is mounted on the panel to make it accessible and to reduce any drift due to heating. A d.p.d.t. toggle switch, also mounted on the panel, allows the plate current of either tube to be measured by flipping the switch.

Either glass or metal tubes can be used in the oscillator without modification—the metal tubes save slightly on space. Either glass or metal tubes can be used in the amplifier, but the shield connection should not be grounded. A glass tube is slightly to be preferred.

The power cable terminates in a 4-prong plug so that the set may be used with any of three available power supplies: a 250-volt 50-ma. generator, a 325-volt a.c. power pack, and a 400-volt 100-ma. a.c. power supply.

Performance

The output terminals of the transmitter should be connected to a link-line coupling to a tuned tank. Any of the usual antennas can be used, and there is no need for elaboration on this point. I have used both end-fed and Zepp-type antennas in this manner, and the output can be connected directly to a low-impedance line feeding the current loop of an antenna, or a quarter-wave grounded Marconi antenna can be used directly from the link, with a variable condenser in series for resonating the system.

In operation with the 400-volt supply, the inverted amplifier draws only 7 ma. with the key up, 20 ma. with the key down but with no amplifier load, and 85 ma. with the amplifier loaded. Heavier loading at this voltage only drops the output and wastes power. The oscillator draws about 25 ma.

Using this transmitter with the regular home Zepp, inputs from 10 to 30 watts resulted in contacts with all districts but W7 on 7 Mc. The reports were good, and must have been fairly accurate, because hour-long contacts with the west coast and middle west were held without interruption at 40 w.p.m.

Roanoke Division Convention

Chamberlin Hotel, Old Point Comfort, Va., August 3rd and 4th

Emphasis on the fraternal side and plenty of time for the vacation features of the historic Virginia Peninsula are to be the keynotes of the Roanoke Division A.R.R.L. Convention being jointly sponsored by the Norfolk Radio Club and the Peninsula Amateur Radio Club, at the beautiful Chamberlin Hotel in Old Point Comfort, on August 3rd and 4th. Liaison officers of both A.A.R.S. and N.C.R. will be in attendance, as will be other notables of the amateur fraternity. For information write the secretary, Laurie Turner, W3BEK, 115 West 33rd St., Norfolk, Va.
A Heterodyne Exciter

Stabilized Frequency-Control Unit for Transmitters

BY W. RODERIC BLISS,* WIFMZ, AND PHILIP A. BAILEY; WIBKO

The production of beat frequencies by the mixture of two other frequencies is well known to the amateur. It is the principle upon which the superheterodyne receiver relies, and the method by which c.w. stations are made audible. It is equally useful in transmission, and has had some application in that field. Before describing the exciter unit shown in the accompanying photographs it may be well to review the method by which beats are employed to obtain stable frequency control.

If a stable high frequency such as is obtained from a well-adjusted crystal oscillator is combined, in a Class-C amplifier, with a low frequency from a high-C oscillator, four major output frequencies will be found. The first will be, of course, the crystal frequency, which we shall call $f_1$. The second will be the low frequency, represented by $f_2$. Then there will be found the two beat frequencies, $f_1 + f_2$ and $f_1 - f_2$. These combination frequencies are the ones used to accomplish our aims.

Suppose we have a crystal oscillator operating at a frequency of 6.5 Mc. and mix this with the output of a 500-ke. oscillator in the grid circuit of a Class-C amplifier. The plate could be tuned to 6.0 Mc., 6.5 Mc., or 7.0 Mc. and an output found on these frequencies with a neon bulb or a flashlight bulb and loop. If the low-frequency oscillator were variable from 500 kc. to 1000 kc., two variable frequencies could be found — 5.5 Mc. to 6.0 Mc., and 6.0 Mc. to 7.5 Mc. This last frequency range would be very useful for QSY on 40 meters and the higher frequency bands.

The stability of the beat frequencies considerably surpasses the stability of the e.c.o.'s commonly used for QSY. The drift at worst is equal to the crystal oscillator drift plus the drift of the low-frequency oscillator, and by design it is quite possible to have the two oscillators drift in opposite directions, and thus tend to balance out when the upper sideband is used. The authors have made no attempt to do this, for it was not found necessary. The frequency drift of a high-C low-frequency oscillator is often less than that of a high-frequency crystal oscillator when measured in cycles per second, so that even the sum of the two drifts is still very small. The stability of a low-frequency oscillator can easily be confirmed by remembering that a b.c. receiver stays tuned on a broadcast station pretty well and no especial care is used in the design of the b.c. oscillator!

Since the output tank could hardly tune to $f_1$, this unwanted frequency is eliminated. It is desirable to eliminate also $f_2$, since this will fall outside the band in which QSY is contemplated. This can be done by using a two-tube mixer circuit, with the crystal frequency introduced into the grids in parallel and the beat frequency taken from the plate circuit to which the plates are connected in push-pull. This circuit is well known as a "balanced modulator."

In the arrangement of Fig. 1 the low frequency is applied to the grids in push-pull. It will be seen, therefore, that with crystal signal balanced out and the mixer tank tuned to many times the

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† 14 Alsop Ave., Middletown, Conn.
In this rear view, the crystal tank circuit is at the extreme left. The next two tubes are the 6V6 crystal oscillator and VR150 regulator. The self-controlled oscillator tank condenser is centered on the panel, with the coil and tube behind it. The three tubes in a row are the two 6F6's for the mixer circuit and the VR150 for the self-controlled oscillator. The output tank of the mixer is at the extreme right.

The self-control oscillator tank condenser is centered on the panel, with the coil and tube behind it. The three tubes in a row are the two 6F6's for the mixer circuit and the VR150 for the self-controlled oscillator. The output tank of the mixer is at the extreme right.

At low frequency, the only resonances found in the output will be at the beat frequencies.

Some experimenting was necessary to determine the lowest $f_0$ which could be used. With $f_0$ too low, $f_0$ plus $f_e$ comes so near $f_e$ minus $f_0$ that the mixer plate tuning does not distinguish between the two. The minimum $f_0$ for 7 Mc. was found to be about 500 kc.; that is, the resonances in the mixer plate were 1000 kc. apart. This minimum value of $f_0$ is subject to experiment by the individual constructor, as it varies with the $Q$ of the mixer plate tank, its loading, and the skill of the operator.

This minimum low frequency is also proportional to $f_e$. If it is desired to work on 3500 to 4000 kc., $f_0$ should not be less than 250 kc., and on 14 Mc. no less than 1000 kc.

The advantages of using the heterodyne method of QSY may be briefly summed up as follows:

1. Less drift than with a conventional e.c.o.

2. Out-of-band crystals, formerly considered useless, may be used.

3. High-power amplifiers operate on a frequency different from either the crystal or variable oscillator, eliminating feedback which causes frequency instability and crystal heating or fracture.

4. Keying may be accomplished more satisfactorily than in other exciter units.

5. Construction does not require the exacting care that would be necessary in an e.c.o. of comparable stability.

6. Calibration is much more positive and more easily checked than in any other variable-frequency exciter.

Exciter Circuit

The circuit which emerged after much experiment is shown in Fig. 1. The crystal oscillator is a 6V6 coupled to the screens of the 6F6 mixers. The 6N7 serves as a push-pull low frequency oscillator which excites the control grids of the mixer tubes.

The 6V6 crystal oscillator is quite conventional in design. The plate voltage is held down to 150 volts by the VR150 regulator tube. This results in low crystal current and heating, in addition to providing some degree of independence from line-voltage fluctuation. If desired, any other form of plate-supply regulation may be used with equivalent results.

The crystal is a Billely B5R unit calibrated at 6499 kc., (6500 kc. would be ideal) and is similar in size and low-drift characteristics to the familiar B5 unit. This 6500±5 kc. unit may be obtained from most amateur supply houses or from the manufacturer. Several other methods of obtaining crystal control outside the band will suggest themselves to the amateur. An 80-meter 'phone band crystal will double into the range of 7800 to 8000 kc. and the lower sideband of the beat frequencies may be used by mixing after doubling in the crystal stage. Another alterna-
tive with the same crystal is to heterodyne the fundamental frequency back into the 80-meter c.w. band and double after the mixer. The fundamental frequency of some 10- or 20-meter harmonically-operated crystals may fall a convenient distance outside the amateur band.

Crystals which have been accidentally ground too thin to fall inside the amateur band may be used if they fall an appropriate frequency outside the band. If they are too near the operating frequency, a few more swipes with carborundum will put the frequency high enough. In this case, the lower sideband would be the one to pick out in the mixer plate-circuit tuning.

The low-frequency oscillator uses a 6N7 double triode to obtain push-pull output. For the sake of stability, the plate voltage for this tube is also kept to 150 volts by a VR150. Since the 6N7 operates as a self-excited oscillator, voltage regulation is particularly important if the maximum of stability is to be obtained. Fortunately, only seven to fourteen per cent of the beat frequency stability is dependent upon the low-frequency oscillator. The tuning condenser used in this oscillator is a common double-section broadcast job, and is quite satisfactory if care is used to see that there will be no excessive thrust on the shaft due to mounting conditions. A small 50-mufd. air trimmer is connected between the stator sections for purposes of calibration.

The circuit of the low-frequency oscillator makes use of a condenser and resistor from plate to opposite grid to effect regenerative feedback. This was the handiest scheme and was left as first hooked up. Possibly other circuits will work as well or better, but no need was felt in the authors' case for a change. In any case, the oscillation should be smooth and continuous all over the range of the tuning condenser. The coupling condensers to the 6F6 mixers are purposely made small in order to reduce the reaction of the other circuits upon the frequency of the low-frequency oscillator. Too small a condenser will, of course, reduce the excitation excessively.

The dial is a homemade affair, based on the works of a National Velvet Vernier, with a celluloid pointer substituted for the regular dial. The card mounted behind the pointer is made similar to the Billey frequency chart. Four scales are calibrated upon it. The outside strip is the direct frequency reading of the low-frequency oscillator.

(Continued on page 78)

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**Fig. 1 — Heterodyne exciter circuit**

- $R_1, R_2, R_3 = 30,000$ ohms, 1-watt.
- $R_4, R_5 = 50,000$ ohms, 1-watt.
- $R_6 = 12,500$ ohms, 1-watt.
- $R_7 = 5,000$ ohms, 10-watt wire wound.
- $R_8 = 500$ ohms, 10-watt.
- $C_1 = 100$-mufd. midget variable.
- $C_2 = 370$-mufd. dual variable, broadcast type.
- $C_3 = 50$-mufd. air trimmer.
- $C_4 = $ Split-stator, 50-mufd. per section.
- $C_5 = 0.02$-mufd. 200-volt paper.
- $C_6 = 0.02$-mufd. 400-volt paper.
- $C_7 = 250$-mufd. 400-volt mica.
- $C_8, C_9 = 10$-mufd. 400-volt micas.
- $C_{10}, C_{11} = 250$-mufd., 400-volt mica.
- $C_{12} = 0.25$-mufd. 400-volt paper.
- $C_{13} = 0.5$-mufd. 400-volt paper.
- **RFC** = 2.5-mh. r.f. choke.
- $L_1 = 15$ turns No. 20 d.s.c. spaced to cover 1 in. on 1½ inch coil form.
- $L_2 = 150$ turns No. 30 d.s.c. close-wound on 1½ inch form, and c.t.
- $L_3 = 26$ turns, c.t., No. 20 d.s.c. spaced to cover 1½ inch on 1½ inch diameter coil form.
- $L_4 = 2$ turn link.
- $L_5 = 40$-mh. broadcast-type choke.
An Acorn-Tube
112-Mc. Converter

BY M. P. REHM, W2HNY

The 112-Mc. converter is a simple gadget. It is built on a single piece of heavy aluminum, with a small piece to serve as a panel and support for the dial. The output-coupling circuit is mounted at the rear of the chassis. The oscillator tuning condenser is the one nearest the dial.

As a start toward improving our ultra-high-frequency gear, a better 112-Mc. receiver seemed imperative. We have a Hallicrafter Five-Ten receiver which has a wide-band i.f. position originally designed to receive 56-Mc. modulated-oscillator signals (remember?), so we decided to try the receiver as a double-i.f. superhet for 112 Mc. with an acorn-tube converter.

The accompanying photograph shows the finished converter using two 955 acorn tubes. The mixer tunes from 106 to 119 Mc., and the oscillator tunes from 81 to 94 Mc., giving a difference frequency of 25 Mc. In operation the Five-Ten is tuned to 25 Mc. and acts as the i.f. amplifier for the converter.

The circuit is quite simple and straightforward, as can be seen from Fig. 1. The detector coil is 8 turns of No. 14 wire ½ inch in diameter, spaced to occupy 3½-inch winding length, and it is tuned by a two-plate midget condenser. The detector plate coil, $L_2$, is 12 turns of No. 18 push-back wire, ¾ inch in diameter, close wound and tuned to 25 Mc. by a small air padding condenser. The coupling link is two turns around $L_1$, and the output is carried through a short twisted-pair lead to the receiver input. Bias is obtained through the cathode resistor, $R_1$, which is by-passed by a small trimmer condenser set to about 20 $\mu$fd.

The oscillator coil, $L_0$, is 5 turns of No. 14 wire ½ inch in diameter, spaced to cover 3½ inch and tapped at the center. The tuning condenser has three plates and the padding condenser is set at maximum capacity. The oscillator coupling condenser is set "very light"—about 5 $\mu$fd. This system of coupling from oscillator plate to detector cathode may be called "cathode injection" and is used to good advantage in ultra-high-frequency work.

With 100 volts on the plates, the detector should draw 0.4 ma. with the oscillator off and 0.6 ma. with the oscillator on, by proper adjustment of the coupling condenser. The oscillator draws about 5.0 ma.

At present, the parts are just mounted on a ½-inch thick aluminum chassis which measures 5 x 7 inches, but everything is "tied down tight." All parts are above the chassis and there is a central ground connection directly under each socket. The sockets are supported on edge by small heavy brackets, as are the condensers $C_1$, $C_2$ and $C_4$. The tuning condensers are ganged and track nicely over eighty degrees of the dial, the 112–116 Mc. band, covering 22 of these degrees. With a five-to-one ratio dial, this spread is ample.

Standard receiving tubes can be used in this circuit but the efficiency will be very poor. The life of acorn tubes is long and their inter-electrode capacity is less than the standard types, so for the slight extra cost, a much better converter will result.

Almost any other i.f. can be used, and a lower frequency would give better efficiency, but it must have a wide pass band. This converter used successfully into a two-stage tuned r.f.

(Continued on page 104)

A converter for 112 Mc. doesn’t have to be a fancy affair to be effective. Here is a simple one that is short on complexity but long on performance, and it will work into any 25-Mc. amplifier or receiver you may have.

* 969 Roanoke Avenue, Riverhead, New York.

July 1940 41
A Portable Transmitter-Receiver

Simple Low-Power Station for All-Around Work

BY LON M. HILDEBRAND,* W6QUE

During the design of the small transmitter-receiver to be described, a few important constructional details were uppermost in the mind of the builder. It had to be small and compact, capable of operation from either a.c. or storage battery power supplies, simple and easy to construct, and the cost was to be kept as low as possible. In addition it was to operate with either end-fed or Zepp-type antennas. Operation was to be confined to the 40- and 80-meter c.w. bands.

This little rig satisfies all of the above requirements, and the results have been better than were anticipated. With an a.c. power supply delivering 400 volts, the input to the 6L6 amplifier is about 30 watts. Using a 250-volt dynamotor or vibrator-pack and storage battery, the input is around 12 watts. In the writer's shack this rig is used as the 80-meter transmitter, and the big rig is left on 40 meters. The middle-western states are contacted regularly on 80. Many of the parts for this rig will be found in the amateur's "junk box." Not much attention was paid to low-loss materials, as the cost was to be kept as low as possible.

Several of these rigs are now in operation in and near Stockton, and all but one are built with separate power supplies, with cable and plug-in connections. The one exception has the a.c. power supply built on the same chassis and, with the exception of a slight hum in the receiver on 40 meters, operates just as efficiently as those using an external supply. The hum is so low that it is not objectionable, and for those who wish to build all the units on one chassis, I would suggest an 8 by 12 by 2 inch chassis. This allows ample room for the gear and will fit into a 13 by 9 inch metal cabinet.

With the particular model shown on these pages, a 7 by 9 by 2 inch chassis was used. By exercising a little care in the placement of parts, the components will not appear to be too crowded. This size of chassis fits nicely into an 8 by 10 inch metal cabinet.

The placement of parts on both the chassis and the front panel can be seen from the photographs, and there is no need for a lengthy description. The band-set condenser in the receiver is mounted under the chassis, with the shaft extending up through the chassis, and it is not touched except when changing bands. The main tuning condenser, C3, is mounted on the panel and gives good bandspread over both the 40- and 80-meter amateur bands. The only shielding used in the transmitter-receiver is a shield can around the 6C6 (or 6D6 — they work equally well) detector tube.

Construction

Before mounting any parts or cutting any holes in the chassis, the two condensers and the meter should be mounted on the panel. The circuit diagram, Fig. 1, shows that the band-spread condenser rotor is grounded, so there is no need to insulate it from the panel, but both sides of the transmitter tank condenser, C3, are "hot" and the condenser must be insulated from the panel.

The complete transmitter-receiver is shown here sitting alongside a dynamotor power supply. The tuning dial on the left controls the receiver tuning and the one on the right controls the transmitter tuning. Along the bottom, from left to right: headphones jack, send-receive switch, regeneration control, pilot light and key jack. The antenna tuning condenser can be seen at the rear of the cabinet.
The fellow interested in a simple and inexpensive station that is complete will find many ideas in this description of a rig that can be either the whole works or a useful adjunct to the regular job.

A small strip of bakelite or hard rubber about 1 inch wide and 2 inches long is used for insulation by first drilling a hole in the center of the strip to support the condenser shaft bearing and then mounting the strip on the panel. The strip is supported by screws through holes at each end of the strip. The hole in the panel through which the condenser shaft extends must, of course, be large enough to clear any of the metal of the shaft bearing and locking nut. The tuning dial covers this hole so there is no reason for not making it sufficiently large. The two tuning condensers are mounted high on the panel to allow plenty of room for the other parts and to give the panel a neat appearance.

The transmitter coil socket, 6L6 socket and 6C5 socket are mounted on the chassis directly in back of the tank condenser, in the order named. They are kept as near as possible to the right-hand edge of the chassis. The crystal socket is mounted on a line to the left of the midpoint between the 6L6 and 6C5 sockets, as close to the sockets as possible without making it impossible to get the tubes and crystal into their sockets. The 4-prong socket that takes the power cable plug is mounted at the center rear of the chassis, as close to the edge as possible.

The receiver coil socket, audio choke and audio tube socket are mounted behind the band-spread tuning condenser, in the order named and close to the left-hand edge of the chassis. The audio choke is an old audio transformer with the primary and secondary connected in series but, if one prefers, resistance coupling can be used, with some loss in signal strength. The detector tube socket is mounted to the right of the detector coil, allowing enough space for the tube shield to clear the meter, and the band-set tuning condenser is mounted on the chassis behind the detector tube socket. Make sure that the band-set condenser will have enough room under the chassis so that the plates can be set to any position. The detector grid leak and condenser are mounted on the band-spread condenser, thus giving a very short lead to the detector grid. After space has been provided for all the parts, punching and drilling can proceed.

The front panel and chassis are held together by the headphones and keying jacks, regeneration control, pilot light and send-receive switch. Only the headphones jack must be insulated from the metal panel, and the necessary fiber washers are readily available at any radio store.

Wiring of all parts is straightforward in all respects. Bear in mind that this is a portable rig and will be subject to some rough use. Make all soldered connections firm and solid.

Two small feed-through insulators are mounted

A top rear view of the chassis shows the relative position of the parts. The knob just visible over the crystal is used to set the receiver band-set condenser, which is mounted under the chassis. The receiver antenna terminal is at the right-hand corner — the empty socket takes the power supply plug.
on the transmitter side of the metal cabinet, about 3 inches apart and about 2 inches from the top. These are used to connect to Zepp feeders when this type of feed system is used to the antenna. An old b.c. variable condenser, mounted as high as possible at the rear of the cabinet, is used for tuning the feed line. This condenser is insulated from the cabinet in the same manner as the tank tuning condenser on the panel. Short flexible leads about 4 inches long, with small battery clips on the ends, are used to connect between the condenser and antenna terminals and permit either series or parallel tuning. When an end-fed antenna is used, the antenna is coupled through a 0.002-mfd. mica condenser to a short piece of wire soldered to the "hot" end of the tank coil on the coil form. Terminals of the antenna winding on the coil form are brought to the top of the form and fastened with a small bolt through each side of the coil form. The bolt protrudes about ½ inch from the form, and it is an easy matter to clip the flexible leads from the antenna condenser and the feed-through insulators to the bolts. This winding is not used, of course, with an end-fed antenna.

Although not shown in the wiring diagram, a small mica condenser of about 0.001-mfd. capacity can be connected between the plate of the 6C5 and the crystal. This will remove the plate voltage (Continued on page 108)
May, that magic month of u.h.f. DX, has come and gone, and the 1940 season is off to a flying start. Greatly increased interest and activity, particularly in W4 and W5, the considerable improvement in equipment and operating technique, and a generally better understanding of the factors involved in working skip-DX have resulted in a total of stations heard and worked which probably exceeds that of any previous season, despite the fact that conditions appear to have been slightly less favorable, to date, than in corresponding periods of previous years.

Skip, in general, has been longer, in keeping with the trend noticed last summer. When 56-Mc. skip was first noted, in 1935, the usual contacts were W1, 2, or 3, to W8 and the nearer W9's; the average distance being of the order of 700 miles. Work thus far in 1940 has been almost entirely over distances in excess of 800 miles, with 900-1200 being most common. Significantly, fellows who are located at in-between distances from populous 5-meter areas have turned in long calls-lists, reporting poor results in making contacts.

Up to 1938, the openings were frequently of long duration, with even the lowest-powered stations hammering in with terrific strength for hours at a stretch; 1940 finds openings spotty in most instances, with small areas open at any given time, and for shorter periods. Constant observation of conditions has taught many of the older hands at the game the fine art of figuring out just when and where the skip is going to pop, however, and most of us are convinced that we work DX on Five plenty of times in 1940 when similar conditions would have produced no excitement a few seasons back.

A complete listing of all the DX worked in the past month would make bulky and uninteresting reading; hence only highlights are reported herein. But let no one think that we are not interested in such reports. It has been requested many times, and we ask, again, that anyone hearing or working any u.h.f. DX report his observations as completely as possible. This information is not only very useful to your conductor but it is also available to anyone who is genuinely interested in studying this most fascinating business of 56-Mc. DX.

The season started, in earnest, on April 29th, with a contact between W4EQK, Clearwater, Fla., and W5VV, Austin, Texas. Now both Tom Herrin, W4AKA (op. at EQK), and Wilmer Allison, W5VV, are hardened campaigners who have worked plenty of DX on the lower frequencies, but when they got together on Five (for the first u.h.f. DX for both) neither could carry on a rational conversation, and both suffered a bad case of "fumblitis." There's something about this business of DX on Five! We work the world on Ten or Twenty without a quiver, but let a W9, a W5, or a W4 break through on Five — and note the tenseness of the voices on the band! We sit on the edges of our chairs, our hands shaking, as we shout ourselves hoarse at some equally excited fellow a mere thousand miles away! We spend two-thirds of the year telling everyone that skip-DX doesn't really count in the u.h.f. picture — but whenever the skip breaks out, so does the gooseflesh!

The first extended opening occurred on April 30th when W4's had quite a time of it working into W1, 2, 3, 5, 8, and 9. Wednesday, May 1st, was better, with 900- to 1200-mile DX being worked generally over two-thirds of the country. May 2d was the peak, with practically the entire period from 9 a.m. to midnight open for DX in some parts of the country. DX was worked in every call area during this hectic period, and thirty-two states are included in the reports. Let
no one say that DX cannot be worked on Five from his location!

HERE AND THERE:

Observer Extraordinary is W1LLL of Hartford. Brownie jumps that Skyrider back and forth from Ten to Five a dozen times an hour when DX is in the offing. And when it breaks, he's the guy who gets the first lick every time — and with a pair of 6L6's and an ordinary city location, too.

Getting on Five in a location where local signals are non-existent is quite a problem. The first thing we heard when we warmed up the receiver on the night of May 1st was a furor of W1's 2's, and 3's, all frantically calling W4EQM. This had not subsided before a calm (and definitely southern) voice was heard "Calling CQ-Five; W4EQM, Langdale, Alabama, calling CQ-Five." Again the roar, as everyone in the skip zone went after Alabama — and again, the same voice "calling CQ-Five; W4EQM . . ." After about three rounds of this, some rather uncomplimentary remarks began to be injected into the calls of the die-hards who were still trying, but still no answer from the gentleman from Alabama! This was all solved a few days later when the boys at W4EQM discovered that the r.f. stage in their converter was not tracking. On May 4th the band opened again for W1-W4 work and the gang in these parts "got Alabama" in rapid succession. As this is being written, W4EQM tells us that he has worked only W1 and that he has never yet heard a local signal.

W4FFM, Atlanta, Ga., got his T-40 doubling from Ten on May 1st. Lee could hardly have picked a more opportune moment than 8:34 p.m. of that date, when his first "CQ-Five" netted W1HXF, quickly followed by W1's INJ, EKT, LKM, and HDQ; W3's KUJ, CUD, AIR, and GYQ; and W9's PK7 and FYC. Not bad for first-night work.

New stations in W5 are bringing out the fact that this area is one of our best bets for skip DX. W5AJG and W5VYV have reported the band open frequently during May, when no DX has been heard in the east at all. North-south DX, particularly W6-W5, has been quite frequent. Top performance of the month was turned in by W5AJG, Dallas, Texas, who polished off an even 50 contacts on May 2d. Starting at 9 a.m., Leroy worked W8CIR, and followed with 49 others in 14 stations (weeks, N. Y., N. J., Pa., Ohio, Mich., N. Va., S. Va., Ill., Ind., Iowa, Wis., Minn., and S. Dak.); finishing up at 10:21 p.m. with 540 Marathon points for one day's work! The first 50-point contact to be recorded in the U.I.F. Marathon was made by W6AJG with W1DEL, Natick, Mass., 1550 miles. Also worked was your conductor but we happen to be a mere twelve miles under the 1500-mile mark! Leroy says he might have done better but he was sick that day and had to rest from 2 to 5 p.m. DX was worked from Dallas (by W5AJG or his partner, W5EHM) on May 1st, 2d, 13th, 16th, 18th, 19th, and 21st. On the 21st, both boys worked into Massachusetts again. This 1500-mile work is the subject of much discussion hereabouts, with some of us wondering if it is not extended single-hop work; 1500 miles is normally considered to be the limit of single-hop DX but the nature of this particular work has made it appear that only one hop was involved. If it was double-hop, then it must have been along a somewhat devious route, for there was no 750-mile business being done at the time Leroy and Pat were heard in Massachusetts.

Others in W5 who have been giving these oldhands some competition and who are known to us are W5BZJ and KEE of Houston, Texas, W5N almost directly across Lake Michigan, W5FSP and W5SL of Big Lake; FNQ and FWS of Texon; and YYV of Austin, all of Texas; and EYF of Oklahoma City. W5FYF heard W1HDQ, W2MO, W3BZJ, W5CIR, and W9USI, on May 2d. It seems that quite a few of us missed a chance at Oklahoma that evening — just because we neglected the high end. Yes, the band still goes to 60 Mc., and Vance holds forth on 59,476.

Another high-end is W1JCE, Westport Harbor, Mass., 59,120. And while we're on the subject, W1ELP, Cambridge, Mass., would have been glad to have you take a look above 58.5 for his f.m. signal. Bill runs 400 watts to 35't's — you can do that with f.m. — and the signal is easily read on even the most selective receivers. It may not sound too smooth, but it can be copied. There will soon be a 12-element beam up in the air 110 feet at W1ELP!

Did someone say that high power is needed to work DX on Five? Ask W3HJO, Houston, Texas, how does it with 15 watts, a super-regen receiver, and a half-wave vertical antenna 12 feet off ground! The 600 watts at W5VYV seem to produce a slightly different result. Wilmer gets plenty of heard cards but is having some trouble pulling in weak signals, though he seems that his DM-36-HRO combination should do the trick if anything will.

W6QQ, Santa Ana, Cal., worked W7EIA, Zillah, Wash. (125-45, 225 watts; freq. 58 Mc.); W7FFE, Houlton, Ore. (110 watts to 800's freq. 58.5 Mc.); and W7FFD, also of Houlton (160 watts to HF-100 on 57.2 Mc., 8-element vertical beam), on May 1st, between 8:35 and 9:30 p.m. (P.S.T.). Ray runs 80 watts, "phone; 80 watts, o.w.; to a single 800. He reports that W9IOJ, North Hollywood, worked the same stations.

These fellows in California have a somewhat limited field for ordinary 900-1200-mile skip, as this radius takes in much sparsely-settled country. May 12th appeared to hold promise, as shore skip was pronounced on Ten, but nothing was heard until 8:55 p.m. when an unidentified DX-1 was heard calling "CQ United States." The signal was badly frequency-modulated and was not positively identified but is believed to have been genuine, as the harmonic of XDA was reported in several places in the west at about this time. Five was all W6QQ again on May 13th and Ray worked the boys at Houlton, Oregon, again; and W7EIA of Kirkland, Wash, W9USI, who runs 75 watts, says that he finds that the band frequently appears to be open when he listens around mid-day, but that signals are seldom heard. The band was open for W6-W7 work from 12:30 to 2 p.m. on the 18th.

Ground-plane antenna used by W8CIR/8 during the May Relay. This looks like the answer to the problem of an efficient portable radiator. Concentric feedline permits vertical feeder without the usual mechanical troubles.
U.H.F. DX RECORDS

Two-Way Work

56 Mc.: WIEYM — W6DNS, July 22, 1938. 2500 miles.
112 Mc.: W6OIN/6 — W6BCX/6, April 28, 1940. 200 miles.
224 Mc.: W1KJI — W1HDF, May 18, 1940. 13 miles.

RELAY HIGHLIGHTS:

W6QZK is going to set up some fellows on Five if he has to supply the equipment for them to operate! Jim sent a receiver up to G6BN at Estrella Peak, and Tommy (GBN) now supplies the missing link between Phoenix and Tucson. Both W7DBZ and W6OVK are now working on W6PBD at Douglas, Ariz., to get him on Five. W6N1N at Silver City, N. M., is expected to join this group in a projected Phoenix-to-El Paso 56-Mc. relay.

Vince picked up 2.W6QZK (of all months, Vince) to undergo an operation, but he got in on the fireworks early in the month, and expects to spend quite a bit of time at home "re recuperating." Since worked 23 stations on ship, on May 24.

W6RHB got going at 10 a.m., May 2d, and worked W6's AJG, EHM, EIN, IHT, ENQ, and YY before 1:30 p.m. That night worked W1KRW; W3's GQS, AIR, CYW, and FD; and W4AUI. At 11:22 p.m., Ed ran across the harmonic of W6SBU, Colorado Springs, who was on Ten. Changing to 28 Mc., ZHB found that EDU could not transmit on Five but could listen there, so Ed went back to Five and a contact was made with size equal to that on 28 Mc. Ed got all excited when he heard the harmonic of LSD on Five on May 19th, and dug deep down for some sign of South American DX, but without success. We are reminded that VY4AE promised W4FFM that he would be on Five shortly.

He says he has heard W5 signals on Five and is determined to make the first Intercontinental QSO in 56-Mc. history.

RELAY HIGHLIGHTS:

With many of the high scorers yet to be heard from this is being written, it is impossible to present a true picture of the scoring in the Fourth U.H.F. Relay of May 18th and 19th. Far greater participation was in evidence, and messages were handled over much longer routes than in previous events. It looks like W3AC/3 again, though Goyin had plenty of close competition this time. W2DKJ/2 was right up near the top, despite a misfortune which cost him plenty at the outset. Art was working portable in a hospital, of all places, when the a.c. line he was using was switched to d.c. Some fireworks ensued, but luckily not much of the truckload of expensive apparatus Art had assembled for the event was in use at the time.

Messages were exchanged between W6CVQ, Kahaluu, Hawaii, and W6AMJ, Bergesfield, N. J., during the contest period over a network consisting of W6CVQ, W8QDU, W8NYD, W8CIR, W8CTF/8, W3BEB, W3BJJ, W2AMJ, and W6SKL, and slight variations of this set, to include W3AG/3, W8FWM, W8RL, and W5, and a bank of W2's and W1's, provided a ready service route for east-west traffic.

Several openings for sporadic-E DX provided the means for an exchange of messages between stations which have been isolated in previous relays. A new record for spotty long-distance work was set when a brief opening gave W6OVK, Tucson, Ariz., a chance to give a message directed "To any East-Coast Amateur" to W5V, at 7:12 p.m. Saturday. This was handed on by Wilmer to W6LCH, somebody. Ed caught the message, if a farseen route later. By route not yet definitely known, but probably W6LCH, this message was given to W8CVQ, who passed it on to W8QDU. Fred got it off to W4QN at Orlando, Fla., at 6:04 p.m., Sunday, thereby completing the nearest thing we've yet seen to a 56-Mc. Transcontinental Relay. That three skin contacts were required shows that we are still have approximately 15 minutes' operating at this elevation.

The sky was not clouded for these results except by the use of high power in the extreme nature. On both 56 and 112 Mc., contacts over distances of 100 miles or more are frequently made with very low power. Ray would like schedules with stations north of San Diego for tests on 224 Mc., to see whether this fortunate condition would permit long-distance work on this frequency aboard.

The record of 160 miles established last fall by W9VYK and W9WYX was also exceeded on May 6th, when Mike Villard, W1DMV, operating under the call W6YX/6, piloted a Zipper Cub Trainer at an elevation of about 8000 feet, maintaining contact with W6LCH located at Linch Observatory on Mt. Hamilton, until they were 165 miles apart; contact being lost abruptly when the plane was just north of Chico, Cal. The rig used in the plane was a pair of 110W-15's in a resonant-line oscillator, powered with a 20-watt pack operated from a tiny 17-ampere-hour storage battery.

At Mt. Hamilton, W6HJT/6 used a pair of HK-24's at 150 watts and a 3-element rotary beam.

These fellows point out that the advent of the new low-cost light plane has brought down the cost of rental of a ship to a point where any group interested in setting up a new record for 112-Mc. work might do well to hire a couple of these ships and go to it. They point out that, for $30, a 65-h.p. ship and pilot service can be had for an hour's time. This is sufficient to climb to 10,000 feet and still have approximately 15 minutes' operation at this elevation. With two ships at 10,000 feet, a range of operation of 200 miles is theoretically possible; a distance which is probably beyond the range of possibility from any ground location.

Our past experience in high-altitude portable work indicates that there are other factors than mere height above the surrounding country in this business of long-distance work on the ultra-highs. A good beam; a quiet location; a good base; a lot of power — these are the things that count. (Continued on page 100)
The selfish and irresponsible attitude has considerably says the editor, is to cooperate with the author. "Flagrant fashion." The duty of all real amateurs, "and we don't out the experimenters of the danger from their attempts to suppress any further illicit transmissions. "We can hardly expect the pen... the editorial in April "Amateur Radio" points session with regard to the restitution of our... in the c.w. division. A unique feature... won by LY1AP in the radiotelephone section and LYIBX in the c.w. division. A unique feature of this L.R.M.-sponsored event is that it invites given points for their receiving work. The society points out that one purpose of these contests is to acquaint the general public with the work of the radio amateur. Many such listeners, having heard a number of local stations at work, become interested themselves in the hobby, join the association and so strengthen their numbers. The Council has strongly urged each division to continue their activities, including regular meetings and publication of monthly news letters. (Continued on page 70)
1940 A.R.R.L. QSO Party Results

BY E. L. BATTEY, W1UE

Actions speak louder than words — and the scores listed here, representing the actions in the Third Annual A.R.R.L. QSO Party say more than words ever could regarding the success of the affair. Held January 6th-7th, 1940, this get­
erably greater participation than either of t,he
graved diamond-shaped pendants have been
Alaska or P. I. The champs are:

and

Entries were received. There were no logs from
K6PAH, W6PAR, W6PBV, W6PUZ, W3BES, W6CW, W6FYK, W6IPH, W6KFC, W6MUS, K6PAH, W6PAR, W6PBV, W6PUZ, W7AYQ, W7FQJ, W7GPP, W7JC, W8DZC, W8LCN, W8NOJ, W8OFN, W8QDU, W9CW, W9EI, W9ENH, W9FOQ, W9FS, W9GKS, W9RQM, W9SO, W9QPG, W9TH, W9VKF, W9ZAR, and W9ZTL. 27 of these were also winners in at least one of the previous A.R.R.L. Parties, and their calls are indicated by italics. Special credit
is due the following, who led their Sections in all
least one of the previous A.R.R.L. Parties, and
their calls are indicated by italics. Special credit
is due the following, who led their Sections in all
least one of the previous A.R.R.L. Parties, and
their calls are indicated by italics. Special credit
is due the following, who led their Sections in all
least one of the previous A.R.R.L. Parties, and
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their calls are indicated by italics. Special credit
is due the following, who led their Sections in all
least one of the previous A.R.R.L. Parties, and

Participants' Comments

Some representative comments received from participants with their logs will serve to express the spirit of the affair and the manner in which it was received: “It was a lot of fun and I met a lot of old pals I used to QSO on 200 meters back in
1924.” --- W5CJP. “Surely had a swell time and
‘W.A.S. has eluded
many of the SS, ORS and DX contests combined.” --- W9IOP. “Enjoyed copying the ‘clean cut’ c.w. signals in this Party, but regretted the lack of participation on the ‘phone bands.” — W2HXQ. “Handled 15 messages during the contest just to show the spirit of the ‘A.R.R.L.’ Will be looking for the next party.” — W3GJY. This contest is more fun than others I think because there is more of a personal feeling in the contacts.” — W1KRQ. “This con­
test affords a nice diversion and chance to contact
lots of old boys and know that they are still alive.” — W9CW. “The inactivity of the ‘phone gang was the big disappointment of the contest. There were hours at a time when I failed to hear a single ‘phone station besides my own call ‘A.R.R.L.’” — W7UQ (W9AHR op.) “It was great fun working all the familiar calls again. I have been in all three of the A.R.R.L. parties held so far and enjoy them a lot, even more than the SS.” — W9RQM.

Highlights

The highest scorer in each district: WITS 37,200; W2GSA 36,669; W3BES 43,140; W4EV 29,441; W5WG 31,742; W6KFC 32,860; W7GPP 10,752; W9OFN 36,934; W9RQM 38,491.


Leaders in number of members worked: W3BES 360, W2GSA 360, W9RQM 316, W2IOP 313, W9OFN 313, WITS 310, W9RSO 310, W9EYH 301, W9ZAR 289, W9VDY 285, W3EDP 283, W9TH 278, W9FS 276, W8QDU

(Continued on page 70)
STARTING TOOL FOR DRILLS

Reading the article about polystyrene insulation, page 32, QST, Aug., 1939, in which it is stated that a heavy blow with a center punch may cause a star fracture, prompted me to write you suggesting the use of a tool which I have found extremely useful for starting holes in the construction of radio apparatus. The tool is easily made from a small triangular file, as shown in the illustration of Fig. 1.

The file is ground similar to one half of an ordinary drill bit, but comes to a point in place of the web and has no twist. It is used in an ordinary hand drill. It cuts quickly and will not slip or run. Drills have no tendency to slip or run when the hole is started with this tool; it is not necessary to use a center punch. — Gordon Crayford, Lacombe, Alta.

LOW-COST 14-MC. VERTICAL

W9EVD of River Forest, Ill., sends in the description of simple 14-Mc. vertical antenna which he and several of the other boys around his neck of the woods are using with good results. The thing is so simple that it ought to be possible to run it up in an hour or two.

A rough idea of the arrangement is shown in Fig. 2. The bottom part is a 22-foot “two-by-two” on which are mounted stand-off insulators to carry a 21-foot length of antenna wire. To the top end of the “two-by-two” is fastened one of those collapsible “window-sill” b.c. receiving antennas. These antennas may be obtained with a 12-foot length which, when added to the 21-foot wire, makes a 33-foot half-wave antenna for 14 Mc.

The assembly is light enough so that one person should have no difficulty in managing it on top of a roof while the guying ropes are fastened in place. Wire could be used for the guys if broken up into small sections with insulators but W9EVD has found that rope guys will do a good job and last a long time if they are soaked in linseed oil before using. He uses ordinary clothesline.

Any conventional method of feeding the antenna may be used; W9EVD feeds his at the base with Zepp feeders.

ELIMINATING 'PHONE INTERFERENCE WITH LINE TELEPHONE

If other amateurs operating powerful 'phone transmitters in the 20-meter band have as much trouble as I have had in clearing crosstalk with their own (and neighbors’) telephones, the diagram of Fig. 3 will enable them to clear entirely the interference without impairing the operation of either the telephone or radio transmitter.

This type of trouble results in the radio transmission being heard often S9-plus in the telephone receiver and is the result of r.f. rectification in the carbon telephone transmitter. The standard telephone practice is to put r.f. chokes in the fuse box in the telephone line and, in some cases, by-pass the transmitter with a mica condenser of about 0.002-µfd. capacity. This generally clears up interference from r.f. pick-up from
Pig.

Filter for eliminating interference with telephone installations from ham 'phone transmitters. R.F.C. is a jumble-wound coil of 25 turns No. 24 d.c.c. 1½-in. diameter. C is a capacity of 0.002 µf. adjacent police radio stations, 80-meter 'phones and other stations operating on the lower frequencies. In my case all the usual devices failed to stop the interference and the telephone trouble department was unable to do anything further, while complaints were becoming severe.

A series of experiments showed that the trouble could be reduced by shielding the telephone lead-in wires. The most effective and complete cure, however, was simply to wind about 25 turns of No. 24 d.c.c. wire in a jumble-wound coil about 1½ inches in diameter and put it right in back of the telephone transmitter, connecting it in series between the lead connected to the center terminal as shown. A mica by-pass may be required on some installations and it is a good preventive against more complaints if the station operates on other frequencies. The telephone trouble men were shown this and were glad to find a way of clearing the trouble. They put in similar chokes at several other points where interference was severe, entirely clearing the trouble in every case. They said that the same conditions were noticed on the telephones near the local airport because of interference from the radio stations there and because several frequencies were used, the trouble had been difficult to clear entirely.

I hope this may help some of the other boys who may run into this trouble. — A. G. Sheffield, VE4SS.

NEUTRALIZING R.F. STAGES WITH A MODULATING MONITOR

I suppose that there is nothing new in ham radio, but from time to time we do run across ideas that are new to us. Here is something I discovered by accident. I have never seen the idea published.

While changing bands in the old rig, I always tuned the buffer stages with the final plate power off and, in so doing, I noticed the modulation monitor's carrier-level meter showing a reading. With a little thought, I realized I had a very sensitive neutralizing indicator.

With this method I re-neutralized all the r.f. stages and was surprised at the amount of neutralization that was necessary to eliminate all the r.f. in the various tank circuits. For a high degree of accuracy, the monitor can be rather tightly coupled as the tubes become more perfectly neutralized. Also, the percentage-of-modulation indicator will register any audio frequency that might be introduced in the various stages by hum or feedback.

Try it sometime and see if your stages are perfectly neutralized. — Philip F. Jones, Jr., W4PVW.

SCOPE COUPLING

Coupling a cathode-ray 'scope for r.f. energy from a 'phone rig employing link coupling from the final to antenna or antenna-tuning unit generally means the use of an extra coil. The diagram of Fig. 4 illustrates a simple but effective means of securing the voltage without the necessity of an extra coil, while the coupling may be easily varied to the correct value for any band.

In the diagram C₁ may be any small condenser, such as a double-spaced 35-µuf. variable. This condenser is connected to one side of the link coil, which may be any of the numerous types on the market. Then, the other side of the condenser is connected to the ungrounded terminal of the vertical deflection plates. The r.f. input may be varied by increasing or decreasing the capacity of the condenser.

With link coupling to an antenna tuner unit, the link may have to be grounded either directly or through a condenser, C₂. This might be of more importance at low power than at the higher powers. The idea of unbalance may be suggested, but satisfactory operation doesn't require much capacity and any unbalance introduced will be slight. — George W. Brooks, W1JNO.

IMPROVING THE USEFULNESS OF A GLOBE

This is a relatively simple way to fix up your globe (without mutilating it) to enable you to determine the great circle direction of certain points from your home. The necessary implements are a pencil, a short piece of fine wire, and a common pin.

Wrap one end of the wire around the pin, place the pin on the equator of the globe, run the wire along the equator to a point 90 degrees from the pin point and at this point wrap the wire around the pencil point. A little nick on the side of the lead near the point will help to keep the wire from
slipping off the pencil point. Check a number of times and make certain you have exactly 90 degrees between your pencil point and pin point. In this checking you will notice that unless your wire is taut and exactly along the equator, your measurement may be off as much as a degree or more. Be sure the wire is near the points of the pin and pencil to reduce error.

Then, put the pin point on the location of your home and proceed to make a circle around the globe with your home as the center. The idea is shown in Fig. 5. I found the best way to do this was to swing the pencil through an arc of an inch or so, holding it taut, then mark the globe for about a half inch or so, and then move on and repeat. The reason for taking this added precaution is that the wire has some lag in following the pencil and it tends to bring the pencil a degree or so closer to the pin point.

After you have the circle completed, mark due South on it and make certain it is accurate. If your globe doesn't have a ring on it, you can run a string from pole to pole through your home town and determine due South in this manner. (If you are south of the equator, due North will be your starting point on the circle.) Now take your wire, pin, and pencil, without altering, and mark off your 90-degree spots on the circle. If your work is accurate, you will come out even. (Suggest you work both ways from starting point.) Then mark off 45-degree spots and 10- or 15-degree spots if you wish.

Now take a narrow strip of paper and place it along the equator and mark off 15 or 45 individual degrees on the paper and then, with this paper scale, mark off the degree points on the circle.

In numbering your degrees on the circle, start with North as zero and move westerly from this point around the world numbering every 10 or 15 degrees back to North as 360 degrees; i.e., NE is 45 degrees, East is 90, South 180, West 270, etc.

Now whenever you want the true direction of a certain place from your home, just stretch a string between the two places and see where it crosses the circle you have made and you have it.

A card or a composition disc with 360 degrees marked on it is a handy thing, especially when you have determined where true North is by means of Polaris or old sol (covered in previous issues of QST).

You are now ready for a lot of fun and quick calculating and figuring for that new antenna or directive array you have been planning. — John S. Ingraham, W7CYC.

**NOTE ON TUBE KEYING SYSTEMS**

W5CY points out that a reduction in drive to a stage in which a tube keyer is connected may result, if provision is not made to keep the operating bias at the same value used without the keying tubes. The amplifier grid return is normally made to ground, as shown at “A,” Fig. 6, so that if the keyer tubes are connected between the amplifier center tap and ground, the voltage drop across the keyer tubes will be applied as additional bias to the grid. W5CY suggests connecting the grid return to filament center tap, as shown at “B,” but this leaves the keying tubes in the negative high-voltage line only. It should be possible to effect an equivalent remedy by simply decreasing the grid-leak resistance, leaving the grid return connected to ground and maintaining center-tap keying.

---

**OUR COVER**

W2BRO's 21/4-meter crystal-controlled television transmitter rates the nomination for Cover 1 this month. The u.h.f. boys may well benefit from the description of Lee Waller’s rig — even those not committing television at the moment.

Our thanks go to Bob Burnap of R.C.A. for getting this shot for us.
CORRESPONDENCE FROM MEMBERS

READ THE REGS

Cheney, Washington

Editor, QST:

There seems to be a growing practice lately of purposely removing some of the final power supply filter for the purpose of making the note "easier to distinguish," particularly during contests. I have heard that a few actually admitted this practice. Now, while the resulting note isn't exactly raw a.c., it is definitely not the ideal note for amateurs today. In fact, it is illegal, besides being very undemocratic with regard to other amateurs who strive to keep the c.w. note nothing less than 10. Let's see if we can't all strive to keep our notes on a 10 basis.

Another point which many of us have forgotten or neglected is section 324 of the F.C.C. R.R. It is in effect, you know, and pertains to amateur radio as well as commercial. It in effect says that all stations must use only sufficient power to insure satisfactory communication over the given distance and under the existing conditions. Now we can't possibly stick to this rule with engineering precision, but we can do something about the abominable practice of using 600 watts or more for those cross-town roundabouts on 160 meters. There are many grounds for a short call or test across the street on a k.w., but if we are going to spend the evening talking to the next door neighbor or the friend two miles away let's use a low-power rig — say a two-stage plate-modulated rig running 3 to 10 watts input. My 6F6 final with 5 watt input gives me very nice reports on 160 'phone at distances of 90 to 100 miles... and does not interfere with stations across the state during the busy hours on the band. You'd be surprised what you can dig out of the junk box. I didn't spend one cent for my flea-power rig. Also it saves a great deal on power bills on local contacts.

I advise all amateurs to take an evening off during the next thunderstorm and read all the rules and regulations of the F.C.C. Then let's resolve to keep our operating and engineering practices within the law. It is the best insurance I know of to keep our rights to use the amateur bands.

— Harry K. Long, W7OQK

W2AOE, W9AEJ AND OTHERS

742 Central St., Plainfield, N. J.

Editor, QST:

I note with interest W9AEJ's comments on my proposals. Evidently he and undoubtedly many other hams fail to realize the size of our need for new amateurs on the ultra high frequencies. If all the hams that we will get in the next twenty years by the present methods could be brought on the air at once and forced to go on u.h.f. for all time, our u.h.f. population would still be pitifully small. We need new types of amateurs and new methods of getting them.

Amateurs fail to realize that playing dog in the manger is a good game only if you are sure of your manger. In our case the F.C.C. can take away our little used playgrounds on the basis of lack of occupancy. With commercial television, frequency modulation, facsimile, aircraft and countless other services crying for more room, how can we possibly expect to hold large slices of the spectrum when giving them little or no use?

If amateurs really are supposed to be of assistance to the country in time of war, I would like to point out that the opinion of our Australian friends has long been outmoded. Our Army is going to 'phone in an increasing number of places where speed, not secrecy, is essential. In time of war we will need thousands of radiotelephone operators and what is more important, people who can service this type of equipment. It is of course quite true that we will need trained c.w. men, but we are getting them by our present methods.

In the light of the present blitzkrieg tactics in Europe, it seems to me that the League can be of the greatest possible service to the country by immediately instituting steps to prevent our government from committing the colossal folly of shutting down amateur radio stations in time of war. Let us present instead a comprehensive plan for the creation of country side u.h.f. nets with inter-connections to the present A.A.R.S. and N.C.R. for the purpose of reporting aircraft flights, parachutists, etc. We need little elaboration to see that with wire communications disrupted, amateur radio offers the only possible means of taking care of this situation. Such a plan would require thousands of operators, not the paltry few in action to-day.

With such a plan in force, the old idea that a shutdown of amateurs in war time is essential would have little or no ground to stand on. This idea is based on the assumption that with no amateurs on the air no spies will use radio. It is about as effective as the "concealed weapon" laws are in preventing criminals from carrying guns. But unless amateur radio can offer some actual benefit to the country, there would be no point in maintaining it and taking the time to supervise it.

Can someone give a good reason why we should not have 50,000 hams on the u.h.f. bands, with or without code training, that will outweigh in importance the saving of those frequencies for amateur use, and the obvious service such a group can render in time of war?

— D. A. Griffin, W9AOE

Huron, So. Dakota

Editor, QST:

I think the suggestions of W9AEJ in his article "Another Solution" on page 51 of the June, 1940 issue of QST practical, and would like to see it a part of our regulations. Too many new hams who have not been with us long enough to acquire the proper ham spirit go on 100-meter 'phone with tight-coupled misfit antennas, doubling in the final and causing widespread harmonic interference to b.c.l.'s. They never become good operators nor do they ever find out the advantages of c.w. over 'phone. The suggestions of W9AEJ would build a better class of amateurs.

— Philip G. McGinnis, W9IQD

Griffin, Indiana

Editor, QST:

May QST arrived yesterday, and as usual I turned first to the "Correspondence" section. An article under the heading of "Another Solution" met my eye. I read and re-read it and found it hard to believe that any one individual could sign his name to such a mess of words and statements. I went back and gave a few minutes to the ideas expressed by W2AOE in his story of how it should be done and I would be held myself in check, but not W9AEJ come forth with the complete solution. I am not fully in accord with W2AOE, not by a long shot! When someone comes along with a problem to be solved, of course then we must have a solution. But until there is a problem to be solved, why in tarnation (Continued on page 68)

July 1940

53
A.R.R.L. Extends Its Code of Neutrality Precautions to Prohibit Any European Contacts. The extension of the European conflict again focuses attention on the necessary precautions that radio amateurs should observe to permit unrestricted continuance of our amateur radio in the United States.

This is not the time to demonstrate how amateur radio can cross certain international boundaries. For the last three months QST has recommended avoidance of any radio work with belligerents or any amateurs in the theater of war. Irresponsibility of certain licensees cannot be condoned. It must be emphasized that any amateur who will work a belligerent or a European (since all are involved or close to involvement) is totally inconsiderate of the more important rights of himself or his fellow amateurs. It is high time that individual tolerance of every license holder toward any few who insist on jeopardizing his privileges, be thrown out of the window. It is the right thing for all of us to monitor our DX bands closely and ask full cooperation of any amateur who flouts any part of our precautionary code. The League’s Official Observers are on the job doing this, but let every one of us help.

The League now extends its code of operating precautions, printing them prominently again below. Please comply with the following points carefully, and also make yourself part of the informal Neutrality Patrol. Contact by radio direct (or send radiograms if unsuccessful) any amateurs heard wherein it seems necessary to ask better observance of any one of the operating precautions set forth. Send A.R.R.L. the name and call of any amateur who is uninformed, or non-cooperative, or misunderstands this situation and its importance to all of us, so we may take steps to send him information.

The views in Washington on the actual situation are extremely realistic in the various governmental departments. Our friends there hope that for our own good we shall not require more monitoring surveillance or restriction. This is a request that every licensee who reads these lines may do his part in observing the precautionary code, and assisting others to do likewise. A.R.R.L. will gladly send information to any amateur who tells you he is uninformed or misunderstands. Let us remember that there is surveillance, and be watchful to see that the sensible precautions are observed, to avoid possible curtailment.

—F. E. H.

AMATEUR RADIO AND THE IMPERIAL VALLEY EARTHQUAKE

"On Saturday, May 18th, at 8:37 P.M. P.S.T. (time courtesy of stopped clocks), a sharp earth tremor was felt at many points in Southern California. Most severe shocks were at Brawley and Imperial, where the writer was at the moment passing several others who were in a hurry to get out from under a building. We were in the downtown area at the time. Most of the people killed were doing the same as we were, running out of collapsing buildings and being struck by falling arcades; however, I guess my number wasn't up!"

"As the brick dust settled from fallen buildings in the first shock, I was able to find my car under an arcade, not undamaged, and finally drove over to the house. Everyone at home seemed OK except for fright, so I proceeded to put the rig on the air, the power having come on in the meantime. I raised W6DZC at Loma Linda and requested him to notify the Red Cross, etc. Shocks continued, a very severe one at 10:30 P.M. doing over a million dollar's damage at Brawley.

"Notable work was done by W6DZC, who stayed on the air all night handling messages and watching the frequencies of stations active in the area. Numerous messages were handled by W8PTM, DAZ, DZC, OXQ, VBY, GG, EFQ and and MMW on 3.9 Mc. The Amateur Net for the American Legion on 1.78 Mc. was active all night, with W6LCU and W6NLY in the valley doing an excellent Job. W6QNM, San Diego, whom I contacted shortly after 9 P.M., and W6JVK, W6DEP and W6DXM, and many others on the Coast, did splendid work. Telephone lines were not entirely out but were swamped under the tremendous traffic load. A Los Angeles newspaper stated that its first information about the quake came via amateur radio."

—Chuck Lunder, W6HWJ

POINTS IN EXTENDED A.R.R.L. CODE OF OPERATING PRECAUTIONS

1. Do not contact any European station.

2. Do not relay anything from one country to another; confine any international contact to technical subjects or trivial small talk.

3. Do not use any code or cipher*; use plain language, English recommended. Sign each transmission with your assigned call; do not permit unlicensed operators to use equipment; contact no unlicensed stations; follow every F.C.C. regulation with utmost care.

4. Do not talk about the war over the air (even among ourselves), or discuss any happenings that might have military significance.

*Only exception, authorized AARS/NCR station drills.
ARTICLE CONTEST

Which do you consider "the most interesting amateur band?" If you have followed the contest in the past few issues of QST you know what some of the gang have to say on this subject. We are inviting more articles for the C.D. contest based on various individuals' ideas of the most interesting band. What is your choice?

A. J. Burton, W5BDX, wins the prize this month with his article, which approaches the question from a somewhat new angle.

Send in your article on why band-and-band is, in your opinion, the best available. Each month we will print the most interesting and valuable article received on this subject. So far articles have been printed on the Ten, Twenty, Forty and Eighty Meter bands. Please mark your contribution "for the C.D. contest." Prize winners may select a 1940 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.R.L. supplies of equivalent value. Try your luck!

The Most Interesting Band

BY A. J. BURTON, W5BDX*

My favorite band? Why One Hundred-Sixty Meter C.W. is the best band for local ragchews with low-power, for passing traffic across town and for medium distance contacts, although it isn't very hard to work all states on One-Sixty C.W. if a fellow wants to make the effort. On the One-Sixty 'phone band, practically any kind of a contact can be made, as is often any evening will demonstrate. Most of the Army Amateur Phone Nets operate on this band with excellent results and for neighboring contacts with fellows you have met or hope to meet in the future, One-Sixty 'phone is swell.

Now, to take part in organized activity on C.W., Eighty Meters is perfect. There we find the trunk lines, the group nets, and Army Amateur C.W. nets. To pass traffic to practically anywhere just get on Eighty C.W., give a short net call or request others to call you too. Ten Meter C.W. is good for everything, too, but fixed station or mobile, and any time DX might pop into your receiver. What a thrill it is to talk to locals and have the DX start to roll in.

Now Two-and-a-Half Meters is opening up with lots of experimenting with both amplitude and frequency modulation, if we are of an investigative mind by all means we should get on that band or even One-and-One-Quarter Meters. There's lots of room for experimenting.

So it settles down to this: My favorite band — the Most Interesting Band — is the band I choose to operate on any given time, depending on my operating interest at that time! They are all interesting, depending on what I want to do.

O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 76): W1LVE, W2HXQ, W2KXT, W4RFD, W8REC, W9BQY.

Brass Pounders' League

(April 15th-May 15th)

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<td>1800 176 2247</td>
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<td>W4PL</td>
<td>9</td>
<td>27</td>
<td>1019 25 1952</td>
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<tr>
<td>W8EKO</td>
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<td>125</td>
<td>1022 100 1334</td>
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<td>26</td>
<td>113</td>
<td>911 91 1326</td>
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<td>W8BQ</td>
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<td>77</td>
<td>1134 59 1295</td>
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<td>W3EML</td>
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<td>210</td>
<td>678 206 1175</td>
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<td>755 79 977</td>
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<td>380 32 412</td>
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<td>401 215 715</td>
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<td>159</td>
<td>1090 106 1996</td>
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<tr>
<td>W1AW</td>
<td>81</td>
<td>99</td>
<td>315 92 527</td>
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These stations "make" the B.P.L. with total of 500 or over. One hundred deliveries + Ex. Del. Credits also rate B.P.L. standing. The following one-operator stations make the B.P.L. on deliveries. Deliveries count?

W9ZFC, 240 W9MT, 135 W5GFL, 113
W5HAG, 183 W6RQ, 132 W6FIF, 111
W6HRS, 176 W5HJ, 121 W6SBOE, 111
W5Gzs, 158 W6NCs, 119 W5FM, 169
W3ZBE, 153 W8HY, 117 W8SAW, 107
W7AWT, 149 W92HE, 116 W9HT, 102
W5CGK, 145 W6ZM, 116 W1KCT, 102
W9YQG, 136 W9DUX, 115

A.A.R.S.

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<tr>
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<td>98</td>
<td>496 88 732</td>
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MORE-THAN-ONE-OPERATOR STATIONS

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<td>177</td>
<td>167</td>
<td>3270 94 3266</td>
</tr>
</tbody>
</table>

A total of 500 or more or 100 deliveries + Ex. D. Cr. will put you in line for a place in the B.P.L.

* 910 South 25th St., Fort Smith, Arkansas.
FLASH . . . A.R.R.L. Code Proficiency Certificates are to be issued monthly to amateurs who qualify for them.

WIAW regular transmissions by tape at 15, 20, and 25 words per minute will be supplemented by additional practice transmissions. One schedule per month will be transmitted on all WIAW frequencies for rating purposes. See full details next month.

Every licensed amateur is eligible for one of the Code Proficiency Certificates. It will be a challenge to prove yourself a true amateur, and receive evidence of your increase in skill after being licensed. The certificates will be given for reporting "solid copy" by ear on the official monthly transmission of plain language groups at fixed speeds.

As the transmissions are continued increased skill will receive recognition when it is demonstrated. QST will report the calls of all who receive certificate awards. See next month's announcement for details. It is not too early to start practicing copying the WIAW and other OBS transmissions, planning round-table groups (clubs) for making deliniee code speed gains possible. There will be a Club Certificate available for individual attainment in such groups, too. The way to get set for the first test transmission is to try to set down on paper for 15 to 20 minutes each day something that is a little faster than can conveniently be set down correctly. Count on nailing down an A.R.R.L. Code Proficiency Certificate in the first run, to be announced in next QST.

--- Communications Manager

BRIEFS

Capt. S. C. Collins completed four years as Liaison Officer, Army Amateur Radio System, this June. His new post will be at Patterson Field, Ohio. His successor is Lieutenant Stevenson who was formerly the Officer in Charge of station K11HR. He will arrive in Washington sometime in June.

NATIONAL SOARING CONTEST

The Eleventh Annual Soaring Contest will be held in Elmira, N. Y., from June 26th to July 14th. Amateur radio has played a big part in all the soaring meets held in Elmira, providing emergency communication in case of disaster, handling traffic, and furnishing communication between the different take-off sites and between the launching winch and the glider, which many times were out of sight of each other.

The Elmira Amateur Radio Association again this year is sponsor of radio communications and has appointed John Mulligan, WS1RTW, director of communications. Application has been made to F.C.C. for the call W8USA, which was granted for use at the 1930 meet. It is hoped a 100-watt all-band transmitter will be available for traffic handling and general rag chewing. Portable-mobile rigs will handle the launchings and landings. All amateurs are cordially invited to attend this meet. Bring your tickets! All field operations will be carried on in the 28-Mc. band. There will be daily 28-Mc. glider-to-ground work, and it is requested that all bands be on the look-out for this flax-power transmitter. Any and all reports of reception will be greatly appreciated.

April '40 O.R.S.-O.P.S. Parties

With the absence of W8BES from the April O.R.S. Party, "the dark horse" stepped up into first place with a "beautiful score"—W3HQE. We understand that BES was on for less than one hour. It may have been a case of "when the cat's away . . ." Hi. Congrats to W3HQE and also to W8DGM, who was a close second. In the O.P.S. group W9WXL pushed up into first place, followed by W2MJE and W4QV, all more or less new faces in the front row, F.B.I. The next quarter-get-togethers for O.R.S., O.P.S. and all League officials are scheduled for July 27th and 28th. Don't miss them!

Official Relay Station Scores (April)

<table>
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<td>14</td>
<td>236</td>
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<tr>
<td>W3DGM</td>
<td>20,916,212</td>
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<td>5</td>
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<td>W9CPE</td>
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<td>153</td>
<td>10</td>
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The score of WIAW, not competitive with any of the above, is recounted for the information of members; WIAW (Hal): 18,070,278; 224; 54; 21; 1000; 17.

Official Phone Station Scores (April)

<table>
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<tr>
<th>Station</th>
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<td>W3WBF</td>
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<td>W9WPM</td>
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<td>2,879,244</td>
<td>138</td>
<td>39</td>
<td>177</td>
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</tbody>
</table>

The score of WIAW, not competitive with any of the above, is recounted for the information of members; WIAW (Hal): 18,070,278; 224; 54; 21; 1000; 17.
**JULY HAMFEST SCHEDULE**

July 7th, at Shelton, Conn.: A ham get-together will be held in Shelton, Conn., starting at 2:00 P.M. E.D.S.T. on Sunday, July 7th. Sponsor is the Southern Connecticut American Emergency Network. The affair will be held on the grounds of the White Hills Coon Hollow Club, about 1½ miles southeast of Sunbury, Pa. Registration should be made in advance. All hams, their families and friends, are invited. There will be games, dancing, plenty of prizes and refreshments. Fee: $7.50 for OM’s, XYL’s and children free. Further information may be obtained from the secretary, S. M. Sill, 305 Derby Ave., Derby, Conn.

July 20th—21st, at Glacier Park: The Fifth Annual Glacier Park Hamfest is to be held at Two Medicine in Glacier Park, July 20th and 21st. There is no registration fee. Walter E. Parlow, W7FQZ, 1308 3rd Ave. No., Great Falls, Mont., is the president for the hamfest, and further information can be secured from him, W7AQK, W7ABT, W7FUQ or W7DSS. Program and antics will be arranged for the amateurs as well as for the ladies, with fishing, hiking and boating on Two Medicine, portable radio operation and plenty of subjects for the camera fans.

*July 21st, near Peoria, Ill.*: The Peoria Amateur Radio Association is holding its Second Annual Central Illinois Hamfest on Sunday, July 21st. The place: Loserch Park, about 1½ miles north of Peoria, on Route 150. As usual, there will be free refreshments, and plenty of prizes, including several large prizes, such as an RME DM38 and a Meissner Signal Shifter. There will be the traditional contests, and plenty of interesting activities are planned for the ladies. Facilities will be available for playing ping-pong, baseball or horseshoes. A dance is planned for the evening. Lunch may be purchased at the refreshment stand, or you may bring your own. Advance registration is $7.50 for the OM, $2.50 extra for the YL or YF and children. At the gate, fees will be $1. and 50c.

*July 21st, at Rolling Green Park, Pa.*: The Third Annual Hamfest of the Susquehanna Valley Amateur Radio Club is scheduled for July 21st at Rolling Green Park, on Route 11, midway between Sunbury and Selinsgrove, Pa. Registration at 1:00 P.M.; program starts at 1:45 P.M. The program will include a demonstration and talk on frequency modulation, and several reels of motion picture. Banquet will be held at 6:30 P.M. in the Park restaurant, followed by a short program and the prize drawing. The afternoon activities will be in the Park theatre. Additional details may be obtained from the club secretary, John W. Fisher, R. D. 2, Selinsgrove, Pa.

*July 21st, at Round Lake, Wis.*: The Round Lake Hamfest is staged annually by the Fox River Valley Affiliated Radio Clubs, Sheboygan, Fond Du Lac, Two Rivers and Manitowoc. It has come to be a firm established part of amateur radio activity in that region. This year’s hamfest will be held again on July 21st. The Round Lake site, approximately 18 miles southeast of Fond Du Lac, Wis., is ideal for an outdoor hamfest. Last year’s attendance was 247, representing 38 communities. An even greater turn-out is expected this year. Don’t miss it!

**W1AW Summer Schedule**

**JULY-AUGUST OPERATING-VISITING HOURS**

7:00 P.M.-1:00 A.M. E.D.S.T. daily, including Saturday—Sunday.

**ADDITIONAL STATION HOURS**

1:00 P.M.-7:00 P.M. E.D.S.T. daily, except Saturday—Sunday.

**OFFICIAL BROADCAST SCHEDULE** (for sending addressed information to all radio amateurs):

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Starting Times (P.M.)</th>
<th>Speeds (W.P.M.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.600 kc. Phone/CW</td>
<td>2:30 P.M.-3:00 P.M.</td>
<td>25,600 kc. Phone/CW</td>
</tr>
<tr>
<td>14,237 kc. Phone</td>
<td>7:00 P.M.-7:30 P.M.</td>
<td>14,237 kc. Phone</td>
</tr>
<tr>
<td>14,254 kc. CW</td>
<td>7:30 P.M.-8:00 P.M.</td>
<td>14,254 kc. CW</td>
</tr>
<tr>
<td>3825 kc. CW</td>
<td>8:00 P.M.-8:30 P.M.</td>
<td>3825 kc. CW</td>
</tr>
<tr>
<td>3950.5 kc. Phone</td>
<td>9:30 P.M.-10:00 P.M.</td>
<td>3950.5 kc. Phone</td>
</tr>
<tr>
<td>7250 kc. CW</td>
<td>11:00 P.M.-11:30 P.M.</td>
<td>7250 kc. CW</td>
</tr>
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<td>1898/1701 kc. Phone/OW</td>
<td>11:30 P.M.-Midnight</td>
<td>1898/1701 kc. Phone/OW</td>
</tr>
</tbody>
</table>

At other times, and on Saturdays and Sundays, operation is devoted to the most profitable use of bands for general contacts and to participation in special week-end operating activities. The station is not operated on legal national holidays.

Give W1AW a call for an accurate frequency measurement, to communicate with any department of A.R.R.L., to rag-chew when time permits, or to pass a message to ham friends, making use of the Headquarters station’s multi-band facilities.

Except for weeks of July 7th, 14th, 21st, and week of Aug. 4th providing for the attendants’ vacations.

**W2USA, World’s Fair**

A busy corner of the "shack" at W2USA, New York World’s Fair. Fred Seid, W2MQ, keeps an eye on the operators as they do their stuff, Nils M. Hansen, W2LSD, organizer of Forty Traffic System, is working the 7-Mc. rig, in the foreground. The receiver and transmitter beyond him, is on 3.5-Mc. c.w., and the pair of units at the end of the bench are on 28-Mc. 'phone. The large transmitter on the floor is on 3.9-Mc. ‘phone. At this writing W2USA is getting under way for the new Fair season. All bands will be used with a good number of operators making possible full operation.

**July 1940**
HOW

If you have been tolerant enough to follow this pillar since its inception a few years ago, you may have noticed that from time to time a note of pride has crept into the stuff, pride in being among the exploiters of the DX gang which, we think, is one of the most highly specialized and developed groups in the amateur radio game. We've always had that pride about them since the old days when we found them the first to take up new technical developments and learn things about DX conditions. Occasionally there have been incidents that have tried to shake that faith but they never got to first base with us.

Recently our confidence and loyalty for the DX gang has been put to a real test. Into this gang of bowled owls there has filtered an element that we aren't too keen about. We like to think that the element is made up of some of the newcomers, unfamiliar with their heritage and the traditions that make up the DX gang, but we can't be sure. We refer to these DX men who are either too stubborn or too stupid to refrain from working belligerents during these troubled times, even though the reasons for not doing so have been pointed out to them time after time in the pages of QST.

Some we can partially excuse because they haven't seen that particular part of our magazine, and others should be excused, we imagine, because they can't read. Then there is a small group of tterms who get a boot out of working ham stations in belligerent countries, and they just won't stop (they claim) unless they are told to by the F.C.C. We think just a little too much of ham radio to let any such lads be responsible for our privileges being curtailed, and that's why we'd like to make an informal suggestion. If you hear any such going on, call the ham and tell him lightly and politely to lay off until the time comes again when we can work any and all stations without jeopardizing ham radio's position.

If he's any kind of a guy at all he'll realize he isn't doing anything to help ham radio and will desist. We aren't just talking to take up space. We know that the enthusiasm this month is about KH5SHS (14,307 T9). Jerry apparently is squared away with the government down there and is now pretty active, having worked W1HX, W2GTZ, W8OSL, W5BB and others. His address, if you don't already have it, is Jerry Petranek, Box 88, Tutulia, U. S. Samoa. W1FTR, down that way on WCFT, says there are two licensed hams in Samoa, but we don't know who the other one is . . . . Another Pacific Islander the gang is catching up with is KE45KA (14,300 T9), W2GTZ, W6YN, W6AS, W5BB and others worked him, but we haven't yet seen anything of the list he was going to send through for DXCC credits . . . . Just as W6MUS was going to tear down his rotary antenna he hooked KA4YN (14,295 T9) at 1340 GT. Now he's building a fence around the antenna and has hired two small boys to keep it polished and shiny . . . . W1IX heard a KE6SPI (14,390 T9) in the early evening . . . . Cards have been coming through from a couple of EA's. The addresses, if they'll help, are: EA7BA, Dr. Jose M. Gil Guerra, General Queipo de Llano, num. 33., Cadiz, Spain; and E4AC, Luciano Garcia, Antonio del Rincon, 5, Guadalajara, Spain . . . . Speaking of cards, you'll notice in the L.A.R.U. news section this month that QSL cards to go out of South Africa are not accepted, and incoming cards are being held by the censor.

(Continued on next left-hand page)

For a long time we didn't believe there was any W2GTZ, because we never heard him on the air, but we finally tracked the guy down and got a picture and the dope. Doubtless the reason we hadn't heard him was that while we were after the milk, W2GTZ was skimming off the cream. Ed Hopper of Bergenfield, N. J., is an outstanding example of what hard work and determination can do for a fellow who's interested in DX. Ed has more patience and less power than a lot of fellows, but neither seems to have handicapped him. The receiver is an HRO, and the transmitter uses a 181 e.c.o. into a 6L6 buffer working Class A, and that drives a 35T at 150 watts input. Practically all the work is done on 20, with a rope-driven 3-element rotary antenna. Ed has been a ham for the past 16 years, but most of the DX has been worked in the past 3½ years.
Pie wound transmitting chokes such as the R-152 and the R-154 have served the amateur well for some six years. This is a long time, particularly in amateur radio where there has been a steady trend toward higher plate voltages and higher frequencies. The old pie-wound chokes have protested this state of affairs from time to time by a strong odor of burned insulation, but mostly they have just shown passive resistance. (Editor's Note: Passive resistance absorbs power just like any other kind of resistance.)

Such being the case, we decided to make a thorough investigation of transmitter choke design. A large number of chokes were tested at frequencies from 1.5 to 30 MC with a peak RF voltage of 2500 volts. Measurements were made throughout this range to determine whether the chokes were inductive, capacitive or resonant at the amateur bands. Approximate impedance values were noted, and close attention was given to temperature rise and "hot spots." Measurements of input and output power were taken with and without connection of the RF chokes, and accurate information was thus obtained on the effect of the chokes on amplifier efficiency.

The tests included not only the conventional chokes already available, but also scores of new chokes, ranging from the simplest single-layer windings to the most unusual looking shapes and forms. Various combinations of single-layer windings, conical windings and duo-lateral pies were used.

We finally arrived at the new choke shown in the sketch at the top of this page. Different diameters are combined in such a way as to give sufficient inductance for high reactance at 1.7 and 3.5 MC, and to keep the distributed capacity low, causing the series-resonant frequency of the choke to fall at about 26 MC. Single layer helical windings are used throughout the choke because this type is best for low distributed capacity.

The impedance of the choke is high for all of the amateur bands between 1.7 and 30 MC, and may be used anywhere in this range except at 26 MC. It may be used in parallel-feed circuits without overheating, and without causing a detectable loss of efficiency in the RF amplifier to which it is applied. It is free from voltage breakdown at RF peaks as high as 20,000 volts.

This new type of choke is necessarily somewhat taller than those in present use, but this is likely to prove an advantage in the actual construction of an RF amplifier. The height of the choke is about the same as that of the currently popular medium-power tubes. Thus the connection to the top of the choke may be made by an almost horizontal, short connection from the plate cap of the tube.

By and large, we think the new choke is FB.

T. M. FERRILL, JR.
The output filter condenser has two important functions—

1. It suppresses hum.
2. It prevents common coupling through the power supply. The power supply impedance must be low to prevent oscillation (motorboating), or unwanted degenerative effects.

Here, as in other filter circuit applications, FP Capacitors are unequaled from the standpoint of low impedance, dependability and compactness. A few of the many stock sizes are:

<table>
<thead>
<tr>
<th>Type</th>
<th>Capacity</th>
<th>Working Voltage</th>
<th>Can Size</th>
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<tr>
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<td>125 mfd.</td>
<td>350 v</td>
<td>1½” dia. x 3”</td>
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<tr>
<td>FPS146</td>
<td>40 mfd.</td>
<td>450 v</td>
<td>1” dia. x 3”</td>
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<tr>
<td>FPS149</td>
<td>80 mfd.</td>
<td>450 v</td>
<td>1½” dia. x 3”</td>
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<tr>
<td>FPD238</td>
<td>40-40 mfd.</td>
<td>450 v</td>
<td>1½” dia. x 3”</td>
</tr>
</tbody>
</table>

In the past, space and cost limitations have frequently prevented engineers from using optimum capacities in filter condensers.

The startling compactness of FP Capacitors removes this limitation—now you can use enough capacity to produce real results. But insist on genuine FP construction—it is your guarantee of proper life and performance.

**P. R. MALLORY & CO., Inc.**
**INDIANAPOLIS INDIANA**
Cable Address—Pelmallo

*NOT etched Construction*
"It Beats Receivers Costing Twice as Much!"

... says W3EOZ

Thomas A. Consalvi—W3EOZ—knows receivers. He has seen just about all of them—and he's actually given most of them a whirl. Many manufacturers have sent him sets to be tested under normal as well as exceptional amateur conditions. Here's what he says about the new RCA AR-77 with which he recently replaced a receiver costing more than $300 in his shack:

"In many features, the AR-77 is superior to any other I ever tried—at any price. In every way, it matches the performance of my old receiver costing more than twice as much. Some features, particularly the noise silencer, are far superior. Its performance on high frequencies is unbeatable; its signal-to-noise ratio excellent and its stability unmatched. I've tried it under all sorts of conditions and there is negligible drift, even over long periods."

Getting back to the noise limiter, Mr. Consalvi states: "It's the first really effective noise silencer I've ever tried. It really works. For instance, I've had three automobiles at the same time going full blast just outside of my shack, making all possible ignition noise. Then, I've gone to my AR-77, picked up the weakest signals I could find—signals inaudible without the noise limiter in operation—and brought them in 100%!"

Tests under average conditions show maximum drift at 30 Mc to be only 3.0 KC on one hour run, thereby keeping signal audible. A 2-to-1 ratio of signal-to-noise is obtained at an average sensitivity of 2 microvolts throughout range. Frequency coverage, 540-31,000 KC in six ranges. Try it at your nearest RCA distributor's store. You be the judge! Complete Technical Bulletin sent on request.

Net Price, $139.50 f.o.b. factory.
8" Speaker in matched cabinet, $8.00.

RCA MANUFACTURING COMPANY, INC., Amateur Division, CAMDEN, N.J. A Service of the Radio Corporation of America
HIGHLY ACTIVE: Instantly snaps into oscillation. Accurately follows keying.

POWERFUL: Uniformly high power standardized in a loaded oscillator with measured output.

ACCURATE AND STABLE: Frequency guaranteed .03% accurate. Drift less than 4 cycles/mc./°C.

DEPENDABLE: Thirty-one checks and inspections, including a final overload test, assure reliable operating characteristics.

Ask your distributor for Circular A-7
In ever-increasing numbers, amateurs are turning to the "HQ-120-X" because they find it to be everything they have ever hoped for in a medium-priced receiver. Loud praise from thousands who are already using "HQ-120-X" receivers was earned by pioneering on the part of Hammarlund engineers. They put into this receiver features which hams could really use, features which are rapidly changing the whole scheme of receiver design. And, today, the "HQ" is even better than ever because our engineers are ever alert to make the slightest improvement. In buying an "HQ-120-X" you do not get two or three year old engineering, but right up-to-the-minute improvements.

Words can hardly express the quality of this fine receiver. To really appreciate its smooth performance, it is necessary to hear and operate it. By all means, visit your dealer and operate the "HQ" yourself, and experience "selectivity and stability plus."

SEND FOR DETAILS!

HammArLund MFG. CO., Inc.
424 W. 33 St., N. Y. City
Please send 16-page "HQ" Booklet.
Name..................................................
Address...............................................,
City..................................................State..........

Canadian Office:
41 West Ave. No., Hamilton

SELECTIVITY "Plus" AND STABILITY
YOU'VE solved your problem of getting maximum efficiency from your transmitter when you invest in a Model 1696-A Modulation Monitor.

And . . . better yet . . . it saves you money by increasing your range without the added expense of remodeling your transmitter. (Amateur experience has shown that a properly modulated 10-watt rig can be as efficient as a 50% modulated 40-watt transmitter.)

The Model 1696-A is easy to use. Plug it into your A.C. line - make simple coupling to the transmitter output and the monitor shows:

- CARRIER REFERENCE LEVEL
- PER CENT OF MODULATION
- INSTANTANEOUS NEON FLASHER (no inertia) indicates when per cent of modulation has exceeded your predetermined setting. Setting can be from 40 to 120 per cent.

Use of the monitor permits compliance with FCC regulations. Two RED DOT Lifetime Guaranteed Triplett instruments . . . Modernistic metal case, 14½" x 7½" x 4½", with black suede electro enamel finish. Black and white panel.

Modulation Monitor Booklet — regular purchase price $1.00 — Furnished FREE with each Model 1696-A. Tells you what you want to know about this monitor, and includes details, including diagrams, for operation of Model 1696-A.

For More Information — Write Section 287, Harmon Drive

THE TRIPLETT ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

115: W&ADP, WSCYS, GSRV, WIVW, WCU, WPHX, G5BD
114: W&KB, WS&PK, W2DC, WICH, GDH, G5DH, G5BD
113: G5CL, WZCM, W4DFR, W2DSB, W7GRQ
112: G5DF, W2Z, W4DF, W3AS
111: WZCU, W7DF, W4DF
110: ONUU, PAKO, W5UM, ZAER, W4IW, W4LW, W7DF
109: W7DF, W4DFZ, G5M, W4DF, W7DF
106: W7DF, W4DF, W7DF, W4LW, W4LW, W7DF, W4LW
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101: W7DF, W4DF, W7DF, W4LW, W4LW, W7DF, W4LW
100: W7DF, W4DF, W7DF, W4LW, W4LW, W7DF, W4LW

Since Century Club applications are falling off, and more personal time will be required for issuing the Code Proficiency Certificates, the next listing of Century Club Awards and standings will be scheduled for September QST.
THE new Hammarlund "PA-150" is an ideal final amplifier for the amateur interested in medium power. The "PA-150" is extremely compact, measuring only 11 ½" x 8" x 5 ½" and is capable of outputs up to 175 watts with low-priced HK-24 tubes. Other tubes such as 35-T can be used for higher outputs. The entire foundation unit is designed around the new Hammarlund "HFB" insulated rotor condensers, further adding to the economy of this excellent unit.

If your present rig uses an 807 or similar output tube of around 15 watts, it will be a simple matter to add the "PA-150" and really go places. For further technical information, see October 1939 "OST" Page 38, and write for folder containing diagrams of amplifier and power supply, as well as complete list of parts. Ask your dealer to show you the new "PA-150" — it's really FB.

WRITE FOR FOLDER!

Hammarlund Mfg. Co., Inc.
424-438 W. 33 St., N. Y. City

Please send "PA-150" folder

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

HAMMARLUND MFG. CO., INC.
424-438 WEST 33rd ST., NEW YORK

EXPORT DEPT. 100 VARICK ST., NEW YORK CITY
The new improved 54 GAMMATRON offers greater plate voltage capabilities up to 3000. The U. H. F. efficiency is higher. This great combination of features makes the 54 ideal for a wide range of applications. Efficiencies shown below are obtainable in conventional circuits of proper design. WRITE FOR DATA.

WTDR

The Schoolship of the Massachusetts Nautical School, the steam bark Nantucket, is on her annual cruise, this year to Central American waters. From May 11th to September 22d, the following points will be visited: Boston, Gloucester, Washington, Norfolk, St. Thomas, San Juan, Guantanamo, Cristobal, C. Z., St. Petersburg, Havana, East Lamoine, Glen Cove, Fall River and Catanent, Mass., an estimated sailing distance of 8985 miles. The Nantucket carries 118 cadets in training for officers’ positions in the U. S. Merchant Marine, and has a crew and officer complement of another 25 men, including 3 radio men. The radio call is WTDR. Communication with amateur stations is desired, with the view of having personal messages from the cadets forwarded to their parents and friends. WTDR will listen on the 7-Mc. amateur band at 0700 GMT, and will answer on 8280 kc.; and will also listen on the 14-Mc. band at 1900 GMT, answering on 12,420 kc. A.R.R.L. will be interested in hearing of any contacts with the Nantucket.

New Receiving Tubes

NEW BATTERY TUBES

SYLVANIA announces a group of three new 1.4-volt, 50-ma. battery tubes which are designed for efficient performance at low plate voltages. All are of the loktal type.

ILC5

This type is an r.f. amplifier pentode with medium cut-off characteristic satisfactory for a.v.c. circuits. Operating conditions are as follows:

- Plate voltage: 45 90
- Screen voltage: 45 45
- Grid voltage: 0 0
- Plate current: 1.1 1.15 ma.
- Screen current: 0.25 0.2 ma.
- Plate resistance: 0.7 1.5 meg.
- Mutual conductance: 750 775 µmhos.

ILC6

The 1LC6 is a pentagrid converter with operating conditions and characteristics as follows:

- Plate voltage: 1590
- Screen voltage: 1535
- Anode grid voltage: 45 45
- Control grid voltage: 0 0
- Oscillator grid resistor: 0.2 0.2 meg.
- Plate resistance: 0.3 0.65 meg.
- Plate current: 0.7 0.7 ma.
- Screen current: 0.75 0.7 ma.
- Anode grid current: 1.4 1.4 ma.
- Oscillator grid current: 0.035 0.035 ma.
- Total cathode current: 2.9 2.9 ma.
- Conversion conductance: 275 µmhos.
- Control grid voltage at 0: 250
- Control grid voltage at -2: 150
- Control grid voltage at -5: 5 5 µmhos.

The LD5 is a diode-audio pentode with characteristics and operating conditions as follows:

- Plate voltage: 10
- Screen voltage: 2
- Grid voltage: 0
- Plate current: 0.1 ma.
- Plate resistance: 0.05 meg.
- Transconductance: 600 µmhos.

* A resistance of at least 1 meg. should be in the grid return to negative filament, Pin No. 8.
† Obtained preferably from by-passed series resistor.
‡ A resistance of at least 1 meg. should be in the grid return to negative filament, Pin No. 8.

(Continued on next left-hand page)
WHEN you choose a "Super-Pro", you are joining a large family of technicians and engineers who have consistently used and specified "Super-Pro" receivers for practically every type of communications service. This is your assurance that you are getting the finest receiver money can buy — for experts use the best. The new Series 200 "Super-Pro" has automatic noise limiting, five-point crystal selectivity with continuously variable I.F. band width, ranging from single signal to high quality broadcast; adjustable "S-Meter"; two T.R.F. stages, and just about everything required for either commercial or amateur service.

Export Dept.
100 Varick Street, New York City

HAMMARLUND

HAMMARLUND MFG. CO., INC. Q-7
484-488 W. 33rd Street, New York City
Please send 16-page "Super-Pro" booklet
Name:........................................
Address:....................................
City:........................................State:................
NEW LOKTAL TYPES
Sylvania also announces a new list of equivalent types which are now available in loktal form as follows:

<table>
<thead>
<tr>
<th>Loktal</th>
<th>Service</th>
<th>Equivalent or Similar to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1LA4</td>
<td>Power pentode</td>
<td>1A5G</td>
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<tr>
<td>1LA6</td>
<td>Pentagrid converter</td>
<td>1A7G</td>
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<tr>
<td>1LB4</td>
<td>Power pentode</td>
<td>1T5G</td>
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<td>1LE5</td>
<td>Med. Mu Triode</td>
<td>1E4G</td>
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<tr>
<td>1LE6</td>
<td>Diode-triode</td>
<td>1F5G</td>
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<tr>
<td>1LN5</td>
<td>R. F. pentode</td>
<td>1N5G</td>
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<tr>
<td>7E7</td>
<td>Duodiode-pentode</td>
<td>6BSG</td>
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<tr>
<td>7F7</td>
<td>Double triode</td>
<td>6CSG</td>
</tr>
<tr>
<td>7H7</td>
<td>Semi-remote cut-off</td>
<td>6AB7/18S3</td>
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<td>7N7</td>
<td>Double triode</td>
<td>6F8G</td>
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<td>12B7</td>
<td>R. F. pentode</td>
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<td>14B6</td>
<td>Duodiode-triode</td>
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<tr>
<td>14J7</td>
<td>Triode-heptode</td>
<td>7J7</td>
</tr>
<tr>
<td>14Q7</td>
<td>Pentagrid converter</td>
<td>7Q7</td>
</tr>
</tbody>
</table>

NEW APPARATUS

IMPROVED ACORN SOCKET
Those who use u.h.f. gear should be interested in the improved Hammarlund acorn tube socket Type UHS-900. The base of low-loss "Iso-Q" is fitted with new-type silver-plated beryllium contacts which are grooved so that the tube snaps firmly into place and will not jar loose nor shift position. In addition, a shield is available which completes the internal shielding of the acorn pentode, greatly reducing coupling between input and output circuits.

NEW SOLDERLESS CO-AXIAL FITTINGS
Communications Products Co. of Jersey City, N. J., now have a complete line of compression-type fittings for concentric lines and antennas which require no soldering. The fittings are waterproof and it is claimed that a saving of 75 per cent in labor of installation is possible. The concentric half-wave antenna is made in three sizes for powers up to 1000 watts.

NEW SOLDERING IRON
Something new in the way of soldering irons is the Ducan "Solder Master." In this iron, the head is fitted with a spill-proof cup which holds 48 drops of solder which is kept in a molten state by the heat of the iron. Each pressure of the thumb on a button on the handle of the iron releases a single drop of solder through a nozzle. This feature makes it unnecessary to hold the solder strip to the point of the iron, thereby releasing one hand for holding the work. It should also prove handy in making connections which are difficult of access. It is made by the Dual Remote Control Co., Inc., 31776 West Warren, Wayne, Mich.

U.H.F. PUSH-PULL TRANSMITTING PENTODE
The latest trend in transmitting tubes seems to be toward the multiple-unit type. Close upon the heels of the double and quadruple parallel-connected triodes of Eimac comes the announcement of the 829 by RCA. The envelope of this tube, which is designed for u.h.f. performance, contains two beam tetrodes. The cathodes are connected together inside the tube, while the heaters are connected in series with the center tap brought out to a separate terminal so that they may be operated in series from a 12.6-volt supply or in parallel from a 6.3-volt supply. The tube is designed particularly for push-pull operation.

Maximum CCS ratings in Class-C telegraph service are: d.c. plate voltage, 500; total plate current, 240 ma.; total plate dissipation, 40 watts; maximum plate input, 120 watts. Typical power output is approximately 83 watts. The tube may be operated at full ratings at frequencies up to 200 Mc. and at reduced input to 250 Mc. Less than 1-watt driving power (at the grid) is required for full output at 200 Mc. and no neutralizing is required.

Correspondence Department
(Continued from page 65)

must there be a solution? I could not swim when I was five years old, but I learned in due time. I could not operate 75- and/or 20-meter "phone when I first became a ham, but I can do so now. Ten was not worth the effort just a few years ago; even 20 and 40, not to mention 80 and 160, were not everything that the ham wanted. Needless to say "we got there just the same." We got there just the same way that we are getting to the ultra-high's to-day. New equipment is being developed along with new theories and practice. I think all of this effort being expanded on how to solve a problem that is not even a problem could well be directed to doing a little more "actual practice" on the ultra-highs. In other words give us the dope on your discoveries, show us some simple circuits and put them on pages and pages of QST. . .

And all of this talk of killing two birds with one stone. The only birds that some of your other birds want to kill are the little young birds who, as yet, have only a little fuss on them. Some day you old birds are going to slip, and when you do, since you killed two birds with one stone while they were unable to defend themselves, ham radio will be no more, Why persecute the beginners? — Russell M. Price, W9GWL

Strays

I.R.E.-A.I.E.E. PACIFIC COAST CONVENTION
The Institute of Radio Engineers plan a Pacific Coast convention to be held in Los Angeles on August 28th, 29th and 30th. This is a combined effort of the A.I.E.E. and the I.R.E. with one joint session of interest to both groups.

In reference to the Stray which appeared on page 18 of QST for May, the Precision Transformer Company, Grand Haven Road, Muskegon, Mich., advises that antenna wire in any length can be supplied.

Automobile-radio antenna connectors make good and inexpensive mike connectors. They are handy wherever shielded leads are to be connected. The cost — just six cents. — W6BKS.
Robert Hecksher, an DX Century Club Member, uses Eimac tubes to work 134 countries on both phone and CW... 104 countries on two-way phone.

Eimac Representatives:

California, Nevada
HERB BECKER, 1530 W. 104th St., Los Angeles, Cal.
Wash., Ore., Idaho, Mont.
Colo., Wyo., New Mexico, Arizona, Utah
RICHARD A. HYDE, 4253 Quinlan St., Denver, Colo.

Texas, la., Okla., Ark.
J. EARL SMITH, 2821 Live Oak St., Dallas, Texas
Chicago, Illinois, Wisconsin
ADOLPH SCHWARTZ, 14725 Elm Ave., Flushing, New York

Outstanding results like this, coupled with economy in operation, are the reasons why most of the leading radio amateurs in the world use Eimac tubes. Chances are you'll find it easier to get results if you switch to Eimac TUBES.
YOU CAN'T FOOL AN ENGINEER

The old time medicine man was a colorful character but he has no place in an age which insists upon quality—not fanciful claims.

Take transformers, for example! We could make claims, ballyhoo our product to high heaven—but it wouldn't mean a thing because you can't fool an engineer—he buys on Fact not Fancy!

Typical of this is the Kenyon line of Plug-in Transformers which, because they give PLUS value, are favored by engineers who read specifications.

QUALITY ALWAYS TELLS

Note these Kenyon features which challenge comparison!

1. Over 20 different types
2. Uniform response 30 to 20,000 cycles. (No D. C. in primary)
3. No wire sizes smaller than No. 44 (assuring absolute dependability)
4. Positively Submersion-Proof (½ lap on all sealed joints)
5. Humbucking construction employed (not practical in smaller sizes)
6. 11-prong base allows maximum electrical versatility plus more rigid mechanical mounting
7. A 'first' by Kenyon

Send for the new Kenyon Catalog which gives complete data on the more than 20 different types of plug-in transformers as well as Laboratory Standard transformers, broadcast and industrial transformers, etc. Many graphs, charts and valuable data. It's yours for the asking.

KENYON TRANSFORMER COMPANY, Inc.
840 BARRY STREET • NEW YORK, N. Y.
Cable Address: KINCO, New York, N. Y.

A.R.R.L. QSO Party Results

(Continued from page 48)


As is the case with all successful contests and ham get-togethers the parting shot was "Let's have another." A.R.R.L.'s activity schedule calls for another member-QSO-party next January. Don't miss it!

Scores

Third "A.R.R.L." QSO Party, January 1940

(Scores are grouped by Divisions and Sections. . . . The operator of the station first-listed in each Section is winner for that Section. . . . Asterisks denote stations not entered in contest, reporting to assure that stations they worked get credit. . . . Listings show score, number of A.R.R.L. members worked, number of Sections worked. . . .)

ATLANTIC DIVISION

<table>
<thead>
<tr>
<th>Call</th>
<th>Score</th>
<th>Number Worked</th>
<th>Sections Worked</th>
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<tbody>
<tr>
<td>W8RJL</td>
<td>8400-120-35</td>
<td>273</td>
<td>360</td>
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<tr>
<td>W3DGM 1</td>
<td>27328-248-35</td>
<td>265</td>
<td>248</td>
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<td>W3ATR</td>
<td>22323-247-45</td>
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<td>W3GKO</td>
<td>20350-226-51</td>
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<td>W3GTH</td>
<td>21785-222-49</td>
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<td>21855-221-49</td>
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<td>W3SHG</td>
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<td>W3GGH</td>
<td>18292-194-18</td>
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<td>11860-146-41</td>
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<td>W4IK</td>
<td>11412-151-50</td>
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<table>
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<td>103</td>
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<td>103</td>
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<td>W2IOP</td>
<td>8400-120-35</td>
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<tr>
<td>W9TH 57</td>
<td>8400-120-35</td>
<td>47</td>
<td>120</td>
</tr>
</tbody>
</table>

1 Two operators, W3DGM and W3RAK.
2 W3HIF, W3GK.
3 W9RQM now W9BY.
4 W9RAK, W3WJ, W3HIF, W3GK.
5 Scores of three ops.: W1BFT 350, W1DIA 300, W2KVE 250.

(Continued on next left-hand page)
Count these features

- quality construction
- separate speaker
- professional appearance
- separate band-spread condenser
- low price — only $49.50 net with speaker

Prove its performance

prove to yourself the high performance of the NC-44 by an actual competitive test. Prove, as thousands have done, its ability when the going is tough!

And rate it "BEST BUY!"

NATIONAL COMPANY, INC.
QUALITY ABOVE ALL!

SOLAR CAPACITORS

XL TRANSOIL
For Permanent Fillers

MD-Del-D.C.
W3JUM 17688-201-44
W5OQ 15530-169-48
W2CA 3550-67-20
W3HTW 3200-55-29
W4GJ 1441-39-30
W3CQ 912-20-16
W3CDQ 30-5-3
W3HIL 18-3-3

Mid-New York
W3BBY 10993-201-49
W3DOD 12150-165-42
W3NQ 8992-114-39
W3FLA 7335-131-28
W3BOO 5600-80-35
W3ALP 5169-70-31
W3HLS 5100-105-24
W3WU 3200-75-25
W3WT 1760-46-20
W3WU 1465-43-17
W3AOR 1405-37-10
W3QQ 1159-28-18
W3YQ 1115-21-18
W3RQ 253-15-11
W3RQ 290-14-10
W3TH 198-11-9
W3HIT 112-8-7
W3BEI 3168-66-24
W3EWK 1160-29-20
W3HVM 1024-33-16
W2BWW 540-18-15
W3EUH 80-10-4
W8PUD 5644-83-34
W8GON 5644-83-34
W8DN 3900-75-26
W8DHU 3900-75-26
W8SAY 3366-52-33
W8RTA 2112-44-24
W8CEO 264-12-11
W8ACU 264-12-11
W8ASF 40-5-4
W8QLZ 18-3-3
W8LSU 28-3-3

Western New York
W3IB 10993-201-49
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W3JF 8992-114-39
W3KLV 7335-131-28
W3JU 5600-80-35
W3HLS 5169-70-31
W3HLS 5100-105-24
W3WU 3200-75-25
W3WT 1760-46-20
W3WU 1465-43-17
W3AOR 1405-37-10
W3QQ 1159-28-18
W3YQ 1115-21-18
W3RQ 253-15-11
W3RQ 290-14-10
W3TH 198-11-9
W3HIT 112-8-7
W3BEI 3168-66-24
W3EWK 1160-29-20
W3HVM 1024-33-16
W2BWW 540-18-15
W3EUH 80-10-4
W8PUD 5644-83-34
W8GON 5644-83-34
W8DN 3900-75-26
W8DHU 3900-75-26
W8SAY 3366-52-33
W8RTA 2112-44-24
W8CEO 264-12-11
W8ACU 264-12-11
W8ASF 40-5-4
W8QLZ 18-3-3
W8LSU 28-3-3

No. Minnesota
W3IB 10993-201-49
W3RJ 12150-165-42
W3JF 8992-114-39
W3KLV 7335-131-28
W3JU 5600-80-35
W3HLS 5169-70-31
W3HLS 5100-105-24
W3WU 3200-75-25
W3WT 1760-46-20
W3WU 1465-43-17
W3AOR 1405-37-10
W3QQ 1159-28-18
W3YQ 1115-21-18
W3RQ 253-15-11
W3RQ 290-14-10
W3TH 198-11-9
W3HIT 112-8-7
W3BEI 3168-66-24
W3EWK 1160-29-20
W3HVM 1024-33-16
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W3EUH 80-10-4
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W8GON 5644-83-34
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W8DHU 3900-75-26
W8SAY 3366-52-33
W8RTA 2112-44-24
W8CEO 264-12-11
W8ACU 264-12-11
W8ASF 40-5-4
W8QLZ 18-3-3
W8LSU 28-3-3

(Catalog Free Upon Request)
MORE NEW

"Designed for Application"

MILLEN GEAR

ESPECIALLY for mobile rigs! 33991 is socket for RCA 991 voltage regulator tubes. 32150 is entirely new type of Isolantite bushing. Fits ¼" hole in chassis. Locked in place instantly with drop of solder. No nuts to vibrate loose. 33087 is "snap action" base clamp for 807, etc. No tools required to remove tubes. 10050 is dial lock that does not cause detuning when operated. Single hole mounting. 10060 is concentric type shaft lock for "screw driver adjusted" controls. 33888 is socket shield to permit full advantage from use of "S" type of single ended metal tubes in high gain amplifiers. Provides effective electrostatic shield between grid and plate circuits. 20935 is double spaced ultra midget variable. 39006 is a radically new type of insulated flexible coupling which permits hubs to slide back and forth, in and out, twist, etc., without backlash!

THESE are just a few of the many new products that are continuously being added to the MILLEN line of ENGINEERED radio products. Other recent products, still too new to be listed in our general catalog, include FM discriminators (60504, etc.) and IF transformers, terminal blocks (37104, etc.), and many new styles of "UHF" transmitting and receiving condensers, etc., etc., etc.

YOUR distributor can show you these and other new as well as regular MILLEN components.
The Type "F" Frame

Through no particular effort on our part, this sturdy frame, capable of housing a variety of both fixed and variable air condensers, is staging a "comeback" via the commercial radio application route.

Since our recent catalogs have not included them, we present two representative types with general characteristics for your information. Amateur and commercial engineers will be interested in the fixed units for loading medium power tank circuits, and the dual variable is noteworthy for its adaptability for mechanically balanced, low torque work, particularly where a necessity for perfect bearings dictates the use of ball races.

General Characteristics of the "F" Frame:

- End plates and tie rods — Brass, nickel plated.
- Plates, fixed or variable — Aluminum (35).
- Insulation — G.E. Mycalex No. 1364.
- Frame size — 4" wide x 4" high.
- Mounting — Two standard "X" mounting feet, or four special long brackets (see cut of variable unit) or by three mounting posts on end plate.
- Bearings (on variable) — May be standard thrust ball rear bearing with front shoulder bearing, full ball bearings at each end, or any desired combination.
- Capacity — Standard combinations in the variable type.

Special Type FS-200-YS
Fixed Capacitor

Quotations on request, but a list of standard types will be soon in Catalog No. 42, soon to be released.

THE ALLEN D. CARDWELL
MANUFACTURING CORPORATION
64 PROSPECT STREET, BROOKLYN, NEW YORK
Here's the Guide you've been waiting for—the most genuinely helpful, complete and practical volume of its kind RCA has ever issued. Written specifically for the amateur, it contains 48 pages filled with timely technical information on transmitter construction, transmitting tube circuits and complete data on amateur radio's greatest line of tubes.

Easy-to-build rigs designed from "mike to tank"; latest in cathode modulation; "hot" plate-modulated and c-w rigs; straightforward single-stage circuits, up-to-the-minute data on famous tubes such as the RCA-802, 806, 807, 808, 809, 810, 811, 812, 828 and many others. Tells what to do and exactly how to do it. Richly illustrated, it is a boon to the newcomer, indispensable to the old-timer—a book that is a "must item" for every shack.

Available through RCA Power Tube Distributors, or send 15c direct to RCA Commercial Engineering Section, Harrison, N. J.

**HAM TIPS**

*Free*

*This helpful little publication is prepared by RCA specifically for the amateur. Free from all RCA Power Tube Distributors.*
### NEW Attenuators at NEW Low Prices

**The Daven Company**

#### Series LA-800

<table>
<thead>
<tr>
<th>Ladder Network</th>
<th>Attenuation (dB)</th>
<th>Price</th>
<th>20 Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA-800</td>
<td>2.0</td>
<td>Linear</td>
<td>20</td>
</tr>
<tr>
<td>LA-802</td>
<td>2.0</td>
<td>Linear</td>
<td>20</td>
</tr>
</tbody>
</table>

- **Compact low impedance mixing controls for use in portable broadcast equipment and public address systems, similar to construction of larger and costlier units. Dependable, accurate, noiseless in operation and constant impedance over operating range.**

#### Series CP-800

<table>
<thead>
<tr>
<th>Grid Control</th>
<th>Attenuation (dB)</th>
<th>Price</th>
<th>20 Steps</th>
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<td>CP-800</td>
<td>2.0</td>
<td>Linear</td>
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<tr>
<td>CP-802</td>
<td>2.0</td>
<td>Linear</td>
<td>20</td>
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</tbody>
</table>

- **These Potentiometers are designed for use as gain controls in portable amplifiers and public address systems. They are rugged, compact, and are readily adaptable to popular priced systems. Long and trouble-free service can be obtained from this type of attenuator.**

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(Continued on next left-hand page)
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The famous Taylor 866 is celebrating its Seventh Anniversary—seven years of Sales Leadership—seven years of real "dollar and cents" savings to thousands of amateur and commercial users.

In 1933, with competitive tubes selling for $7.50, (just reduced from $12.50) the announcement of the broadly guaranteed Taylor 866 at $1.65 was the sensation of the radio world. Sales of Taylor's 866 skyrocketed and leadership has been constantly maintained.

In 1939, Taylor introduced its new Heavy Duty Shielded 866 at $1.50*. Since then increasing numbers of unsolicited reports have acclaimed its performance in Broadcast, Police, Airline and Amateur installations.

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* Same characteristics as 866A. Peak inverse 10,000 volts.

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14th Annual Rocky Mountain Division Convention

Lincoln Park and Auditorium, Grand Junction, Colo., July 6th and 7th

The Western Slope Radio Club, sponsoring the 14th Annual West Gulf Division A.R.R.L. Convention to be held in Grand Junction, Colo., July 6th and 7th, expect to cover every square foot of the 125 acres of recreation grounds in Lincoln Park with conventioneering hams. To secure this result they have arranged a program including demonstrations, technical talks, special meetings, a conducted tour through the Rio Grande shops, prize drawings, etc. The preregistration fee (deadline July 1st) is $2.50; thereafter $3.00 (ladies, $1.50). Special rates on the Rio Grande Railroad. Write M. E. Erickson, W9FQT, Grand Junction, Colo.

Heterodyne Exciter

(Continued from page 40)

oscillator. The next in is the five-meter band calibration. This is followed in turn by 10- and 20-meter band scales. A dial drive such as the National PW would probably give smoother action, but has the disadvantage of not being directly calibrated.

The frequency range of the variable oscillator is 500 to 1000 kc. This is very convenient, for the calibration is easily obtained by beating with broadcast stations. With 150 plate volts, regulated by a VR150, the stability as regards drift and shift due to line voltage variation is highly satisfactory. Even better stability could be obtained by using a pair of electron-coupled oscillators in place of the 6N7, but in the authors’ case it was not found necessary.

The mixer stage is the most unorthodox. The screens are not given any positive voltage; they are returned to ground through an r.f. choke. If (Continued on next left-hand page)
Down around Dallas, amateurs know Sneed Greever. The country over, amateurs know his call: W5EXW. And amateurs respect Mr. Greever's judgment. He says:

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80

the ordinary screen voltage is applied to them, the load is too heavy for the crystal oscillator, and the conversion efficiency is reduced. Obviously, no r.f. at the crystal frequency can appear in the plate tank, for the screens are excited in parallel, and the r.f. balances out in the push-pull output. The control grids are driven in push-pull by the low-frequency oscillator, but no signal from this source can be found in the mixer plate circuit because its resonant frequency is far removed from that of the driving oscillator.

Two points of resonance will be found in the output of the 6F6's. One is the frequency 6499 kc. plus 500 to 1000 kc., and the other 6499 kc. minus 500 to 1000 kc. The first and higher frequency resonance is the correct one, of course, for it gives an operating range of approximately 7000 to 7500 kc. If the double frequency of an 80-meter 'phone-band crystal had been used, the lower frequency sideband should be used.

Operating Data

Doubling is possible in the mixer stage but is to be strongly discouraged because it gives four output frequencies. If the low-frequency oscillator is set at 500 kc., these would be 14,000, 14,500, 12,000 and 12,500 kc. It is easy to mistake one of these frequencies for the other, and may lead to off-frequency or double-frequency operation.

With no load on the mixers, the low frequency will be found to change about 200 cycles when the mixer plate tuning is swung through resonance. This is due to a reactive load reflected through the tubes. When the output is loaded, however, this effect becomes very small. The coupling to the next amplifier is obtained by a link, and is the most satisfactory method found.

The plate circuit efficiency of the 6F6's runs up to 15 watts output as compared with about 3 watts for the 6L6's. The plate current was correspondingly greater, but they were never free of parasitics. A pair of 6L6's, for instance, will give 15 watts output as compared with about 3 watts for the 6F6's. The plate current was correspondingly greater, but they were never free from spurious oscillations. Because of increased loading of the low-frequency oscillator, the frequency stability was much less.

For c.w. work, either the crystal or the low-frequency oscillator may be keyed. Both methods give a clean-cut note with no chirp. This is probably because the other tuned circuits in the transmitter are on a frequency different from either of the oscillators and thus there is much less liability of transients acting upon them.

This variable frequency exciter has been in use at W1BKO for over two months and is used to drive three 6L6's as doublers in cascade, ending up with a pair of 6L6's on five meters. It is very easy to set the v.f. unit on a station's frequency by means of either of the oscillators and thus there is much less liability of transients acting upon them.

This variable frequency exciter has been in use at W1BKO for over two months and is used to drive three 6L6's as doublers in cascade, ending up with a pair of 6L6's on five meters. It is very easy to set the v.f. unit on a station's frequency while listening to him, and come back to him on his own exact frequency. The signal has never failed to get a report of excellent stability. It is definitely better than most e.c.o.'s of ordinary design and equally as stable as any crystal controlled transmitter that we have heard.
Hammarlund SUPER-PRO
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<thead>
<tr>
<th>Model</th>
<th>Capacity</th>
<th>Net Price</th>
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<td>2.1-10 MMF</td>
<td>$1.80</td>
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<tr>
<td>SP-210-X</td>
<td>3.2-14 MMF</td>
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<tr>
<td></td>
<td>3.8-14 MMF</td>
<td>$3.90</td>
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Model Capacity Net Price
N-10 2.1-10 MMF $1.80
N-15 3.2-14 MMF $3.60
N-20 3.8-14 MMF $3.90

Tuning Range Cash Payment Per Mo.
SP-110-SX 7½-240 meters $279.00 $277.90 $22.18
SP-110-X 15-560 " 279.00 27.90 22.18

Includes 10" Speaker in cabinet to match receiver

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Per Mo. for 12 mos. 10.97

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ISO-O insulation, Beryllium copper silver plated contacts, supplied with shield for complete internal shielding.
Net Price 66¢

Kit of Parts for the QST 112 MC
Self Contained Battery Transceiver
Described in April '49 QST on Page 28 by Vernon Chambers
All parts of nationally advertised manufacturers, and as recommended in the original article, drilled chassis and panel including cabinet. Complete instructions, layout blueprints, and diagrams.

Accessories used in 112 MC Transceiver

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<td>1 RCA 6LG6</td>
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<tr>
<td>1 Kit 4 &quot;B&quot; and 1 6V &quot;A&quot; Burgess batteries</td>
<td>.40</td>
</tr>
</tbody>
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Net Price 71¢

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New Hammarlund Acorn Socket Model UHS-900
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During July and August only
MAINE - SCM, H. W. Castner, W1ITE - The Pine Tree Division for the New England Radio Club, held its regular meeting May 3rd, with an unusually large attendance, for the most successful season. Your S.C.M. had the pleasure of visiting the Portland Amateur Wireless Ass'n on May 14. I am most happy to report some real action in Waterville. The boys there have formed a fine club called The Waterville Amateur Radio Club, HSE president and LMM secretary, BGT is vice-president. The boys meet every two weeks in the summer and every week in the winter. We expect to hear them on 2842 kc. soon. The boys at OR are doing a fine job, with both the C.W. and S.F. on 14 Mc. with 500 watts 'phone and 1 kw. on c.w. Many of the boys down this way forwarded a lot of messages to our vice-president, "George," W1KH, on his birthday, May 14th. This fine idea was started by "Ed" W1LTK. Any of you fellows who belong to radio clubs anywhere in New England will be most interested to find out more about the New England Radio Club Council. Information is available from Frank L. Baker, Secretary, W1APL, 30 Colby Road, North Quincy, Mass. This Council does a tremendous good in gathering opinion for the information of the New England Director. I most sincerely urge every radio club to investigate. FV is planning to get a good rig on the air by fall, with either 807's or 809's doing the pushing. I enjoyed a visit to the Northeastern Amateur Radio Club in Woonsocket, May 1st. HYK entertained, and passed out a swell feed. We never saw a new ham make faster improvement than MLE, Good work, Carl. We are going to need many more Emergency Coordinators in our towns. Fellows, this is a most worthy activity. We had a serious flood disaster last August, over West Baldwin way, and no one on earth knows where or when these things strike, so be prepared. The best preparation is to be lined up with the Emergency Corps so that the authorities know where help can be obtained. I have a full and complete instruction sheet telling you exactly what to do and what NOW is doing to get the things in good shape. Better ask the people in charge to line you up and get your signal. Council does a tremendous good in gathering opinion for the New England Radio Club Council. Information is available from Frank L. Baker, Secretary, W1APL, 30 Colby Road, North Quincy, Mass. This Council does a tremendous good in gathering opinion for the information of the New England Director. I most sincerely urge every radio club to investigate. FV is planning to get a good rig on the air by fall, with either 807's or 809's doing the pushing. I enjoyed a visit to the Northeastern Amateur Radio Club in Woonsocket, May 1st. HYK entertained, and passed out a swell feed. We never saw a new ham make faster improvement than MLE, Good work, Carl. 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We are going to need many more Emergency Coordinators in our towns. Fellows, this is a most worthy activity.
for over 5 weeks, and has been using the portable emergency transmission equipment. 

Although there has been some difficulty at times getting through solid, I have been able with about 15 watts and a piece of No. 14 rubber-covered wire about 50 feet long, to make contact in 2108.000. Power Supply with Vibration-grid-approx. $12.00. Have visited JA9, BVK, BIK and JLT while in this, as well as attending two nice meetings of the Pittsfield Radio Club and a Hobby Show at the Berkshire Hotel. I am practicing for the 1950 Commonwealth President. I believe this rig is absolutely dependable and reliable. 

Cost me: Receiver - approx. $15.00; Transmitter - approx. $25.00; Power Supply with Vibration-grid approx. $12.00. Have visited JA9, BVK, BIK and JLT while in this, as well as attending two nice meetings of the Pittsfield Radio Club and a Hobby Show at the Berkshire Hotel. I am practicing for the 1950 Commonwealth President. I believe this rig is absolutely dependable and reliable.

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2½ Meter Transceiver

Ideal for spring and summer portable operation — simple and convenient

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GENERAL: The DK2 is a completely self-contained 112 mc. radio-phone transmitter and receiver, for use in your car, plane, boat, or while lying carried, for portable work. It is very simple to operate. The working results have been obtained.

SPECIFICATIONS

CASE: Size 11½" long x 9½" high x 6½" wide, grey wrinkle finish metal, heavy leather handle. All batteries are self-contained in case. Removable side panel for easy access to the batteries and tubes.

FREQUENCY: Will cover 112 mc.

BATTERY REQUIREMENTS: Three 15 volt B batteries like Burges 5308; and four No. 6 dry cells, or two Burges SFHH batteries.

TUBES USED: One type 6J5GT, one type 6G6G.

SHIPING WEIGHT: 12 pounds.

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2½ METER HI-POWER MOBILE TRANSCEIVER

20 WATTS — INPUT

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BOOK REVIEW

Radio at Ultra-High Frequencies, published by RCA Review, 75 Varick Street, New York City, 456 pages; gratis to subscribers to RCA Review.

This volume is a collection of technical papers, by engineers of the RCA Laboratories, dealing with various aspects of work above 30 megacycles. Many have previously been published in engineering journals, including RCA Review, but a number make their first appearance in the present volume. An extremely useful purpose is served in bringing together important material, from an organization which has done considerable research work in this field, on the subject of ultra-high frequencies. The book is divided into five parts: transmitting methods and equipment, propagation and relaying, measurement, reception, and ultra-high frequencies above 300 megacycles. Papers on television, phase and frequency modulation, frequency control, uh.f. antennas, and many related subjects are included. Amateurs interested in uh.f. work will find plenty of worth-while reading.

Radio at Ultra-High Frequencies is not sold directly, but is given free with the third year of a subscription to RCA Review. It is a companion volume to previously-published Television and Radio Faceience, which are similar groupings of RCA papers on the subjects indicated.

G. G

PORTABLE KINKS

(Continued from page 81)

denser, vintage of about 1927, still obtainable in most junk shops for from 50 cents to $1.00. Each end two of its 360-µuf. sections are paralleled, the whole making a split-stator condenser with 720 µuf. per section, or a net of perhaps 360 µuf. but having a grounded center very necessary to our purpose. The coil L1 is tapped and the taps connected to a Centralab switch. I will not give the number of turns in the taps because they must be determined by experiment according to the feed system in use. In any event, use about 1 to 2 µuf. per meter in the tuning condenser because there are no other tuned circuits between the final plate and the antenna. You will gain in harmonic suppression and ease of driving the final. W1ANC has never had a pink ticket or an OO card in ten years of operation.

Now as to some of the simplified output circuits used in the portables. All of them follow the general scheme of Fig. 7. A coil is used which can be tapped at every turn by a number of connecting points, with the cathode (or filament) to the plate, and the antenna. You will gain in harmonic suppression and ease of driving.

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Our favorite antenna is a center-fed wire about 130 feet long, with several bends in it to keep it all on the property. It runs in a general North and South direction but is not particularly directional, we hope. Figs. 7A to 7E show rough antenna dimensions and corresponding output feed connections to put energy into almost anything which will conduct electricity.
The CENTRALAB Family of VOLUME CONTROLS

In every branch of the electronic industry Centralab Controls play a major part in producing certain, smooth, flawless attenuation. Set manufacturers, servicemen and experimentors turn to Centralab for positive performance. Whatever your Volume Control needs may be . . . specify Centralab.

WIRE WOUND RADIOHM
Identical in size with Standard Radiohm. Range from 2 ohms to 10,000 ohms, Rating 3 watts. Furnished plain or with SPST, SPDT, DPST, and a special dial lite push switch for battery sets.

SUB-MIDGET
The smallest diameter reliable control. Wall type resistor gives low noise, rapid transfer of heat to metal shell. Rating of 1½ watts. No switch or taps.

TWIN AND TRIPLE CONTROLS
Two or three sections assembled in tandem. Each section fully shielded with all contacts attached to a single shaft. Twin controls available with concentric shafts. Supplied with or without snap switches.

The resistor curve of a volume control is more important than its overall resistance . . . that is why all Centralab controls are furnished with the variety of curves shown here. Curve six is most widely used for high resistance radio grid and diode controls. Curve 1, or 4, are best for C bias, and Curve 3 for antenna C bias. Curve 10 is used on tapped controls.
(Continued from page 85)

equipment for F.D. Walt is a busy guy as R.M., O.R.S., E.C., as well as being on the job as T.L. "A." A.A.R.S., and O.P.S., is now engaged in a series of twelve week traffic work. ARS says that the damage to his beam reported in this column two months ago never happened. Sorry, I was misinformed, and glad that the beam is OK. Ramsey Radio Club meets once a month and expects to grow. The officers are MOO, pres.; FXZ, vice-pres.; and MSR, sec. and treas. FPM and DBY expect to be in F.D. with a 110 volt generator. The problem is to make it portable without using a hub truck (the 907 has always been a problem). Offically a "Livingston Radio Club is LZW Pres. and JQE Sec.-treas. CBL Livingston Radio Club are LZW Pres. and JQE Sec.-treas. Woodruff, Bailey, Handy, Budlong, Goodman, Battey, meetinJ>: were 1BDI, 2GVZ, SJMX and 2DBQ. A recent A.A.R.S. emergency power contest. The Hudson half-ton truck. (GVZ had the same problem.) Officer is well informed, and glad that the beam is OK. Ramsey Radio Club reports that the lease is OK. Thanks are due to the Convention Committee of The gang who attended the convention had a good time, all present were 34JF, JHE, BEW, QKO, HZT, HRD, and thanks to the Section and the Convention Committee for cooperation in maintaining 5- to 8-hour traffic service to KB, K5, etc. 3BES moved to another QTH: 6042 WICK. W3ADT is in the rebuilding mood again. Got a new second-class telegraph operator. 3AGV snagged three new countries in one morning, KA, KE, KF. SAOC gave 1.8-Mc. cathode modulation a whirl, but is back on 3.5 for the summer. R.M. 3AQN thanks the traffic gang for cooperation in maintaining 5- to 6-hour traffic schedules. WM4J says that KB and MCG should be glad to help anyone in our Section. W3ADT is in the rebuilding mood again. 3AVG snagged three new countries in one morning, KA, KE, KF. SAOC gave 1.8-Mc. cathode modulation a whirl, but is back on 3.5 for the summer. R.M. 3AQN thanks the traffic gang for cooperation in maintaining 5- to 6-hour traffic schedules. WM4J says that KB and MCG should be glad to help anyone in our Section. W3ADT is in the rebuilding mood again. 3AVG snagged three new countries in one morning, KA, KE, KF. SAOC gave 1.8-Mc. cathode modulation a whirl, but is back on 3.5 for the summer. R.M. 3AQN thanks the traffic gang for cooperation in maintaining 5- to 6-hour traffic schedules. WM4J says that KB and MCG should be glad to help anyone...

ATLANTIC DIVISION

EASTERN PENNSYLVANIA — SCM, Jerry Mathis, W3LFX, 10 volt going. 3AVG snagged three new countries in one morning, KA.
Radio Council has been reorganized with GFP as chairman and IIO secretary. A better understanding exists between the clubs, and the Council is going along in fine shape. The Buffalo Mike and Ken Club is in full swing in the new meeting place. They will hold a picnic on July 23rd at Emerly Park. A good time and a good turn-out are expected. Lloyd Childs, famed Army and Navy plane-testing pilot from the Curtiss plant, spoke at the last meeting on “Testing New Planes for Army and Navy Use,” and plans to attend the Fall Field Day meeting during June and July. The Kenmore-Buffalo- Tonawanda Radio Club attended a Radio Council joint meeting, and several difficulties were ironed out. NWH announces a kw. 110-volt 300-watt emergency transmitter for all bands will be used, and the Field Day activities will have the full support of the entire club membership. The 112-Mc. contest, sponsored by the club, closed June first, and prizes will be awarded those attaining the highest number of contacts on this band. Last meeting of the club will be held on May 18th. It is expected that the club will have a transmitter next season. JJW manages to hook such stations as KAKD and H12MC with his 15 watts on 14 Mc. Howy has just received his A-1 certificate. NEL, disillusioned with “phone, is planning a cw. rig. DIB moved to a camp on the St. Lawrence River for the summer, URI, a new ham at Waddington, will be on all bands but will work into the new 8W Lawrence Valley normally. MLM expects to run on 1.75-Mc. “phone soon with 170 watts, TEP and IFN visited NNJ. CRC/4 is running a fishing boat at Clearwater, Fl. CUY keeps schedule with CMW/9, formerly of Alexander. DSS expected to have his new 90-foot mast up by June first. The St. Lawrence Valley stations are keying in. DIB has given up 1.7/i Mc. for the summer and is exploring the ultra-highs. GOU would appreciate the comments on his operation. Until next month, you are copying him. NCH will be active around Sept. and will continue the best known amateurs of the world. KCH thanks the members of the O.P.S. Net for their endeavors during the contest. The contests are also members of the Emergency Corps. Much credit is due RVM for the formation of this net. Traffic: WSBZK 318 BWT 667 CXL 286 (WLM 3698) CDG 8 CIZ 730 EBC 415 EIZ 10 E3Q 16 GYQ 43 IQU 360 ICT 55 LMN 29 WW 1. (Mar.-Apr. WSBZK 245.) DELTA DIVISION LOUISIANA — SCM, W. J. Wilkinson, Jr., WSDW— VHF is active on 28 and 7 Mc. FZQ moved to Lafayette. AYB is back in the area and received a new receiver. IXL is on operating on 28 Mc. IZQ is also on operating on the same band. Congrats, OM. HQN visited HBY. HG is showing interest on “phone bands. HBY has new portable. FXF and HJF are trying to get on 28 Mc. I1CH is building new rig. IBW is now stationed in Venezuela. GIZ is about ready to put kw. on air. DGB visited in New Orleans. DKR is now located in Miami. Gatz added Sky Hook to his contesting equipment. YZQ is on operating on 28 Mc. CQX recently visited R.C.A. factory in N. J. CJO is building new shack. EB3B has been visiting, I1HM has been transferred to New York, and DXK to Pennsylvania.
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OF AN AMATEUR
WHO NEEDS
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It's no disgrace to be licked by some "dit dah" speed artist. Real code speed is practically impossible to get alone, regardless of the hours upon hours spent in practice. It requires special training in fundamentals, proper mental co-ordination and expertly directed practice—all of which you get with Candler Training. You'll be amazed at the progress you can make in only a short time. Thousands upon thousands of amateurs and professional ops owe their smooth, rhythmic speed to Candler Training. Code Champions, like T. R. McElroy and L. R. McDonald, W8CW, attribute their amazing speed to the mental training that Candler gives. It's the real short-cut to the Code Speed—and it is not expensive.

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BARKER & WILLIAMSON
Radio Manufacturing Engineers • ARDMORE, PENNSYLVANIA

A Stabilized Variable Oscillator
(Continued from page 17)

6L6 either amplifying or doubling, providing variable condensers having the same plate shape are used and the ratio of fixed to variable capacity is the same in both circuits.

Although the rectifier alone, or the rectifier and voltage regulator could have been built as a separate unit, thereby avoiding some heating, it was decided that to eliminate extra units and cables an integral power supply would be installed. This uses a standard receiver power transformer and type 80 rectifier tube. The single-stage condenser-input filter was found to provide adequate filtering for the crystal oscillator, buffer, and output stages.

Additional filtering for the variable frequency oscillator is provided by the voltage regulator, using a 6F5 (VT5) for the amplifier and a 6C5 or 6J5 (VT6) for the series regulator. The circuit of the regulator is similar to that discussed by Gramm in August, 1937, QST, with minor changes. The 6C5 or 6J5 was used in place of the 2A3 originally specified, since the smaller tube can easily pass the low current required for the oscillator, and a separate filament winding is not required. With all heaters supplied from the same grounded 6.3-volt winding, the heater-cathode potential of VT5 is 150 volts, which seems to cause no difficulty.

Capacitor C17 is included since it reduces output ripple of the regulated supply by 6 to 8 dB.

Keying Circuit

Although this equipment was not designed for oscillator keying, tests were made to see just what it would do. In the course of these tests, a rather interesting keying circuit was developed for use with the voltage-regulated power supply, which is applicable to any oscillator using a similar supply. This circuit makes it possible to key plate voltage without breaking high current with the keying relay, and with complete control over both the "make" and "break" time constants. Unfortunately, triode oscillators still do not have the best keying characteristics, and it was found that when the time constants were so increased as to avoid clicks, some chirps were produced, particularly on the high-frequency bands. Although it has not been tried, it is entirely possible that the electron-coupled 6SK7 oscillator as discussed by Perrine in September, 1939, QST, could be used in place of the 6J5 with somewhat more satisfactory keying. And while we are borrowing ideas from Perrine, the method he uses for feeding the oscillator tube heater looks good, too.

In any case, and particularly on the high-frequency bands, it is recommended that a later stage, rather than the oscillator, be keyed. Then the full advantages of the circuit isolation will be realized.

For those who may wish to try it, the operation of the rectifier keying circuit is as follows: The

IT is the textbook, written by J. Douglas Fortune, W9UVC, in collaboration with the Thordarson engineering staff, in answer to thousands of requests for a simplified book on becoming a radio amateur.

It takes you step-by-step — how to study code — how to get your license — radio theory made understandable — how to build your first transmitter and receiver — how to use those same parts in building larger equipment. 160 pages. Over 100 illustrations!

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UTAH 5—10—20

Just what you’ve been wanting! And now at a price anyone can afford. A compact 5, 10, and 20 meter phone and CW Transmitter of respectable power — 45 watts. Complete band switching — no plug-in coils (two separate final stages).

RF Chassis: 6CS Pierce 40 meter crystal oscillator, 6L6c, doubler, 807 (HVq1-RA39) finals. On 5 and 10 an additional 6L6c doubler is automatically switched in.

AF Chassis: 6J7, 6N7, 6N7, 6L6. 15 watts audio. 5Z3 rectifier.

RF Power Supply Chassis: 5Z3, 860 11/2.

These three units mount into the neat, grey wrinkle finished cabinet measuring only 15” wide x 10” deep x 11” 1/2 high.

This Utah Transmitter kit contains every necessary part, all of the highest quality (National, Aerovox, IRC, Utah, etc.). The chassis and cabinet have all holes drilled. Clear schematic and pictorial instructions — full to wire and operate!

Complete kit, less only meters, tubes, and crystals. Former Regular Price — $86.75

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OIL FILLED CONDENSERS

Here’s a compact, modern radio filter condenser, in a cylindrical aluminum container, only 11/2” long by 2” in diameter. Imregnated and filled with recently developed condenser oil. Full 2 md. 1000 volt DC continuous duty rating guaranteed (for 10% higher).

Universal mounting bracket for above or below chassis.

Because of the extremely low price, we cannot mention the name of the maker. One of the largest. But you’ll recognize the high quality!

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96c each — Six for $4.98

HAMMERMUND CONDENSERS

Brand new transmitting variable condensers at less than half price! For full description see Pg. 106. Price per set.

Type Cap. Air Gap 1/16 Price Value
TG 30 A 30 .192” .505 .650 .710
TG 50 A 50 .192” .630 1 .930
TG 100 A 100 .192” .800 1 .800
TCD 250 C 240 per sec. .035” .800 1 .800

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168 24 hour time reads directly — time in the 24 zones of the world — local AM and FM time — and GMT.

For 110 volt, 60 cycle, 5 1/4” x 4 3/4”. Neat brushed brass finish. Advertised and formerly sold regularly at $5.98. Every modern stations should have one.

6L6G

Our own special tube that stands up under Ham abuse. We’ve sold thousands at 79c each. SPECIAL! Three for $1.14. 30 day free replacement.

GENERAL

The plate control switch S1 is of particular importance. In the first of its four positions, “Off,” the negative of the rectifier and the positive lead to the 6L6 output tube are both open. In the “Auto” position, the circuit to the 6L6 is closed, and the negative of the rectifier is connected to an external lead, which should go through a normally-open contact of the transmitter plate control relay or switch to ground for automatic operation. The “Tune” position of S1 grounds the negative of the rectifier, placing plate voltage on the oscillator and buffer, but removes plate voltage from the 6L6. This is the position normally used for setting frequency on the low-frequency bands, since a signal of about the proper strength to produce a strong heterodyne in the receiver is generated. If a stronger

(Continued on next left-hand page)
A NEW CHOKE FOR THE AMATEUR BANDS

The R-175 transmitting r.f. choke is suitable for parallel-feed as well as series-feed circuits in transmitters of up to 3000 volts modulated plate supply. Without plate modulation of the transmitter, they are suitable for 4000-volt amplifiers.

Use of pie-wound r.f. chokes in parallel-feed circuits resulted in decrease of transmitter r.f. output—often as much as 15%. The decrease with the R-175 is less than 1%.

In contrast to conventional r.f. chokes, the inductive reactance of the R-175 is high throughout the 28- and 14-mc. bands as well as the 1.7-, 3.5-, and 7-mc. bands.

The characteristics of this new National choke are:

** RATINGS **

- Voltage breakdown to metal base: 12,500 volts
- D.C. Resistance: 6 ohms
- D.C. Current Rating: 800 ma.
- Inductance: 225 µh.
- Distributed Capacity: 0.6 µµfd.

Price, Type R-175: List $2.75. Amateur Net $1.65

NATIONAL COMPANY, INC., Malden, MA.

AUTOMATIC SENDERS

Type S—Sends 4 to 60 W.P.M. 10 rolls of double perforated tape made up of carefully selected and arranged matter for the most practical results. $20.00

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RCH relays are designed to have a curve of attractive pull vs. armature spacing that changes very sharply near the point of closure. With such a curve, small changes in current cause a relatively enormous variation in magnetic pull, resulting in unusually high drop-out ratio. Light in weight, rugged and dependable. Rated power sensitivity 3.0 milliwatts. Drop-out ratio at 1.5 ma.: 70% min. Coil: 6000 ohms. Contacts: solid silver.

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Available as complete crystal unit at following frequencies, AIRCRAFT: 3105 KC., 3120 KC., MARINE: 2700 KC., 2718 KC., 2110 KC., 2118 KC., 2126 KC., 2134 KC., 2142 KC., 2158 KC., 2166 KC., 2174 KC., 2182 KC., 2198 KC., 2206 KC.

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signal is needed on 10 or 20, the switch may be placed in the "On" position, energizing the entire unit and producing additional radiation from the coupling link to the transmitter.

To take full advantage of the frequency sta­
bility of such an oscillator as this, a precision dial which can be read to at least one part in five hun­
dred should be used. If expense is not too important a consideration, a National PW dial is about the best available. The dial used on the original model, however, was home made, and probably merits description here. A standard 12/1 split­

...gear worm drive was removed from an old automobile broadcast-receiver tuning condenser, and so fitted that it could be used to drive C5 and C14 on a common shaft. The worm shaft was brought out to a dial on the front panel, which was hand calibrated from 0 to 100 for 360 degrees rotation. With the 12 to 1 reduction, this dial makes 6 revolutions or 600 divisions, for 180-degree rota­
tion of the tuning condenser. A small dial, number 1 to 6, was driven by a dial cord belt from, and used to count revolutions of, the worm shaft. Backlash is of no importance in this string linkage, since the small dial need be read only to one part in 6. It should, of course, be so belted that it makes somewhat less than one revolution for six revolutions of the main dial.

A rather desirable variation of this dial was used by W2ACB in the oscillator that he con­structed. In place of the small dial for counting turns of the main dial, he used a four-inch dial

...drive from the worm shaft by dial cord that it makes about 300 degrees rotation for 180 degrees rotation of the tuning condensers. Direct frequency calibrations are then engraved or written directly on the large dial for the various bands. Even with the best of workmanship, how­ever, these scales are only intended to be approxi­mate, and the linear calibration must be used for precision frequency setting. Incidentally, W2ACB used a 50 to 1 worm drive instead of 6 to 1, which accounts for the 25 divisions needed for the linear scale.

A few words about performance are probably in order. During almost two years of operation of the original model, its frequency calibration has consistently stayed well within ±0.025 per cent. It was once carried in the trunk of a car for 300 miles, during which it was demonstrated at a banquet, which included a thorough "bounce test," and when rechecked found to be less than 1 kc. off calibration at 3900 kc. Warm-up drift in the 3500-4000 kc. band is approximately 1 kc., mostly confined to the first minute.

As for mechanical stability, the "bounce test" referred to above consists of listening to the c.w. note on a communications carrier while the entire unit is dropped approximately 12 inches to a table. Each time this test has been made the only effect on the note has been a single warble almost obscured by the crush as the unit strikes the table.

Although 7 tubes are used in the original unit, construction is not difficult, since all circuits are straightforward and no critical adjustments need

(Continued on next left-hand page)
Model MT-8 is the high fidelity extended range reproducer built primarily for broadcast monitoring and recording work. It employs an especially designed eight inch loud speaker working in conjunction with the well-known Jensen Peri-dynamic and Bass-Reflex principles.

Mean energy density acoustic measurements show an excellent frequency characteristic from 50 to 10,000 cps. The polar characteristic is substantially superior to any single speaker device we know of. It represents the final perfection in the technically superior amateur station. Cabinet dimensions are $24 \times 17\frac{1}{2} \times 11\frac{3}{4}$. Complete with heavy duty Permanent Magnet Speaker — wall mounting brackets included — $17.70$ amateur’s net. Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago.
2½ Meter TRANSCEIVER KIT
with drilled panel and chassis complete with recommended parts and tubes as described by Mr. Vernon Chambers W1JEQ in April QST. Kit supplied completely assembled and ready for wiring... $14.95 net
Set of Batteries consisting of four Eveready long life Mini-Max C Batteries and one 6-Volt A Battery.............. $4.72 net

GREENLEE Socket Punches
NO HAMMERING — Just turn bolt. Cuts up to 1/8" steel panel.
Sizes Prices
1½", 1 1/16", 1 1/4", 1 1/8"............. $2.13 net
11/4" size will mount ALL Amphenol RSS, RS, RST sockets except large seven prong.

PLEXIGLAS Spreaders
Light, durable, unbreakable
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The NEW Coto Inducto-Cap Turret
W2IJL W2LJA W2KWY

Efficient U.H.F. Television Unit
(Continued from page 95)

one side of the a.c. line. Also, when the 5-pin male cable connector is pulled out of the transmitter chassis, the primary circuits of the high-voltage transformer is automatically opened.

Primary rheostat R1 is used to reduce the d.c. output voltage of the supply, which has a maximum full-load value of about 510 volts. This arrangement is very convenient when the r.f. stages are being adjusted initially. A Jones plug is used to connect R1 in the circuit; the rheostat is not mounted on the chassis because of the large amount of heat it must dissipate.

It should be noted that excellent filtering is required for television transmitter plate supplies. Otherwise, hum "bars" will appear on the received picture. The four electrolytic condensers comprising C4 are not shown in the bottom view of the power supply. The circuit was revised and these condensers were added after this photograph was taken.

Performance
The transmitter, essentially as described, was operated on plate-modulated 'phone over a period of several months at W2BRO. After the usual "bugs" were eliminated, it performed as smoothly as any low-frequency rig the writer ever built — and a lot better than some!

A television "field test" has been made with the receiver (operated by portable W2ICA) located at Nutley, N. J., and the transmitter at Delaware, N. J., a distance of about 1 1/2 miles. Excellent pictures were received on the 906-P4 Kinescope, even with a poor inside antenna on the receiver. Tests over much greater distances are planned for the near future. On the basis of the various operating tests made, it is anticipated that distances of 10 to 15 miles can easily be covered with this equipment. A close-spaced 3-element beam antenna is recommended for both receiver and transmitter.

Much work remains to be done on the antenna problem, to say nothing of the interesting circuits of the apparatus involved. At last, amateur television is in a position to go places. New hurdles are waiting to be leaped, new records to be set. The pioneering amateur again has a vast new field for research and experimentation. The problems involved are new and tantalizing — and, although within our ability to solve, are not too-easy. Amateur ingenuity is due for a real workout.

Let's go!
Take the Meissner "SIGNAL-SHIFTER"
along on your vacation —

Yes, sir! The Meissner SIGNAL-SHIFTER is really a surprisingly efficient little transmitter — all by itself! Just lift it from your operating table and give it a vacation, too. In the tourist cabin, summer home, shooting lodge or cottage-at-the-shore — wherever 110-volt power is available — the SIGNAL-SHIFTER is always ready to keep you in contact with your skeds!

Its crystal-pure note and extreme flexibility make it easily capable of WAS on 40, 80 or 160 meter CW. Provides 7.5 watts (conservatively rated) on 20, 40 and 80 — somewhat higher on 160.

Easily coupled to a zepp or single-wire feeder, its ability to "get out" will amaze you. And its economy can't be overlooked! Just one moderate price covers a De Luxe variable-frequency exciter for your home station and at the same time provides a husky little portable rig — complete and ready to operate!

Better look it over at your Jobber's — NOW!!!
Prevents u.h.f. Oscillations

The way amateurs have taken to this Ohmite Parasitic Suppressor is proof of the swell job it is doing in preventing u.h.f. parasitic oscillations. Combines a non-inductive vitreous-enameded resistor with a choke into one integral unit. Small, light, easy to install.

Ask Your Jobber — Write for Catalog 17

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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. 10 stamped envelope (standard business size, 9½” x 4¼”). 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.

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W2 — H. W. Yahnel, W2SN, Lake Ave., Helmetta, N. J.
W3 — Maurice Downs, W3WU, 1311 Sheridan St., N. W., Washington, D. C.
W4 — G. W. Hoke, W4DYB, 328 Mell Ave., N. E., Atlanta, Ga.
W6 — Horace Greer, W6TI, 414 Fairmount Ave., Oakland, Calif.
W7 — Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8 — F. W. Allen, W8GER, 450 Fountain Ave., Dayton, Ohio.
W9 — Alva A. Smith, W9DMA, 238 East Main St., Caledonia, Minn.
VE1 — L. J. Fader, VE1FQ, 125 Henry St., Halifax, N. S.
VE2 — C. W. Skarsstedt, VE2DR, 236 Elm Ave., Westmount, P. Q.
VE3 — Bert Knowles, VE3QB, Lanark, Ont.
VE4 — George Behrends, VE4RO, 186 Oakdean Blvd., St. James, Winnipeg, Manitoba.
VE5 — H. R. Hough, VE5HR, 1785 First St., Victoria, B. C.
K4 — F. McCown, K4RJ, Family Court 7, Santurce, Puerto Rico.
K6 — James F. Pa, K6LBH, 1416D Lunalilo St., Honolulu, T. H.
K7 — Jerry McKinley, K7GSO, Box 1533, Juneau, Alaska.
KA — George L. Rickard, KA1GR, P. O. Box 849, Manila, P. I.

U. S. Hydrographic-Office Chart No. 5192 is a time-zone chart of the world, 2¾ feet by 4 feet, in colors. It may be obtained from the U. S. Hydrographic Office, Navy Department, Washington, D. C., for fifty cents postpaid. This map is excellent for marking countries worked and for readily obtaining information on time zones.

— W2GVZ
RME really has something in the new RME-99, 12-tube communication receiver. Look at that big, easy tuning, calibrated band spread dial. This receiver uses the new Loktal type tubes, and has all the desirable features such as a 5-position crystal selectivity switch, stand-by switch, stable characteristics, and noise limiter with panel adjustment for peak operation. Take it from me, when I say this receiver can't be beat for value.

I offer you fast service, a personally financed 6% time payment plan with a minimum of red tape, and the best trade-in on your equipment. I have thousands of satisfied customers everywhere, who will gladly vouch for the fairness of my dealings. Write me today, for complete information on my sales plan, and see if you don't agree that my offer is the best obtainable anywhere. Tell me what you want and how you want everything handled. I will cooperate with you to see that you are 100% satisfied.

I have a complete stock of all amateur receivers, transmitters, kits, antennas, tubes, crystals, parts of all sorts. Send to me for amateur apparatus at the lowest net wholesale price in any catalog or ad. I guarantee you can't buy for less or on better terms elsewhere. Your inquiries and orders invited.

HENRY RADIO SHOP
W9ARA
BUTLER, MISSOURI
AN ANNOUNCEMENT of General Interest to "RADIO HAMS"

It is with great pleasure that SUN RADIO announces the addition to their staff of Mr. H. Kahn, associated for many years with Leeds Radio Co. Well-liked, Mr. Kahn brings with him to SUN the well-wishes of thousands of "Hams" throughout the world who have come to know him through personal acquaintance or correspondence for his fair, honest dealings. SUN is proud to acquire the services of such a personage as Mr. Kahn, long steeped in the tradition of the radio industry.

His many friends will be glad to learn that he is now on top at SUN where his many years of broad background and experience help round out a diversified SUN STAFF — aimed to give you BETTER SERVICE.

A PERFECT COMBINATION FREQUENCY/AMPLITUDE MODULATION RECEIVER — HALLICRAFTERS S-27

NOW! — Enjoy FM programs and Amateur Communications from the same receiver! 3 bands — 27—145 Mc. 15 tubes, band switch from FM to AM. Beam power tubes in A.F. amplifier. Acorn tubes in R.F. and converter system.

Amateur Net Price — complete with tubes $175.00

IN STOCK — MIMS SIGNAL SQUIRTERS for DE LUXE ANTENNA INSTALLATIONS

The Beam Antenna System of Today and Tomorrow

DE LUXE ROTATOR — Powerful, high-starting running torque, completely weatherproof. Quiet, continuous rotation in either direction. Electrically operated brake locks unit in any position.

Amateur Net Price $69.50

DIRECTION INDICATOR — Operates in either direction. Affords visual monitoring of beam at all times. Control switch operates the Rotator.

Amateur Net Price $24.50

Write for latest Mims catalog describing complete line of elements and accessories

THESE THIRD PARTIES

W2JEH — W2DXC — W2LFV — W2GCX

An Amateur Version of a POLICE CAR TRANSMITTER popularly priced

Type T-510 — 12 watt Crystal Controlled Portable Mobile Transmitter with 28 and 50 Mc. Band Switching.

As used by Ansel E. Gridley, W4GJO in covering 33 states from his car in Florida.

Write for a complete description of this sensible unit that is powerful, yet easy on your battery and purse.

Type T-510 Kit $21.80

WWV Schedules

EXCEPT for the special broadcasts of WWV using 20 kw. as described below, WWV is now running a continuous schedule (day and night) on 5000 kc. with a power output of 1 kw. This continuous transmission is modulated with the standard pitch in music, 440 cycles per second.

Each Tuesday, Wednesday and Friday (except legal holidays), the National Bureau of Standards station, WWV, transmits with a power of 20 kw. on three carrier frequencies as follows: 10:00 to 11:30 A.M., E.S.T., on 5000 kc.; noon to 1:30 P.M., E.S.T., on 10,000 kc.; 2:00 to 3:30 P.M., E.S.T., on 15,000 kc. The Tuesday and Friday transmissions are unmodulated c.w. except for 1-second standard-time intervals consisting of short pulses with 1000-cycle modulation. On the Wednesday transmissions, the carrier is modulated 30% with a standard audio frequency of 1000 c.p.s. The accuracy of the frequencies of the WWV transmissions is better than 1 part in 10,000,000.

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the F.C.C. requires a record of all transmissions. Have you a separate log for your U.H.F. portable mobile work?

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Home Study or Residence Training in RADI0 & TELEVISION ENGINEERING

New developments in radio provide amazing opportunities for men in various branches of radio and television engineering. But it takes ABILITY to earn good money in the good jobs. You can improve your present position thru CREI courses, just as other radioengineers have done in preparation for the good jobs open for trained men. The fact that men in more than 300 broadcasting stations select CREI courses, is proof that our training pays! But it takes ABILITY to earn good money in the good jobs.

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In writing please state briefly your radio experience, education and present position — and whether you are interested in home-study courses, or residence training.

Capitol Radio Engineering Institute
Dept. Q-7
3224 16th Street, N.W., Washington, D.C.

WIRELESS VICS

Carleton College, Northfield, Minn.
Editor, QST:

Lately I have been coming into contact with a great number of these so-called "wireless vics." In the dormitory that I am in here there are no less than three of them, and prospects of a few more. The fellows are not satisfied just to have the vio and let the sig carry a few feet to a couple of radios, but have gone so far as to put antennas on them. They have not as yet put out any great signs, but if they carry out their present intentions WLYV will have some competition! Now two of them have the bright idea of talking back and forth on their transmitters — point-to-point communication on the broadcast band! What next? Maybe I have the wrong slant on this, but for two fellows to be able to buy some simple equipment and also a regular radio set and be able to broadcast entertainment and use it for point-to-point communication burns me, especially after the work that we hams have to put in to get that "ticket." I guess according to law they are within their rights to a certain extent, but just how far does this little idea go? Can we all go on the air with our low-powered broadcast station and make a little side money, too, as some fellow is able to broadcast entertainment and to use it for point-to-point communication? Maybe I have the wrong idea on this, but for two fellows to be able to buy some simple equipment and also a regular radio set and be able to broadcast entertainment and use it for point-to-point communication burns me, especially after the work that we hams have to put in to get that "ticket."

Editor's Note.—Use of wireless record players as described by W9YBV is illegal. See May 1939 QST, page 26. Such operation should in every case be reported to the local Radio Inspector.

Catalysts and Pamphlets

The following catalogs and pamphlets are available at no charge upon request addressed to the manufacturer or his local representative:

Collins Radio Co., Cedar Rapids, Iowa

A 12-page bulletin describes the new 23IC transmitter which is available in 500-, 1000- and 3000-watt models covering a range of 2500 to 20,000 kc. An automatic tuning device is incorporated which tunes the circuits to predetermined frequencies by remote dial control. The transmitter is equipped for high-speed c.w. and i.c.w. code, or telephone transmissions.

Hygrade Sylvania Corp., Emporium, Penna.

The new radio-tube base chart being distributed to Sylvania dealers and servicemen, although reduced in size (21 1/2 by 13), has an increased number of base views. For the 976 types extant, there are shown 118 views and an index and cross-index are included.
ALL BEST KNOWN AMATEUR RECEIVERS AVAILABLE ON EASY PAYMENT PLAN!

Pick out any set you want and order it. Include your filter condensers, transformer or other supplies you need in the same order. ENCLOSE ONLY $1.00 to establish your credit. We notify you when credit is approved and ship your order upon receipt of the rest of the down payment as stated below.

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<td>Hammarlund Super Pro</td>
<td>$279.00</td>
<td>27.90</td>
<td>$306.90</td>
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All sets complete ready to use. Shipped in brand new, original unpacked factory cartons, from stock on hand.

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Think of it! Only $1 establishes your credit, opens a "charge account" at Newark. You can deduct the $1 from your down payment when you buy. Select any items you want and pay only 10% down ($5 minimum down payment). Minimum $25 purchase required on each order, but you can ADD FUTURE ITEMS to your "charge account" at any time. Carrying charge 0%. You make small monthly payments on net balance as follows:

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| Net balance $100 to 150 | Monthly payment 15.00 |
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Considered better than the SX-17, yet costs $50.00 less! Complete with 12 tubes, crystal filter and 10" speaker in matching cabinet. .. $99.50

Model Cash Price
RME-99, complete ........ $137.40
Hammarlund HQ-120X, complete ... 138.00
RCA AR-77, complete ............ 147.50
Hallcrafters S80R, complete .... 49.50
Hallcrafters S19R, complete ..... 29.50
National HRO Sr., less power supply and speaker ............... 179.70
National NC-100A, complete .... 120.00
Hallcrafters SX-24, less speaker ... 69.50
Hammarlund Super Pro, complete... 279.00

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Headquarters for amplifiers and accessories for every P.A. need. Write today for our complete P.A. catalog.

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2 stores in NEW YORK CITY
Vanderbilt 6-5050 • Cable: TERMRADIO

Pioneer Gen-E-Motor Corp., 466 W. Superior St., Chicago, Ill.

A new catalog No. HC-4-40, covering a complete line of rotary converters for converting 6, 12, 24, 32, 38, 110, 220 or any special d.c. voltage to 110 or 220 volts a.c. in capacities of 40 to 5000 watts has just been issued. Engineering specifications, pertinent data, weights, dimensional drawings and tables for quick reference are included. Literature is also available on engine-driven units and generators for aircraft and marine use.

Solar Manufacturing Corp., Bayonne, N. J.

Circulars describing the condenser “Quick-Check” and a new more compact line of electrolytic condensers.

The “Quick-Check” is combined with a Wien bridge for checking capacities of condensers out of circuit and quality under conditions of dynamic or static performance. The capacity range is 10 µfd. to 70 µfd.

A 112-Mc. Converter
(Continued from page 41)
receiver at 25 Mc. and will later be incorporated into a frequency-modulation receiver.

By direct comparison between a 955 neon super-regenerative receiver and the converter-

---

Fig. 1 — The 112-Mc. converter circuit.

C1, C2 — 15 µfd., modified. See text (National UM15).
C3 — 3-30 µfd. mica compression (Hammarlund MEX or National M30).
C4 — 25-µfd. air trimmer (Hammarlund APC-25).
C5 — 100-µfd. mica.
C6 — 0.001-µfd. mica.
R1, R2 — 10,000 ohms.
R3, R4 — 20,000 ohms.
R5 — 2000 ohms.

All resistors are ½-watt size.
L1, L2, L3 — See text.

superhet, signals that registered three to four on the "S" meter and were readable QSKS were in most cases indistinguishable on the "rush box." Signals that began to take the rush out of the super-regen, were S7 to 8 on the converter. The superiority of the converter-superheterodyne should be self-evident.
A directory of suppliers who carry in stock the products of these dependable manufacturers.
Portable Transmitter Receiver

(Continued from page 44)

from the crystal mounting and eliminate any possibility of shock from this source.

Operation

There is not a great deal to be said about the operation of the rig because it has been repeated so often for similar ones. With 400 volts on the plate of the 6L6 and with the antenna closely coupled, the plate current will run from 80 to 100 ma. With 250 volts from a generator or vibrator-pack supply the plate current will be about 40 ma. A ¼-watt neon bulb can be connected to one of the output terminals to indicate maximum output or a small dial lamp can be used in series with one wire if a tuned feed-line is used.

A short piece of wire about 5 or 6 feet long has been found to be very satisfactory for the receiving antenna, and quite sufficient headphone volume is obtained. The antenna trimmer condenser, C, is usually set to give quite loose coupling, particularly on the 7-Mc. band. Once set, the trimmer does not have to be touched again.

The send-receive switch transfers the plate voltage from the receiver to the transmitter and back. The heaters of all the tubes are left running at all times, to eliminate any delay in the switch-over process.

On the Ultra Highs

(Continued from page 47)

long way toward making up for a few thousand feet of altitude.

W3BZJ went up in a plane with an Abbott transceiver, on May 4th, as scheduled. Poor visibility prevented their going much over 1000 feet but ten stations were worked, of which eight were 25 or more miles distant. Best DX was W2BBR, Pulaski, N. Y., contacted when the ship was over Langhorne, Pa., a distance of 75 miles.

The Marathon award for April was won by a 112-Mc. man, W6BVL, Los Angeles, came through with some nice contacts (including two of 100 miles each) to turn in the highest score reported for April: 89 points.

112-Mc. work accounted for quite a percentage of the points reported in the May Relay, too. Though no long relays were reported that we know of, the boys on Five and 224 worked together much more successfully this time. Messages originating on 112 Mc. were handled over longer jumps on Five in several instances. Operating atop High Point, N. J., alongside W3AC/3 was W2IQQ/3. Using a pole oscillator with an RF-34 on a perilous perch some 15 feet off ground, Wilson had a flock of contacts with W2's in the New York area and out on Long Island, a distance of approximately 70 miles.

224 Mc.: Our "Centimeter Net," W1's JJR, HDF, KJC, AIY, and KLJ, got together Saturday night, May 18th, to fatten up their Relay scores with some contacts on 224 Mc. at 10 points each. Since last month W1KLJ and W1HDP have done two-way work on 14 Mc., so our record box now shows this 13-mile work on 224Mc. There may have been longer two-way contacts than this on this band. If so, we'd certainely like to hear about it. Work on 224 Mc. appears to be almost entirely confined to someone putting on a rig and then going out for a ride with a receiver to see how far it can be heard.

New tubes recently announced bring multi-stage transmitter design within the realm of practicability. Thus far, only W3GLV and W6QLZ have reported attainment of crystal control on 224 Mc. The new, but expensive, 829 and 6R28 make this a cinch — if you have the price. Other tubes which have possibilities are the new HY-75, and even the old standbys, the HK-24, 54, and 537.
QUARTZ — direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Donald E'OR sale: Collins 30FXB phone transmitter. No reasonable offer refused. W9AR.


W9GFQ, for your ham wants. Wholesale Radio Labs., Council Bluffs, Iowa.

NEW Utah 5-10-20 kite, 369 value, $49. Van Sickle, W9KXF Indianapolis, Ind.


RECONDITIONED transmitters, receivers, at lowest prices. Special terms: 250 watt speech amplifier. $250 cash. Details on request. Box 293, Barberton, Ohio.

CANDLER course (Advanced), Fundamentals of Radio (Terminal), Radio Manual (latest), Practical Radio Communication, both new, $7.75 postpaid. Price list W9QKM. Providence, R. I.


WANTED: one set Rider Manuals, W9EQZ.

QSL'S — SWL's, Colorful, economical. W9KXL — W9QKS, 810 Wyandotte, Kansas City, Mo.


QSL'S- SWL's. Colorful, economical. W9KXL - W9QKS, 810 Wyandotte, Kansas City, Mo.

MINOR beam tubing — 12' lengths, two sizes, 90¢ and $1.07. Price list W9QKM, Providence, R. I.

WANTED: used RME-69, W9KRB.

CALLBOOKS — Summer edition now on sale containing complete up-to-date list of radio hams throughout entire world. Also world prefix map, and new time conversion chart. Single copies $1.25. Canada $1.05. Radio Amateur Call Book, 616 S. Dearborn, Chicago.


QSL'S — SWL's, Colorful, economical. W9KXL — W9QKS, 810 Wyandotte, Kansas City, Mo.

RECONDITIONED transmitters, receivers, at lowest prices. Special terms: 250 watt speech amplifier. $250 cash. Details on request. Box 293, Barberton, Ohio.

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WANTED: used RME-69, W9KRB.
BEST place to get amateur receivers, transmitters, parts is W9ARA. Most complete stock, lowest prices, best trade-in allowances, best terms (financed by myself and arranged to suit you), personal cooperation so that you are 100% satisfied. Write and tell me what you want and how you want everything handled. Bob Henry, W9ARA, Butler, Mo.

RECONDITIONED guaranteed amateur receivers at lowest prices. All models. Shipped on free trial. Terms with no red tape. Write Bob Henry, W9ARA, for big free list.

HALLICRAFTER SX-23s $79.50. Reconditioned at factory, like new, brand-new receiver guarantee, trade-ins accepted, terms available. Send $5. deposit and will ship on ten-day free trial. W9ARA.

NEED quick cash — Pair RCA-813s $35. National NTE-C exciter $50, 1 kw. Thordarson TIP-708 $129, W9ARA.

COMPLETE Ham station, everything new, for $54.06 — UTC SX-25 kit, $32.50 with tubes, xtal, meter — Hallicrafters Sky Buddy, $39.50 — Mic key, $1. — Easy terms. Scell's Radio, Hartford, Conn.

RADIO ENGINEERING, broadcasting, aviation and police radio, servicing, marine radio telegraphy and telephony, Morse telegraphy and railway accounting taught thoroughly. 48 weeks' engineering course equivalent to three years of college radio work. School established 1874. All expenses low. Catalog free.

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Gordon RF Relay

Full 34 inch contact spacing with husky 1/2" silver contacts. Easily handles 1 kw. Heavy duty relay for Antenna Changeover, Multiband Trans. Tank Switching and 60 cycle. Separate Switching Ideas for Beam Ant. Allowing 100 RF Isolation. 110 V AC. Only $9.00 net. See Your Jobber or Write for Details

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One of these dealers is probably in your city—Patronize him!

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<tr>
<th>ATLANTA, GEORGIA</th>
<th>JAMAICA, L. I., NEW YORK</th>
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<td>Radio Wire Television Inc.</td>
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<td>265 Peachtree Street</td>
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<td>Radio Wire Television Inc.</td>
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<tr>
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<td>100 Sixth Avenue</td>
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<td>542 East Fordham Road</td>
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<td>&quot;The World's Largest Radio Supply House&quot;</td>
<td>Harrison Has It! Phone WOrth 2-6276 for information or rush service</td>
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<td>927 Asylum Street</td>
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<td>What do you want? We have it. Radio exclusively</td>
<td>W3EOO — &quot;The Virginia Ham Headquarters&quot; --- W3FBL</td>
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<td>519–521 Mulberry Street</td>
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<tr>
<td>&quot;Specialists in Amateur Supplies&quot;</td>
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You can be sure when you buy from QST Advertisers

"Advertising for QST is accepted only from firms who, in the publisher's opinion, are of established integrity and whose products secure the approval of the technical staff of the American Radio Relay League."

Quoted from QST's advertising rate card.

Every conceivable need of a radio amateur can be supplied by the advertisers in QST. And you will know the product has the approval of the League's technical staff.

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COMPLETE COVERAGE
90 KILOCYCLES—60 MEGACYCLES

Instantaneous Finger-Tip Control of Low, Medium or High Frequency Tuning

CONVENIENT . . . SELECTIVE . . . EFFICIENT

Imagine tuning all frequencies from 90 kilocycles to 60 megacycles, efficiently and accurately from one receiving position, with never a thought to peaking critical circuits, plug-in inductances or complicated switching arrangements. Imagine having at your finger-tips the finest superheterodyne type receiver for reception of almost everything to be heard in the present day radio spectrum.

You can have all this and more when you assemble RME units as we have them pictured above. The basic, foundation unit is the new RME-99, outstanding precision communications receiver. The unit at the extreme left is the LF-90 LOW FREQUENCY INVERTER which permits reception of all channels from 90 to 600 kilocycles. The center unit is the DM-30X BAND EXPANDER designed to expand the RME-99's frequency coverage to include all channels up to and including 60 megacycles (or the DM-36 for specific ham band coverage of 28 and 60 MC permitting extended bandspread tuning).

This line-up presents a truly commercial control panel with every adjustment for precise and efficient FULL RANGE reception. In this modern era of diversified radio reception, the receiver which does not receive all the useful communication channels, is a receiver of incomplete capability.

In buying your new receiving equipment, check its tuning range for FULL COVERAGE. Make certain it is COMPLETE. A combination of RME receiving units assures you of COMPLETE tuning. Write us today for complete information, and be satisfied in the long run.

Radio Mfg. Engineers
—Inc.—

111 Harrison Street
Peoria, Illinois
FOR PLATE MODULATION

Any modulator tubes to any R F load ... plate modulation

- S-18 up to 12 watts audio, net $2.10
- S-20 up to 65 watts audio, net $3.90
- S-19 up to 30 watts audio, net $2.85
- S-21 up to 110 watts audio, net $6.00
- S-22 up to 250 watts audio, net $8.40

FOR NEW GRID-CATHODE MODULATION

From all popular tubes to Grid and Cathode

- GCM-2 up to 15 watts audio, net $4.50
- GCM-3 up to 30 watts audio, net $6.90
- GCM-4 up to 115 watts audio, net $3.80
- GCM-5 up to 200 watts audio, net $13.50
- GCM-6 up to 110 watts audio, net $10.00

FOR NEW CATHODE-MODULATION

From all popular tubes; with tapped secondary to match cathode

- CM-15 up to 15 watts audio, net $2.40
- CM-16 up to 35 watts audio, net $3.30
- CM-17 up to 100 watts audio, net $7.20
- CM-18 up to 12 watts audio, from 200 or 500 ohm line, net $2.40

The UTC Special Series includes Audio Transformers for input, matching, driver, and output applications of every type. These units, expressly designed for amateur service, set a new standard of value per dollar. They are attractively housed and ruggedly constructed, with mounting facilities suitable for chassis or breadboard type equipment.

Revolutionary QRM Piercer?

That's what they call our VT-10 Band Pass Filter (described in December QST). So good, others are already copying

QST for July, 1940, EASTERN Edition
NEW CONVENIENCE!
NEW FLEXIBILITY!
NEW TMK CONDENSER!

compact construction
panel or stand-off mounting
swivel coil mount
coil mounts at top or rear
uses AR-16 coils or XR-16 forms
low loss construction
aluminum plates

NATIONAL COMPANY, INC., MALDEN, MASS.

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Prices do not include coil. Extra for swivel coil hardware.

NATIONAL COMPANY, INC., MALDEN, MASS.

Capaci!~-~ Min. Cop. Air-Gap Catalog Symbol List Price Amateur Net
Amateur Iconoscope
RCA-1847

Just announced by RCA—designed and licensed specifically for amateur and experimental use—engineered by the same men who produced the larger Iconoscopes—this "Mini-like" paves the way for a brand new thrill for the radio pioneer. In size it is 7½" long, with a 2" face on which the images are focused. The free booklet mentioned below includes full specifications, with circuit diagrams and equipment information.

Amateur Net Price . . . . . $24.50

Think of the thrill of seeing the fellow amateur you've been talking with—of pioneering your way to new air adventures!


The experimental equipment pictured on this page was designed and constructed by RCA engineers to illustrate the possibilities of the new RCA-1847 Iconoscope in Amateur Television. Demonstrated in actual operation, this equipment was the hit of the Chicago Parts Show. Most amateurs already have many of the required components. And, even though you start from "scratch," it is possible to duplicate this system for no more than the cost of a medium-power transmitter!

Images are 30 frame, 120 line; require a total band width of less than 0.4 Mc, and are amazingly clear and stable. Operation is on the 2½-meter band where there is plenty of room. See articles in May and June QST for further details.

FREE! A new booklet, hot off the press, containing complete data on how to build this complete Television Rig is yours for the asking. Get one from your nearest RCA Amateur Equipment Jobber, or write to RCA Commercial Engineering Section, Harrison, N. J.

See Page 75 for Announcement of RCA HAM GUIDE