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"IT SEEMS TO US—"

We had luncheon the other day with an amateur who showed us two insurance policies he had taken out. One was on his rotary beam and its tower, covering damage by wind or lightning, and the other covered the fire hazard on his station equipment. They were not expensive. It seems to be a good idea, particularly for the station representing an appreciable investment, so we pass it along.

Speaking of insurance, we have the impression that the average residence fire policy, while of course permitting radio receivers, does not authorize the operation of a transmitting station. Such permission can be had upon request, as an indorsement on the policy, and we recommend to amateurs who own their own homes that they make it a point to obtain such a "rider." Where the circumstances are not already fully known to the agent, it may be necessary to arrange for an inspection by the underwriters organization. The code to-day is a reasonable one, readily complied with, so that if your station doesn’t already comply with it, it ought to for safety’s sake.

So don’t cheat. Don’t do as we did years ago, when there was an outlandish code that required huge lead-throughs, huge conductors and huge outdoor switches on both antenna and counterpoise. One of the requirements in those days was that lead-throughs had to protrude at least five inches on each side of the wall. We have some mammoth power-house porcelain tubes that went clear through the house wall, carrying heavy threaded brass rod mounted in sulphur, a favorite insulation of those days. The system would have carried a bolt of lightning but unfortunately the tubes lacked several inches of the necessary length. But were LMO and 1BH un daunted? Not we — because the tubes would slide in the wall. When the inspector came we showed him first the inside of the station, with the tubes pulled in. When one of us took him around the house to see the outside, the other remained behind to push the tubes out so that they measured a neat six inches on the outboard side. Hi! But because the code to-day is a sensible one, such artifices are highly inadvisable and you’d only be cheating yourself of the necessary protection.

What many of us would like to know is precisely how far away from our own frequency a CQ is worth answering. While the general answer is that "It depends," we could wish that it were lots farther than it generally is.

In the main, there’s always a good reason for a crystallized amateur operating habit. It settles down on a basis that experience shows to yield the most results for the effort expended. We suppose it is for this reason that the CQ-er’s tuner seems to stick pretty close to his transmitter’s frequency — probably it’s logical.

But thereby we deprive ourselves of many pleasurable contacts, as anyone can prove for himself by listening to the answers to another station’s CQ and observing how many “get left” because they are too far away. We would therefore like to urge once more the covering of the whole band after a CQ, particularly when an acceptable answering station is not immediately picked up.

And we repeat our periodic plea for break-in operation, answering CQs in short bursts with intermittent listening, shorter CQs, and CQs that indicate in what part of the band the station is going to listen for replies.

A very gratifying token of the bond of interest which exists between the various American countries is to be found in the action of the recent Santiago conference in continuing the right of amateurs to handle messages on behalf of third persons. This policy was originally adopted at the Habana conference with a statement of principles in which it was said that “It is apparent that the community of interest of the peoples of all the Americas would be fostered by encouraging the exchange, by amateur stations, without charge, of friendly messages emanating from our citizens.” So well recognized is this principle now that the Santiago conference simplified the language to provide that “The American countries, with the purpose of further improving the close and friendly relations existing between the peoples of America, and when their internal legislation permits, agree that amateur radio stations” may exchange these

April 1940
messages. As with the Habana language, it is provided that the messages shall be of a character that would not normally be sent by any other service and on which no compensation is paid.

While the Santiago agreements are not effective until July 1st, this traffic provision is the same as in the Habana arrangement which became effective in 1938. It is a practical difficulty that the average amateur has no means of knowing what countries have ratified the agreement and what haven't. And even if he did know which had ratified, he would have no means of knowing whether “their internal legislation permits.” In this latter respect he would be dependent upon the amateur of the other country to tell him whether he could handle messages. (Mexico, we remember, regretted at Habana that her domestic laws did not so permit, and it was implied of Argentina; it may be true of other countries.) But our own government is heartily in favor of this arrangement, so far as we are concerned, and it appeals to us that W and K amateurs, after July 1st, may tender traffic of this description to Latin amateur stations and be safe in taking their cues from them. In the meanwhile we should remember that we already have special treaties with Chile and Peru which fully regularize such exchange with those countries.

Outside the Americas no such arrangements exist. It should scarcely be necessary to point out that no such messages should ever be handled by an amateur, particularly at such a time as this, and especially with Europe.

K. B. W.

**SPLATTER**

Editors are supposed to gaze into the future, predict trends and provide material to suit the seasons. Material for this issue is of the type to hit the ham touched with spring fever — a far cry from the weather now present in Concord, N. H., which is the blustering zero variety with snow at car-roof level along the roadsides. But by the time this issue is well circulated we are sure that kite and balloon skywires may appear intriguing; if they don't, there is always that desire to own a transceiver. This issue contains battery jobs for either 2½ or 5 meters.

U.h.f. men and experimenters will be particularly interested in Goodman's windup of the present f.m. series with a wide-band i.f. amplifier.

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**Our Cover**

For a month the Hq. gang has been spending spare moments taking a whack at the electronic key that W2ILE sent up. It has proved to be a most fascinating gadget and a contribution to the art; certainly a worthy addition to any station. And it's no pipe to get the swing of, either. It will take practice, plenty of it, but with mastery the operator will be sending perfect continental.

Like all innovations it arrives in complex form, but work goes on step by step until it is presented as it develops.

On the cover is a profile of Huntoon, W1LVQ, taking his “trick” on the electronic “bug.”

---

**Strays**

Are you a sleep-walker? If you are, take warning from W2HNH's experience. It seems that he worked one day pulling down iron castings and breaking them up with a sledge hammer. That night his XYL was awakened by a loud crash. HNH had pulled his rack-mounted rig off the table and was just about to break it up with a baseball bat.
The electronic key makes dashes as well as dots, at speeds from 15 to 40 words per minute. Speed is quickly regulated by turning one control.

Electronic Keying

BY HARRY BEECHER,* W2ILE

An Electrical "Bug" Which Makes Both Dots and Dashes

No doubt the desirability of a semi-automatic key which would make dashes as well as dots has occurred to many amateurs. No one, however, seems to have designed a key of this sort which is practicable for home construction.1 Realizing the need for such a key, the author some time ago started work on one which would do the job electronically. As might be expected, the early attempts were crude and in one way or another did not fulfill all the specifications that such a device as this should. Since the work was done in spare time the whole works would be shelved, sometimes for months, until a new idea would suggest itself.

The final circuits presented here are in our estimation foolproof and simple. The parts necessary are readily obtainable, and cost about what one would have to spend for a good speech amplifier. The heart of the key is the argon gas-filled triode Type 885, used in a modified sweep-oscillator circuit, with the rest of the apparatus to adapt it to practical electronic keying applications. In the hands of a good operator the device is capable of sending perfect code at speeds from 15 to 40 words per minute. Three convenient controls — overall speed, dash length, and dot length — permit the operator to set the characteristic best to suit his style of sending. With the key thrown to either the dot or dash position a characteristic begins immediately, and a train of characters will follow if the key is held down; however, if the key is released the action is immediately to cut off the characteristic. Pressing the key always starts a new characteristic. At any given speed the space between dashes in a train of dashes is exactly the same as the space between dots in a train of dots; this is set automatically by electronic means. All characters in a train are the same length.

How It Works

In the following explanation of the electronic key, it is necessary to keep in mind the characteristics of the 885 gas triode, which is a miniature thyratron. Like all thyratrons, the grid is effective as a control element only in determining the plate voltage at which the gas in the tube will ionize; once ionization occurs the grid loses control and the plate-cathode circuit behaves as though there were no grid in the tube. As is the case with other gas tubes, a certain minimum voltage is necessary to maintain ionization; at a critical voltage known as the extinction potential the ionization ceases and there is no current flow in the cathode-plate circuit. The extinction potential is a constant for the type of tube (in the case of the 885 it is about 15 volts) and is independent of the grid bias. The breakdown or starting potential, however, is determined directly by the grid bias and can be varied over a range of 30 to 300 volts, approximately. The effective plate-cathode resistance is quite low when the tube is ionized, and is extremely high when there is no gaseous conduction; we have, therefore, a tube in which the transition from no plate current to high plate current is extremely abrupt. This is an ideal characteristic for keying applications.

Only those who have had an opportunity to try a key which makes dashes as well as dots can appreciate what a fascinating gadget it is to operate. And what a c.w. Utopia it would be if some of those “speed” artists had to make dashes of length commensurate to the dots which rip-snort from a flying bug vibrator! This key will not only force your fist into closer resemblance to perfect Continental; it will enable you to send faster, more easily, and improve your timing on regular keys. Here’s how it works and how to make it.
The operation is best explained in a series of steps. Fig. 1 shows the fundamental circuit. At the instant the "B" voltage is applied, practically the whole voltage appears across $R_6R_7$, since condenser $C$ is in effect a short-circuit for the momentary surge. Thus the voltage at the same instant across the plate and cathode of the 885 is nearly zero, since the tube is effectively in parallel with $C$. After the initial application of voltage, the voltage across $C$ rises as the condenser becomes charged, and if the 885 was not connected across its terminal voltage would eventually reach the same value as the applied "B" voltage. The time required for this to occur depends upon the time constant of the circuit, which is the product of $C$ times the resistance of $R_5R_7$.

However, as the voltage across $C$ rises it will at some instant reach the ionization or breakdown potential of the tube. When this happens the plate-cathode resistance suddenly becomes very low, effectively short-circuiting $C$ and thereby discharging it. With $R_6R_7$ sufficiently high in resistance to prevent instant recharge, the voltage across $C$ will drop below the value sufficient to maintain ionization in the tube, plate current will cease, and $C$ will start to recharge as before. The cycle will repeat indefinitely just so long as "B" voltage is continuously applied. While $C$ is charging, the relay is open and the external keyed circuit is closed; when $C$ discharges, the relay closes and the external keyed circuit is open. Thus the charge period represents a "mark," or character (dot or dash), and the discharge period a "space." The length of a space is determined by the resistance (and inductance) in the relay and tube circuit, and the length of a dot or dash by the resistance at $R_6R_7$, assuming a fixed value of $C$.

Although the train of characters can be started by applying "B" voltage as described above, this method would not be satisfactory in practice because the back-contact relay would keep the external circuit closed continuously when the key was open, since no current would be flowing in the relay circuit. This can be overcome by using the circuit of Fig. 2, in which an auxiliary relay switches the condenser as shown. With the key open, $C$ is grounded and a continuous non-oscillating current flows through $R_6$, $R_7$, $R_{Y1}$ and the 885, keeping $R_{Y1}$ closed and the keyed circuit open. When the key is closed, $R_{Y2}$ connects $C$ to the junction of $R_6$ and $R_{Y1}$, which momentarily short-circuits the voltage between this point and ground, causing the tube to de-ionize, and cutting off the current through $R_{Y1}$. This closes the keyed circuit and starts a character. $C$ then charges and the oscillations continue as previously described. On opening the key, condenser $C$ is discharged to ground and a continuous current again flows through the relay and tube circuit.

The operation is shown graphically in Fig. 3, where the effective 885 plate voltage, which is also the voltage across $C$ (less the drops through the relay and cathode resistor, when present) is plotted against time. At the instant of closing the key the completely-discharged condenser short-circuits the 885 plate voltage. After the voltage has reached the breakdown potential the condenser discharges through the tube, making a space. The voltage does not go completely to zero, but to the extinction potential, and as a result the first character, dot or dash, is longer than the succeeding ones. This can be overcome by the arrangement shown in Fig. 4, where $C$ is not grounded when the key is open, but is returned, through a back contact on $R_{Y2}$, to a point on the "B" voltage divider which keeps it charged to a minimum potential equal to the extinction potential of the tube. More accurately, the voltage at which the relay drops out. This may be slightly higher than the extinction potential because the condenser discharges the current decades.
the purpose of preventing sparking at the relay contacts, and \( C_1 \) to provide a reservoir from which \( C \) can be charged quickly.

As previously mentioned, the discharge time depends upon the time constant of the circuit comprising \( C, R_y \), and the tube. This time is fixed regardless of the resistance used at \( R_g R_7 \), hence the time occupied by a “space” is constant. On the other hand, the charge time is a function of \( R_6 R_7 \), and the time occupied by a “mark” or character can be varied by varying \( R_7 \). There are some other considerations, however. The steady plate current of the 885 is limited to 2 or 3 milliamperes by the tube ratings, so that a sensitive relay must be used; the available ones work in the range of 1 to 2 milliamperes. On the basis of a steady current of about 1.5 ma, the total resistance at \( R_y R_7 \) cannot be too high, or the “H” voltage will be insufficient to force the requisite plate current to flow. On the other hand, the resistance of \( R_y R_7 \) cannot be too low or condenser \( C \) will be unable to discharge completely enough to reach the extinction potential of the tube, and the sawtooth oscillations will not occur. This will be especially true if additional resistance is introduced in the tube-relay circuit to lengthen out the discharge time and thus the time of a space; there is, therefore, a limit to the amount of resistance that can be used for this purpose. In practice, it will be found that a circuit of the type shown in Fig. 4 will make satisfactory dashes, but that \( R_y R_7 \) cannot be reduced to a low-enough value to make dots, while still maintaining oscillation.

Since nothing much can be done about the “space” time, what is needed is an automatic means to lower the resistance of \( R_y R_7 \) during charge and raise it during discharge so that the charge time will be shortened but the discharge will be unaffected. This is shown in Fig. 5. A triode, with its plate-cathode circuit in series with the relay and the 885, replaces \( R_6 \). Its grid is connected to the previously unused “make” contact on the relay so that when current is flowing through the relay coil the grid is connected to ground. This biases the grid negatively by the voltage drop across the tube and relay; the value of this grid bias is sufficient to cut off the plate current of the 37 so that its plate-cathode resistance is practically infinite. A path for the continuous current is provided by \( R_{14} \), which has high-enough resistance to prevent interference with the discharge of condenser \( C \), but low enough to pass the current necessary to keep the relay closed while the key is open. On closing the key, \( C \) is connected in the circuit and

and may reach the drop-out value for the relay before conduction actually ceases. Although for simplicity the charge and discharge of the condenser are shown in Fig. 3 by straight-line curves, the actual curves should be exponential. The shape does not matter here, although it is an important consideration in sweep circuits.
Fig. 6 — Circuit diagram of the electronic key shown in the photographs.

C1 — 16-µfd. 450-volt electrolytic.
C2 — 1-µfd. 400-volt paper.
C3 — 0.004-µfd. paper.
H1 — 40,000 ohms, 1-watt.
R1 — 20,000-ohm wire-wound potentiometer (Yaxley A-20MP).
R2, R7 — 20,000-ohm wire-wound potentiometer (Yaxley A-20MP).
R3, R11 — 30,000 ohms, 1-watt.
R4 — 1000 ohms, 10-watt.
R5 — 5 megohms, 1⁄4-watt.
R6 — 12,000 ohms, 20-watt.
R8 — 2500 ohms, 1-watt.
R9 — 250,000-ohm potentiometer (Yaxley Y-250MP).
R10 — 150,000 ohms, 1-watt.
R12 — 25,000 ohms, 10-watt.
R13 — 1500 ohms, 1-watt.
R14 — 100 ohms, 1-watt.
R15 — 500,000 ohms, 1-watt.
Ry1 — Sensitive relay (operates on 1.7 ma.). (Ward Leonard 507-543.)
Ry2, Rys — Sensitive relay (0.65 ma.). (Ward Leonard 507-545.)
S — D.p.s.t. toggle switch.

Practical Circuits

All that remains to be done is to include a switching method by which the resistance of R7 can be changed to give either dots or dashes.

All the wiring is below-chassis. Parts are few and inexpensive, except for the three relays along the lower chassis edge.
The practical circuit for the purpose is shown in Fig. 6. When the dash switch is closed the total charging time of $C_2$ is determined by the combination of $R_1$, $R_2$, $R_9$, $R_{11}$, and the plate resistance of the 37. Closing the dot switch actuates relays $R_{12}$ and $R_{13}$ simultaneously; $R_{11}$ and $R_9$ are shorted, thereby allowing condenser $C_2$ to charge in a relatively short time and discharge in about the same period to form a theoretically perfect dot.

The power supply circuit is given in Fig. 7. To prevent the possibility of cathode leakage in the 37, the filament voltage for this tube is taken from a source separate from that of the 885. The center tap on the winding is not grounded.

The arrangement shown in Fig. 8 is essentially the same as that of Fig. 1, except that 6-volt a.c. relays are used at $R_{12}$ and $R_{13}$ for sake of economy. An extra pair of contacts on $R_{13}$ shorts $R_9$ and $R_{11}$ in the dot position.

The following precautions are necessary if radiation of transients is to be eliminated: Use a metal chassis with a bottom cover, mount the relays on inside, and if a dust cover is not employed place a shield over the 885 tube, as the tube radiates a slight hash when the gas ignites. Use shielded two-wire microphone cable for the lead to the key, with the shield connected to the frame of the key and chassis. A good direct ground is helpful. If interference is radiated into the 115-volt line during keying with the a.c. relay model, add a choke (100 turns of No. 22 d.c.c. on a wooden dowel) in each leg of the primary leads to the transformer supplying the relays, with a pair of 0.02-µfd. condensers across the line. Use of a commercial line filter with chokes incorporated is also to be recommended. A test to determine if interference is caused by sparking at key contacts is to eliminate the rest of the circuits by removing the 5Y3G rectifier. A shielded cable from the unit to the transmitter can also be used to prevent radiation of 885 ignition hash as well as b.c.l. interference from the transmitter.

The mechanical construction should present no difficulties. Relays should be mounted so that during operation the arm is not opposed by gravity. The 110-volt switch is mounted on the dot length control as it is least used of the three. The switching arrangement is an ordinary bug with the bar connecting the dash and dot terminals removed and the proper wires installed. The dot contact is, of course, rendered non-vibrating. The constructor can also use a simple home-made arrangement similar to a "side-swiper" key. Very close adjustment of the bug contacts can be tolerated with the electronic key.

The constants of the circuits have been carefully chosen and each represents an optimum value; some are critical and others not critical at all. Large changes in line voltage have no undesirable effects, and if good material is used in construction the only parts requiring replacement are tubes. Filament voltages should be applied 30 seconds before the high voltage. The toggle switch has the purpose of breaking the relay contacts when the high voltage is off, and conserving power and tube life during long standby periods.

**Relay Adjustment**

To obtain satisfactory operation from the key, the relays must be adjusted correctly. Two fundamental rules in making adjustments for fast operation are: Set the contacts as closely as possible, and use just enough current to kick them over firmly. In practice the screws can be set so that a piece of typing paper can just be wedged between the contacts. Since little or no sparking occurs at the contacts of relays $R_{12}$ or $R_{13}$, close spacing is permissible. In adjusting these relays simply set the outside screw (drop-out contact screw) to the proper spacing; factory settings of springs and drop-in screw should be left as is. As a check on these adjustments the power supply with its filter condenser, choke, bleeders and switches can be temporarily assembled. Relays can be connected in series arrangement through $R_{15}$, and a buzzer, code oscil-

This "key" can be made from a jack-switch in a few minutes, eliminates the need for two relays in the electronic key.
In ordinary buffer or oscillator circuits using the cathode resistor, spacing equal to the thickness of a sheet of typing paper should be satisfactory. With higher inputs, or where considerable sparking is encountered, the spacing may be doubled. A vacuum-tube keying system would be ideal in eliminating arcing. Actual adjustments can be made by actuating the relay from the high voltage of the power supply in series with $R_{10}$. The tension of the spring should be left as is, and the sensitivity will have to be decreased slightly by screwing the drop-in contact screw in, pushing the arm farther from the core. Two turns is sufficient for first trial. It is important that the current flowing through $R_{y1}$ during key-up positions should not hold the arm too firmly, since this may cause a slight delay in starting a character. If the arm is not held firmly enough there will be a drag in breaking a train, or the relay will chatter. With this random setting of the drop-in side, the spacing between the drop-out contacts can be set. With the external oscillator connected to the relay arm and drop-out contact, current flowing through the relay winding will hold the arm against the drop-in contact screw. The contacts may be broken by the toothpick method; when holding the arms against the drop-out contact, current flowing through the relay winding will hold the arm firm. The contacts may be broken by the toothpick method; when holding the arms against the drop-out contact, the magnetic attraction should be sufficient to bend the end of the toothpick about $\frac{3}{16}$ or $\frac{3}{32}$ inch. If the attraction is too strong, unscrew the drop-out screw and tighten the drop-in. After checking spacing, recheck the magnetic pull. Fine adjustment can be obtained by a slight change in spring tension, but the tension should not be loosened too much or the spring will not throw the arm rapidly into the dash position. When the key is assembled the tension of the actuated relay can be rechecked under operating conditions. With current flowing through the relay coil, hold the arm open (for this test remove the 37 from its socket and with the external oscillator or buzzer connected to the output terminals of the device the circuit should be open). Pushing the contact arm against the drop-out terminal should require a force equal to that described. While making these adjustments connect a red 110-volt bulb in parallel with the power transformer primary to remind you to turn off power before touching the relay. Once made, the settings can be locked into permanent position with

*Fig. 8—Circuit using a.c. relays for dot and dash controls. Values are the same as in Fig. 6 with the following exceptions:

- $C_2 = 1$-µfd, 400-volt paper.
- $R_{16} = 100$ ohms, 1-watt.
- $R_{y1}, R_{y2} = 6$ volt a.c. relay, d.p.d.t. (Ward Leonard 507-505).*
Twister Strikes Georgia

BY LELAND W. SMITH,* W4AGI

W4GHU, base station for amateur radio emergency communication following tornado at Albany, Georgia. John Cripps, station licensee, is at the mike. Over a thousand messages were handled on 160-meter 'phone.

NOTHING can be so devastating and death-dealing as a sudden tornado swooping down upon a community of unsuspecting humans. That is just what happened in the little town of Albany, Georgia last February 10th at about 4:30 in the morning. The tornado, according to those who were awakened by its approach, sounded like "a thousand freight trains setting a runaway pace." Like the Gainesville tornado of four years ago, it struck the business district hardest, destroying some eighty-five per cent of that section. Fortunately, however, there was scarcely a soul in the downtown district at the early hour in the morning when the cyclone came. Had it been a few hours later, hundreds of persons might have been added to the casualty list.

Only a few minutes after the tornado struck, Johnny Cripps, W4GHU, was on the job and began portable operation on 1.7-Mc. 'phone. With the aid of the other members of the Albany Radio Club — W4BIW, W4ESA, W4DIA, W4GLB, W4GIN and W4FD — almost constant communication was maintained with stations outside the disaster area from early morning of February 10th through Tuesday, the 13th. With power lines down and telegraph and telephone service temporarily paralyzed, W4GHU provided the town's only source of rapid communication until regular facilities could be re-established. But with the unprecedented load of traffic inflicted upon the commercial communication channels, even when the latter were restored W4GHU and the other stations operating portable at Albany added to a noteworthy achievement in the field of emergency communication and service.

The operation on 1.7-Mc. 'phone by W4GHU, was soon followed by W4ATO, John C. Davis, who routed considerable traffic on 3.9-Mc. 'phone. Later in the day, Keith Mathis, W4ARX, of Montezuma, Georgia, arrived in Albany, bringing with him a complete portable station powered by a gasoline-driven a.c. supply. By setting up in the very heart of the devastated

(Continued on page 94)
A Complete 56-Mc. I.F. System

An Amplifier for Use with Either F.M. or A.M.

BY BYRON GOODMAN,* W1JPE

When we first started to fool around with amateur f.m. equipment, we had hoped that we might make it so inexpensive and simple that anyone with the inclination — and not much more — could get started in this very fascinating field of communication. However, we have had to change our viewpoint slightly. Although the transmitter 1 and a suitable converter 2 can be made quite simply, there doesn’t seem to be any way, at the present time, greatly to reduce the number of tubes in the i.f. system of the receiver. But, when we look back at it, exactly the same condition prevailed when crystal-controlled transmitters and single-signal receivers were introduced and, as we analyze the reaction, we see that it wasn’t so much the complication of the equipment as it was the grasping of new conceptions and the resignation to the fact that we were going to have to use more tubes to realize the advantages of the new systems. Exactly the same situation prevails in f.m. technique at the present time. The i.f. amplifier described on these pages may look like a lot of tubes and condensers and resistors, but that’s mainly because the gear was assembled on a small chassis. A glance at the circuit diagram shows that it is no more complicated than the i.f. system of any good receiver, while the photographs show that the wiring is not so complex as that that has appeared in some of the other compact gear described in QST. We should hesitate to recommend to a beginner or to one with little or no knowledge of receiver construction the construction of a similar i.f. amplifier, but then we should just as quickly not recommend to him the construction of a 10-tube crystal-filter superheterodyne. We don’t say he couldn’t build it (we rather think he could) we just shouldn’t like the responsibility. We heartily recommend to the serious but inexperienced-in-construction amateur that he build a converter and work it into an f.m. broadcast receiver i.f. amplifier, as described in a previous article.

On the other hand the experienced amateur with several successful construction jobs to his credit should have no trouble at all with an f.m. i.f. amplifier. Anyone who can build — and align — a regular i.f. amplifier can do the same with one designed for f.m. All that is necessary is a general understanding of how the thing works and some of the pitfalls to be avoided. Fully conscious that it may sound like boasting to the uninitiated but also knowing that others will appreciate it for what it’s worth, we might say right here that there wasn’t the least bit of trouble encountered in building the unit to be described — it worked right off. But then that isn’t so strange — the

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The 5-Mc. f.m./a.m. amplifier is built, complete with power supply, on a 7-inch by 9-inch by 2-inch chassis. Controls on the front, from left to right, are audio volume control, B-plus switch and limiter control. The switch on the side is for changing from f.m. to a.m. and back, and the jack allows a meter to be plugged in to read limiter current.
principles involved were all proven ones and, after all, these things are made to work 1-2-3 in commercial production, and amateurs should be able to duplicate the job. So, if you know anything at all about the construction of i.f. amplifiers and the principles involved, don't be afraid to jump in head first and join the gang in this latest and quite fascinating field.

The amplifier to be described is quite similar to the one described in our first story on f.m., with the exception that it is designed to work with either f.m. or a.m. signals. Because a wider-band amplifier is required for f.m. than for a.m., the amplifier is not so selective as it could be on a.m. signals, but this presents no particular difficulty at the present time, with QRM presenting a problem only in rare instances. Used with the converter described (or any converter capable of working into a 5-Mc. amplifier), the system can be used for the reception of a.m. and f.m. signals in the 45-Mc. band, a.m. amateur signals in the 56-Mc. band, and f.m. and stabilized a.m. signals in the 112-Mc. band. If you can get the fellows you work on 112 Mc. who are using modulated oscillators to cut down their modulation (and thus bring their frequency deviation down to a reason-

able range), the system makes a grand receiver for the reception of modulated oscillators, and even the smallest transceiver will sound many times better and save audio power as well.

**The Circuit**

As can be seen from an examination of Fig. 1, the circuit is no more complex than that of the i.f. of a good communications superhet. Two stages of high-gain amplification using Type 1852 tubes are unconventional only in that resistors are used across the transformer windings, to widen the pass band, and no gain control is included. No control of gain is required because it is always desirable to work the stage following the amplifiers, the limiter, at its highest level. The limiter stage uses a 6SJ7, with provision through R1s to control the plate and screen voltage to set the limiting action to meet operating conditions.

The use of a grid leak and condenser, R15, and C1, and low screen and plate voltage allows the tube to saturate quickly, even at low signal levels, and the tube wipes off any amplitude modulation (including noise) and passes only frequency modulation. For a.m. reception, the audio system is switched, by Sw1, on to the grid leak, R16, and C7, and low screen and plate voltage allows the tube to saturate quickly, even at low signal levels, and the tube wipes off any amplitude modulation (including noise) and passes only frequency modulation. For a.m. reception, the audio system is switched, by Sw1, on to the grid leak, R16, and the grid and cathode of the tube are used as a diode rectifier to feed the audio system. The jack, J, in series with the grid leak, is used for plugging in a low-range milliammeter so that the limiter current indication is invaluable in aligning the amplifier, and the meter can be used as a tuning meter during operation.

The discriminator circuit is conventional and uses a 6H6 double diode in the regular circuit. Audio from the discriminator (or from the limiter stage, in a.m. reception) is fed through the volume control, R2s, into a two-stage audio amplifier.
using a 6SF5 and 6F6 output pentode. The resistor $R_{11}$ and the condenser $C_{12}$ in the input of the audio circuit serve as a combined r.f. filter and a compensating network to attenuate the higher audio frequencies. It is necessary to include some sort of compensation when listening to 43-Mc. broadcast stations, since nearly all of them use "pre-distortion" (accented higher frequencies). A 0.01-µfd paper condenser can be added across the output terminals for further compensation, if it is considered necessary.

The power supply uses a two-section filter, and an outlet socket is provided so that the converter power cable can be plugged in. A VR-150 regulator tube is used to regulate the voltage on the converter, making for additional stability of the converter with changes in line voltage. The addition of the regulator tube adds little in the way of expense to the amplifier and, although not absolutely necessary, is a nice refinement. If desired, it can be left out by simply erasing it from the circuit.

**Construction**

The amplifier is built on a 7-inch by 9-inch by 2-inch chassis, which seems to be about the optimum size for the equipment used. Reference to the photographs will show the location of the parts on the chassis to be straightforward and follow in logical order. After all of the holes have been drilled for the various components, the sockets and the transformer should be fastened in place on the chassis, leaving off the variable resistors, switches, binding posts, jack and chokes until after most of the wiring has been done.

If the amplifier is to be built to use low-impedance input coupling, the first i.f. transformer must be modified. A link winding is made by first winding a short strip of half-inch wide paper for a form in the i.f. transformer. Eleven turns of No. 30 d.s.c. wire are then close-wound flat around the center of the paper ring. Holding the wire in place with a finger, paint the coil with Duco cement. When the cement has dried, it should be possible to slip the coil off the cardboard form. The plate and B-plus wires are removed from the trimmer condenser in the transformer, and the wires from the plate coil to the trimmer condenser are disconnected.
By unwinding and cutting off a turn or two of paper from the inside of the paper ring, the 11-turn coil can now be slipped easily over the grid coil and fastened in position so that it covers the ground end of the grid coil. A piece of paper should be slipped between the grid coil and the ground lead from the grid coil, to avoid any possibility of this lead shorting against the turns of the coil when the paper ring is slipped in place. The two ends of the link coil are brought out the bottom of the transformer can and later fastened to the input terminals of the set.

It is, of course, possible to use the transformer as is, by running the plate lead of the transformer to the plate of the mixer tube in the converter, but this makes it less convenient to use the converter with sharper i.f. amplifiers, since it would require soldering and unsoldering wires in the converter each time the change was made. Further, the long lead to the mixer tube would increase the chances for stray pickup of signals in the vicinity of 5 Mc.

The usual procedure is followed in wiring the amplifier. One side of the heaters is grounded. By-pass condensers are mounted and grounded as close to the associated tube as possible. The screen by-pass condensers, \( C_1, C_4 \) and \( C_5 \), are mounted across the sockets so that they act as a partial shield between the plate and grid of the tube, as is the custom with single-ended tubes. Tie-points are used wherever they are needed for mounting resistors and condensers. It is recommended that the 1852, 6SJ7 and 6H6 stages be wired first, so that the leads carrying r.f. can be made as short and direct as possible. After that, the rest of the leads can be filled in wherever convenient. The wires from the audio volume control, \( R_{25} \), are shielded by running them over in a single piece of flexible copper braid. Whenever convenient, spare pins on sockets were used to support resistors, condensers, etc.

If the parts list is duplicated, it will be found that the two variable resistors mounted on the front of the chassis will not clear the spade bolts projecting down from the i.f. transformers above, and this is easily remedied by cutting off \( \frac{1}{4} \) inch of the spade bolts before mounting the transformers in place. Also, in order to make room for the 6SJ5 cathode by-pass condenser, \( C_{17} \), some of the binding post strip for the output terminals had to be filed off. A simpler way would be to mount the binding-post strip nearer the bottom of the chassis. The input terminals, a Millen crystal holder, are mounted on the outside of the chassis so that they will clear the limiter control. A handy connector for plugging into this input terminal can be made from an old 5-prong tube base or coil form, by sawing across the base and removing the two correctly-spaced pins and their supporting strip of bakelite.

**Aligning the Amplifier**

If you have a source of 5-Mc. signal, such as a signal generator, aligning the amplifier is a very easy matter. If you don't already have the source available, a simple e.c.o. can be built with the grid circuit on 2.5 Mc. and the plate on 5 Mc. using an ordinary receiving pentode like the 6K7. Or, if you already have the converter, tune your regular receiver to 5 Mc., couple in the converter and tune in a steady signal, such as a harmonic from

(Continued on page 74)

Underneath the chassis, the parts are arranged for short leads and convenience in wiring. Tie points are used wherever convenient for mounting parts, and spare socket terminals are also used for supports. The choke on the side of the chassis is \( 1 \frac{1}{4} \).
The Chile Conference

Amateur Bands and Privileges Generally Retained Throughout Americas at Second Inter-American Meeting

BY A. L. BUDLONG,* WIJFN

The Second Inter-American Radio Conference was held during January of this year at Santiago, Chile. It was attended by government delegations from nineteen North and South American countries, as well as by "observers" representing a number of private companies and services, including the A.R.R.L. Whipping through a difficult schedule in the near-record time of nine days, the conference revised the 1937 Habana Arrangement and achieved a new and more generally acceptable set of radio regulations for the American countries.

The conference (a) continued our present bands as exclusively amateur generally throughout the Americas, (b) reiterated the Habana resolution permitting the handling of friendly third-party messages between the amateurs of the two continents, and (c) abandoned for the time being any agreement amongst the Americas on the specification of 'phone sub-band limits.

These were the amateur highlights of a meeting that was notable for the fact that, right up until the opening session, we had very little knowledge of the intentions of the other participants. The A.R.R.L. had, of course, been represented in the preparatory meetings of our own United States government, whose proposals were in all respects in agreement with our desires, but since there was no actual requirement for the advance submission of proposals, few of the other countries had made them.

Such advance information as became available, however, indicated that we might be faced with some differences of opinion on amateur matters from our South American neighbors. Colombia, for instance, had proposed that all third-party message handling be prohibited among amateurs, even domestically, and that amateur regulations be standardized, and Cuba indicated her support of both points. There was also a last-minute proposal by Brazil to include all the amateur sections merely as an annex to the new Arrangement; this had the obvious object of thereby rendering these sections ineffective, and is more understandable when it is explained that Brazil had previously expressed dislike for the Habana provisions for the exclusive amateur use of the 3500-4000-kc. band, the third-party message agreement and the 'phone sub-band figures.

Of real interest, however, was the disclosure to me by Chilean amateurs, the day before the opening session, that the Habana 'phone sub-band assignments had apparently never been put into effect in South America and that 'phone there is generally permitted throughout the entire 7-Mc. band as well as in the 300 kc. between 14,000 and 14,300 kc. From the strictly legal standpoint this is quite within their rights, since virtually none of the South American signatories to the Habana documents have as yet ratified them, but we have always hoped that ratification was merely a matter of time and that the Santiago Conference would continue without material alteration the original Habana figures. I now gathered, however, that there was considerable sentiment for the much wider assignments currently being observed there, and this, if true, indicated the

* Assistant Secretary, A.R.R.L.
likelihood of some real difficulties with respect to this question. Later events indeed proved this to be the case.

However, with this one exception, our amateur matters went through with little or no real difficulty, and the final Santiago document, in its amateur provisions, conforms in all essential particulars to our wishes as put forward by the United States. Primarily, this was due to the capable efforts of those of the U. S. delegation who had our matters in tow. Mr. E. K. Jett, Chief Engineer of the F.C.C., gave flawless handling to our allocations and technical questions, while Mr. Gerald Gross, Chief of the International Division of the Commission, skilfully presented and steered through the third-party message agreement. Too many amateurs do not realize fully the degree of vigorous and wholehearted backing given us United States amateurs by our people at Washington, but it is very apparent indeed at these conferences. It would be a sad day for amateur radio in this country should we lose their confidence and support.

Our principal concern was, of course, the basic amateur allocations, and I am happy to report that these were continued without change on an exclusive basis for North and South America with these exceptions: first, in continuing to designate Appendix 4 of the Cairo treaty as a guide for the allocation of frequencies between 30 and 300 Mc. in the Americas, the 112-Mc. assignment was changed to conform to our present U. S. figure of 112–116 Mc.; and second, there are two minor modifications affecting South America only: In the 1.7-Mc. allocation, the South Americans specify their band as 1715–2000 kc., rather than our own 1750–2050 assignment which is continued for North America (although the change from 1715–2000 has not yet been made), and they further designate the 28–30-Mc. band as shared between the amateur and experimental services.

The explanation of both these modifications lies in the desire of the South Americans to adhere to the Cairo table in these regions of the allocation table, and has no other significance.

As already mentioned, the third-party message agreement was repeated, with some simplification of language but no change in sense or effect. Because of its importance it is here quoted in full:

"The American countries, with the purpose of further improving the close and friendly relations existing between the peoples of America, and when their internal legislation permits, agree that amateur radio stations in their respective countries and possessions may internationally exchange messages emanating from third parties; provided, however, that such messages shall be of a character that would not normally be sent by any other existing means of electrical communications and on which no compensation may be directly or indirectly paid."

Also continued is the recommendation that the signatory administrations require prior amateur experience before permitting 'phone operation in the 14-Mc. band. A new item (suggested by us) is a recommendation to prohibit amateur stations from being used for any type of broadcasting service.

The Habana document contained a paragraph whose object was to encourage the various administrations to discourage amateur use of the 7- and 14-Mc. bands for "short-distance" communications and, instead, to direct their attention to the advantages of the 1.7- and 3.5-Mc. bands for such work. This had been included at Habana only at South American insistence and was more pointless than dangerous, but it might become troublesome and we wanted it eliminated at Santiago. It was.

The only remaining item is that concerning the 'phone sub-bands, and this turned out to be too tough a nut for the conference to crack. While the discussions on it took place variously over a period of several days, during which Mr. Jett and I engaged in lengthy out-of-hours study and con-
sultation in an endeavor to find some way of continuing reasonable assignments in the new agreement, the story is a brief one: We could secure nothing whatsoever in the way of a compromise between our proposals and the widely divergent ones of the South Americans, and so pushed for and secured elimination of the entire section.

Thus, there is no agreement for the next several years on inter-American 'phone sub-bands, and each country is free to assign 'phone anywhere in any of the bands as it wishes. From a practical standpoint the outcome represents no change, of course, in the present South American situation as it has existed for at least the past two years, and so in that respect we are no worse off than now. On the other hand, there is a definite advantage to us in the United States in that it leaves us free to expand our 'phone assignments or change their location, if we wish.

Although any specification of 'phone sub-bands is left out of the new Arrangement, the conference showed that it is very much aware of the desirability of some uniform plan by writing in the following:

"It is recommended that the organizations of amateurs on the American continent reach an agreement among themselves through their respective Governments to establish and propose at the next Inter-American Conference a continental plan for the sub-division of the bands among the various types of emission."

A solution to the 'phone sub-band problem is thus put squarely up to us, the amateurs of the two continents. The matter is one of considerable importance, too, for we cannot now afford to go to the next conference, in 1943, without a showing that the amateurs of the Americas can tackle this problem and work out a solution. The A.R.R.L. expects to initiate correspondence on this subject with the various South and Central American groups in the near future.

The effective date of the Santiago Arrangement is July 1, 1940, but we do not know how many of the signatories will have ratified it by that time. For that matter, it is not possible at this writing to say with what reservations some of them may have signed; only two members of the U. S. delegation remained for the actual signing, the others of us having left some hours before the final ceremonies to take the last train to connect with our ship at Valparaiso. Information on this will undoubtedly be available shortly.

The United States delegation was headed by the Hon. Henry Norweb (a one-time amateur himself), then U. S. Minister to the Dominican Republic but since appointed the new Ambassador to Peru. The other members were F.C.C. Chief Engineer E. K. Jett; Gerald Gross, Chief of the International Division of the Commission; Rear-Admiral Stanford C. Hooper, representing the Navy; Captain W. T. Guest, of the U.S.A. Signal Corps; Lloyd H. Simson, of the C.A.A.; and Joseph T. Keating, of the State Department. Mr. Norweb, a "career" man, is an expert on Latin- and South-American affairs, and made an ideal chairman. With the exception of Mr. Keating, the other members are old hands at radio conferences. The delegation, as usual, was a most capable one.

The next Inter-American Conference is scheduled to be held in 1943, at Rio de Janeiro.

This story would not be complete without an account of my contacts with Chilean hams, particularly those of Santiago. It is most unfortunate that circumstances made it necessary to leave the conference ended and that the sessions themselves were so crowded as to leave little time for visiting, for certainly it is difficult to imagine a more hospitable group of amateurs anywhere than those I was fortunate to meet in Chile. Everything possible was done to make my stay pleasant, and their chief regret seemed to be -- as was mine -- that I had so little time for the things they had planned.

First contact was with CE1AO and CE1AR, who drove a hundred-odd miles to meet me during the evening our ship put in at Antofagasta; then, farther down the coast, I had the pleasure of meeting CE1BC during an hour's stay at Chanaral. At Valparaiso, the amateurs of the local club (Continued on page 59)
160 to 2½ in One Transmitter!

Medium-Power Seven-Band Final and Driver

BY E. P. TILTON, WIHDQ

Not so long ago any transmitter which covered the bands from 1.7 to 14 Mc. merited designation as "all-band." The popularity of 28-Mc. 'phone in recent years has given rise to many designs which do a fairly good job on both 1.7 and 28 Mc., this being a useful combination for many 'phone stations.

With the stabilization requirements adopted December 1, 1938, making multi-stage design mandatory for 56-Mc. work, a rig to qualify as "all-band," should be capable of covering the range from 56 to 1.7 Mc. Yet how many are there which will accomplish this without a major "rebuilding" whenever the change is made from one end of the spectrum to the other? Here is a job which not only operates correctly on 1.7 Mc. but runs at full ratings on "five" — and goes on even further to provide operation on 112 Mc. as well!

Exciter

Before going on to the story of the final and doubler stages shown it might be well to describe the exciter briefly. Not every exciter provides six-band output, and this one does it without the use of plug-in coils. The present exciter is a development of the original model described in QST some time ago, with a five-band plate circuit assembly installed in place of the plug-in coils originally used. This band-switch unit provides link-coupled output on all bands from 1.7 to 28 Mc.

To provide output on 56 Mc. an additional series-tuned circuit is used. Though the change from the five-band unit to the series-tuned circuit could probably be made with some sort of low-capacity switch, it was thought that the use of separate flexible leads for attachment to the 807 plate cap provided the simplest solution. A double-pole double-throw snap switch connects the link circuit to the band-switch unit or to the series-tuned doubler coil, as shown in Fig. 1.

The seven-band push-pull HK54 final, with TZ-40 driver. Coils in place are for 56-Mc. operation, with the TZ-40 doubling from 28 Mc. The tank condenser shown is used alone on the three highest-frequency bands; a larger condenser below the base is paralleled for lower-frequency operation.
A three- or four-band transmitter was once something to be proud of, and even now a six-band rig is out of the ordinary. But here's one which covers seven bands, right through from 1.75 to 112 megacycles! Reasonable care in construction is necessary, but it's not at all tricky.

Due to the relatively high efficiency of the series-tuned circuit, the output obtained from the 807 when doubling to 56 Mc. is practically equal to that obtained on the lower frequencies.

**Final Layout**

Efficient operation of most low-frequency transmitters on 28 or 56 Mc. is usually well-nigh impossible, because of the long leads and high minimum capacity present in the average layout. Even when the components are arranged so that the leads are short and the circuit symmetrical, the minimum capacity of most condensers having sufficient capacity for the use of plate modulation on 1.75 Mc. will be high enough to prevent any chance of attaining an efficient tank circuit for 28 Mc., and will eliminate any thought of operating this same final stage on 56 Mc.

This problem is solved neatly and simply by the use of two tuning condensers, one a special uhf. job (shown above the base in the top-view photograph) and the other a conventional high-capacity unit which is mounted below the base. At the time that this amplifier was being worked out, no suitable low-minimum-capacity split-stator condenser was available, hence the re-

---

**COIL TABLE**

<table>
<thead>
<tr>
<th>TZ-40 Grid (L3)</th>
<th>TZ-40 Plate (L3)</th>
<th>HK-64 Grid (L3)</th>
<th>HK-64 Plate (L3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>112 Mc.</td>
<td>1 turn each side, 1&quot; dia., length 1'&quot;</td>
<td>2 turns, No. 8, 1&quot; dia., length 3/4&quot;, Link 2t. flex. wire. No base used</td>
<td>2 turns No. 12, 1&quot; dia.</td>
</tr>
<tr>
<td>56 Mc.</td>
<td>2 turns No. 12, spaced 1/4&quot;, 3/4&quot; long</td>
<td>3 turns each side, 1&quot; dia., 1/4&quot; long</td>
<td>2 turns each side, 21/4&quot;, No. 12. Base is sawed-off XP-53 6-prong coil form</td>
</tr>
<tr>
<td>28 Mc.</td>
<td>7 turns No. 12, 11/4&quot; dia.; 5 turns each side, 11/4&quot; dia., overall length 21/4&quot; long</td>
<td>3 turns each side, 1&quot; dia., No. 12. Base is sawed-off XP-53 6-prong coil form</td>
<td>3 turns each side, 21/4&quot;, inside dia., No. 8, 3/8&quot;</td>
</tr>
<tr>
<td>14 Mc.</td>
<td>17 turns, c.t., No. 20, 11/4&quot; total length</td>
<td>36 turns, c.t., No. 22, 11/4&quot; total length</td>
<td>11 turns each side, No. 12, 5/8&quot; spacing</td>
</tr>
<tr>
<td>7 Mc.</td>
<td>80 turns, c.t., No. 28, 11/4&quot; total length</td>
<td>90 turns, c.t., No. 28, 11/2&quot; total length</td>
<td>20 turns each side, No. 16, spaced 1 diameter</td>
</tr>
<tr>
<td>3.5 Mc.</td>
<td>90 turns, c.t., No. 28, 11/2&quot; total length</td>
<td>90 turns, c.t., No. 28, 11/2&quot; total length</td>
<td>20 turns each side, No. 16, spaced 1 diameter</td>
</tr>
</tbody>
</table>

1 Bases are round Polystyrene disks, with G.R. plugs with spring portions removed (to fit socket holes).
2 Bases are Polystyrene strips 3/4" x 3", G.R. plugs.
3 14-1.7-Mc. Hammarlund XP-53 forms.

QST for
Fig. 1 — Exciter plate circuit for six-band operation. The 1.75- to 28-Mc. tanks are parallel-tuned, using a 5-band switching unit (Browning BL-5PL). The 56-Mc. series tank has a 30-µfd. variable condenser at C1; L1 is 10½ turns of No. 12, 5⁄8 inch inside diameter, with turns spaced half the wire diameter. Appropriate links are picked up by the switch shown at the right. RFC is a 2.5-mh. choke.

Vamped condenser shown. This was originally a Cardwell Type MG-35-NS, a single-section condenser which was converted to split-stator by removing the center stator plate and sawing the metal side bars in half. Several suitable low-capacity types are now readily available. Anything of 25 µfd. per section or less should be satisfactory, provided the plate spacing is adequate. As may be seen from the schematic diagram, the low-capacity unit is in the circuit at all times, while the larger one is connected in by means of an extra set of contact pins and a pair of jumpers which are incorporated in the final plate coil for operation on 14, 7, 3.5, or 1.7 Mc.

When activity on 112 Mc. began to pick up we were seized with the desire to see what could be done on this band if a fairly husky stabilized signal was put to work. The TZ-40 doubler stage, to be described later, provided us with a fair amount of grid drive on 112 Mc., but the problem of getting resonance in the final plate circuit had us stumped for a while. This difficulty was finally overcome by eliminating the use of the regular plug-in jack bar and soldering short pieces of No. 12 tinned wire directly to the stator terminals of the plate tuning condenser, C1, and also to the feedthrough lead which carries the high voltage to the center of the final plate coil. A small coil, having for its terminals three of the slip-on clips normally used for plate and grid contacts on the HK-54 and similar tubes, was slipped into place on these contacts and we were quite surprised to find that our final now delivered approximately 100 watts on 2½, with an efficiency of about 50 per cent. Although the grid drive is not sufficient for plate modulation at full ratings, the rig may be run with frequency modulation at inputs up to 275 watts or more without undue strain on the tubes. This qualifies

(Continued on page 98)

Fig. 2 — Circuit diagram of the unit shown in the photographs. The TZ-40 stage is used only on 28, 56 and 112 Mc.

C1 — 15-µfd. per section split-stator transmitting condenser.
C2 — 100-µfd. per section split-stator transmitting condenser.
C3 — 100 µfd. per section.
C4 — 35 µfd. per section, double-spaced.
C5 — 8 µfd., double-spaced.
C7 — Disc-type neutralizing condensers (see photograph).
C8 — 0.01-µfd. mica. Mid-connections of these filament by-pass condensers are grounded to chassis.
C9 — 0.002-µfd. mica.
R1 — 5000 ohms, 10-watt.
R2 — 5000-ohm adjustable.
L1 — Final plate tank coils; see text and photograph.
L2, L3, L4 — See Coil Table.
RFC — 2.5-mh. r.f. choke.
GROWTH

Reflecting the same growth that we mentioned recently in A.R.R.L. membership, the Federal Communication Commission’s report to Congress for the fiscal year ended June 30, 1939, shows an increase in amateur station licenses during the twelve months from 49,911 to 53,558. The report contains a general discussion of amateur activity which is complimentary to us, pointing out that “wherever the flag flies are likely to be found radio amateurs maintaining communication that may become vital in time of emergency or local disaster.”

WARNING

Recently a couple of bad cases of “gypping” or attempted gypping by fly-by-night radio schools have come to our attention. This is a word of caution:

The only way to be safe is never to pay any money directly to any salesman or representative. Don’t sign up for or pay for any course, either resident or correspondent, without getting a report on the school from your local Better Business Bureau or from the National Better Business Bureau at New York, Chicago or San Francisco, or through your own bank, or from us.

Schools advertised in QST have been investigated by us and are reliable. Besides those, there are a number of other good and honestly-run schools. But for every honest one in the country there are probably a dozen or so gyps. Don’t get taken in!

ASK HEADQUARTERS

Thus, by the way, is a good place for us to say that A.R.R.L. headquarters makes it its business to keep fully informed on the regulations and interpretations of the F.C.C. concerning amateur operation. We probably centralize more such information in our office than any one desk at the F.C.C. or any one radio inspector’s office possesses. When members are confronted by a problem concerning their operating, we would suggest that they write to us rather than direct to F.C.C. or the R.I. It is ten to one that we have the answer on tap and can supply it immediately, and if we don’t have it we can always get it with less fuss and feathers and possible disturbance to the smooth administration of amateur radio than direct letters would cause.

FINANCIAL STATEMENT

The business operations of the League in the last quarter of 1939 showed a nice gain, following the usual rule that the last three months contribute a substantial profit to buck against the operating losses of the duller summer season. By order of the Board of Directors, the operating statement is here published for the information of members:

STATEMENT OF REVENUE AND EXPENSES, EXCLUSIVE OF EXPENDITURES CHARGED TO APPROPRIATIONS, FOR THE THREE MONTHS ENDED DECEMBER 31, 1939

Revenues

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership dues</td>
<td>$18,119.87</td>
</tr>
<tr>
<td>Advertising sales, QST</td>
<td>23,643.03</td>
</tr>
<tr>
<td>Advertising sales, Handbook</td>
<td>7,588.00</td>
</tr>
<tr>
<td>Newsealer sales, QST</td>
<td>11,611.17</td>
</tr>
<tr>
<td>Handbook sales</td>
<td>21,773.20</td>
</tr>
<tr>
<td>Spanish edition Handbook revenues</td>
<td>16.75</td>
</tr>
<tr>
<td>Booklet sales</td>
<td>6,139.76</td>
</tr>
<tr>
<td>Calculator sales</td>
<td>398.67</td>
</tr>
<tr>
<td>Membership supplies sales</td>
<td>2,516.53</td>
</tr>
<tr>
<td>Interest earned</td>
<td>399.25</td>
</tr>
<tr>
<td>Cash discounts received</td>
<td>294.30</td>
</tr>
<tr>
<td>Bad debts recovered</td>
<td>21.42</td>
</tr>
</tbody>
</table>

Total Net Revenues: $88,380.24

Expenses

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication expenses, QST</td>
<td>17,131.14</td>
</tr>
<tr>
<td>Publication expenses, Handbook</td>
<td>20,572.72</td>
</tr>
<tr>
<td>Publication expenses, booklets</td>
<td>3,120.64</td>
</tr>
<tr>
<td>Publication expenses, calculators</td>
<td>178.01</td>
</tr>
<tr>
<td>Salaries</td>
<td>38,266.27</td>
</tr>
<tr>
<td>Membership supplies expenses</td>
<td>1,722.70</td>
</tr>
<tr>
<td>Postage</td>
<td>1,587.13</td>
</tr>
<tr>
<td>Office supplies and printing</td>
<td>1,644.16</td>
</tr>
<tr>
<td>Travel expenses, business</td>
<td>1,136.31</td>
</tr>
<tr>
<td>Travel expenses, contact</td>
<td>522.20</td>
</tr>
<tr>
<td>QST forwarding expenses</td>
<td>1,091.01</td>
</tr>
<tr>
<td>Telephone and telegraph</td>
<td>698.36</td>
</tr>
<tr>
<td>General expenses</td>
<td>1,505.12</td>
</tr>
<tr>
<td>Insurance</td>
<td>27.69</td>
</tr>
<tr>
<td>Rent, light and heat</td>
<td>1,143.00</td>
</tr>
<tr>
<td>General Counsel expenses</td>
<td>285.11</td>
</tr>
<tr>
<td>Communications Department field expenses</td>
<td>182.60</td>
</tr>
<tr>
<td>Headquarters Station expenses</td>
<td>268.32</td>
</tr>
<tr>
<td>Bad debt charged off</td>
<td>192.37</td>
</tr>
<tr>
<td>Provision for depreciation of</td>
<td>298.45</td>
</tr>
<tr>
<td>Furniture and equipment</td>
<td>448.89</td>
</tr>
<tr>
<td>Headquarters Station</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Total Expenses: $90,133.80

Net Gain before Expenditures against Appropriations: $8,246.44

26 QST for
OPERATING ON CLASS-A FREQUENCIES

The current situation of course makes it particularly important that there be no infraction of F.C.C. regulations. There still seems to be some lack of understanding about who can operate a 'phone station in the 4- and 14-Mc. bands.

Since our regs were last revised in late 1938, the rule on the Class A allocation has provided that the station must actually be operated by an amateur operator holding Class A privileges. Only such a person may throw the switches or make calls or sign off the station. (And of course the station must be identified at the end of each transmission unless working break-in in bursts of less than one minute.) In other words, when a station is working on Class A frequencies, the only thing that may be done by a person not also holding Class A operator privileges is to speak over the mike in between the manipulations and pronouncements of the licensed operator in charge. And then all such persons must sign the log in person for each QSO, under some indication that they also spoke over the microphone.

NEW TRANSMITTING TUBES

HIGH-POWER DUAL-UNIT TRANSMITTING TRIODE—152TL

A new idea in transmitting-tube design is brought out in the recently announced Eimac 152TL. In this tube, the glass envelope contains two sets of triode elements the plates and grids of which are connected in parallel. The filaments are brought out separately so that they may be operated in either series or parallel.

Some of the advantages claimed for this type of construction are small physical size, high-power output at low plate voltages and high thermionic efficiency.

The tube requires a special 4-prong socket to which filament connections only are made. The plate lead is brought out to a terminal on top, while the grid lead is connected to a metal ring on the outside of the envelope.

Tentative ratings and characteristics follow:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament voltage</td>
<td>6.3 V, 2.75 A</td>
</tr>
<tr>
<td>Filament current, max.</td>
<td>60 Mc.</td>
</tr>
<tr>
<td>Plate current, ma. max.</td>
<td>1500</td>
</tr>
<tr>
<td>Plate voltage, max.</td>
<td>1250</td>
</tr>
<tr>
<td>Grid current, max.</td>
<td>20</td>
</tr>
<tr>
<td>Grid voltage, max.</td>
<td>150</td>
</tr>
<tr>
<td>Amplification factor</td>
<td>10</td>
</tr>
</tbody>
</table>

Typical Operating Data

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Plate voltage</th>
<th>Plate current, ma.</th>
<th>Grid current, ma.</th>
<th>Output, watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Mc.</td>
<td>1500</td>
<td>450</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>30 Mc.</td>
<td>1500</td>
<td>150</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>40 Mc.</td>
<td>1500</td>
<td>50</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>50 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>60 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>70 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>80 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>90 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>100 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>110 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>120 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>130 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>140 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>150 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>160 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
</tbody>
</table>

Another tube, the 304TL, is designed along the same lines but contains 4 sets of triode elements in a single envelope. This tube is designed to deliver a power output of 1500 watts at a plate voltage of 2000.

U.H.F. TRANSMITTING TRIODE—HY75

The HY75 is a medium-power triode just announced by Hytron. It is designed specifically for highly efficient operation at frequencies between 50 and 300 Mc. Ratings and operating characteristics follow:

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament (directly heated)</td>
<td>6.3 V, 2.75 A</td>
</tr>
<tr>
<td>Plate dissipation, max. watts</td>
<td>150</td>
</tr>
<tr>
<td>Amplification factor</td>
<td>10</td>
</tr>
</tbody>
</table>

Typical Operating Data

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Plate voltage</th>
<th>Plate current, ma.</th>
<th>Grid current, ma.</th>
<th>Output, watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Mc.</td>
<td>1500</td>
<td>450</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>30 Mc.</td>
<td>1500</td>
<td>150</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>40 Mc.</td>
<td>1500</td>
<td>50</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>50 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>60 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>70 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>80 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>90 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>100 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>110 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>120 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>130 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>140 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>150 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>160 Mc.</td>
<td>1500</td>
<td>100</td>
<td>20</td>
<td>15</td>
</tr>
</tbody>
</table>

W5CY sends in a couple QSL cards he found in his collection. They are from W5HIP and W9HIP. Each bears a photograph of the operator in uniform — both are “Highly Intelligent Policemen.”

April 1940
A Battery Transceiver for 112 Mc.

Compact Self-Contained Unit for Field Work

BY VERNON CHAMBERS,* W1JEQ

The change in regulations a year or so ago to extend the low-frequency stability requirements to the 56-Mc. band spelled the end of ultrasmall transceivers on "five." The real place for this type of equipment is now 112 Mc., and with the coming of warmer weather it is to be expected that more and more 2½-meter transceivers will be carried out on field trips. The unit described here was built for just that purpose. It can be assembled for less than twenty dollars, including tubes and batteries, weighs about sixteen pounds, and — something not usually found in transceivers — spreads the 112- to 116-Mc. band over practically the whole tuning-condenser scale.

The tubes used have 6.3-volt heaters, which may seem a bit odd in a unit intended for dry-battery operation. This, however, was a matter of necessity rather than choice — necessity, that is, if sure-fire and non-critical operation was to be expected. Considerable work was done with the comparable 1.4-volt types before we reluctantly decided that they wouldn't meet the requirements. Besides, the 6.3-volt tubes permit the transceiver to be readily adapted to a.c. operation, which will conserve battery life if the outfit is to be used at the fixed station.

As the circuit diagram shows, an HY-615 is used as the oscillator-detector, and a 6G6G as the modulator-audio amplifier. The HY-615 functions well in u.h.f. circuits, and the 6G6G makes an excellent audio tube for the purpose, giving high output with small input.

The detector-oscillator tuned circuit consists of $C_2$, $C_3$, and $L_1$. The circuit works best with fairly high $C$, and $C_2$ provides this capacity. $C_3$, tapped across one-half of $L_1$, serves as a bandspread tuning condenser. The incoming signal and the d.c. voltage are both fed in at the center-tap on $L_1$. This is the best place for connecting the d.c. lead, and connecting the antenna at the same point affects the circuit least while still providing sufficient coupling. Converting from superregeneration to straight oscillation is accomplished by shorting out the larger of the two grid-leak resistances, $R_2$, by a set of contacts on the ganged send-receive switch. A second set of contacts connects the HY615 plate to the plate winding of the transceiver transformer, for receiving, or to the 6G6G plate circuit for transmitting. A third set of contacts grounds one side of the microphone jack during the transmission period.

The audio circuit is quite conventional and needs no description. $R_s$ is the regeneration control as well as the volume control.

Construction

The cabinet which houses the unit measures 6 inches deep, 7 inches wide, and fifteen inches high. If longer battery life is desired, it will be advisable to secure a larger cabinet so that several filament batteries may be paralleled. The

*Technical Information Service.

A front view of the transceiver panel layout and the battery compartment. The antenna is a half-wave rod; the upper of the two insulators is only a support.
Looking down into the r.f. circuit. The hand-spread condenser is tipped as shown so that it may be adjusted from the rear after the panel and chassis have been slipped in the case.

A commercial channel-type chassis is used in conjunction with the cabinet. It can be easily duplicated by bending a piece of aluminum sheet. The width is 5\(\frac{3}{4}\) inches and the depth 5\(\frac{1}{2}\) inches. A 1\(\frac{3}{4}\) inch section is bent down along the panel edge for mounting. Side pieces \(\frac{1}{2}\) inch wide are bent down along the two short edges to add strength and rigidity.

A view of the panel and battery compartment of the transceiver is shown in one of the photos. The main tuning dial turns a bakelite shaft which runs through a bearing centered on the panel 2\(\frac{3}{8}\) inches down from the top edge. The two antenna support insulators are to the right, the lower one in line with the shaft bearing and the top one 1\(\frac{1}{2}\) inches above; both are \(\frac{3}{8}\) inch in from the right edge. The volume control, at the left, and the selector switch at the right, are mounted 1\(\frac{3}{4}\) inches from the edges of the panel and 5\(\frac{1}{4}\) inches down from the top. After these two holes have been drilled, holes of the same size and spacing should be drilled in the supporting section of the chassis. Later, when the components are mounted, the variable control and the switch are used to fasten the panel and chassis together. Jacks for the headset and microphone are \(\frac{1}{4}\) inches below the controls just mentioned and 2\(\frac{3}{4}\) inches in from the panel edges.

The HY-615 is mounted at the center of the chassis. The grid-cap of the tube is to the left. A socket for the 6G6G is centered 1 inch in from the rear chassis edge and just behind the HY-615. The modulation transformer is to the left of the tubes.

Compactness in the detector-oscillator mechanical layout is the only real objective. This is easily attained by mounting the band-spread condenser on a 1\(\frac{3}{8}\)-inch stand-off insulator (Millen type 30001) which keeps the condenser clear of the tube. The condenser, with all but three plates removed, is first fastened by running a \(\frac{3}{8}\) inch machine screw up through the inside of the insulator and through the condenser-frame mounting hole. This assembly may be placed quite close to the tube provided the condenser mounting is reversed so that the mounting hole comes under the shaft at the front rather than under the plates at the rear. The insulator may then be placed so that the mounting ring barely touches the tube base. A shaft coupling connects the condenser to the bakelite extension shaft.

Next, \(C_2\) and \(L_1\) are paralleled and one end of the combination is soldered to the left-hand stator terminal of \(C_3\). This should be a solid connection because it is the main support of \(C_3\) and \(L_1\). The opposite end of this combination is supported by \(C_4\), which also connects to the grid cap of the HY-615. \(C_1\), the antenna coupling condenser, mounts between the rotor terminal of \(C_2\) and the antenna feed-through insulator. A second connection runs from the rotor of \(C_2\) to the center of \(L_1\) to form the band-spread tap. The d.c. voltage, which comes up through the r.f. choke at the right, is also fed in at the tap on \(L_1\). Another r.f. choke, in series with the grid leaks, connects to the grid of the tube. Both the grid and plate chokes are attached to victron through-point bushings mounted in the chassis to the front of the tube. The plate and grid connections are soldered to the tube caps to

Comes spring and visions of green fields, high hills — and outdoor fun on ultra-high frequencies. This year it's 2\(\frac{1}{2}\) meters for simple portable equipment. Here's an example.
ground sides connect to a lug held in place by the nut which locks the tube socket in place. The transceiver transformer is at the left, with the grid winding facing the tube sockets. $C_9$ and $R_5$ are at the rear of the chassis. $C_9$ is the large paper condenser at right angles to $C_5$. $R_1$ runs between the selector switch and the through-point bushing at the right. $R_2$ goes from the switch to ground (the soldering lug). $Sw_2$ is mounted on the potentiometer and connects to the lug strip at the rear of the chassis. Incoming voltage leads are attached to this same strip.

**Power Supply**

Four of the new Eveready Mimi-Max type 482, 45-volt blocks form the plate supply. These were chosen because of their compactness and relatively long life—fifty-five or sixty hours of intermittent operation. The Burgess type F4P1, 6-volt battery was selected for the filament supply because it offered the same advantages for "A" supply as the Mimi-Max does as a "B" battery. One of these 6-volt units will permit twenty-two to twenty-five hours of operation. With a larger cabinet, three of these blocks could be paralleled so that sixty or more hours of service could be secured.

A suggested power supply circuit and parts list for a.c. operation is given in Fig. 2.

**Adjustment and Operation**

To put the transceiver in operation, the battery leads are soldered in place, an antenna (the length is not critical, but it should be around 45 inches)
is attached, and the 'phones and microphone are plugged in the appropriate jacks. Resistor $R_1$ is then rotated in a clockwise direction to full scale. This snaps on the plate and filament switches and sets the regeneration and volume at maximum. $SW_1$ should be thrown to the receive position.

After a second or two of warming up, the superregenerative hiss should become audible. It is probable that the detector will superregenerate properly only at frequencies in and near the $21/2$-meter band, which will be found with $C_2$, the band-setting condenser, at nearly full capacity. A quarter turn back from maximum capacity should be quite close. Methods of making the frequency check will be discussed later.

The band-spread adjustment is quite easily made because of the construction of the coil. In our model the band could be spread over the entire dial when the band-spread tap was placed at the exact center of the coil. Less spread is obtained with the tap more toward the grid end of the coil and more when the tap is moved back toward the plate end.

It may be well to experiment a bit with the position of the d.c. voltage tap, as sometimes a considerable improvement will result. It is also worthwhile to try different values of grid-leak resistance. A point closer to straight oscillation is reached as the value of the resistance is decreased.

The oscillator is not at all seriously affected by antenna loading, but it is advisable to spend a few minutes trying different adjustments because proper loading does permit the circuit to work at its best. A setting which allows approximately three-quarters of the coupling condenser capacity to be used is about optimum.

**Frequency Checking**

The problem of finding the band can be solved, at least approximately, by the use of Lecher wires. A set of wires should be made up as described in the *Handbook* (Fig. 1718 in the current edition). To cut down radiation from the wires we used one-inch spacing between them. The measurement procedure is described in the *Handbook*; briefly, it consists of loosely coupling the loop at one end of the wires to the oscillator, then running a shorting bar along the wires and noting the points where the oscillator plate current "kicks" slightly. Keep the coupling loose enough so that the kick is quite small. The distance between two such consecutive points is equal to a half wavelength.

The accuracy of the method depends principally upon the accuracy with which the lengths can be measured and, for calibration purposes, upon the degree of coupling between the oscillator circuit and the wires. The oscillator frequency will be changed by the presence of the coupling loop, so it is well to keep the coupling as loose as possible.

As a matter of interest, we also had available a harmonic on 112 Mc, the frequency of which was known to a fairly high degree of accuracy, and checking the Lecher-wire measurement against this harmonic showed that the former was slightly low. The difference was quite small — of the order of 1 per cent — but for higher accuracy it may be desirable to take it into account. The formula:

$$\text{Length, inches} = \frac{5850}{f \text{ (Mc.)}}$$

or

$$f \text{ (Mc.)} = \frac{5850}{\text{Length (in.)}}$$

is probably about right.

Of course, the best method is to use harmonics of accurately-known frequencies for calibrating the unit, with the Lecher wires to make sure that the right harmonic is used. The wires alone, however, will be sufficient if operation is confined to parts of the band a megacycle or so in from either edge.

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**Strays**

Receiving several QSL cards smeared so badly with stamp-cancelling ink that their beauty was nil reminds me that this can be avoided by enclosing cards in an open envelope marked: "Please cancel by hand." Matter marked in this fashion is dated and postmarked by hand instead of being put through a cancelling machine.

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*W9PFR.*
Improving the Flying Skywire

Details of an All-Wind Kite with A.W.C.

BY DANA A. GRIFFIN,* W2AOE

Some months ago QST carried a story describing the field day of the Tri-County Radio Association, in which kite antennas were used in conjunction with 56-Mc. rigs. It was then intimated that we had much to learn, and that further experiments were required, not only with the kites but also with this type of antenna on the lower frequencies. Experiments with the kite and 56-Mc. gear were conducted during the fall and spring, and the flying skywire was given its first test on the lower frequencies on the A.R.R.L. Field Day. This article is a "log" of these several activities.

At the outset it is safe to say that the kite antenna offers a whole new field of experimentation to those so inclined and, furthermore, offers to those interested in emergency work a highly useful tool with which to increase the range of low-powered equipment on all bands. It is particularly helpful when the regular antennas are not available through accident or a storm. The kite to be described will fly in anything between a "breath of air" and a wind of gale force. Sleet and a lightning storm directly overhead are the only two things that make flight impossible. Imagine an 8-foot dipole 800 feet high with a single wire feed for 56 Mc. without trouble from surrounding buildings, etc. How would you like to have a mere 8 half-wave radiator on 80 meters? Work? You bet they work, and if you're interested just follow along.

The first fact that was definitely established was that the larger the kite the more stable the performance, in addition to a greater weight-carrying ability. The second point that was established was that, on five meters, the long wire consisting of a hundred or more half-waves does not work so well as a dipole located in the kite, with single-wire feed. These two points, together with the consideration of the wire to be used as the "string," led to the establishment of a standard dimension of 8 feet 2 inches high by 8 feet 2 inches wide. The type of kite selected and shown in the photograph, was invented by a Mr. Eddy many years ago. It is a consistent performer in light breezes and with some modifications, to be described later, it also behaves nicely in strong winds. The first kites which were built were covered with Kraft paper, which may be secured in any grocery store. For a trial we suggest that this material be used, in order that damage in testing will not prove too costly. Then we recommend oiled silk for a covering, so the kite may be flown in the rain without difficulty. The material is extremely light, tough, and of course waterproof. It is commonly used in women's raincoats and umbrellas. Sufficient material to cover a kite of the size indicated (6 yards) costs approximately $3.00.

One of the first "inventions" was a method of construction that would permit quick assembly and dismantling of the kite so that it might be transported by car. The solution is in the other photo, where we find a gusset plate of 1/4-inch

* Communications Measurements Laboratory, 136 Liberty Street, New York City.
Griffin, "Tri-County Takes a Holiday," QST, June, 1939.

W2AOE isn't exactly a midget, but he is dwarfed by his 8-foot high silk-covered kite. Note the arrangement of the bridle—a very important point if maximum performance is to be obtained.
plywood fastened permanently to the 8 foot 2 inches vertical stick. Both the vertical and horizontal sticks are made of %\text{\small{\text{\textfrac{3}{4}}}}\text{-inch clear white pine. The horizontal stick, which is the same length as the vertical member, is clamped in position by means of the movable wooden plate and the two machine screws. It is only a matter of a few minutes to put the cross stick in place and tighten up the screws to complete the frame assembly. Conversely, when the screws are loosened, the cross stick may be swung around parallel to the vertical stick and the “bundle” easily tied to the running board of the car. The gusset plate should be located so that the cross stick is about 18 inches from the top of the vertical member. The most important point of all is that the frame be tested for lateral balance in still air. First the cross stick should be set at exactly right angles to the vertical stick and this position marked on the gusset plate for future use. Then the balance should be tested and adjusted by planing off a few shavings from the heavy side. It is surprising how much difference one shaving can make. The covering must be removable. This is easily done by drilling holes that will pass No. 18 wire about 1\text{\frac{1}{2}} inches in from the four ends of the frame. Some heavy fish line, preferably the tarred variety somewhat larger than mason’s cord, should be obtained. This should be strung around the outside of the kite frame. First tie one end of the string temporarily to the top of the frame, and then run the string out to one end of the cross stick. Here a knot is tied in the string to form a loop. Some No. 18 wire is run through this loop and made fast permanently. With about six inches of wire projecting beyond the end of the loop, the wire is then put through the hole in the end of the stick and wrapped around the stick. All of this is done so that when the job is finished and the string drawn up tight the outside end of the loop in the string is about 1\text{\frac{1}{2}} inches “inside” the hole where the wire is fastened. This allows subsequent stretching of the covering which is bound to occur. This same procedure should be followed all around the kite frame. When it is completed we have a pattern by which the material for the cover may be cut. All that is necessary is to lay out the material, place the kite frame over it and cut to leave about one inch of material outside the string. The covering can then be glued on if it is paper, or sewed on (here’s where the XYL stars) if cloth is used. All of the corners and the openings for the bridle, etc., should be reinforced by patches. Then, when it is necessary to remove the cover, the wire binders at the ends of the sticks are unwrapped and the cover falls off ready to be folded and stowed away. The entire operation of assembly should not take more than two minutes once some practice has been obtained. The kite should again be balanced laterally with the cover on. If the cover has been cut symmetrically no additional work will be required. The easiest way to achieve balance at this stage is to wrap a small piece of solder around the stick on the light side and slide it out towards the end until balance is obtained. The next step in the construction is to provide a bow string. First the two ends of the cross stick are notched. Then a loop is tied in the end of a piece of the fish line. This loop is slipped into the notch at one end of the cross stick and the string is then drawn across the back of the kite. This string is tightened so that the distance from the string to the vertical stick is about 8 inches. Another loop is made and slipped into the notch at the other end of the cross stick. This serves to tighten up the covering and makes it possible for the kite to “spill air” uniformly. If directions have been followed, we now have a kite capable of giving many hours of trouble-free service, provided it is properly adjusted. Once the bridle is constructed, the point at which the string is attached determines the manner in which the kite will fly. If the string is fastened too near to the head, the kite will fly flat and do little useful work. On the other hand, if the string is fastened too low on the bridle, the kite will go into a succession of dives and in strong winds will pull itself apart or break the string. It is obvious that there is an optimum point for every wind speed.

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Kite antennas are a natural for almost any kind of portable operation. Here is the dope on a kite that will fly in any kind of wind and is capable of hauling up a piece of wire to over 1200 feet. It features the first real contribution to kite-flying technique in many a moon—“automatic wind control.”

April 1940
A Hundred-Dollar Half-Kilowatt

Economical C.W. Transmitter Using Push-Pull-Parallel Final Amplifier

BY JOHN G. OSBORNE,* W1DWL

The new W1DWL transmitter now operating on 10 and 20 meters was designed with the idea of obtaining maximum power for the sum of approximately $100, yet without shortening the life of tubes and other components by overloading. Investigation disclosed that four medium-power triode type tubes in push-pull parallel in the final amplifier would provide maximum power per dollar, on the basis of continuous-service ratings. And since relatively low plate voltage would give full power input, further savings were indicated in the power supply equipment.

Naturally crystal control is essential, and further to reduce the cost of the transmitter, a crystal having a 14-Mc. fundamental was selected. Oscillator output at either 14 or 28 Mc. can be secured by using a suitable oscillator circuit, and consequently doublers could be eliminated. A single buffer stage is then ample to build up the excitation to the value necessary for the final stage.

The tubes selected for the final amplifier were HY40's, which have continuous-service ratings of 40 watts plate dissipation at 1000 volts. They require about 5 watts driving power each, and double this amount is furnished by the buffer stage, which uses an HY69 tube rated at an r.f. output of 42 watts with 600 volts on the plate. The excess power readily takes care of circuit losses. The buffer tube, a beam tetrode, is easily driven by the crystal oscillator on both 10 and 20 meters, and does not require neutralization. The oscillator is a ceramic-based 6L6GX.

Since $100 was the cost limit, it was found expedient to use breadboard construction and a wood type cabinet rack with Presdwood panel. Likewise only one meter, with a circuit selecting switch, is employed.

Circuits

The electrical circuit of the transmitter is outstandingly simple, yet highly efficient as judged by the performance of the completed transmitter. The complete r.f. diagram is given in Fig. 1.

Link-coupling to the final amplifier was discarded in favor of capacity coupling since the transmitter had to be both compact and use no superfluous components. The efficiency of the capacity-coupled circuits is high since there are losses in one tank circuit only. The flexibility in adjusting coupling is somewhat reduced, but in this case tapping the amplifier grids one-third down on the buffer tank coil was found to be entirely satisfactory.

Use of capacity coupling to the final permitted separate r.f. chokes on each side of the push-pull circuit, making it possible to read the d.c. grid currents individually. This was found to be of help in adjusting the grid taps on the coil.

Separate filament windings were used for each pair of paralleled tubes in the push-pull final, thus permitting reading the plate currents of each side separately. This proved of value in loading up the amplifier symmetrically.

Since the HY40 tubes have a medium value of amplification factor, it is necessary to provide bias to limit the static plate current to a safe

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value. Because of its simplicity, cathode bias was chosen. Adjustable 500-ohm 50-watt resistors are used in the center tap lead of each filament winding. The resistors are adjusted for 35 ma. per tube with 1000 volts on the plate, which gives a static plate dissipation of 35 watts per tube. Naturally, when the amplifier is loaded the bias across the resistors increases because of the increased cathode current. This increased voltage is just about the optimum value of grid bias, making it unnecessary to employ resistors in the grid circuit for additional bias. In this way two birds are killed with one stone: a bias power supply is eliminated and self-bias from grid leaks is not needed.

Furthermore, it is advantageous not to have the plate current cut off to zero with the key up. The 140-ma. total static plate current has a considerable stabilizing effect on the power supply voltage and greatly reduces flickering of electric lights when the transmitter is keyed, since fluctuations in line load are reduced by about 35%.

Cathode bias is also employed with the HY69 tube for the same reasons. However, in this case it is necessary to use a 2-watt 10,000-ohm resistor in the grid circuit to obtain sufficient additional bias for most efficient operation.

The oscillator circuit uses cathode regeneration with a choke in that circuit to pep up the 28-Mc. output when doubling. A grid choke was found to be unnecessary and consequently was omitted. Plate and screen potentials are obtained from a bleeder resistor in the low-voltage power pack. Plate voltage is about 350 and the screen voltage is adjusted for optimum excitation of the HY69 on 10 meters.

Construction

The layout of the r.f. circuits more or less follows conventional ideas. The four tubes in the final stage are arranged in a row with the plate and driver circuits symmetrically placed on either side. The variable condensers used contribute immensely to the ease of construction and facility with which symmetry is obtained. The final plate tuning condenser has its own mounting feet and the final plate coil is fastened to bolts on the top.

The buffer tank circuit is somewhat unusual in that the buffer coil is placed close to the chassis, thereby reducing the length of the leads to the grids of the final amplifier. The variable condenser is mounted in an inverted position upon ceramic stand-offs, since both the rotor and stator are hot with r.f. The use of long stand-offs makes it possible to mount the grid coil below the condenser. This coil is placed at right angles to the final amplifier tank coil to prevent unwanted coupling. Although not illustrated, a tube shield was finally used with the HY69 to remove traces of circuit instability.

Parasitic suppressors are used in series with each grid lead; 100-ohm 2-watt composition resistors with six turns of wire wound on them were found to be both inexpensive and satisfactory. No plate circuit suppressors are necessary since the paralleled tubes are connected together with a lead approximately two inches long, with the connection to the tank circuit taken from the midpoint. These short leads from plate to plate in conjunction with the grid suppressor make it practically impossible for u.h.f. parasitics to exist. For convenience and protection from absentmindedness, ceramic-insulated grid caps are used.

All r.f. wiring is above the deck and for that reason the steatite sockets are mounted on pillars. The “cold” leads, such as filaments, are brought directly through the chassis to the bottom, where they are by-passed for r.f. Most by-passes are inexpensive tubular paper condensers. The final plate by-pass and grid coupling condensers are mica for lowest losses and high voltage breakdown.

Space on the chassis was definitely limited,
which meant that compact neutralizing condensers had to be used. The new Millen tubular units fit perfectly for they are small and yet have the required capacity for neutralizing two tubes, as well as ample voltage rating. A third condenser of the same type was employed across one half of the buffer tank circuit to balance out the capacitive loading on the other half by the plate-to-filament capacitance of the buffer tube.

Although the buffer and oscillator tuning condensers are split-stator types, in this case the two stators are tied together to double the capacitance. Push-pull circuits in the buffer are obtained through the use of a by-passed center tap on the coil rather than a split-stator condenser.

The oscillator plate coil is mounted atop the condenser at right angles to the final tank circuit to prevent inductive coupling. The coil is self-supporting like the others, which saves the cost of coil forms. Furthermore, this construction makes it possible to vary the inductance easily by stretching or compressing the windings. A flashlight bulb is used in series with the crystal to protect it and give an indication of crystal current.

Power Supplies

The center chassis in the rack contains the low-voltage plate-supply and filament transformers. It is the “nerve center” of the transmitter since all circuits are connected to it. The a.c. power comes into the low-voltage chassis, and the plate and filament switches are located at the front. Usual 110-volt home-wiring toggle switches with pilots (costing 45 cents each) are used. The high-voltage power supply gets its primary voltage from this deck.

All electrode returns from the r.f. section are brought back separately to the “nerve center” and pass through the circuit-selecting switch. In this way it is possible to measure current in all grid, screen, and plate circuits. A Mallory-Yaxley 12-circuit switch is employed. For circuit
The low-voltage power supply, shown in Fig. 2, uses UTC Special Series components, and on the 750-volt tap delivers approximately 600 volts from the filter. Hytron 866 Jr. tubes, having top-cap plate connections, are used since the total current drain from this power supply is less than the 250 milliampere capacity for a pair of these tubes.

Two 4-µfd. 1000-volt condensers are used to reduce ripple to a minimum. A two-section filter is employed with swinging-choke input followed by a smoothing choke. This filter is more than ample, in spite of the low capacity employed.

The high-voltage power supply, Fig. 3, contains only the plate transformer, filter choke, rectifier filament transformer, filter condenser and bleeder. Plate voltage outputs of 850, 1000 and 1250 volts d.c. are obtainable at full load. The 850-volt potential is desirable when operating the HY40 tubes as plate-modulated amplifiers, since this is the maximum voltage rating for this class of service. The 1000-volt d.c. output is used for c.w. Actually, the voltage output from the filter is close to 1100 volts. However, it must be remembered that 100 volts are utilized in supplying bias so the net plate voltage is 1000, in accordance with the maximum rating. Shielded 866's are used as rectifiers.

The bleeder and voltage divider resistor is a 100-watt adjustable unit with several sliders. This and the final amplifier bias resistors have been mounted above the chassis to take advantage of maximum air circulation. Resistors dissipate heat so they should be placed where they will run coolest.

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A single-section filter with choke input is employed and on-the-air tests show that this provides ample filtering. The condenser is a 4-µfd. 1500-volt unit. The 1600-volt rating was chosen so that there would be an ample margin of safety, should the 1250-volt d.c. output from the power supply ever be needed. A 100,000-ohm 50-watt bleeder is used — this high value was selected because the tubes draw 140 ma. without excitation and there is consequently no need of.

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a bleeder current in excess of ten milliamperes. By reducing the value of bleeder current, it is possible to use a lower-wattage resistor and reduce costs.

The wooden cabinet, measuring 30 inches high, 20 inches wide and 13½ inches deep, was constructed of cedar which is easy to work. The four corners are glued and screwed together for strength. The sides are neatly perforated with 1-inch holes near the top and bottom of each chassis to obtain good air circulation. The cabinet and the panel were given an overall coating of black lacquer. Ordinary black paint should not be used there or on the chassis since in many cases it contains lampblack, which is a conductor of electricity.

Tuning

Adjusting and operating the transmitter is very simple and no bugs were encountered. The oscillator coil is adjusted so that with all the tuning capacity in, the circuit tunes to 20 meters. Then, with approximately all the capacity out, the circuit should tune to 10 meters. This is likewise true of the buffer plate coil.

The final amplifier cathode bias resistors are adjusted so that the static plate currents of both sets of paralleled tubes are the same, approximately 60 to 75 ma. for each pair. Then excitation is applied on 20 meters and the grid taps on the buffer tank coil are adjusted so the d.c. grid currents to each pair of tubes are about equal. The final plate voltage is off during this test. Grid current for each pair of tubes will run from 75 to 100 ma.

Then the final amplifier stage is neutralized by any one of the usual methods. After that, plate voltage is applied to the final. The d.c. grid current will drop to 50 ma. or less per pair of tubes. If the grid current is not the same in both halves of the push-pull circuit, the taps on the coil should be adjusted so that it is. The actual value of grid current should be the maximum, (not over 25 ma. per tube) which can be obtained without causing the buffer tube to draw more than its rated 100-ma. plate current. This permits maximum efficiency in the final amplifier. With this adjustment complete, the final amplifier is balanced on 14 Mc.

Next, the oscillator output and buffer stage are tuned to 28 Mc. (minimum capacity in the tuning condensers) and the 28-Mc. final amplifier plate coil substituted for the 14-Mc. coil. After resonance is obtained in all circuits, the balancing condenser connected from one side of the buffer coil to ground is adjusted so that the final amplifier grid currents are again equal. This last adjustment equalizes the asymmetrical capacity loading caused by the buffer plate-to-filament capacity.

Coupling to the antenna is by adjustable clips which connect, by feed-through insulators, to a non-resonant feeder system. The clips are adjusted so that the final-amplifier plate current is 250 ma. per side. With such an adjustment, loading is the same on both pairs of tubes and a plate power input of 500 watts is obtained.

Measurements and comparisons with two 200-watt load lamps indicate that better than 350 watts power output are obtainable on both 14 and 28 Mc. Since the four tubes have a combined plate dissipation of 160 watts, the plate dissipation actually encountered is below the rated continuous-service value.

Reports from amateurs contacted, plus local monitoring, show that the transmitter puts out a good signal, free from ripple and key clicks. First contact on the transmitter when tried out at W1BVL was a W9 in Colorado who reported S9. While this in itself is no record, it does show that the rig gets out with a wallop.

By careful selection of parts, it is possible to duplicate the transmitter for approximately $100.
This rear view shows the three decks. R.f. section is at the top, low-voltage power supply and control section in the center, and high-voltage power supply at the bottom.

including tubes, meter, and power supplies. If parts on hand are used, the cost will be so much less. Not only is 1000 volts economical, but it is easier to handle and build a transmitter since no cumbersome high-voltage precautions need be taken. Of course, 1000 volts is dangerous and should be handled with due respect.

All in all, this design has satisfied us that push-pull parallel is practical and the use of medium power tubes at 1000 volts most economical.

New England Division Convention

Hotel Bancroft, Worcester, Mass., April 20th-21st

The Worcester Radio Association is planning to give you the time of your life at the 1940 New England Division Convention. If your appetite for conventions has become somewhat jaded in recent years, here is one that will be so new and fresh you'll never forgive yourself if you miss it. One new idea is the "Hamboree," a gala ham party occupying the entire evening of the 20th, with noisemakers, dancing, luncheon, games and a floor show. Another is the unique way in which the 2½- and 5-meter treasure hunt will be conducted. And in between there will be plenty of solid technical talks by experts on new phases of radio, operating meetings and forums, and other features of general interest. Special arrangements are being made for the ladies attending. For more information write C. A. Sandner, Jr., W1IOR/WLGJ, Chairman, 32 Lincoln St., Worcester.

Midwest Division Convention

Hotel Allis, Wichita, April 27th-28th

Wichita, Kansas, the Air Capital, will be the rendezvous for hams from all over central U.S.A. when the A.R.R.L. Midwest Division has its annual convention at the Hotel Allis, on April 27th and 28th. From Denver, from Kansas City, from Portage, Wis., from Iowa, Nebraska, Oklahoma and even Tennessee, the registrations have been pouring in. Unusually interesting speakers of national reputation will be on the program, including QST"s M.E., "Roddy," W1SZ. Nifty prizes will be given, with a special drawing for sold-in-advance tickets only; these advance registration tickets can be secured from Treasurer Clarence Wallace, W9ABJ, 835 Porter, Wichita. The price is only $2.50 — and that includes the feed, Saturday evening, and banquet, Sunday. For further particulars on the convention, write A. B. Unruh, secretary, Wichita Amateur Radio Club, 1617 S. Seneca St., Wichita.

The Chile Conference

(Continued from page 88)

under the leadership of CE2BX had planned a welcoming dinner for me, as I later learned on my return when I spent several hours with CE2BX and CE2AW; it is most regrettable that a combination of late arrival and a mixup in the resulting schedule caused us to miss connections.

At Santiago, I was immediately among friends. Although we did not arrive in Santiago until nearly midnight, I was promptly waited on by a delegation consisting of Luis Desmaras, CE3AG; Arnold Siemsen, CE3CZ; J. Bermain, CE3DG; and R. Sinitsky, CE3AD. The next night, these fellows joined with others of the Santiago gang in giving a dinner for Senor Carlos Tudela, OA4Z, the Peruvian delegate, Senor Alberto Lopez, YV5AL, the delegate from Venezuela; Srs. O. N. Cardi and F. Dellamulla of the Argentine delegation, and myself. Throughout the conference I was enabled to keep in touch with West Hartford through daily phone schedules arranged by CE3AG and CE3CZ with W1EH, while CE3DG maintained daily c.w. skeds with W1AW. To all of these people I am deeply grateful for the many kindnesses shown me.
Balloon-Supported Antennas

Dope on the Use of Real "Sky Hooks" for Radiating Systems

Syracuse, N. Y.

Technical Editor, QST
38 LaSalle Road
West Hartford, Conn.

January 11, 1940

Dear Sir:

In studying the Antenna Handbook published by the A.R.R.L., I was intrigued by the fact that apparently no one has done any work on antennas suspended from balloons. Do you know of anyone who has worked along this line, and what the results were, if any?

I am so situated that it would easily be possible for me to put up a balloon to almost any distance under a thousand feet. In your opinion, would it be worth-while pursuing this line of thought, and what results might be anticipated from such an antenna working on 20, 40, 80 and 160 meters?

Very truly yours,
Hugh L. Walker, W8ENF

January 22, 1940

Mr. Hugh L. Walker, W8ENF
Syracuse, New York

Dear Mr. Walker:

Some work has been done with antennas suspended from balloons but not to any great extent. It has been done mostly by the military services and in other emergency applications. The disadvantages, of course, are obvious; the necessity for storage of the gas and other equipment and the difficulty in designing a suitable antenna. For example, a single long wire won't do the trick — an examination of the patterns of long-wire antennas shows that vertical antennas longer than a half-wave length have very little low-angle radiation and this is undesirable on most of the amateur frequencies. However, a balloon-supported half-wave antenna on 160 meters might really put out a signal. On the higher frequencies you would probably run into difficulties with feed systems and the poor radiation patterns mentioned above. However, if you are interested in experimenting with half- or full-wave balloon-supported antennas on the 80- and 160-meter bands, we should be very much interested in your results. From a point of interest, just how does it happen that these balloons afford you no problem? They aren't readily available, are they?

We have had a few articles in the past dealing with kite-suspended antennas — you might like to refer to one of the recent articles on page 30, of the June, 1939, issue of QST.

Sincerely yours,
Byron Goodman
Asst. Technical Editor, QST

Syracuse, N. Y.
February 5, 1940

Thank you for your letter of January 22nd which I delayed answering purposely, inasmuch as I was right in the middle of beginning my experiment. As yet I have no results worth reporting although I have had some communication on 75-meter phone with the balloon-supported antenna.

Balloons as a support for antennas are not going to be satisfactory with the balloons which are now available, although I believe that a usable balloon could be designed for the purpose. Sounding balloons are available from Dewey & Almy Chemical Co., Cambridge B, Mass. The only ones which would be of interest are Nos. 350 and 700. The No. 350 balloon will lift a weight of approximately five pounds when inflated to 6 feet in diameter with hydrogen. The bursting diameter of this balloon is 13 feet, so you will see that it can be inflated larger than 6 feet. However, the wall of the balloon is so thin that the slightest contact with a twig or branch of a tree will cause a large bang and much mending with Scotch tape.

The No. 700 balloon is similar to the smaller one except that its bursting diameter is 18 feet and, of course, it has a correspondingly increased lift. The difficulty with both balloons lies chiefly in the fact that they are spherical in shape, and even a wind of eight to ten miles per hour will cause them to blow down at such an angle that if there are any trees in the vicinity the antenna becomes useless.

I am writing to the Chemical Company and suggesting that they do a little experimenting with different balloons, and I am also at present working on a design of a different type antenna which I hope to experiment with. I doubt if anything startling will come out of this work but at least it has been interesting and I will advise you of the final results.

Very truly yours,
H. L. Walker

P.S. Several interesting by-products:
1. The whole town has been in the shack.
2. Owners of .22 rifles are sorely tempted!
3. The ribbing is awful on the air!
4. B.C.L.'s have no difficulty spotting the source of their annoyance!
5. The ground wave is terrific!

February 8, 1940

Dear Mr. W.:

Many thanks for your response to our inquiry about the balloon-supported antenna. Unfortunately, we have no suggestions or recommendations to make at this point, but we do hope you will continue your experiments and keep us informed about them.

Incidentally, if you have a photograph showing the balloon antenna in actual operation, it might be just the thing to run along with a recital of your experiences to date. We could list those “by-products,” mention that you had actually used the thing on the air, and show the photographs.

Byron Goodman

Syracuse, N. Y.
February 13, 1940

Dear Mr. G.:

Re your letter of February 8th, I regret to advise that experiments have ceased. My worst fears are realized. The balloon offered a temptation which the youth of the vicinity found themselves unable to resist. The balloon is gone, the antenna is gone and all insulators are gone. You can readily understand why experiments have ceased.

That is the 6th and final by-product of the experiment.

Hugh L. Walker

P.S. You can also understand why there are no photographs to enclose.

Don’t forget the Hudson Division Convention, Kreuger Auditorium, Newark, N. J., May 11th. Full announcement in QST next month.
The exciter to be described has been in use for over a year at my station as a driver for a single 6L6 amplifier stage running at 30 watts input. The advantage of the exciter is that it can be operated either pure crystal-controlled or variable-crystal-controlled.

As can be seen from the diagram (Fig. 1), the oscillator circuit is similar to the Pierce circuit except that a tuned circuit \( L_1C_1 \) is in series with the crystal. When operating pure crystal controlled the coil \( L_1 \) is replaced by a shorting plug. However, with the tuned circuit in, a variation of about 5 kc. can be obtained with a 7-Mc. crystal.

When tuning for variable control, the circuit can first be checked by setting \( C_1 \) at minimum capacity. The crystal will oscillate in this position, and as the capacity is increased the frequency should start to change. The point at which it starts to change is the nominal crystal frequency, and increasing the capacity further will change the frequency in gradual changes for about 5 kc. Further increase in the capacity will result in a click in the receiver or monitor, indicating that the 5-kc. span has been concluded, and a new frequency will appear from 10 to 15 kc. lower. Approximately four more frequencies can be obtained as the condenser is advanced towards maximum capacity. Only one of these will exist at any one time, but their quality will depend to some extent on the grade of crystal being used. The output on these lower frequencies is about 20 per cent lower than it is over the normal 5-kc. span.

These lower frequencies are mentioned simply to avoid “discovery” of them by other experimenters, and it is not recommended that they be used for normal operation. The 5-ke. variation gives enough to get out from under QRM.

The second stage is a conventional buffer-doubler stage and operates in the usual fashion. In my set-up, \( C_1 \) and \( C_2 \) are ganged, for ease in tuning.

Tracking is most easily adjusted by making the oscillator self-excited. This is done by replacing the crystal with a shorting plug. Set \( C_1 \) and \( C_2 \) at half capacity and adjust the turns on \( L_1 \) until maximum output is obtained. The exciter will now track for any crystal that is used.

The exciter is built in a homemade box 10 inches long, 8 inches wide and 9 inches high, although any arrangement should be satisfactory. Short leads and rigid mechanical construction are advisable and, with a good d.c. power supply of 250 volts, no trouble should be experienced.

Either capacity or link coupling may be used, although link coupling seems to be more satisfactory. The stage that is being driven should of course be well-neutralized, to avoid trouble from feed-back.

**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 20,000 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 5,000,000.
It Did Happen Here...

Hints for Eliminating B.C.L. QRM

BY GENE TURNEY,* W2APT

Running a kilowatt in an eighty-five family apartment house in the heart of New York City presents many interesting problems, to say the least. (For instance — the necessity for moving about thirty b.c.l. antennas so the three-element rotary could make a complete revolution! And the radiator just about clears one of the skywires which could not be moved for lack of space.) But the interference problems were naturally the worst, and it goes without saying that tempers, in many instances, were short. In the end, however, all the difficulties were surmounted. This story deals with the finding, diagnosing, and curing of more than 55 b.c.l. sets which were interfered with by our 14-megacycle 'phone. We shall not attempt to deal with complicated theories, but rather shall confine our description to the causes of b.c.l. interference, running them down (before the F.C.C. offers to help), and, last but not least, effecting a cure.

The reader should let firmly and solidly sink home one important point — all cases of b.c.l. interference can be cured! This may be hard to believe, but we covered everything from the old Majestic 90 to the present day "bargain package" variety put out by a local power company on a sales promotion in conjunction with a lamp and toaster. Further to emphasize the point, there were no "deaths" on our list of patients — all recovered. We will take up in order of importance the procedure that should be followed.

First and foremost is what we shall call (to use a salesman's expression) "customer approach". More than one well-meaning ham has put his foot in it by starting off with a chip on his shoulder, and since the b.c.l. has already been swinging his axe, a barrier is automatically created between our hero and the patient. If you will but swallow your pride and set off with that famous old elegy "the customer is always right" you will have licked half your problem. A friendly patient will overlook the fact that he can hear you by putting his ear to the loud-speaker, but to an antagonistic one this QRM is sufficiently annoying to impel him to write his Congressman, the Board of Trade, the F.C.C., the landlord, and what not. Above all, never go into a complainant's home with the idea that if it were not for us amateurs there wouldn't be any such thing as broadcast reception. This is really like throwing gasoline on a smouldering fire, and is apt to do irreparable harm to your case. Ham radio to the average b.c.l. is like the old adage of which got there first, the chicken or the egg. I cannot too strongly stress the point, for it is imperative that you attack the situation with your most charming smile and cordial manner. The old days when we were awed by the mere sight of a transmitting antenna are gone, and radio broadcasting is just as much a necessity to the average human being as washing his face or getting his breakfast. The b.c.l. has just as much right to listen to the Smith Family as we have to work DX — maybe a greater right, for while the average broadcast receiver will provide enjoyment to people in all walks of life, a transmitter is for one person's sole pleasure. If you will let your attitude be influenced by the above statement you will not only have made a friend but at the same time gotten a much clearer picture of how the other half of the world lives.

Fundamental Causes

Next down the line is the fundamental cause of the QRM. This depends a good deal on the type of receiver. The old t.r.f. sets (of pre-a.v.c. days) are usually subject to cross-modulation, where the QRM rides in on top of the broadcast signal to which the set is tuned; plain lack of selectivity may also bring the ham signal in over all or a good part of the dial when the local transmitting field is strong. Superhet's usually will show "spot" tuning, because some harmonic of the receiver oscillator mixes with the transmitter frequency to give a beat at intermediate frequency which is then amplified and detected in the same way as the desired signal. With all types of receivers the QRM may get in either through the antenna or by direct pickup in some exposed part of the circuit, including the audio end. Further to complicate matters, the interfering voltages may exist in the receiver not only by brute force but

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in many cases because some combination of circuit elements inadvertently happens to resonate near the operating frequency. For instance, a by-pass condenser-resistor combination may become resonant; this is usually found in screen and cathode circuits. A thousand possible combinations will produce such an effect, and to attempt to list them all would be impossible since no two radio sets are identical so far as troubles are concerned. Once we know that such a condition exists it becomes a matter of routine to find and cure the particular “loop” which is causing the trouble.

**Diagnosing the Case**

To expedite clearing the trouble it will be necessary to proceed in the following manner: With a licensed amateur operating the transmitter and yourself at the b.c. set, tune in the interfering signal so that it is received at its loudest point. Disconnecting the antenna will show whether the interference is coming in by the front door or not, but in either case it is best first to see if the trouble cannot be cleared up internally. Antenna or line traps work best at only one frequency, and we want to get at the root of things and avoid such expedients if possible. Now, with the signal doing its worst to jam the receiver, start taking out tubes beginning with the first r.f. or that expedient exists it becomes a matter of routine to find and cure the particular “loop” which is causing the trouble.

To expedite clearing the trouble it will be necessary to proceed in the following manner: With a licensed amateur operating the transmitter and yourself at the b.c. set, tune in the interfering signal so that it is received at its loudest point. Disconnecting the antenna will show whether the interference is coming in by the front door or not, but in either case it is best first to see if the trouble cannot be cleared up internally. Antenna or line traps work best at only one frequency, and we want to get at the root of things and avoid such expedients if possible. Now, with the signal doing its worst to jam the receiver, start taking out tubes beginning with the first r.f. or that tube which is directly fed by the antenna.

If the receiver is a superhet, especially of the type used for a grid suppressor. This consists of about ten turns of number 20 d.c.c. wound around a 100-ohm 1-watt resistor. If it is in the screen circuit it will be necessary to change the screen by-pass or resistance to some other value. Many screen circuits have a load resistance connected from screen to ground equal in value to the dropping resistance which is connected from screen to “B”-plus, and it will only be necessary to change the resistor from screen to “B”-plus to one of slightly higher value. In practice we found it satisfactory to increase this resistance about 20 per cent and to increase the screen by-pass capacity accordingly. If one of the suppressor grids is the guilty party the trouble may be cured by using our parasitic choke, or shielding the suppressor-grid lead. We have yet to find a case where both were necessary, but it is not beyond possibility so we mention it here. The control grid is the source of most evil, especially in the midget variety, the chances are that removing the converter (combined mixer-oscillator) will kill the interference. If so, and if the tube and the grid lead are unshielded, the logical thing to do is to shield completely the tube, grid lead and top cap, making sure that all the shields are grounded to the chassis. An unshielded glass tube may be replaced by a metal tube of the corresponding type, in which case the tube shield will not be needed, although shielding the grid lead and cap is still necessary. When substituting a metal tube for glass, make certain that the shield pin on the tube socket is grounded to the chassis. If this shielding still does not completely remove the QRM, a metal plate should be installed to enclose the bottom of the chassis — making good electrical connection to the chassis, of course.

Most receivers of this type respond quite satisfactorily to this treatment, and no further digging into the receiver is necessary.

On the other hand, if the pickup is somewhere after the first tube and ahead of the rectifier the interference will continue to come in despite the fact that one or more tubes have been removed from their sockets. There will be one tube which, when removed, will cause the QRM to disappear completely, and it is here where we should begin to look for trouble. Replace the tube in question and remove the socket connections one by one starting with the grid lead, following with the suppressor, screen, plate and cathode. Replace each before taking off the next. (You may well hesitate before starting this part of the procedure if you haven’t had some experience with fixing b.c. sets, because it won’t help diplomatic relations with the b.c.l. if his set refuses to work as a result of your ministrations! In case you have any doubts as to your ability to keep the receiver working, better enlist the good offices of a ham who has had service experience.) It will be observed that only one connection is causing the trouble because when it is unsoldered all interference disappears. If it is a plate lead it will be necessary to insert a small parasitic choke such as the type used for a grid suppressor. This consists of about ten turns of number 20 d.c.c. wound around a 100-ohm 1-watt resistor. If it is in the screen circuit it will be necessary to change the screen by-pass or resistance to some other value. Many screen circuits have a load resistance connected from screen to ground equal in value to the dropping resistance which is connected from screen to “B”-plus, and it will only be necessary to change the resistor from screen to “B”-plus to one of slightly higher value. In practice we found it satisfactory to increase this resistance about 20 per cent and to increase the screen by-pass capacity accordingly. If one of the suppressor grids is the guilty party the trouble may be cured by using our parasitic choke, or shielding the suppressor-grid lead. We have yet to find a case where both were necessary, but it is not beyond possibility so we mention it here. The control grid is the source of most evil, especially in the midget variety, the chances are that removing the converter (combined mixer-oscillator) will kill the interference. If so, and if the tube and the grid lead are unshielded, the logical thing to do is to shield completely the tube, grid lead and top cap, making sure that all the shields are grounded to the chassis. An unshielded glass tube may be replaced by a metal tube of the corresponding type, in which case the tube shield will not be needed, although shielding the grid lead and cap is still necessary. When substituting a metal tube for glass, make certain that the shield pin on the tube socket is grounded to the chassis. If this shielding still does not completely remove the QRM, a metal plate should be installed to enclose the bottom of the chassis — making good electrical connection to the chassis, of course.

1 Removing leads in this way may sometimes lead to a false conclusion if the lead in question has an important influence on the operation of the remaining elements. For example, disconnecting the screen lead in an r.f. receiving tube will practically cut off plate current so that in such a case the trouble might be in either the screen or plate circuit. It might be well to have available a few resistors and condensers so that different values could be substituted temporarily for those originally in the receiver, thus permitting the tube to continue working, but under different operating conditions. It is suggested that the cathode be investigated last because disconnecting it will practically "kill" the stage except for resonant effects in the plate circuit which do not depend upon plate-current flow.

— Enron.
If, as they say, experience is the best teacher, then W2APF ought to be an expert on curing b.c.l. QRM. Where once his 20-meter kilowatt laid b.c. receivers low right and left, the air is now quiet and serene. Some valuable hints on keeping peace in the neighborhood.

Shielded wire produces much the same result as able to add the smallest by-pass condenser possible in getting a signal into the tube, using an unshielded wire produces much the same result as attaching an antenna directly to the grid. In most cases a shielded lead will cure the trouble, but in some instances it was found necessary to use the choke which we have described in conjunction with a tube shield and shielded grid lead. The combination of all three was only found necessary in those receivers having no r.f. stages. In some instances it was only necessary to substitute a metal tube for the existing glass one (again making sure that the shield connection on the socket was grounded).

The above procedure licked all of the problems we encountered where the interference was picked up in the r.f. section of the receiver. Troubles found in the audio-section were of a completely different nature, so a few generalities will be discussed.

Audio Systems

Audio systems in most radio receivers are relatively “rectification free” so far as amateur signals are concerned, but occasionally one finds all the trouble originating in the first audio or following stages. These cases are relatively simple, since it is only necessary to change the cathode by-pass condensers to a different value or to insert our parasitic choke in either the filament leads or the grid lead. No cases were encountered where the screen was the offender. By-pass condensers of the order of 10, 15, 20, 25 and 30 µfd. are desirable for audio purposes, the necessary working voltage being about 50 volts maximum. In correcting troubles in audio circuits it is advisable to add the smallest by-pass condenser possible inasmuch as too great a capacity will cause hum. Typical of the cases we encountered were those where the signal was being rectified in the phonograph section only and was not being picked up in any of the r.f. stages. One interesting case had a shielded grid lead of sufficient length so that when used in conjunction with the crystal pickup a complete circuit was set up enabling the signal to be picked up and rectified. Adding two feet of shielded lead and bonding the pickup arm to the motor frame and thence to the audio chassis cured the trouble. All in all, interference because of rectification in the audio circuits was extremely small, so small in fact, that it does not further require any discussion.

General Hints

A.c.-d.c. midgets are probably the worst offenders, and in these cases we decided that if an antenna trap or line filter would cure the interference we should go no further. However, this was not effective in all cases, so it became necessary to resort to the previously-outlined methods to effect a cure. For tube substitution purposes it will be necessary to take a 25-volt and a 6.3-volt tube and cut off all but the filament prongs. The tube does not have to be a good one since its only function is to provide continuity, inasmuch as the filament in these receivers are usually connected in series. Incidentally, the F.C.C. does not consider these receivers as being of modern design, and in many instances a proper explanation together with a copy of the F.C.C. rules will make the complainant realize that he cannot expect too much. At their best the midget a.c.-d.c. receivers are a headache, and if possible they should be brought to the shack to be fixed because here we have conditions at their worst. While on this subject I suggest that if it is possible all the b.c.l. sets should be worked on in the actual room where the transmitter is housed. With the rig connected to a dummy load it is a comparatively simple matter to hook a headset across the voice coil leads and hunt for the cause of trouble. This method saves plenty of chasing and will greatly cut down the time element. We have often threatened to make a portable battery-operated job which we could carry right to the heart of the enemy’s camp, and with a load across the output do the whole job right on the premises. As it was, we had so many cases it became necessary to rig up a portable telephone line from receiver to transmitter and ‘phone instructions back and forth.

It might be a good idea to be sure that you have done all that is necessary at your own end before leaving for the b.c.l.’s castle. Such details as line filters in the transmitter itself, using transformers with shielding between primary and secondary, proper housing of the transmitter (breadboard construction is out so far as crowded apartment houses are concerned), using antenna coupling which discriminates against all except the transmitter output frequency, a good ground, and similar essential points of good practice, will greatly reduce the number of complaints.

The work described consumed about six months’ time, and the consensus was that all cases of b.c.l. interference can be cured. All that is needed is that cordial appearance, a cooperative attitude, a little common sense, and someone to operate the transmitter. The author wishes to extend his sincere gratitude to W2BKZ and W2KZT, without whose untiring help this story would not have been possible.

April 1940
A 56-Mc. Crystal-Controlled Transceiver

A Completely Portable Battery-Operated Station

BY FRANK JACOBS, W2BSL

Many radio amateurs remember the fun on five meters when they could run around the country with small battery-operated transceivers. At one time hundreds of these were to be found at almost any outdoor hamfest near densely-populated cities. Many of them covered remarkable distances when taken on high buildings, on mountain tops or in airplanes or gliders.

Those who intend going on 2½ meters may be interested in comparative field strength measurements made through and around buildings in New York City. A wavelength of 7 meters showed an attenuation of 50 per cent every 500 feet whereas 3-meter radiations were reduced the same amount every 225 feet. There are many contributory factors to be considered, but generally speaking 56 Mc. will surpass 112 Mc. point for point, especially in portable operation where absorption is always present.

Regulations requiring more stable transmitters were intended to improve the coverage and general usefulness of the 56-Mc. band. Results have improved remarkably, but sad to relate comparatively few of the old gang have stuck to "five" because of the seeming difficulty of changing over to stable equipment. This is a serious accusation and a challenge to the ingenuity of the amateur fraternity.

The following article describes a complete battery-operated portable station that greatly outperforms the older modulated-oscillator models and yet is no larger, nor is it heavier. It is costlier by the price of a meter, a few tubes and some small parts. A careful examination of the circuit diagram (Fig. 1) shows why this transceiver is better. The reasons for superiority are briefly as follows:

1. The transmitter r.f. circuits employ a 1J6G twin triode as a 28-Mc. crystal oscillator (or tuned-grid if preferred) and 56-Mc. doubler. Midget air dielectric condensers are employed for tuning. A 1F5G straight r.f. amplifier having an input of 4 watts follows.

2. The receiving circuit employs a 1D5GP tuned r.f. stage which greatly improves selectivity and prevents radiation. A standard superregenerative detector circuit is used. The two stages have ganged tuning.

3. The common audio channel makes use of a 1H4G first stage for amplifying the output of the detector or of the microphone, and a 1J6G in Class-B delivering 2 watts of audio.

Four tubes only are used at any time. The other two have their filaments opened by the send-receive switch when not in service. This same switch throws the antenna from the trans-
mitter to the receiver. As the transmitter filaments take somewhat higher current than do those of the receiving tubes, a small network of \( \frac{1}{2} \) watt resistors is inserted automatically to keep the voltage constant when the send-receive switch is thrown.

4. Users of the old-type battery transceivers will remember that they had several annoying defects. (a) Optimum antenna coupling for transmission was too tight for reception. When coupling was best for reception, transmission was badly hampered. This trouble is obviously elimi-

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Fig. 1 — Complete wiring diagram of the battery-operated 56-Mc. transceiver.

C1 — 25 µfd. midget.
C2 — 25 µfd. midget.
C3 — Neutralizing condenser (National NC600); not required in some layouts.
C4, C5, C6, C7, C8 — 0.004-µfd. paper.
C9 — 250-µfd. mica.
C10 — 250-µfd. mica.
C11 — 0.1-µfd. paper.
C12 — 50-µfd. mica paddler.
C13, C14, C15 — 10-µfd. midget.
C16 — 0.004-µfd. paper.
C17 — 0.004-µfd. paper.
C18 — 0.004-µfd. paper.
C19 — 0.004-µfd. paper.
C20 — 0.004-µfd. paper.
C21 — 3-µfd. electrolytic.
C22 — 50-µfd. air paddler, mounts in L1 plug-in coil form.
R1, R2 — 500 kΩ 1/2-watt.
R3, R4 — 500 kΩ 1/2-watt.
R5, R6 — 500 kΩ 1/2-watt.
R7 — 10-ohm rheostat with off position on wire and snap switch on back.
R8, R9 — 100,000 ohms, 1/2-watt.
R10, R11, R12 — 1 ohm, 1/2-watt.
T1 — mike and plate-to-single-grid transformer (high ratio type).
T2 — Class-B input transformer for 1J6G.
T3 — Class-B output transformer, 1J6G plates to 3500 and 5000 ohms.
SW1 — D.p.d.t. rotary switch.
SW2 — D.p.d.t. toggle switch.
SW3 — S.p.s.t. snap switch (see text), dashed lines indicate ganging.
L1 — Optional 28 Mc. grid coil. 9 turns No. 12 wound on 5/8-inch diameter form, spaced with No. 14; inserted in interior of plug-in coil form.
L2 — 28-Mc. oscillator tank — same as L1, but not plug-in.
L3 — 56 Mc. doubler tank. 7 turns No. 14 on 5/8-inch diameter form, spaced with No. 14; inserted in interior of plug-in coil form.
L4 — 56 Mc. amplifier tank. 6 turns No. 12 on 5/8-inch diameter form, spaced with No. 14; center tapped.
L5 — 4 turns No. 12 on 5/8-inch diameter form spaced with No. 14, wound over L4 or 2 turns at each end.
L6 — 7 turns No. 14 on 5/8" dowel to occupy 1" — remove dowel.
L7, L8 — 6 turns No. 14 on 5/8" dowel to occupy 1". Space between coils should be greater than 1", inductive relation not required.
RFC1 — 2.5-mh. r.f. choke.
RFC2 — 70 turns No. 30 d.c. on 5/8" dowel (wood) that has been boiled in paraffine. Paint winding with low-loss coil dope.
nated when separate optimum coupling is provided for each, with a switch to transfer the antenna. (b) The receiver tuning of the old types directly altered the transmitter frequency, with the result that the operators spent most of their time chasing each other over the band. This difficulty is also entirely eliminated by the use of separately tuned circuits for transmitter and for receiver. An additional refinement in the form of screwdriver-slot tuning of the transmitter circuits prevents accidental detuning that may occur when knobs are used. The insulated tool is clipped to the side of the case, where it is always handy. Plug buttons may be employed to cover the holes, if one wishes the unit to be entirely dust tight. (c) Another bothersome feature of battery transceivers was the open windings of perfectly new and nice-looking standard transformers. The plate currents of these units were not excessive enough to create an open circuit, and no one ever found an open while in operation. The transformer "burn outs" were always discovered after periods of idleness. The reason: formation of electrolysis because the "B" batteries were not disconnected. The remedy: a separate "B" switch on the back of the filament rheostat which automatically removes the high potential from all circuits when the transceiver is turned off.

Construction

The transceiver shown measures 12\frac{1}{2} inches high by 15 inches wide by 5 inches deep, holds all batteries, and weighs 15 pounds less batteries. The user has the choice of employing batteries having a combined weight of 11\frac{3}{4} or 5\frac{3}{4} pounds. The heavier batteries are somewhat cheaper and give slightly greater life than do the lighter-weight batteries. The heavier type 45-volt batteries are Burgess No. 5308 and Eveready 762. The lighter types are Burgess Z-30-NX and Eveready No. 482. Two 1\frac{1}{4}-volt portable "A" batteries like the Burgess 4FA or Eveready 724 are recommended for filament supply. Burgess also makes a 3-volt "A" battery designated as No. 2F2H and another as No. 4F2H. The latter is huskier and exactly equivalent to two No. 4FA mentioned, or to two of the common old style No. 6 dry cells with which everyone is familiar, although lighter and smaller than the Number Sines.

The 1940 Handbook contains a nice listing of available batteries and their service life on page 275. Most of the types mentioned above are included.

The general layout of the unit is shown quite clearly in the various photographs, and needs little description. The receiver section is at the right, with the r.f. amplifier at the rear of the aluminum shelf. A baffle shield separates it from the detector circuit, which is next the panel. The two audio tubes are in the center, while the transmitter occupies the left-hand (from the rear) part of the chassis. The two tubes, oscillator-doubler and amplifier, are along the rear edge of the chassis. The crystal tank circuit is underneath, and the doubler tank circuit on top, of the shelf.

Tuning

Tuning the rig is quite simple, and when completed operation consists simply of turning the send-receive knob.

Connect the proper batteries and rotate the combined filament rheostat, filament and high-voltage switch sufficiently to the right for the superregenerative hiss to be heard in the "receive" position. This usually occurs in the neighborhood of 1.8 to 2.0 volts.

Next turn the switch to the "send" position and the meter switch to the "oscillator-doubler" side. The meter will read about 50 ma. with a tuned grid coil, and by checking the output with a 2-volt pilot lamp and two-turn pickup loop, the current can be reduced to 40 ma. by grid tuning without sacrifice of output as indicated by the pickup loop. When operating with a 10-meter crystal the total current will be about 15 ma. out
of resonance, and will rise to 40 ma. when the crystal frequency is reached by tuning the oscillator plate tank.

When the oscillator is "putting out" nicely, the doubler condenser is rotated for a dip of 10 ma. in the total plate current read on the meter. The oscillator and doubler now take 30 ma. Should these values not be attained when using 135 volts on the plates, tap the lead from $C_1$ to $L_2$ a turn or two from the hot end of the coil, and also tap down the wire from $C_5$ to $L_3$ until the doubler dips 10 ma. when $C_7$ is resonated.

Now throw the meter switch to the amplifier, where it will read 35 ma. out of resonance and 10 ma. when the plate tank condenser $C_3$ is in tune, and antenna disconnected. Connect the quarter wave antenna and tune the antenna condenser $C_1$ for maximum rise in plate current. Retune the plate tank condenser for a new dip and repeat the process until the amplifier draws about 30 ma., or a power input of 4 watts.

A 2-volt 60-ma. (No. 48) pink-bead pilot lamp may be connected in the circuit between the "send" side of switch SW1 and $C_1$. When so connected it will be near a current loop as the circuit is really a doublet, with a quarter wave rod working against the metal chassis as a simulated quarter wave. The lamp will light to full brilliancy and may even burn out on voice modulation. If it does it is a sign of good output and the lamp may be replaced with a 6-volt 150-ma. (No. 40) brown-bead bulb. No difference has been observed in the signal by the introduction of the lamps, and as they give a real indication of current flowing in a feederless antenna system they can replace expensive and cumbersome thermo-couple milliammeters in portable gear.

I will not go into detail on the results obtained. Suffice to say that compared to the old transceiver the range and quality are greatly improved, not only because of stability, freedom from annoying electrical defects, mechanical encumbrances and receiver re-radiation, but also because there are now many fixed and mobile stations with sensitive superheterodyne receivers or converters that will really do things to a stable low-powered signal.

Before jumping to 2½ or 1¼ where the coverage is far less than on 5 meters, it might be well to modernize those transceivers that are collecting dust. When you incorporate the features described you will be well repaid for your efforts and will have a job that will be capable of running rings around old-fashioned equipment.

Arizona State Convention
Adams Hotel, Phoenix,
April 19th-21st

The Arizona boys haven’t had their annual convention the past couple of years, and they’ve missed the regular get-together. So this year they plan to make up for lost time. Sponsored by the Radio Club of Arizona, the Arizona State (Southwestern Division) A.R.R.L. Convention is to be held at the Adams Hotel in Phoenix, Friday, Saturday and Sunday, April 19th through 21st. The program promises to be an unusual one, with well-known technical speakers, QST’s Managing Editor C. C. Rodimon, W1SZ, and a variety of stunts and features. The total charge for attendance will be $2.00. Write Chas. E. Spitz, W6FZQ, Box 3804, Phoenix, Ariz., for tickets and reservations.

Strays

Replace the rubber feet of the bug with small vacuum cups. Wet the cups and slap the bug on the operating table. Not only will it not slip, but you’ll probably have to pry it up to move it. --- K6QPD/6.
The Design of Speech Amplifiers

BY PAUL E. MILLINGTON,* W9KSW, AND DOUGLAS W. FATH,** W9UST

The speech amplifier of the modern amateur radio-telephone transmitter consists of the voltage amplifiers in the audio channel between the microphone and the grid or grids of the driver stage, although many amateurs also include the driver stage within the meaning of the term. With the possible exception of the drivers, which often must deliver considerable power, each of the stages in any such amplifier should operate Class-A, which means that the grids are not usually driven positive and that the plate current remains constant under all conditions. Class-A amplifiers give low distortion and high gain but rather poor plate efficiency.

The two most popular methods of connecting Class-A tubes are by means of resistance coupling and transformer coupling. These alone will be considered at this time, in the order named and with particular emphasis upon the first.

Resistance Coupling

The circuit of an audio voltage amplifier, resistance coupled to another, is given in Fig. 1-A, using triodes with indirectly heated cathodes. Tubes such as the 56, 76, 6C5 or 6F5 are of this type. A signal voltage "e" is developed by the microphone between grid and B— of the first tube across \( R_k \). The cathode is maintained positive with respect to ground by the flow of current through \( R_k \) and hence positive with respect to the grid, which is another way of saying that the grid is negative with respect to the cathode. The value of \( R_k \) is usually given among the operating data on the tube, or it can be easily calculated from the recommended operating voltages and current. A large cathode by-pass condenser, \( C_k \), provides a low-impedance path from cathode to ground for audio voltages. The plate current of VT1 flows through \( R_k \) and causes an appreciable audio voltage to appear between cathode and ground unless the resistor is well by-passed. Since any audio voltage between cathode and ground caused by the plate current flow is, in its effect on the grid, in the opposite direction to the signal voltage, it tends to cancel the effect of the signal and hence the amplification of the stage. If too small a cathode by-pass condenser \( C_k \) is used, the amplification will fall off at the lower frequencies. To avoid the use of \( R_k \) and \( C_k \), one or more small bias cells, B, may be inserted between \( R_s \) and B— or ground to maintain the grid properly negative, as in the case with VT2.

\( R_s \) is the series plate load resistor which offers high impedance to the amplified audio voltages, \( e_l \). The amplified audio output voltages, \( e_l \), appearing across \( R_s \) are fed to the next grid through a coupling condenser C. The function of this condenser is to block off the high d.c. voltage of the plate of the first tube from the grid of the second while simultaneously transferring the alternating audio voltages from the one to the other. \( R_p \) is the grid resistor of the second vacuum tube, VT2, across which the voltage \( e_l \) now appears. No flow of direct current occurs through this resistor and hence the resistor in itself has a negligible effect upon the bias of the tube. The constant bias voltage may be secured from bias cells as shown, or by means of the \( R_k-C_k \) combination of VT1.

Many suitable triode tubes are available for audio amplifier work, although pentodes are often used as triodes by tying the proper electrodes together. For example, the 57, 58, 6C8, 6D6 and 6J7 pentode tubes readily become medium-µ triodes if the suppressor and screen grids are connected to the plate. The correct connections for triode operation with other multi-grid tubes are usually suggested in their data when the tubes are suitable for this sort of service. Pentodes are often used in the first stage of speech amplifiers, particularly with low level input, because of their greater voltage gain. They
If you're building or trouble-shooting a speech amplifier, it's always well to know the "whys" of Class-A amplifier operation. Here's a non-mathematical explanation of those of most interest and practical use.

are not generally used following high-gain pentode stages because the high amplifications often cause instability in the amplifier. A typical Class-A pentode is given in Fig. 1-B, in which the suppressor is tied to the cathode (or to ground), the screen being maintained at a fairly low positive potential from a tap on the d.c. voltage divider $R_1R_2$ across the plate supply. Incidentally, to emphasize an oft-repeated point, the screen voltage must never be too high, otherwise the stage may oscillate, rendering it more or less completely inoperative. $R_1$ is usually 50,000 ohms, $R_2$ 100,000 or 200,000 ohms. The screen is by-passed to $B-$ with an electrolytic condenser to provide a low impedance return for amplified audio voltages. That is, as far as audio voltages are concerned, the screen must be at zero potential.

Bias cells for control-grid bias may be used to particular advantage with pentodes, since usually only one or two cells are necessary.

The amplification of resistance-coupled amplifiers varies with frequency, being greatest with those frequencies in the intermediate ranges, falling off more or less sharply in both the low and high portions of the audio spectrum. Over the intermediate frequencies, the amplification is essentially constant. The maximum amplification that can be expected with a triode-connected resistance-coupled stage is about 7 per cent of the amplification factor, or $\mu$, of the tube. The familiar 56 and 76 will thus each give a maximum practical amplification of only 9 or 10 per stage, corresponding to a gain of about 20 db, while some of the newer tubes, such as the 6C5 and 6F5, are much more effective in this respect. The 58, 6C6, 6D6 and 6J7, acting as medium-$\mu$ triodes, have effective amplifications varying from 13 to 14 (23 db) per stage. A pentode, however, may give a maximum amplification of approximately 8 per cent of its $\mu$. Thus the 57, 6C6 and 6J7, connected as suggested in Fig. 1-B, will each yield a rather conservatively estimated voltage gain of 100, corresponding to 40 db.

The overall amplification and the amplification at low and high frequencies vary considerably with the circuit constants. Increasing the value of the grid resistor to one or two megohms increases the maximum amplification, at the same time favorably affecting the low-frequency response from 30 cycles upward. The electrolytic cathode condenser affects favorably the low frequency response if its capacity is large, as previously pointed out. Except for the by-passing of 60-cycle ripple, however, practical results do not justify capacities much beyond 4 $\mu$fd., although capacities from 10 to 25 $\mu$fd. are often used, since the condensers are not expensive in the low-voltage ranges. Increasing the coupling resistance, $R_p$, decreases the high-frequency response and increases the gain. The advantages are not particularly marked unless the high values of $R_p$ are accompanied by high plate supply voltages, due to the considerable d.c. voltage drop across the resistor. The practical effect of a change in the desired direction with ordinary power supplies is limited to values of $R_p$ two or three times the plate resistance characteristic of the tube itself, which may be ascertained from the tube data. The capacity of the coupling condenser $C$ has a very direct bearing upon the amplification at low frequencies, where its reactance is greatest. Capacities beyond 0.1 are scarcely necessary, however; usually 0.05 $\mu$fd. is ample to extend the frequency response to 40 or 50 cycles, and 0.02 $\mu$fd. is often used where extreme low frequency response is not essential. The effect on the intermediate and high frequencies is negligible with

(Continued on page 118)

![Diagram A](https://via.placeholder.com/150)

![Diagram B](https://via.placeholder.com/150)

April 1940
The Third U.H.F. Relay at least served the useful purpose of giving us a chance to find just what the ultra-highs are really capable of in the way of reliable communication, even under the worst possible conditions. From start to finish this contest was run off without the slightest assistance from the weatherman; in fact, he did his worst for those hardy souls who attempted portable operation.

In direct contrast to its predecessors, both of which started off with a bang as the result of fortunate breaks in the form of extended operating range resulting from lower atmospheric bending, the Third Relay started with the operating range at practically its absolute minimum. Before the contest was many hours old the gang accepted their fate and the contest became a traffic-handling bee which saw messages shuttling up and down the eastern part of the country and across the Great Lakes area with a speed and precision which would do credit to established trunk-line routes.

Though the interchange of messages between the East Coast and Middle West stations accomplished in the November relay was not repeated, new territory was added in other directions, with the north-south route extended to cover all the territory from Exeter, N. H., to Richmond, Va. Much credit should go to W3FJ and W3CYW of Richmond and W3DBC of Washington, D. C., for extending the relay to Richmond. Only Maine and North & South Carolina are now needed to complete a Maine-to-Florida 56-Mc. network! Who will volunteer to break the ice in these areas?

Some excellent work was turned in by a network of W8's and W9's extending from W8CIR in Alliguioppa, Pa., to W9ZHB, Zearing, Ill. Given a halfway decent break by conditions, this combination could have connected up with the east and speeded our west-bound traffic on its way with ease. The next relay is scheduled for May 11th-12th. If past performances mean anything, this one should surely be a wow! With the year's best conditions often coming up about this time, the Fourth U.H.F. Relay should be our golden opportunity for completion of that long-awaited coast-to-coast route.

Here and There:

Probably the youngest YL ever to modulate a 56-Mc. rig is Nancy Carol Collamore, who at the tender age of three minutes announced her arrival at the home of W1LPF of Lowell, Mass., at 11:05 P.M., Feb. 12th. Cal, the proud father, insists that it sounded just like "CQ-Five" to him! WILTF, Cal's brother-in-law, had been listening on Five for more than twelve hours for the glad news! If you W4's and W9's miss W1KEE in the group of W1's you work the first time the skip breaks on Five, look for a familiar voice signing W1AZ. Yes, you guessed it, George is another of those old-timers that the ultra-highs brought back to amateur radio. Many years ago he had that call and now has it again. Congrats, George, but it'll take the gang a long time to forget "W1KEE"! As this is being written, W1AZ is just about ready to christen a new rig. With up to 350 watts to a pair of 35T's, a.m.c., and an 8-element rotary beam, W1AZ will put East Longmeadow, Mass., on the map in short order.

Over Albany way, W2FBA seems to be holding forth alone these days. With 500 watts and up to a pair of 100TH's, Bob is doing all right. He works W2MO (130 miles, over rough country) quite regularly. Interest in u.h.f. work seems to be picking up over there and Bob may have company on Five soon.

The composite beam at W4EDD. Top section is a 5-element 3/4-wave spaced affair for 56 Mc. The bottom section is a similar type for 28 Mc., while in the center is a 3-element close-spaced array for 14 Mc. The entire structure, complete, weighs only 137 lbs.
W4EDD in 1940 dress. Five 66-inch racks contain separate kilowatt rigs for each band from 28 Mc. up. The u.h.f. apparatus is in the two sections on the left side and consists of separate 500-watt transmitters for 56 and 112 Mc. The operating position includes speech amplifier and transmitting 'scope at the left, with recording amplifier and receiver 'scope at the right. Receiver is a DM-36 converter ahead of a DB-20-69 combination.

soon. W2FBA reports hearing a harmonic of XDA on Dec. 17th.

W2MO's nightly skeds with W1's LPS, LLL, and AZ have not been going quite so well during February, though on several nights good contacts have been made. In the absence of W2HGC, Earl is maintaining regular skeds with W3IIS of Catonsville, Md., with contacts made on a fair percentage of the attempts. Signals over this path, and those of the W1's, have frequently had the familiar "flutter-fades" recently.

Activity in W3 seems to be picking up all along the line, if the number of new calls appearing in the various Marathon reports is any indication. W3BYF sticks by his post valiantly, though with his poor QT1 (low elevation 100 feet from heavily-traveled Route 22) Pres says that when he "works" a station he means just that! The rig is a pair of T-20's at 75 watts: while a 954 concentric line r.f. stage working into an 1851 conventional r.f. and 6L8 mixer (with oscillator on 28 Mc.) comprises the "business end" of the receiver. Pres wants to try some form of tilted antenna on skip this spring as he is of the impression that some of the sigs of this type must come almost straight down in order to get into the valley at Allentown.

At Alexandria, Va., W3EIS hopes that about one more box of cigars for the janitor will turn the trick in overriding the ruling against tenant being allowed on the roof, where-upon the sigs of W3EIS may cover a wider area than at present.

We are pleased to note the success of W3JJ and W3CYW of Richmond, Va., in extending the relay route 100 miles farther south, by establishing contact with Washington, D. C. Keep at it, boys, and try to promote activity still farther south in the hope of ultimately contacting the fellows in Georgia and Florida.

From the appearance of the new W4EDD, shown in the accompanying photos, we should be hearing plenty from Robbie 'most any day now. Note that 5-element full-spaced horizontal rotary. Robbie, with W2HIZB, is definitely against this business of "taking his standing up."

For sheer perseverance we award the medal to Vance Dewey, W5FYF, who stays with Five regularly, signals or signals! Nothing whatever was heard in Oklahoma City during the entire month of January. We hope that February was more promising, Vance, though from what we've heard from other sections of the country thus far, there has been little encouragement for the unhurtful who must depend upon skip-DX this month, either. Your day will come, erc long, however — May is not far off! Many others of the u.h.f. reports from the sixth call area tell of goings-on on 112 Mc., with little mention of 5-meter work. W6BPT, Santa Clara, Cal., reports that W6QLP (HK-54's and converter-SX-24), W6LZL (807 and r.f. super), and W6LNS (HK-54's and SX-10) are active each Thursday evening between 7:30 and 9:30 P.M. local time. They stand by each quarter-hour to listen for other stations. Thus far W6LZL is the only one of the group who has succeeded in working other than locals, having contacted W6RZC in San Francisco from San Jose on Five.

W6OVK, Tucson, Ariz., talks up Five to everyone he contacts on other bands, and counts W5VV as one of his best prospects to date. Wilmer has a DM-36 and promises to be on Five some time soon.

In East Bloomfield, N. Y., W5PK heard W5QDU, Detroit, during the contest from 6:36 to 7:30 Saturday night. This is a 300-mile jump and would have looked pretty nice in the Marathon box score. Better luck next time!

W6QSs tells us that W5QDU got up from a sick bed to take part in the relay and fill an important gap. He says of Fred: "His voice wouldn't work, but he sure cuffed the key to beat the band!" W5QDU maintained skeds with W8NYD, Kent, Ohio, and W8CVQ, Kalamazoo, Mich., both long hops, throughout the contest.

W8RFW, Grand Rapids, Mich., lost his beam in a high wind just a few days before the contest. By some heavy night work he got a new 4-element horizontal array up and set to go by Saturday afternoon. Sigs all seemed to be 'way down until one feeder was disconnected. This brought them up well, so he promptly re-erected the beam in a vertical position. This move brought all signals up above any previous experience. Victor has definitely joined the ranks of those who "take theirs standing up." The new array at W8RFW uses tenth-wave spacing, with one reflector and two directors. The feeders are inductively coupled to the radiator. This array replaces a 4-section '8JK,' with improved results.

From the "horizontal champion." (W9ZIB, not Phil Scott) comes a breezy story that we'd like to print in its entirety if space permitted, but with the large amount of dope on hand this month a few quotes will have to suffice. "In the East you have your Boreataders, Minutemen, and other networks. Here in Illinois we have our 'Pink Networks' — not red or communistic in any form — just slightly 'pink' towards accepted (?) theory we can't take. Having our own peculiar problem to lick in working over the flat land which is characteristic of the Middle West, we went to work with a will and have seemingly had a fair measure of success."

The success of the "Pink Network." (W9's ARN, RGB, W0Q, CBJ, W1Y, ZHB, and others) in working out with horizontal antennas is well known. Their daily skeds have helped greatly to maintain year-round interest in the area around the Great Lakes.

(Continued on page 60)
Application of Transverse Phase-Shifts to Amplifier Design Problems Involving Fortuitous Feedback Paths

BY J. K. BACH* W4CCE

The employment of neutralizing voltages to solve certain adhesive problems incident to vacuum-tube applications ranging from magic eye indicators to pin-ball machines according to the formula:

\[ E \sin \phi + e \sin \phi = 180^\circ = 0 \]

where \( E \) is the interfering electromotive force and \( e \) the opposing voltage, is of a comfortable antiquity, comparatively speaking.

When the present writer was but a child it was quite the accepted practice to eliminate oscillation in resistance-capacity coupled amplifiers by means of a phase-shifting bridge network, the special variable-condenser element of which, in fact, closely resembled one used in a bridge circuit in a modern receiver. See Fig. 1.

Additionally, C. D. Tuska’s “Superdyne” circuit, the revolutionary labyrinths of Messrs. Rice and Hazeltine, as well as the experience of thousands and thousands of constructors who got their ticklers backwards, emphasizes the efficacy of this classic technique.

At some slight risk of becoming redundant, the direct-coupled audio-frequency amplifier due to Loftin and White employs the same principle. In fact, if you want to give credit where credit is due, Wheatstone is to be thanked for the peekaboo method of keeping stray voltages put.

Hughes, of “induction balance” fame, comes in for his share of credit also, but let us take up the work of contemporary scientists, notably Black, of the Bell Telephone Laboratories, who took a distinctly miscellaneous aggregation of components and produced an amplifier so flat in frequency-gain characteristics that no one believes it even at this late date.

Quite obviously, this principle, but 67.3% less generally applicable than that of gravitation, can be used over and over again for invention purposes, and there is no very good reason why the writer—and indeed, the Public At Large, cannot invent it also.

The selection of something to invent is simplicity itself—two minutes listening to any frequency in the radio spectrum all but forces the selection of selectivity as the problem to embark upon. That is to say, instead of the flat frequency response obtained by Black, we desire quite the opposite effect. Positive re-

* P. O. Box 2902, Miami, Fla.
Despite the formidable-sounding title and the rather "technical" appearance of the circuits and graphs, the author's unusually lucid style will make this article just as clear to the raw beginner as to the most advanced engineer. The results are astonishing.

definite point where the algebraic sums of regenerative and degenerative voltages is equal to zero. This corresponds to a feedback phase of 90 degrees with its implication of so-called "wattless power," or zero power factor: At this point, the resonant circuit voltage is solely that due to the input to the circuit. This point should, of course, be as near resonance as possible, in the interest of selectivity.

The simplest method of reverse-feedback having sufficiently flat frequency characteristics is the un-by-passed cathode-resistor method, and this we may employ. In order to use standard parts in our amplifier, which might best be an intermediate-frequency one of, say, 5,000 kc. for use in a communications-type superheterodyne, we shall also use the so-called tuned-plate-tuned-grid circuit for the positive feedback, together with an auxiliary variable air-condenser between control-grid and plate of the tube. In accordance with the above, an experimental amplifier was built up using the circuit shown in Fig. 2, curves for which are given in Fig. 3.

Note that the negative-regeneration cathode resistor $R_k$ is un-by-passed, and that the inclusion of a voltage divider to provide a positive bucking potential for the grid, permits increasing $R_k$ to all but fantastic levels without allowing the input grid to reach the cut-off point; this results in so much degeneration, with the grid at the rated bias, that as much as 13 $\mu$fd. may be necessary at $C_1$ to secure oscillation.

Actual tests gave rather startling results. Whenever $R_k$ was increased beyond about 522 ohms, even when $C_1$ was increased to the oscillation point, nothing whatever was received. After much retuning, it was discovered that the carrier frequency used in the test had to be left on the exact resonant frequency of the amplifier for at least nine seconds before the sidebands due to switching the test frequency on an off (even at the slowest possible rate) would permit the carrier to get through. Calculations too abstruse to include here indicated that the sideband width of the amplifier was but 0.000000007 cycle under these conditions. Less feedback, with consequently wider sideband response, will probably obtain in actual commercial practice.

(Editor's Note: It is noteworthy that, for some occult reason, revolutionary developments of this type are frequently — in fact, almost invariably — disclosed in the month of April. Perhaps some of our readers can fathom this mystery.)

Strays

W1AI2, W1IIM, W1I8S and W1IXL, vacationing in New Hampshire with a 500-watt rig as company, rose to meet the emergency created when their Zepp tank condenser failed. With the aid of two tin pie plates, two glass plates from picture frames and a pint of water, the problem was quickly solved. The first pie plate was placed on the table upside down; the two glass sheets served as the dielectric and the second pie plate rested on top and was filled with water to provide cooling to compensate for heating of the iron pie plates.

This condenser served as part of the 500-watt, 75-meter 'phone rig for the two weeks' vacation during which 200 contacts in 32 states were made. W1LDD, who is an undertaker, uses his embalming tools to work in tight corners of his u.h.f. gear — W1LAQ.

VE2CN points out that tickler-type beat-frequency oscillator units for battery-tube circuits, sometimes difficult to find, can easily be made from the e.c.o. type by scramble-winding a feedback coil of 15 or 20 turns on the same core near the regular winding.

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Fig. 3 — Experimental response curves with the amplifier of Fig. 2. (A) no regeneration or degeneration; (B) regeneration only; (C) critical combination of regeneration and degeneration. Reproduction difficulties make it impossible to show justice to the actual (C) curve, since a graphic line has to have some thickness.

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April 1940
HAM SHACKS

W8KSL'S Rotary Antenna
W2ELN, Jamaica, N. Y.

W9ZVO, Chippewa Falls, Wis.
W3E1M, Baltimore, Md.

Lower Left—W6MQF, Santa Ana, Calif.
Lower Right—W8KSL, Hazel Park, Mich.
W2ELN

Norwood Bradshaw, pre-war 1ESP, now operates W2ELN at Jamaica, N. Y.
The transmitter is built into an old army transmitter panel and frame which was picked up several years ago. A 6L6G is used in the crystal grid-plate oscillator circuit. This is capacitively coupled to a pair of 10's in parallel, running at 100 watts input, which may be modulated by Class-B 46's. A single 57 triode speech amplifier provides enough gain for the single-button carbon mike to swing the Type 10 driver.

A single-ended pi-section antenna coupler is used. This is coupled to the final tank with a link line, one link at the center of the final tank and the other link wound around the input end of the antenna coupler coil. This arrangement has worked out very satisfactorily with several single-wire antennas.

The receiver is a seven-tube Hallicrafters to which several improvements have been added. A control system has gradually been worked out which permits smooth and convenient operation of the station with the least amount of effort.

While he frequently works 160 'phone, W2ELN spends most of his time on 80 and 40 c.w.

W3EIM

John Cann, W3EIM, is a newcomer to the ranks of ham radio. Nevertheless, since receiving his license less than a year ago, he has done quite well for himself with his low-power rig. He has worked 43 states with confirmations from 41 as well as CM, K4 and K6.

The station is located in a convenient corner of the sun parlor. The transmitter is the "QSL 40," described in QST, with a single 6L6G. It is link-coupled to the antenna tuner near the window at the right. The antenna is a 66-foot end-fed Zepp. The receiver is the SW-3 with Brush 'phones.

Only two operating frequencies are used at the present time — 3717 and 7185, the former being used most of the time.

John is planning to build a new all-band rig soon with a 200-watt final.

W6MQF

W6MQF at Santa Ana, Calif., is owned and operated by Earle Kent who is employed in the Postal Service.

The transmitter is a neat rack-and-panel job. The r.f. line-up consists of a 6A6 crystal oscillator, T20 buffer and a pair of 35T's in the final which usually operates at 300 watts input. The modulator starts with a crystal mike and 57-56-56 speech amplifier and ends up with Class-B T240's. A pair of Class AB 45's is used as the driver for the modulator. The speech amplifier is on the operating desk and is connected to the driver through a 500-ohm line running over to the modulator in the rack.

The receiver is a Philco 11-tube superhet with a built-in heat oscillator. The antennas include a 2-element 14-Mc. rotary.

The 7-Mc. and 14-Mc. bands are his favorites, although he works 3.5 quite frequently. Although WAG has been made several times, W6MQF likes a good old rag-chew with anyone who can shoot the breeze interestingly.

W8KSL

Arthur Clarkson has built his station in the basement where it's warm in winter and cool in summer.

The transmitter is in the rack to the left. A 6A6 crystal oscillator drives a push-push 6L6 doubler which is followed by a push-pull HY25 driver. Push-pull HK54's are used in the final which is operated at 500 watts input. All stages are link coupled. The final is modulated by a pair of Class-B T55's driven by push-pull 6L6's. The Shure 70S mike feeds a two-stage speech amplifier employing a 57 and 56.

The speech amplifier is on the operating table beside the Patterson PR10 receiver and regenerative preselector.

The two-element rotating antenna is shown in the photograph to the left. The elements are made of ½-inch diameter copper tubing. The antenna is fed with a 600-ohm line and delta-matched.

The rack to the left contains the rig of W8PAA who occupied the same shack for a time.

W9ZVO

Earl Struve's transmitter is built up in an enclosed rack. It covers all bands from 28 to 3.5 Mc. The push-pull HY40 final amplifier is operated at 200 watts input on 'phone or c.w. It is modulated by Class-B HY 402's. A Turner crystal mike is used.

The receiver is an NC101X which was won as first prize at last year's A.R.R.L. Dakota Division Convention.

Operation is confined chiefly to 'phone work in the 14- and 28-Mc. bands. On these bands vertical half-wave antennas of pipe are used.

In a splendid story of the fascinations of amateur radio appearing recently in a non-radio magazine, the editor (not the author) captions one of the illustrations: "The antenna towers for the station are suspended 110 feet above the ground." Quite an idea if you can work it!

In low-power transmitter stages or in receivers, short lengths of glass tubing, fire-polished at the ends, make a good-looking form of insulation for wires passing through metal sub-bases.

Strays

In the 14- and 28-Mc. bands. On these bands vertical half-wave antennas of pipe are used.

W7TQ

April 1940
AN INEXPENSIVE 50-FOOT ANTENNA MAST

A LITTLE over three years ago, I built a 50-foot mast which has withstood weather so well that I feel that constructional details would be of interest to others. The type of construction shown in Fig. 1 has the advantage that the mast is extremely strong, although light enough in weight to make erection easy. Material for the mast should be obtainable for about $10, plus or minus, depending upon where you happen to live in respect to lumber country.

The bottom section is a 26-foot "6 by 6" of selected Douglas fir. The center section is the part which differs from the usual types of construction. Four 22-foot strips of 1¾-by-3-inch spruce stock are used to form a martingale structure. The four strips are spread at the center by an octagonal piece (or square piece if you don’t want to bother to cut off the corners) 2 inches thick and measuring 10 inches across. The strips are fastened to this piece with lag screws.

The top section is made up to two pieces of 1¾-by-3-inch spruce bolted together with ¾-inch bolts. Eye bolts should be used at the top for fastening guy wires and pulleys.

Before assembling, the pieces should each be given three or four coats of good lead and oil paint. The center section is bolted to the bottom section with ¾-inch carriage bolts 9 inches long with large malleable iron washers at each end. The sections should overlap 4 feet.

The center section is bolted to the top section in a similar manner with an overlap of 4 feet. Here, also, some of the bolts should be eye bolts for fastening guy wires.

Although it has not been found necessary, weakening of the joints by the drilling of bolt holes could be avoided by the use of clamps made up from heavy iron strap as shown in the detail drawing. Two of these clamps could be used at the top and bottom of each joint, the open end of each clamp facing in a different direction. Similar clamps could be used for fastening the guy wires and pulley.

The mast is sufficiently rigid and light so that it may be assembled on the ground and raised into position in one piece. The easiest way is to use a 20-foot gin pole and pull the mast up into position with block and tackle. After raising, the mast is plumbed up and the bottom braces set in place.

The mast was used for over two years with no guy wires at all and stood up well under severe winds which took down two "A-frame" towers with three sets of guy wires. Guys were finally used to prevent the top swaying in heavy winds.

I believe it would be practical to extend the height of the mast to 70 feet by the addition of a...
second martingale section, if desired. The added length would, however, increase the raising difficulties and require an additional set of guys.

— Rex Reinhart, W6PGB.

NOTES ON GASEOUS TUBES AS BIAS REGULATORS

I noticed one thing in connection with McCullough's article on page 54 of the February issue of QST that might be worth checking in case trouble is experienced with one of the details of the transmitter. In order to simplify the bias problem, McCullough indicated that type VR-105 and type VR-150 voltage regulator tubes might be used and advantage taken of the constancy of drop across these tubes. I have tried similar arrangements using gas tubes for providing bias and find that they work out very nicely provided the current through the tubes is fairly high, that is, close to the current limit for the tubes. At very low currents, such as are indicated as satisfactory in the article, the tubes are inclined to oscillate and would, under oscillation, modulate the transmitter.

Another use to which gas tubes have been put, has been fixed bias in 6L6 amplifier work. The OZ4 tube has a constant drop of about 23 or 24 volts and if the current for a 6L6 stage is passed from cathode to ground through an OZ4, a constant bias voltage is developed. This looks perfect on paper and in some tests that I have seen in amplifiers, works perfectly for about an hour with this arrangement and then breaks out in noise produced by oscillation in the gas tubes. The use of gas tubes for these purposes simplifies construction a great deal but the user should bear in mind that he may get into oscillation trouble which will be eliminated only by some rather tricky filtering and on the whole the arrangement looks better on paper than it actually works. — R. M. Purinton, W2ICU.

MORE ON HOMEMADE FEEDER SPREADERS

The article on homemade feeder spreaders by W8Q2P which appeared in the Hints and Kinks section of QST for December has prompted W7DES and W7KK to describe variations in the idea which each has found satisfactory.

W7DES uses 9-mm. neon-sign tubing cut in 6¼-inch lengths. Rather than to use sealing wax to tie the feeders down, he heats the end of the tubing in a gas flame until a quarter-inch at the end is red. Before it has a chance to cool, he presses it against a flat surface, making a bulge on one end. Then, heating the end again, he makes a V-shaped notch across the end by pressing against a small bar. The bulge allows a wire or cord to be tied behind it and the wire running through the notch may be securely tied down. The finished spreader is shown in Fig. 2A.

W7KK cuts his glass tubing in lengths of about 5½ inches. He then obtains rubber corks to fit the tubing and drills wire holes in the corks to fit the feeders. After the corks have been threaded onto the feeders like beads, he inserts them in the ends of the glass-tubing sections as shown in Fig. 2B, and seals the tubes with waterproof cement. Usually the corks will stay on the wire in place without tying.

SUPERHET B.F.O. AS CODE PRACTICE OSCILLATOR

I've discovered a little kink for my Sky Buddy, S19R which doubtless may be applied to other superhets. I wanted some means for code practice, so I changed the b.f.o. circuit as shown in Fig. 3. As may be seen, the only changes made were to disconnect the ground connection from the cathode of the b.f.o. tube and connect the cathode to the ground through a variable 50,000-ohm resistor and a closed circuit jack. To reduce key clicks, a condenser of 0.02 µfd. is put across the jack.

This set-up gives four possibilities:

Fig. 3 — Simple method of converting superhet beat oscillator for code-practice use.

(1) With the key out of the jack and the auxiliary pitch control at its lowest resistance, the set is unchanged from its original performance.

(2) With the b.f.o. switch on, the auxiliary pitch control at lowest resistance and the key in the jack, the set is tuned until the b.f.o. heterodynes with any unkeyed c.w. signal, and the key can be used for code practice. The pitch of the note is varied with the regular pitch control. This gives a musical note.
(3) With the same set-up as in (2) the b.f.o. can be heterodyned with a broadcast carrier, and the program can be enjoyed while the code practice is going on.

(4) The set is tuned to a dead spot on the dial, and at a spot where there is a minimum of static. With the key in the jack, the auxiliary pitch control is advanced until it increases the grid to ground resistance of the b.f.o. tube, to the point that the circuit goes into self-modulation. The note, which is more of a buzz than a musical note, is varied in pitch with this control.

This makes a very handy arrangement for code practice. Most hams have the necessary parts in the junk box and the only change made in the panel is the addition of a key jack and a small knob. This change could probably be easily made on almost any set having a separate b.f.o. circuit.

---Calvin B. Simmons, 1st Lt., Air-Res.

METER SWITCHING WITH TOGGLE SWITCHES

Fig. 4 shows various circuits of a simple and safe meter-switching system which requires nothing more than a s.p.d.t. toggle switch to make a single milliammeter serve for checking two circuits.

In A, the meter and switch are connected so that either grid current or plate current of the same stage may be checked. When the switch is thrown to the left, the meter reads grid current; when thrown to the right, it reads plate current.

Circuit B shows connections for two meters. The first reads grid current of either doubler or final, while the second reads plate current of either stage. As the circuit is shown, both doubler and final tubes may be operated from the same filament transformer, but separate high-voltage supplies are required. In the arrangement at C, separate filament transformers are required but both stages may be operated from the same plate supply. In each stage, grid return should be made to filament center-tap rather than to ground. It will be noticed that neither the meter nor the switch is at high potential above ground in any of these circuits.

The meter-shunting resistances should be 10 to 25 ohms each if no scale multiplication is desired. If a change in the meter range is desired, when switching from one range to another, the shunting resistances may be adjusted to give the desired multiplication. If the resistance of the meter is known, the shunting resistance required to give the desired multiplication may be calculated by the following formula:

\[ R = \frac{R_m}{n - 1} \]

where \( R \) is the shunt resistance, \( R_m \) the resistance of the meter and \( n \) the scale multiplication factor.

The required resistance may also be determined experimentally by connecting the meter in series with a low-voltage battery and rheostat and adjusting the rheostat so that the meter reads full scale. Various shunt resistances then may be tried across the meter terminals until one is found which will cause the meter reading to fall to that fraction of full-scale deflection which is the reciprocal of the multiplication factor desired. The meter reading should fall to \( \frac{1}{10} \) for a multiplication of 10, to \( \frac{1}{2} \) for a multiplication of 5, to \( \frac{1}{3} \) for a multiplication of 3, etc. In all cases the resistances should be of adequate current rating to prevent any possibility of burning out under heavy overload. In most cases, it will be practicable to make multiplying resistances from copper wire.

---Howard E. Gullberg, W5GGS

The insides of old automobile (Chevvy) steering posts make good material for a self-supporting antenna. These are the tubes used to control the spark, throttle and horn. The ones I got had three telescoping sections totaling 12 feet.

---W9EVD
I. A. R. U. News

Devoted to the interests and activities of the

INTERNATIONAL AMATEUR RADIO UNION

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

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THE I.A.R.U. issued during 1939 a total of 762 WAC certificates, compared to 958 the previous year. Of these, 571 were for c.w. work and 191 for 'phone, the same ratio as in 1938. It is perhaps worthy of note that in 1938 there were 46 endorsements showing all contacts made on 28 Mc., but only half that number this past year.

We recently had occasion to check back into the early files of the WAC club, and spent an interesting few minutes reading the names of those pioneers of DX — in the days when the WAC certificate adorned the walls of but a few mighty stations in the world. Recipients of certificates numbers one and two, issued in April, 1926, were Brandon Wentworth, nu60I, and the late Clair Foster, nu6HM. Among early WACers, those who still hold the same calls (or their equivalents after prefix changes) are: Don Wallace, nu9ZT and nu6AM; Jefferson Borden, nu1CMX; John Griman, nj5PZ; 12th Signal Company, op1HR; Hilton O'Heffernan, eg5BY; H. Cooley, nu1AAO; Neville Shrimpton, oz4AO, F. McCreever, nu9DNG, and Jack Berliant, nu2AVP.

By the way, a couple of months ago we mentally prophesied that with disrupted international conditions the issuance of WAC certificates would drop off to almost nothing — but we were somewhat wrong. True, that has happened in the case of applications, from affected countries, but not so much with those from the Americas. It seems that many amateurs here have already worked and received cards from five continents — the elusive one, as always, being Asia. Since that continental division is still well represented on the air and since DX enthusiasts can concentrate more than ever before on that objective, many of them are achieving the award. But the total number of applications is now about one-third that of a year ago.

GERMANY

We excerpt the following from information received from Chris Schmelzer, D4BIU:

"There seems to be a widespread misunderstanding concerning the activities of German amateur stations to-day. According to a statement made by our government, all sport activities, etc., will be continued during the war to as large an extent as possible. Due to this, amateur stations D4ACF, D4ADF, D4BIU, D4BUF, D4HCF, D4TRV, D4WYF, D4HCF and D4DKN have been relicensed recently. More licenses will follow shortly. The stations are

MX3H, station of Sakae Tamogami, Manchoukuoan QSL Manager. The two superheterodyne receivers and 6L6-807-803 transmitter are home-built.

April 1940
supposed to carry on strictly in the usual manner. Please notify all interested."

QSL BUREAUS

The following addition and change should be noted by all societies:

Cuba: James D. Bourne, CM2AZ, Arbol Seco No. 102, Havana.
Manchoukuo: Sakae Tamogami, MX3H, P. O. Box 30, Shinkyo.

NEWS AND NOTES

Australia: The Wireless Association of Australia is taking a census of its amateurs to ascertain the degree of national effort of which they are capable and to gain knowledge of amateur participation in the armed services. Government authorities declined the association's plea for the issuance of licenses to operate on the u.h.f. bands, but officials say another petition will be made shortly. They are also asking permission for an official amateur station for each state, to operate in the 7200-7300 kc. territory and transmit headquarters news, etc., to the membership.

Cuba: CO2WL tells us that their government intends to delete the amateur 'phone prefix "CO" sometime in June, and apply the prefix "CM" to all Cuban stations, c.w. and 'phone alike.

Great Britain: An order issued by the PMG department, designed to prevent assembly of radio transmitters by unauthorized persons, makes it an offense for a person to have in his possession without a permit, "wireless components capable of being assembled into a transmitter." British amateur gear seized by the government has been carefully stored, for return to its owners upon cessation of hostilities.

Mexico: Mexican nationality is a requirement for amateur licenses with the exception of those wishing to operate on the u.h.f. bands, 10 meters and below; these are considered experimental bands and residents of Mexico, not necessarily citizens, can secure permits to operate.

South Africa: The S.A.R.R.L. is still operating its official headquarters station with Sunday morning broadcasts of news items, headquarters notes, etc. Amateur licenses are being cancelled as they expire, since for the most part they are joint licenses authorizing both an amateur station and ownership of broadcast receiving sets. Only authorized officers have the right to seal radio apparatus, the use of which has been suspended or in respect of which a permit has been disallowed.

U. S. A.: We are skeptical about the statement appearing in an American contemporary stating that all PK stations have been closed down — especially when it says the action was taken by the British government!

New Receiving Tube

SYLVANIA announces the addition of another tube to the bantam series. The 6S6GT is a remote cut-off r.f. pentode featuring high mutual conductance and low output capacity. The control grid is brought out to a cap at the top of the tube. Ratings and characteristics follow:

Heater voltage ............................. 6.3
Heater current .................................. 0.45 a.
Plate voltage .................................. 250 max.
Screen voltage ............................... 100 max.
Grid voltage .................................. -2 min.
Plate current, ma. .............................. 13
Screen current, ma. ............................. 3
Mutual conductance, µmhos .................. 4000
Amplification factor .......................... 1400
Plate resistance ............................... 350,000 ohms
Control-grid voltage for 0.1 ma. of 10 µmhos. .......... -10
Interelectrode capacities: G1—Plate: 0.01 µfd.
Input .......................................... 7 µfd.
Output with tight-fitting shield ............... 6.4 µfd.
Output without shield ........................ 4.8 µfd.

Silent Keys

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

Orville O. Benbow, W9DUK, Muncie, Indiana
Elmer R. Gabel, W3CHG, Kennett Square, Penna.
J. W. Hamilton, G5JH, Hardwicke, Glos., England
Frank Herbert, VP4TF, Port of Spain, Trinidad
L. V. Jolliffe, W3DQD, Winchester, Virginia
Les. M. Mollars, ZL1AR, Auckland, New Zealand
Arnold K. Neilsen, W2BSE, Perth Amboy, N. J.
Ramon F. Parrott, Sr., W5GEH, Abilene, Texas
R. E. Powell, W8GWF, North East, Pennsylvania
Charles H. Robinson, W9WLL, Winnetka, Illinois
Marvin L. Roy, W5BJG, Sulphur, Oklahoma
F. E. Royal, Jr., W3EGK, Newport News, Virginia
Warren R. Rudd, W9QGX, Sidney, Nebraska
Dorothea Stoops Taylor, W6QPT, Oakland, Calif.
George Thorson, W3NL, Dover, N. J.
A LETTER TO CANADIAN AMATEURS:

169 Logan Ave., St. Lambert, P. Q.

Editor, QST:

Although I have had the privilege and honour of representing the Canadian members of the American Radio Relay League for a good number of years, it has never before been necessary for me to seek their attention exclusively through the medium of a letter to QST and, while the sentiments to be expressed in the following are directed particularly to the Canadian amateur radio fraternity, they apply to all "Hamdom," and it is my sincere hope that the message will be taken to heart by all and sundry.

In Canada, as in several other countries, ham radio licenses have been suspended due to the current threats in Europe, and it goes without saying that we appreciate the necessity of our Government's taking this step. I am pleased to say that immediately upon receipt of the notices to pull the big switch, the whole of our efforts were put in the direction of what the League represented, their efforts might not have been suspended had the Canadian amateurs expressed their appreciation in writing to their Government for past privileges received and offered their ham equipment and experience for any useful purpose. Many of the gang from Halifax to Victoria are already in some branch of the fighting services — highly self-trained specialists due almost entirely to their ham radio hobby — and letters are filtering back from the absent members of the fold requesting that they be kept informed of ham activities in the home town.

Despite the severe blow and the handicap of being unable to communicate over the air with each other, Canadian radio clubs, in most cases, are continuing as in the past and, strangely enough, larger turnouts to meetings are the order of the day. We still swap tales of the DX we looked with longing eyes upon the frequencies held by the amateurs that send code practice in the 160-meter 'phone band and, while unable to communicate over the air with each other, exchanging views and finding out what the other fellow is doing.

Many of the old-timers will remember the efforts of the A.R.R.L. at the close of the last war to put ham radio back on its feet again after a similar suspension of radio transmitting privileges and, without the weight of numbers which the League represented, their efforts might not have borne such sweet fruit.

The League has spared no effort in furthering the cause of amateur radio in Canada and, representing, as they have always done, the largest organized group of Canadian amateurs, it has always been possible to present a more or less complete opinion of Canadian radio problems to the Canadian Government whenever necessary. Now that we are off the air, the League's publication, QST, is the sole remaining means we have of keeping in touch with each other, exchanging views and finding out what the other fellow is doing.

From time to time in the past, various interests have looked with longing eyes upon the frequencies held by the amateurs that send code practice in the 160-meter 'phone band and, while unable to communicate over the air with each other, exchanging views and finding out what the other fellow is doing.

In any case, the League has had to put up a tough fight to retain our rights. It is beyond my powers to predict just what changes the war will bring about, but I do know that when we have finished it, we shall be looking forward to trundling "Old Betsy" out of the attic and having our p.d.e. R9 chrip split the ether once again down dear old Dogpatch. If for any reason difficulties are experienced in resuming just where we left off, I also know that we shall look to the Canadian section of our League organization for assistance in ironing out the troubles. You understand, of course, that our Canadian section is entirely self-governing in its operating activities and its relations with our Government.

May I suggest, therefore, fellows, that the fact that we can no longer transmit is no reason for you to discontinue your League support. In the League we have a democratic organization of which we can be justly proud. It has always pulled for the ham and will continue to do so without consideration of race or creed, and, if only for past performances, we owe it our allegiance.

So don't forget, OM, when the time comes to renew that membership and QST subscription, to signify your appreciation of all that the League stands for and make sure that your membership is continued by renewing promptly.

73.

— Alex. Reid, VE8BE
Canadian General Manager

LIGHT BEAMS FOR VE'S?

Rouleau Siding, Abitibi, P. Q.

Editor, QST:

Don't you believe W8RWP merits congratulations for his page on "Light-beam" transmission (QST, p. 60, March, 1940)? This is really a discovery that may bring lots of fun and may become important. I'm sure it will not be long before someone finds an important use for this system. Why should not every VE jump on the dope of W8RWP and try to find a way for the "light-beam" to replace, partly, their radio waves?

— J. J. Rouleau, VE8CN

CODE-PRACTICE STATIONS

Old Forge, N. Y.

Editor, QST:

Your article in the front of March issue, and in front of April 1940 issue, sets out that code-practice stations are being put on the air in the future — which brings me to the point of the epistle.

If you won't have any complaint from the 'phone men. I suggest you put the practice on the c.w. band and, while unable to communicate over the air with each other, you can still try to find a way for the "light-beam" to replace, partly, their radio waves.

— J. J. Rouleau, VE8CN

CORRESPONDENCE FROM MEMBERS

The Publishers of QST assume no responsibility for statements made herein by correspondents.
Announcing two changes in word count:
The land line or text-only check was adopted by A.R.R.L. some years ago to simplify the checking of message traffic, as well as the transfer of messages to and from wire circuits. Detailed checking practices are explained in The Radio Amateur's Handbook, 1940 edition, pages 432 and 433, and given in the publication Operating an Amateur Radio Station.

In the regular policy adopted for word count there have been two ways of sending and counting radio calls of amateurs. W1A.W could be counted (as mixed letters and figures always count), each character as one word, and sent together as a group the count was "four." Or it might be sent W ONE AW and counted as "three." Effective with this issue of QST, to simplify handling and counting amateur call signals that appear in the text of messages, all call signals except those sent as three groups (W ONE AW) will, when sent in close formation count as one word only. Sending call signals as one word is an exception to the mixed count rule.

Another change in word counting practice also will be now regarded as officially accepted in A.R.R.L. word count. In counting figures, a group of five digits or less will count as one word. Bars of division and decimal points may constitute one or more of the digits in such a group. While the telegraph companies have revised their practices primarily to make it seem possible to give the public more words for its dollar, our action in adding these things to A.R.R.L. count is primarily taken in the interest of simplified counting, and uniformity with other communications services.

Examples:

<table>
<thead>
<tr>
<th>Transmission</th>
<th>Former Word Count</th>
<th>New Accepted Word Count</th>
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<tr>
<td>W1BDI</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>02384.</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
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<td>129436.</td>
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<td>2</td>
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<tr>
<td>4564.</td>
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</tr>
<tr>
<td>6442.</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>64 A 2</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

The A.R.R.L. Emergency Corps received re-registration blanks at the year end and one third of the members of the Corps have (March 1) returned the blanks. Emergency Coordinators are working hard to build up new registrations and organization in their respective communities. Those A.E.C. members who did not return the blanks are now urged and requested to do so at once, if at all possible for them to remain identified with the Corps. Those whose work has required giving up amateur activity, or who for other reasons did not reply, have necessarily had to be dropped from the rosters. But we urge every A.E.C. member who can do so to return the re-registration form so we can reinstate that call and registration in the file. We need to know the equipment changes; we need to have new addresses; we need to have as large a part of the amateur fraternity identified with preparedness for communications emergencies as possible. Re-register at once, OM, if you haven't — and all licensees that have never identified themselves with the Corps are invited to drop a postal or a message for Emergency Corps blanks right now!

Coming Events. The dates of May 11th and 12th have been set for the next Ultra High Frequency Contest. With the spring all the u.h.f.'s will be looking up. The February activity, in the face of adverse conditions, had practically the participation of the U.H.F. Contest of last November — so need we say more about May. A new high in reports and relay success is anticipated. Announcement is scheduled for next issue.

It is not too early to talk about the Field Day. For a month advance inquiries have asked for tentative dates. Certain preparations are being made. Some vacations are being arranged for the time of the F.D. June 22nd and 23rd have been picked for the A.R.R.L. Field Day. Start your emergency power supply building contests now — for as usual the emphasis will be on the availability of independently powered stations to do a job.

Wishful Thinking and Neutrality Recommendations. We wish that there was no such thing as the war. We wish we could talk freely with all amateurs of all nations with impunity. We have the legal right to talk about the belligerents or to talk with amateurs in belligerent countries if we insist upon it . . . but we know it is unwise to insist upon legalities when to do so invites surveillance and suspicion, and when so doing builds up the case for restriction of some of the privileges we amateurs enjoy. It was good policy in the DX Competition to prohibit any work with the European theater of war. It is good policy for A.R.R.L. to give no credit now or in the future for any contacts now made with amateurs in belligerent territory, or in countries that may be neutral but where amateurs have been shut down as a precautionary measure. It is good policy for the individual to steer clear of things that invite suspicion and inquiry, and possible restriction.
Up to this time, we United States amateurs have been fortunate in having practically no activity in our frequencies to tempt us to violate our self-imposed A.R.R.L. Neutrality Code and the policy of avoiding all contact with European and especially belligerent nations' amateurs. It is just wishful thinking to try to make one's self believe that because he wants to talk about the war, or work a station in or near the theater of war, that it is all right to do it. It is not doing right by either ourselves or brother amateurs to do what is tantamount to inviting the necessity for increased monitoring, or what is simpler for Uncle Sam, more restrictive rules. We wish only well to the amateurs of all countries; but we are obliged in the same breath to point out that an increase in the number of belligerent countries' amateurs on the air working internationally is just so much increase in the risks of further necessities in the line of surveillance or restriction. So we repeat the previous advice. Steer clear of calls or contacts with even legitimate stations in belligerent territory — whichever side they are on! Have no contacts with the theater of war at all. What was good policy at contest time, is good policy for every day.

Warning on international message handling. It is contrary to the international regulations to handle an international message to or from outside the Americas on behalf of a third party. (Domestically only the test of whether direct or indirect compensation is involved must be made, of course.) The United States has ratified the Cairo treaty, and Article 8 applies, limiting amateur international contact to "messages relating to experiments and personal remarks of such unimportance that recourse to the public telegraph service would be out of question. . ." Excepting only when treaty arrangements exist between the U. S. A. and other countries (and then only to the extent agreed upon) may third party messages be handled. This is just to warn that it is illegal to take any third party messages from (for example) British Honduras, Germany, the Belgian Congo, or others outside the American countries that have treaty provisions. Just because a message seems unimportant or in the interest of amateur radio will not excuse one's taking or sending it in contact with any foreign station, and very serious trouble is ahead for the amateur who goes contrary to the international regulations and gets hauled on the carpet therefor. — F. E. H.

Unlicensed Operators Apprehended

A visit by the Radio Inspector to Bridgeport, Conn., on March 4th resulted in the apprehension of two unlicensed operators, posing as radio amateurs in the 112-Mc. band. These individuals, Frank Mayo Sanchioni of 53 Amsterdam Ave., and Jules Kish of Lesco Court, were released on $500 bail and ordered to appear in the District Court, New Haven, to answer charges of operating without licenses.

ARTICLE CONTEST

The contribution by Miss Frances V. Rice, W3AKE, is the second winner in the new article contest announced in February QST. Miss Rice presents her case for "Eighty-Meters" as the "Most Interesting Band."

For the next several months we are inviting articles for the C.D. contest based on various individuals' ideas of "the most interesting frequency band." Practically every operating amateur has a "favorite" band, one that he would swear by to the bitter end. What is your favorite?

Send in your article on why such-and-such-a-band is, in your opinion, the best available. Each month we will print the most interesting and valuable article received on this subject. Please mark your contributions "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 FRANCES V. RICE, W3AKE

We have quite a wide selection from the waves at our command.

But the gem of the collection is the Eighty-Meter band.

Where you spend each passing hour in the maximum of ways Without need for higher power or directional arrays.

Other bands we have aplenty, we all hope to try each one.

We enjoy a crack at Twenty, work on Forty's lots of fun.

When you tune in your receiver, if you hear that faint DX

You can catch a fatal fever that is turning hams to wrecks.

Yes indeed, it's very thrilling to contact the great unknown.

But those waits between are chilling, time and hopes too

soon have flown.

Of the stations that one raises, most have not been heard before

You exchange some formal phrases — and then part forevermore.

On Ten Meters it's erratic, and on Five it's so confined,

And One Sixty's full of static (although no one seems to mind).

But our Eighty's comprehensive, you can reach out far enough

To make contacts quite extensive and so demonstrate your stuff.

A-one type of operation suite the hams who haunt this freq

Where the art of conversation

is all right to do it.

Who won't dig for buried treasure when he

The miles may be much fewer, but the thrill is just the same.

When you're pressed for time you're going to want a sure bet

QRM can't spoil your pleasure, you're not likely to despair.

For the Army and the Navy, and the A.R.R.L. trunks,

Who won't dig for buried treasure when he knows that it is there?

There's enthusiasm hearty, for an FB traffic score.

For contest and for party, and for our Emergency Corps;

There's enthusiasm hearty, for an FB traffic score.

Here's a wish that none will swerve us from the band on which depends

Our major public service and the making of real friends.

Sure, Twenty is the berries — oh, yes. Ten no doubt is grand

But for hamming minus worries, take the Eighty-Meter band!

ADDITIONS, DIRECTORY OF A.R.R.L. NETS

<table>
<thead>
<tr>
<th>Name of Net</th>
<th>Frequency</th>
<th>Operating Hours</th>
<th>Net Members</th>
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</thead>
<tbody>
<tr>
<td>SAN FRANCISCO SECTION NET</td>
<td>3827-kc</td>
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<td>SOUTHERN KANSAS EMERGENCY NET</td>
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<td>9:00 A.M. CST,</td>
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<td>3910-kc</td>
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<tr>
<td></td>
<td></td>
<td>2nd Sun. 5:00</td>
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<td></td>
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<td>2nd Sun. 10:00</td>
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<td>VIRGINIA PHONE NET</td>
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<td>9:30-10:30 A.M.</td>
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<tr>
<td></td>
<td></td>
<td>EST, Sunday</td>
<td></td>
</tr>
</tbody>
</table>

Corrections and Additions to March QST listings: The following participate in the Vermont Traffic Net — W1AD BNS CBX CGX EJK FBS EKJ EKO EUB KVB KWB LWO MJU. The Wisconsin State Net meets from 6:00 to 6:30 A.M. CST. The Washington Regular Section Net meets from 6:30 to 7:30 P.M. EST daily. WS2KW is the Pennsylvania station on Trunk Line "A," rather than WS6HR, who is in Michigan.

O.B.S.


VE/W Contest Awards

In addition to certificates of merit to the leaders in each A.R.R.L. Section, additional awards have been made to high scorers in the 1939 Canada-U.S.A. Contest. The Canadian Marconi Company Silver Cup Trophy to the leading VE was presented to VE3SF, W. E. Smith of Toronto. W2IOP, Larry LeKashman, won the Montreal Amateur Radio Club Trophy for the highest W score. This trophy is to be used as the award to the highest scoring W in each following VE/W contest. Special awards also went to the several highest scoring VE's, as follows: VE2PG, T40 tube; VE3EE, T40; VE3APD, 807; VE3SM, 809; VE3E, variable condenser; VE3AJX, crystal; VE5VO, condenser; VE4AGA, variable transmitting condenser; VE4SO, six r.f. chokes; VE4ZC, 300-volt item; VE3BE, two-power rheostat. These awards were made possible by the cooperation of the Canadian G.E., Hammond Mfg. Co., Blevis Crystal Labs., Aerovox Canada Ltd., Hammarlund Mfg. Co., and International Resistor Corp.

Presentation at a Montreal Amateur Radio Club meeting of the Canadian Marconi Company Trophy for the highest scoring VE in the 1939 VE/W Contest. J. V. Argyle (at right) of the C.M.C. is presenting the trophy to A.R.R.L. General Manager Reid, VE2BE, to be passed along to the winner, VE3SF. Also identified in the photo, seated at end of table, left to right, VE2CO, VE2IE, VE2EWW and VE2IO; standing, left to right, VE3HF, VE2EE, VE2GR and VE2DU.

A.E.C. Emergency Drill

To test the equipment on hand and familiarize the operators with correct message-handling technique, an emergency drill was held in Cumberland, Md., Sunday, Feb. 4th. Seven stations and ten operators participated: V3FME, 'phone was used, with one station on 3.9-Mc. 'phone and one on 3.5-Mc. c.w. W3OL, assisted by W3ON, moved into the local Red Cross office and operated from there during the entire drill. W3FPRV, with WAFQQ operating, set up his equipment in the City Engineer's office in the City Hall building, W3BHE, the only self-powered station available, operated from his automobile for half the drill while it was parked near the State Armory. Later he moved to the highway bridge over the Potomac River connecting Cumberland and Ridgeley, W. Va. He had W3FQL as assisting operator, W3AQV, W3GME, W3ANL and W3GHT operated from their homes. W3AQV, the Emergency Coordinator for Cumberland and vicinity, acted as drill-master control. By previous arrangement and with the help of W3ZD, Regional Emergency Coordinator, a message from the Disaster Relief Chairman of the National Red Cross Headquarters was relayed through W3GME in Washington, D. C., to W3GME in Cumberland, and then relayed to W3OL in the Cumberland office of the Red Cross. W3GME handled the message from the local Disaster Relief Chairman and message from Washington at 9:30 A.M. The drill proper started at 12:45 P.M.

Over 20 messages were handled, and at the close of the drill we were only 18 minutes behind the schedule that had been laid out for the fellows to follow. A good time was had by all those participating — it being something new for a change. The City Engineer of Cumberland was loud in his praise of the way the operators handled the entire affair. A drill worked around the relaying of stream gauge readings for the City Engineer is planned for the next test.

W6PGB sent us the basis for this one: When a GOOD-MAN goes BATTET over ham radio and gets HANDY with a bug, his XYL comes HUNTING for him in his CHAMBERS and in no uncertain GRAMMER tells him to stop and have a HART, should he take it on the LAMB? Perhaps it would be wise to WARNER to let you alone or take her for a drive in your DESOTO and avoid a MIX-up.

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

WOW! We tried to think up a sentence that would fully describe those January get-togethers of League officials and O.R.S.-O.P.S. appointees, but the more we studied the results, the more we wished we had one of those "pictures that take the place of ten thousand words." Failing in that,
we'll sum up in one brief word that seems to fit the occasion — WOW! The January affairs were the most outstanding O.R.S. and O.P.S. Parties of all time! Just "look at the record." In the O.R.S. group, W3BES hit 32 million points. In the O.P.S. group, W2EXX hit 12 thousand. Both are all-time-highs. For exercising the best in operating technique, try an O.R.S. or O.P.S. Party. If you can fulfill the qualifications, your S.C.M. would welcome your application for either appointment. Once appointed and living up to the requirements, you would be eligible to get in on the quarterly parties, the next of which is on April 27th – 28th.

**Official Relay Station Scores (Jan.)**

<table>
<thead>
<tr>
<th>Station</th>
<th>Score</th>
<th>Ref.</th>
<th>Sec.</th>
<th>Call</th>
<th>Score</th>
<th>Ref.</th>
<th>Sec.</th>
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<tr>
<td>W3BES</td>
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<td>295</td>
<td>55</td>
<td>W4CP</td>
<td>30,685,357</td>
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<td>W8BY</td>
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<td>10,380,240</td>
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<td>W8GQ</td>
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<td>51</td>
<td>W9VQ</td>
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<td>322</td>
<td>51</td>
<td>W8FF</td>
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<td>214</td>
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<td>W8GL</td>
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<td>156</td>
<td>39</td>
<td>W96QY</td>
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<td>W3QG</td>
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<td>W8NH</td>
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<td>W8NO</td>
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<td>224</td>
<td>51</td>
<td>W96QY</td>
<td>6,185,485</td>
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<td>49</td>
<td>W8NN</td>
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<td>49</td>
<td>W96QY</td>
<td>5,835,785</td>
<td>130</td>
<td>49</td>
<td>W3QG</td>
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**Official Phone Station Scores (Jan.)**

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<th>Station</th>
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<th>Score</th>
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<tr>
<td>W3HXYQ</td>
<td>12,064</td>
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<td>20</td>
<td>W8DDQ</td>
<td>10,220</td>
<td>69</td>
<td>23</td>
<td>W8PFI</td>
<td>11,718</td>
<td>72</td>
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<td>W3HXYQ</td>
<td>7,722</td>
<td>51</td>
<td>26</td>
<td>W8MLQ</td>
<td>7,722</td>
<td>51</td>
<td>26</td>
<td>W8WET</td>
<td>7,000</td>
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<td>48</td>
<td>23</td>
<td>W8WET</td>
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<td>23</td>
<td>W8WET</td>
<td>5,405</td>
<td>41</td>
<td>23</td>
<td>W8WET</td>
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<tr>
<td>W3HXYQ</td>
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<td>23</td>
<td>W8WET</td>
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<td>4,290</td>
<td>38</td>
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**BRASS POUNDERS' LEAGUE**

(January 16th-February 15th)

<table>
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<th>Call</th>
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<td>3210</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>W8CM</td>
<td>103</td>
<td>49</td>
<td>34</td>
<td>3210</td>
</tr>
</tbody>
</table>

A total of 500 or more deliveries earns Ex. D. Cr. will put you in line for a place in the B.P.L. *December-January.*
HOW's DX?

HOW:
We're regaining the old faith a bit now, since the boys have buckled down to their job and are really digging the stuff out from under. Perhaps the past several years of good conditions have spoiled some of the less hearty DX-ers and leaving them disgusted when things take a turn for the worse. Call weeding out the weaklings or what you will, the evidence is that no matter what happens, the born DX men are going to find DX to work. That, by the way, is the kind of spirit we like to see.

Some of the fellows applying for 'phone DXCC and WAS may not realize it, but they jeopardize their position plenty when they go over the cards they submit, strengthening (and sometimes writing in) the 'phone report, so the Judges will make no mistake that the card was for a 'phone contest. A timely word should be sufficient, and we say, "Leave it to the judges" -- the unmarked card has a much better chance of getting by than the -- let us say -- 'strengthened' one. A card that shows any sign of tampering, even though there was no intent to defraud, immediately points the finger at the one who submitted it.

Speaking of cards, this might be a times to get a few ideas off our chest, or wherever one keeps ideas. Since cards nowadays are used for claiming various awards like DXCC and WAS, there are used for claiming various awards like DXCC and WAS, they are used for claiming various awards like DXCC and WAS. Many of the DX cards fall down in this respect, and so do a lot of domestic ones. The most important things to show are: a two-way QSO actually took place, and particular the first two. Another thing, by way of a suggestion, is that the number of the month be spelled out on the date line, instead of using the number system. Why? Well, as an example, G2M1 tells us that W2AIW didn't acknowledge some of the cards he received because the date was written in a.l.a. the U.S. system of using three numbers (month, day and year), which he interpreted in the European way: day, month and year. Reading it the European way, ZB2B finds no record of K04USC, HA9U, HK2BD, OE3DW, HK5ED, KB4AAN, K7ENA, and K7GTB, presumably warm up for the Contest. Not much on c.w., although WSJW reports hearing O5AB, K4FCV, KAER, and K6QOV, presumably warm up for the Contest.

WHERE:
Nicest bit of DX-ing we heard about this month was two QSO's W2AIW had. One, with XU8SM on 7 Me. one morning, is good DX for any east coaster, but the other is a real honey because it was with none other than our old chautistic friend, AC4YN (14,265). Charlie worked him at 7:45 A.M., and the QSO has been confirmed by radio via KB6RWZ, which makes W2AIW No. 4 in North America to work a certain Mr. Paul R. Halse, Tibet. -- Next best piece of DX'ing, of course, the Snow Cruiser, KC4USC. A few fellows have worked him, including W6BGL, W6LXY, W5BB, WIAKY ('phone sked), W6MCB, W6WV, W2AEG, W2RGR, W6PFR and W4CCN, on both 'phone and c.w. He shows up almost anywhere: 14,270, 14,320, 14,160 and 7000. He is already pretty well fed up with the e.o.o.'s climbing all over him, and refuses to work anyone who pulls the old wolf trick. He will be sending in a XU list shortly, according to the dope we have, and the more polite -- and smart -- folks that worked him will get their DXCC credit.

The wise way to raise him is to call him from 15 to 50 kc. away from his own frequency, and not on the frequency of the fellow he's working . . . . . . . WSJW worked E2SA (14,000 T9) the other afternoon . . . . . . . We don't put much stock in the PXIB and PXIC that have been floating around and, no, we can't forward cards to them because we don't know where they are . . . . . . . WSJW worked HK1EC on 80 little after midnight and, from what the HR told Joe, the perfect DX station has been discovered. The HR said he would QSL but didn't want any card in return because he travels around and cards would only be a burden!

WHEN:
W6SN, recalling the good old days on 40, has been up there renewing old friendships and is surprised to find, how many DX'ers rediscovering Hamerica. Besides the old-timer W gang, he ran into LUTAZ (7000), HK5G1 (7100 T6), D4BIU (7050) and the usual Pacific bunch . . . . . . . W3ATR backs up the viewpoint with HSDF (7180 T8), LUTAZ (7240), XJ5Y (7140), K7ZKR (7265), HC1PC (7250), PY3CG (7210 T8), HK46S (7100) and HK4DD (7100) all between 10 and 12 P.M. W9LEZ adds to that with KAIH1R (7100), KAIH9Q (7000 T7), 3J0V (7075 T9), H9RBD (7070), K7JNA (7270) and K7BDE (7270) . . . . . . W8JSU and WBYX5 pool their report and submit 8G1L (7180 T8), 8U6W (7200 T8), PY1UJ (7170 T6), NY3AA (7020 T8), CP1CF (7030 T9), J8FJ (7100 T9), PY1MK (7280 T7), K4AAN (7298 T9) and HASC (7180 T9). Around 7-8 A.M. for the Asians, and 11 P.M. for the South Americans . . . . . . . W5ABN clinches the deal with HHI0D (7100), 7J2K (7240), XU8SM (7150), HJ1IE (7130), HK3PF (7910), K7G0R (7100), TVA4AX (7250), K7GTH (7250), HK7Z0V (7150) and ZABUG (7030).

Not much on 10 c.w., although W5JW reports hearing O5AAB, K4FCV, KAER, and K6QOV, presumably warming up for the Contest.

W6BB says KB6YN (14,350 T9) showed up one morning, and WSJW grabbed JH2K (14,385 T9), JG2F (14,390 T9), JG2K (14,385 T9), PK1ZX (14,260 T9), KF6JEG (14,320 T9) and KB6RWZ (14,350 T9) . . . . . . WSMVL says stuff on the coast looks like HAIAB (14,400), JHAK (14,400), H6RF (14,385), H6EI (14,385), OW6K3 (14,300), D4BIU (14,400) and Q5SM (14,375) . . . . . . W4FWL has KAILB (14,310 T9), LUF1FO (14,340 T9) and K7ENA (14,325 T9), while W9LIN adds 5LIQF, K6RRU, K6NJC, PY3CG and K6SCN, all in the 20 kc., at the high end . . . . . . . T3EA gets on 14,050 once in a while.

'PHONE:
W6BB lists C6IJJ (28,350), C62RX (28,050) and KA1GC (28,300), while W6UHE has a flock of stuff which includes CE6D (28,225), LUIDA (28,375), HK7C0K (28,110), PY4EJ (28,225), T12AV (28,290), WN5DG (28,130), HP1A (28,151), C60Z (28,255) and PY2AC (28,190).

There seems to be considerable stuff on 20 'phone for those willing to dig. For example, W2JT worked ZP3AC (14,000) and K6BRWZ and some XU's in the evening, and heard ZP9AB (14,200), while WS4AJ knocked off CP2AC (14,070), Carlos Godoy Chippa, Casilla 268, La Paz, Bolivia; ZP3AA (14,070), L1JKV (14,090) and EK1AF (14,065) . . . . . . besides these and XU's, WSJW scared up a good one in PX4DA (14,260) worked at 14 GT . . . . . . W6VMY grabbed CP3AB (14,120) and W6TH knocked off KAME (14,140), JX5A (14,140), XU8R (14,110), K2BB (14,275), KAIFF (14,145), K4VC (14,110), K4BP (14,140), K4AP (14,150), K4CP (14,145), K4CW (14,120), KAIME...
The prize contest which we announced in *QST* last February is going places. Entries are coming in steadily, and they look excellent. W8REC's offering was the first received, and such excessive promptness seemed to deserve some special reward, so we have decided to give him a thousand QSL cards. This is not one of the regular prizes of course, for they will be saved until the judges make their decision next July.

We are tempted to urge you to send in your entry early because we are finding them so interesting that we do not like to have to wait several months. However, rules are rules, and all entries have an equal chance of winning until July first, so do not be discouraged by the early birds.

* * * * *

So many of the letters that we receive from amateurs ask us whether we can install Noise Limiters on HROs that it seems worth while to give the answer, and the reasons, on this page. The answer is "Not yet!" The fact is that any change on a receiver like the HRO requires very careful engineering and painstaking testing. Also there are various special difficulties in the case of the HRO, such as lack of space. All of which adds up to the fact that we cannot undertake any rebuilding for some time. When we can, we will let you know.

Fortunately it is not as urgent as it would be with another receiver, because the HRO already has a certain amount of noise suppression. This is not due to any special noise limiting device, but is the result of divers tricks that we used in the circuit. We are not going to go into details here, but a competitive test under actual operating conditions (comparing the HRO with another receiver) will show how low the normal noise level in the HRO really is.

Space really is a problem. There is no place for a limiter on the chassis, and there is no easy way to make a place. Of course, we might put the limiter in a separate box and stick it on the outside of the cabinet like a wart on a dill pickle, but any such arrangement does not appeal to us very much, and we do not think it would appeal to you. Not on an HRO.

The fact is that the HRO was designed for *maximum performance*, which makes it much more difficult for us to make changes. The design is so nicely balanced that it is difficult to make even minor changes without a loss in performance. Furthermore, our customers have come to expect so much of the HRO that make-shifts are out of the question, even if we wanted to use them. We would not wish our customers to be otherwise. We take a lot of pride in selling the hardest-boiled buyers in the world, and still greater pride in getting back a wire for "a hundred more HROs." It shows they have what it takes.

EUGENE SIMMS
ANNOUNCING!

NEW MALLORY FILTER UNIT
VF-223

A new audio or hum filter unit, the Mallory VF-223, is now available for use with all single unit Vibrapacks.

Designed especially for applications where voltage regulation is important, as in Class "B" Audio Amplification; or where the utmost in hum suppression is required as in high gain audio amplifiers, the VF-223 provides a truly de luxe filtering system.

The filter condenser is a three-section Mallory FPT-390, of 15-15-10 mfd. capacity, 1,500 working volts. The two 15 mfd. sections are used with the choke to form a conventional pi-section filter, while the third 10 mfd. section connects to a separate terminal so that, if desired, a filtered intermediate output voltage may be obtained. The filter choke is rated at 100 m.a. and has a d.c. resistance of only 90 ohms, resulting in a minimum of voltage drop.

Here is the quality filter unit to use with receivers, transmitters, high gain amplifiers and scientific apparatus. See the Mallory VF-223 Filter Unit at your Mallory-Yaxley Distributors.

Be sure you have your copy of Form E-555-B which gives detailed technical data on Mallory Vibrapacks. * Invaluable to all interested in battery-operated apparatus. Available without charge from your distributor, or write...

P. R. MALLORY & CO., Inc.
3029 East Washington Street
Indianapolis, Indiana

*TRADE MARKS REG. U. S. PAT. OFF.

Use MALLORY APPROVED RADIO PRECISION PRODUCTS

Operating News (Continued on page 80)
CATHODE MODULATION

Following are ICAS (Intermittent Commercial and Amateur Service) Class C Telegraphy Ratings on several popular RCA Tubes.

RCA-806—Tantalum-plate triode
Max. plate voltage •••• 3300 V.
Max. plate input •••• 1000 W.
$22.00 Amateur Net

RCA-809—High-mu triode
Max. plate voltage •••• 1000 V.
Max. plate input •••• 100 W.
$2.50 Amateur Net

RCA-810—High-mu triode
Max. plate voltage •••• 2250 V.
Max. plate input •••• 600 W.
$13.50 Amateur Net

RCA-811—High-mu triode
Max. plate voltage •••• 1500 V.
Max. plate input •••• 225 W.
$3.80 each, Amateur Net

When you start out with Cathode Modulation for economical radiotelephony, go all the way! Get double economy plus extra efficiency by using RCA high-perveance transmitting tubes. RCA Tubes last longer. They give you greater power output with less driving power for a given plate voltage. You can get not only 100% modulation, but also relatively high plate-circuit efficiency and high carrier output with the push-pull 810's shown in the circuit above.

The high-perveance of the 810's permits you to obtain optimum results with a low-power, inexpensive modulator such as the class B 809's shown in this circuit. And remember! A cw transmitter using RCA-810's can be changed over to 'phone cheaply and easily. Grid drive requirements are no greater, and a large, high-power modulation transformer is unnecessary.

In short, RCA's are not only economical in themselves but they pave the way for economies throughout your rig—and assure you of ample power to put your signals "where you want them when you want them!"

See RCA HAM TIPS (Jan.-Feb., 1940) for further data on Cathode Modulation. Ask your jobber for a copy—free.

RCA MANUFACTURING CO., INC., CAMDEN, N. J.
A Service of the Radio Corporation of America.
WHY the HQ-120-X has SIX BANDS!

The "HQ-120-X" range of 31-.54 mc. is divided into SIX bands, resulting in better L/C ratio — more uniform gain — and a less cramped dial, making tuning much easier. In the short wave bands, the condenser has 118 mmf. capacity as against over 400 mmf. if the range was crowded into four bands. True, this costs more, but that is why the "HQ-120-X" is better. It wasn’t built the cheap way. Ask your jobber to demonstrate the smooth, precise tuning of the "HQ." Then you will realize why we use six bands and a precision tuning condenser. "HQ-120-X" receivers will be found on demonstration at jobbers listed on the opposite page.

CANADIAN OFFICE: 41 WEST AVE. NO., HAMILTON, ONT.
All of the jobbers listed on this page have "HQ-120-X" receivers in stock. Many also are prepared to demonstrate "Super-Pro" receivers. Visit your nearest Hammarlund jobber for a demonstration. He will also tell you how you can own a Hammarlund for a few dollars a month.

**ALABAMA**
Forbes & Sons Piano Co.  
403 N. 20 St., Birmingham

**ARKANSAS**
Beem Radio Co.  
409 W. 3 St., Little Rock
Williams Hardware  
Fort Smith

**ARIZONA**
Radio Supply Co.  
443 W. Washington, Phoenix
Radio Equipment Co.  
559 E. 6th St., Tucson

**CALIFORNIA**
E. J. DeJarnatt  
1265 Van Ness Av., Fresno
Pacific Radio Exchange Ltd.  
729 S. Main St., Los Angeles
Radio Specialties Co.  
20th & Figueroa, Los Angeles
Radio Television Supply  
1701 S. Grand Av., Los Angeles
E. C. Wenger Co.  
15th & Harrison, Oakland
Offenbach Electric Co.  
Market St., San Francisco
Zack Radio Supply  
Market St., San Francisco

**COLORADO**
Auto Equipment Co.  
14th at Lawrence, Denver
Interstate Radio Supply  
1639 Tremont Pl., Denver

**CONNECTICUT**
Radio Inspection Service  
227 Asylum St., Hartford
Congress Radio Co.  
207 Congress, New Haven
Hatry & Young  
203 Ann St., Hartford

**DELAWARE**
Wilmington Elec. Spec.  
405 Del. Av., Wilmington

**FLORIDA**
Glover Weiss Co.  
219 W. Adams, Jacksonville

**ILLINOIS**
Hammarlund Mfg. Co., Inc.  
424 W 33rd St., New York City

**INDIANA**
Van Sickle Radio Supply  
W. Ohio St., Indianapolis

**KENTUCKY**
P. L. Burks & Co., Inc.  
911 W. Bway, Louisville

**MARYLAND**
Radio Elec. Service Co.  
3 N. Howard St., Baltimore
Wholesale Radio Parts  
312 W. Redwood St., Balto.

**MASSACHUSETTS**
The Eastern Company  
46 Cornhill, Boston
The Radio Shack Corp.  
167 Washington, Boston
Sager Elec. Supply Co.  
201 Congress St., Boston
Ware Radio Supply Co.  
913 Center St., Brockton

**MICHIGAN**
Radio Specialties Co.  
125 E. Jefferson, Detroit
Shand Radio Spec. Co.  
205 W. Kearsey St., Flint
Knight Electric Co.  
220 N. Wash. Av., Lansing

**MINNESOTA**
Northwest Radio  
109 E. 1st St., Duluth
Lew Bonn Co.  
1124 N. Harmon Pl., Minneapolis

**MISSOURI**
Henry Radio Shop  
Butler
Walter Ashe Radio Co.  
1100 Pine St., St. Louis

**NEW JERSEY**
Jersey Electric Co.  
1100 Pine St., Jersey City
J. M. & H. Sportings Goods  
409 W. 3rd St., Little Rock

**NEW YORK**
Lew Bonn Co.  
1124 N. Harmon Pl., Minneapolis

**OREGON**
United Radio Supply Inc.  
205 S. W. 9 Av., Portland

**PENNSYLVANIA**
M & H Sportings Goods Co.  
512 Market St., Phila.
Radio Electric Serv. Co.  
7th & Arch Sts., Phila.
Mrs. Wire  
10 S. 10 St., Phila.
Cameradio Co.  
963 Liberty Av., Pitts.
George D. Berkey Co.  
434 Walnut St., Reading

**TEXAS**
Frank Mayer Co., Inc.  
Corpus Christi
Southwest Radio Supply  
1905 Commerce St., Dallas
Stauss Frank Co.  
Houston

**UTAH**
Radio Supply Inc.  
46 Exchange Pl., Salt Lake

**VIRGINIA**
Five Forks Battery Co.  
764 Loyal St., Danville

**WEST VIRGINIA**
Cameradio Co.  
30 12th St., Wheeling

**WASHINGTON**
Northern Radio Co.  
2208 4th Av., Seattle
Seattle Radio Supply  
2117 Second Av., Seattle
Wedel Co., Inc.  
920 2nd Av., Seattle
Spokane Radio Co.  
611 First Av., Spokane

**WISCONSIN**
Hammarlund Mfg. Co., Inc.  
424 W 33rd St., New York City
De Luxe Dual Three—10 and 20
TWO-BAND OPERATION

- Full efficiency 10 and 20
- Real unidirectional pattern
- Two separate arrays in one
- Uses two Inductostubs
- Instant changeover — no tuning

Dear OM:

The thrill of drawing a long RF arc seems to be pretty well universally enjoyed. Recently in installing a Dual Three at WSAKZ here in Texarkana, some of the assistants could hardly believe their eyes when some rather "hefty" arcs were pulled from the 10-meter parasitic elements.

The performance of the Three Element MIMS beams offer many greater thrills in their ability to put the signal to the desired spot — and in bringing in the signal from the other end with greatest punch and least QRM.

This is the time of the year to get outside and get yours going too — see your distributor.

73,
M. P. MIMS, W5BDB

See Your Distributor

A Complete 56-Mc. I.F. System

(Continued from page 19)

your transmitter or some other strong signal. The converter output can now be transferred to the f.m./a.m. i.f. and the transformers aligned. This is done by plugging in a 0-1 ma. meter in the jack, \( V \), and tuning the trimmers of the transformers for maximum current. You may have to hunt around a bit before the meter shows any indication, but once it starts to read the rest is easy. With a variable-frequency signal source, the signal is swung back and forth until some indication is obtained and then the amplifier alignment is completed. The exact frequency of alignment is unimportant as long as every stage can be tuned through resonance, which means that each trimmer can be adjusted through a maximum reading of the tuning meter. With the resistors across the circuits, it will be found that the transformers tune a little broader than normal, and the correct setting is in the midpoint of the broad point. Now that transformers \( T_1, T_2 \), and \( T_3 \) are aligned, it should be possible to switch \( S_{AC} \) to a.m. reception and hear signals, or at least noise if the converter is on 56 or 43 Mc. There isn't much noise on 112 Mc.

The alignment procedure can be carried on with a speaker connected to the output terminals through an output transformer or, if no speaker is used at this point, the terminals should be shorted with a jumper of wire, otherwise the 6F6 may be injured. The meter for alignment is a necessity, and no attempt should be made to line up the amplifier by ear except for very rough initial alignment.

If you live within the range of an f.m. broadcast station, adjustment of the transformer \( T_4 \) is a simple matter. Switch the amplifier on a.m., plug in the proper coils in the converter and tune in the f.m. station. It will sound pretty awful but don't worry about that. Switch the amplifier to f.m. and tune around with the trimmers on \( T_4 \) until you start to hear the signal again. This is best done with the audio gain almost wide open and the limiter control set at about half scale. The trimmers are best adjusted with an insulated tool, to reduce body capacity effects, and they should be adjusted until the b.c. signal is clearest and loudest. It will be found that one of the trimmers (plate circuit) will affect the volume mostly, while the trimmer in the grid circuit will have the greatest effect on the quality. During this period of adjustment, the receiver is kept tuned to the signal as indicated by maximum limiter current. If one is available, an audio output meter can be used to determine maximum audio output, although it is not an essential.

In the event that there is no local f.m. broadcast station, the only alternative is to line up the discriminator on an f.m. signal from an amateur station or, as a last resort, from a 21/2-meter modulated oscillator. The disadvantage with the modulated u.h.f. oscillator is that it is usually modulated too heavily and it doesn't stay on one frequency long enough to allow the amplifier to be aligned.

(Continued on next left-hand page)
W2IVW SAYS . . . "When the new Super-Pro was placed on the market, I was not the least bit interested, until I heard a salesman in one of the radio stores demonstrate it to a prospective customer. I was intrigued by the noise limiter and before I knew it, I owned one. Its operation was absolutely a revelation to me. I received signals with the noise limiter on, that could not be heard with the limiter off. The variable selectivity of the receiver enabled me to follow stations through the most ear jamming Q.R.M. The operation of the variable crystal filter was beyond belief in eliminating interfering signals."

. . . This is typical of the many favorable reports we have received from "Super-Pro" owners. The new Series 200 is going over big with amateurs who want the best that money can buy. Ask your jobber for complete technical information or write direct to the factory.

Send for 16-page "Super-Pro" booklet
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.

Model 1696-A. Dealer Net Price (U.S.A.) $34.84

For Rack Panel Mounting

Also available as a rack panel mounting unit. Monitor is mounted in heavy steel panel, 19” x 10½”, with wrinkle finish. Dealer Net Price (U.S.A.) ................... $35.51

For More Information—Write Section 254 Harmon Drive

THE TRIPLETT ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

Y YEARS AHEAD

1941 Model 1696-A

MODULATION MONITOR

The final adjustment of the discriminator tuning can be checked by tuning in an a.m. signal. If the discriminator is properly tuned, the audio output (signal and noise) should practically disappear at the point that the signal as indicated by limiter current is a maximum. This is an indication that the discriminator characteristic crosses the axis at the mid-resonance point of the amplifier. Tuning the signal (by tuning the converter), it should be possible to understand the audio output at points either side of this minimum-volume setting. These points should appear symmetrically on either side of the minimum-volume point and should have about the same volume. Slight readjustment of the discriminator-transformer settings will bring this about.

On the f.m. signals around Hartford, the limiter current runs about 0.15 ma., on broadcast signals 5 miles away. The limiter control is moved to reduce the limiter voltage only to the point where effective noise elimination is obtained, which is usually somewhere between half and three-quarters scale, full scale representing zero voltage.

When using the amplifier, it will be noted that the a.m. signals appear to give louder signals than those from f.m. stations, comparing audio-volume-control settings on stations showing equal limiter current. This doesn't indicate that the discriminator isn't working properly nor does it indicate that more audio is obtained from an a.m. signal than from a f.m. signal of similar strength. It is, however, an indication that the discriminator characteristic could have more slope to it and not have its peaks so far apart. We mention this simply to forestall any inquiries on the part of amateurs experimenting with f.m. amplifiers. As discriminator-transformer construction is improved, this apparent shortcoming will disappear.

The performance of the amplifier on a.m. reception could be improved somewhat by the inclusion of a.v.c. on the two 1852 tubes, taking the a.v.c. voltage from the limiter grid leak through the usual filter circuit. However, this was considered an unnecessary refinement because the amplifier will be used primarily on f.m. reception and the provision for a.m. reception was considered of secondary importance. The amplifier should run “wide open” on f.m. reception.

4 Fig. 6, page 15, QST, Jan., 1940.

Strays

The Drake Electric Works, 3654-56 Lincoln Ave., Chicago, familiar to many amateurs as producers of a line of electric soldering irons, now supplies, free of charge with certain models, a new type of holder. This holder is fitted with a cup filled with steel wool which will be found much more practical than the trousers for keeping the tip of the iron free from oxidization.
The Bliley Vari-X, with VF2 Crystal Unit, combines full quartz crystal stability with the frequency flexibility of a self-excited variable oscillator. Engineered for operating convenience, this crystal controlled variable frequency exciter is easily placed in service. Set the Vari-X beside your receiver, couple it to your present oscillator stage by means of the concentric cable supplied, plug in the a. c. power cord, insert two crystal units and you're all set for action.

Output is obtained on 40 or 80 meters simply by rotating the tuning knob and watching the electric eye for resonance. Either crystal is instantly chosen by a convenient selector switch. To vary the transmitter frequency, simply rotate the knob on the VF2 Crystal Unit in use. If you now have 40 or 80-meter crystal units, of any type, so much the better—they'll work in the Vari-X.

See your Bliley Distributor at once for full details—ask for Circular D-2.
Two preselector stages give remarkable image suppression, weak signal response and high signal-to-noise ratio. The usable sensitivity and selectivity are exceptional. Circuit details include AVC and MVC, signal strength meter, phone jack, send-receive switch and crystal filter. Each of the standard HRO coils includes two amateur bands and the spectrum between. A switch reconnects them to bandspread the 10, 20, 40 and 80 meter bands over 400 dial divisions.

The Standard HRO, relay rack model, less speaker and power supply has a List Price of $320.00. A table model is available at $299.50. The special Combination Unit illustrated at the right, consisting of power supply, speaker, coil rack and HRO receiver has a List Price of $439.50.

For those who require the high performance of the Standard HRO but do not need its extreme versatility, the HRO Junior is offered. The circuit and mechanical details of both receivers are identical in every respect, but the lower priced model has been greatly simplified by omitting the crystal filter, the meter, and by designing the coils for continuous bandspread only.

The HRO Junior, table model, less speaker and power supply, with one set of coils, has a List Price of $180.00.

These 11 tube superheterodyne receivers are self-contained (except for the speaker) in a table model cabinet that is readily adapted to relay rack mounting. One stage of R.F. and two stages of I.F. are used. Low loss insulation and high-Q coils give ample sensitivity and selectivity. Separate R.F. and Audio Gain Controls and a signal strength meter are mounted on the panel. Other controls are tone, CW Oscillator, AVC with amplified and delayed action, a B+ switch, and a phone jack. A self-contained power supply provides all necessary voltages including speaker field excitation. The range changing system is unique in that it combines the mechanical convenience of a coil switch with the electrical efficiency of plug-in coils.

The NC-100XA, illustrated above, covers the range from 540 KC to 30 MC, and is equipped with a crystal filter. The large full vision dial is calibrated directly in megacycles and a separate high speed vernier scale provides high precision in logging. List Price, with tubes and 12" speaker, $237.50.

The NC-100A is similar, but without the crystal filter. List Price, with 10" speaker in cabinet, $200.00.
The new NC-44 Communication Receiver combines capable performance with low price. It employs seven tubes in a superheterodyne circuit. A straight-line-frequency condenser is used in conjunction with a separate band spread condenser. This combination plus the full vision dial calibrated in frequency for each range covered and a separate linear scale for the band spread condenser makes accurate tuning easy. Both condensers have an inertia-type drive. A coil switch with silver plated contacts selects the four ranges from 550 KC to 30 MC. Provision is made for either head phone or speaker operation. Like all receivers which have no preselector stage, the NC-44 is not free from images. However, where price is an important consideration, the NC-44 will be found a satisfactory receiver.

The NC-44 is available in three models, for 115 V. AC or DC for 115 V. AC and for battery operation. Each of the three models lists at $82.50, including speaker in separate cabinet.

Designed chiefly for the experimenter, the One-Ten Receiver fulfills the need of the experimenter for an adequate receiver to cover the field between one and ten meters. A four tube circuit is used, composed of one tuned R.F. stage, a self-quenching super-regenerative detector, transformer coupled to a first stage of audio which is resistance coupled to the power output stage. Tubes required: 954-R.F.; 955-Detector; 6C5-1st Audio, 6F6-2nd Audio.

The new National NHU Communication Receiver brings outstanding performance to the range from 27 to 62 megacycles. All features commonly found in the finest communication receivers are provided in the NHU, including a wide range crystal filter.

Many details of the NHU are unique. The RF circuit and tubes are built completely inside the frame of the condenser. The coils are mounted radially in a cast aluminum turret which is easily rotated to position by a knob on the front panel. Inertia-type tuning is used, with a ratio of approximately 70 to 1. The dial pointer is positively driven by rack and pinion, and moves vertically when the coil range is changed, so that it always points to the right frequency.

TYPE NHU, table model, with tubes, and 8" speaker in cabinet but without power supply. LIST PRICE, $275.00

The SW-3 Receivers employ a circuit consisting of one R.F. stage transformer coupled to a regenerative detector and one stage of impedance coupled audio. This circuit provides maximum sensitivity and flexibility with the smallest number of tubes and the least auxiliary equipment. The single tuning dial operates a precisely adjusted two gang condenser; the regeneration control is smooth and noiseless, with no backlash or fringe howl; the volume control is calibrated from one to nine in steps corresponding to the K scale.

Available in three models, for AC operation or DC operation, with 6 volt or 8 volt heaters. SW-3, any model, without coils, phones, tubes or power supply. LIST PRICE, $35.00
TORQUE applications, almost any CARDWELL "X" requirements permit reduction in required increase of frame size. When applied to stock items, it is generally necessary to use the next longer standard frame length. Quantity requirements permit reduction in required increase of frame size. Special end plates are of stamped aluminum and provide shielding. Any size, top or bottom is removable. Submit your commercial requirements—we will quote.
yes — the WONDER TUBES are Champs by ACTUAL FACTS— not by mere claims!
23,000 SOLD TO DATE

TAYLOR WONDER TUBES — T-40 and TZ-40, because of their outstanding performance and value, assumed immediate Sales Leadership upon their announcement 27 months ago. Many “Challengers” have appeared in the $3.50 price class but the T-40’s and TZ-40’s still lead. Your parts distributor will testify to this.

The thinking amateur insists on the popular Taylor Wonder Tubes because of the greater SAFETY FACTOR made possible by the use of Processed Carbon Anodes. He knows that thousands of amateurs recommend T-40’s and TZ-40’s. Proof of this is heard continuously ON THE AIR.

DID YOU GET YOUR MANUAL
Send five cents in stamps or coin direct to us or get one FREE from your distributor. All new material. See T-40 and TZ-40 dual ratings . . . 1,500 V. at 150 MA.

"More Watts Per Dollar"

TAYLOR TUBES, INC., 2341 WABANSIA AVE., CHICAGO, ILLINOIS

$350
Hamfest Schedule

March 30th, at Baltimore, Md.: The big annual Tri-State Hamfest will be held at the Emerson Hotel, Baltimore, on Saturday, March 30th, under the auspices of the Baltimore Amateur Radio Association (formerly the Mike and Key Club). The usual FB time. Ask anyone who has attended in the past Valuable prizes. For complete information contact the club secretary, R. W. Rock, W3EJK, 1621 E. 32 St., Baltimore, Md.

April 6th, at Buffalo, N. Y.: The Kenmore-Buffalo Tonawanda Radio Club will sponsor the Buffalo Hamfest to be held under the auspices of the Western New York Radio Council on April 6th. The place: Hotel Buffalo. The time: Registration, 2:00 to 5:00 p.m.; Banquet, 7:00 p.m.; Dancing, 11:30 p.m. to 2:00 a.m. Be sure to bring the YL or XYL. Prize give-away, including 150T door prize. Tickets: $2.00. Guest speaker: John Kraus, W8JK, with an illustrated talk and demonstration on Antennas. A cordial invitation is extended to all.

April 6th, at Framingham, Mass.: The eighth annual hamfest of the Framingham Radio Club will be held Saturday, April 6th, at the Kendall Hotel, Framingham, Mass. Registration at 2:00 p.m.; Banquet at 7:00 p.m. Fec, $2.00. Treasure hunts (50 and 113 Mt.), afternoon and demonstrations, code contests, evening entertainment, plenty of eats (turkey dinner), prizes, fun — a full program for all. Bring your YL or XYL, and Jr. ops. Registration limited to 200. Chairman of Committee: W. W. Fairbanks, W1LPM, Hartford, Garyville, Mass.

April 28th, at Ypsilanti, Mich.: The twelfth annual Michigan Hamfest, sponsored by the Detroit Amateur Radio Association, will be held Sunday, April 28th, 10:00 a.m. to 6:00 p.m., at the National Guard Armory, Ypsilanti, Mich. Speakers include Dr. Woodruff, W8CMF, A.R.R.L. President; L. R. McDonald, W8CW, code speed exhibition. Bigger and better prizes. Entertainment. Plan to be there! 

1.75-Mc. W.A.S. Party "Highs"

Where you on 160-meters on the week-end of February 17th-18th? If so, you know there was a W.A.S. party under way on those dates!! The reports now reaching us indicate that it was an overwhelming success from every standpoint. There was considerably greater activity than in the first such party, held one year earlier, and the enthusiasm of the participants matched the increased interest. Many operators made contacts with states they never had worked before, placing them that much nearer a W.A.S. certificate award!! From the reports so far received, it appears that the eighth annual "Highs" will be held under the auspices of the insures and key club radio. The place: Hotel Buffalo. The time: Registration, 2:00 to 5:00 p.m.; Banquet, 7:00 p.m. Fec, $2.00. Treasure hunts (50 and 113 Mt.), afternoon and demonstrations, code contests, evening entertainment, plenty of eats (turkey dinner), prizes, fun — a full program for all. Bring your YL or XYL, and Jr. ops. Registration limited to 200. Chairman of Committee: W. W. Fairbanks, W1LPM, Hartford, Garyville, Mass.

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Have you tried one?

FREE An original 8x10 inch photograph of Gabby (without advertising) will be mailed to amateurs who write for it this month.

Electro-Voice MICROPHONES

may not, in themselves, be "alive" ... but they possess clean, crisp highs ... real vibrant lows ... true reproduction qualities for precise inflections that convey easy-to-listen-to, pleasing personalities over the air waves.

W3EGW 7056-106-36 W8JTE (2 opra.)
WITS 7004-206-34 4060-145-28
W1BFT 6591-121-31 W9YCF 4056-104-39
W3Q 6665-181-35 W8EKX 3527-119-33
W9KOH 6640-166-40 W3HXV 3900-130-30
W3FDY 6556-172-38 W9XW 3900-100-30
W6JJW 6711-141-41 W8TFO 3660-122-30
W5K 6207-160-30 W8C 3640-130-28
W9QCF 4983-151-33 W2KE 3657-117-31
W6GR 4508-128-31 W4FLS 3434-93-38
W5PUA 4572-127-36 W3CGW 3390-113-30
W3M 4586-189-27 W8ENG 3292-119-33
WIATE 4552-146-31 WSOQV 3050-122-25
W6DOD 4495-145-31 W8CN 2835-110-27
W1ME 4379-151-29 W3EUK 2820-94-30
W1ERX 4257-129-33 W5HAT 2758-74-30
W3ULT (Continued on next left-hand page)
THIS TUBE IS THE ANSWER

UNITED VERSATILE 70-D
Increase your power with minimum cost and effort
if you have been using the lower power types of this
general construtor.

This heavy duty V70-D has same base style, and
filament voltage. It drives easily, and its similar inter-
electrode capacities makes neutralizing simple when
used in place of these smaller tubes.

★ NONEX means non-expansion and high melting
point. To be sure a tube is made of NONEX glass,
look for tungsten seal wires, rather than copper
clad which is used with soft glass.

$7.25

WORLD FAMOUS UNITED MERCURY RECTIFIERS
HIGH FREQUENCY AND REGULAR COMMERCIAL TRIODES

HV-18
A very widely used United Tube. Interchangeable with T-200 and
HF-200.
PRICE ...................... $9.50

972-A
This member of the illustrious UNITED
rectifier family. Interchangeable with
type 872.
Filament volts .................. 5
Filament current ................. 10
Filament mounting ............. exposed
Plate volts (max. inv. peak) .... 7500
Plate (max. peak) amps. ....... 5
NET PRICE .................... $9.00

966-A
Meeting U. S. Government require-
ments for ample shielding and break-
down test, this mercury rectifier is a
world-wide professional
favorite. Interchangeable with
866-A.
Fil. Volts .......... 9.5
Fil. Amps .......... 5
Shielded Filament
Max. Inv. Volts .......... 10,000
Max. Peak Amps ....... 1
NET PRICE .............. $2.50

BW-11
United Electronics is supplying Civil
Aeronautics Authority with this type
of tube this year. Interchangeable with
834 or 304B.
PRICE ...................... $12.00

972-A
Used widely by U. S. Government and
important commercial transmitters — In-
terchangeable with 872-A.
Filament volts ............... 5
Filament current ............. 6.75 amps.
Filament mounting .......... shielded
Plate volts (max. inv. peak) .. 10,000
Plate (max. peak) amps. .... 5
NET PRICE .................... $11.00

966
The much praised rectifier you hear so
much about. Only 5 seconds preheat-
ing. Measured minimum mercury avoids
amalgams and flash-
overs. Interchangeable with 866.
Fil. Volts .......... 2.5
Fil. Amps .......... 5
Exposed Filament
Max. Inv. Volts .......... 7500
Max. Peak Amps ....... 1
NET PRICE .............. $1.50

(Cable "UNELCO")
UNITED ELECTRONICS COMPANY
42 SPRING ST., NEWARK, N. J.
The Dallas Amateur Radio Club specified Jan. 14th as the date for a Club Field Day at White Rock Lake, near the city of Dallas, Texas. Quite a swirl of portable transmitters and receivers were on hand. A good bit of work was done on 112, 56, 38 and 1.75 Mc. The highlight of the day was a successful two-way communication from sailboat to motor boat, with a shore station acting as control station. The shore station was operating on 1.75 Mc., while the boats were each equipped with 112 and 28-Mc. transmitters and receivers as well as a 1.75-Mc. receiver. Those taking an active part in the proceedings were W5ZCA, W5DAS, W5GZE, W5HIP, W5CY, W5II, W5CHI, W5OEE, W5HC8, W5GSR, W5HM, W5AOG, W5JJ and W5HJX.

WGAN Amateur Radio Dramatizations

Station WGAN (640 kc.), Portland, Maine, is dramatizing the story of amateur radio in a broadcast program series based on Clinton B. DeSoto’s book, “Two Hundred Miles and Down.” The series started on March 13th and will continue at 7:30 p.m. EST each Wednesday thereafter for ten weeks. Technical advisor for the series is Kenneth B. Woodbury, W1TE, station engineer WGAN. The Portland Amateur Wireless Association is also cooperating in the presentations. Reports on reception of these Wednesday evening programs will be appreciated by WGAN.

Cruise of the “Director II”

The 137-foot three-masted schooner Director II left New York on February 1st for a two-year cruise, which will take the party to ports in seventeen to such places as Tahiti, Marquesas, Marigot, Pago Pago, Fiji Islands, New Caledonia, Great Barrier Reef, Solomon Islands, Dutch East Indies, the Celebes, Zanzibar and the Philippines. Director of the expedition is Adam Bruce Fahnestock. Frank O. Chase, W9ZHC, is radio operator, using the following calls: WDFI (R.C.A.), KFAH (N.B.C.) and W9ZHC (amateur). W1AVB reports his operating time as 4 to 6 p.m., local time wherever the ship may be. Frequencies are not known at this writing. Broadcasts from the expedition are expected to be made via the N.B.C. Blue Network. A.R.R.L. HQ’s will appreciate any information regarding amateur contacts with the Director II, or data relative to frequencies used.

The Older Hams

Charles F. Loud, W1JIS, and S. H. Dowell, W5EVR, are cooperating in compiling a list of the “older hams.” They want to hear from all hams who are fifty years of age or older and invite them to join their group, which they call, “The Oldham Radio Club.” We have always maintained that a man never grows old in amateur radio (hi), but it is interesting to note the list already available of the older lads. The most elderly member of the O.M.R.C. is W0CAB, whose photo you saw in February QST (page 10). In honor of his birthday on August 11, 1939, the O.M.R.C. showered W0CAB with birthday cards, which came to him as a complete surprise. One card came from far away as New Zealand. The club is for purely social purposes and for banding together the operators who have reached or passed the half-century mark. Here is the present O.M.R.C. membership, with ages indicated: W0CAB 83; W9CNB 79; X6USMA 78; W5NA 74; W2RT 73; W5GAN 72; W5WJ 70; W5IC (W5GQW) W5QBW 69; HTO W5LTP W5LW W5QW 68; W9RP W5DeL W5QW 67; W5KET W5KTO W5QW 66; W1AQW W1FA W6CBW W6CBI W6HH W7VLM 65; W5BSC 64; W1JBE W7FSP W6XK 63; W6KDX 62; W6EJM W7AXG W7FWD W5TCP 61; W6GO W5MN 60; W1AK W6QW W6SP W7FCR 60; W9XEU 60; W7GVE W6PHE 58; W5BEF W5RRC 57; W5EAE W2MB W2RS 56; W5FMZ W6FZM W6MZF W6PB W6MQR 54; W1FZU W3AQW W5CQW W8LP W8LRN W6WYN 53; W1HE W1HXY W1PM W7PM W1LYK W1SIS W1YV W2KZJ W4EM W5MR W5CY 52; W1DJ W1HJ W1JAS W6KRO W6SAH W7FWR 51; W2ATG W2UGU W7ABK W5DK W5CQW 50.

If you’re eligible for listing with the above “older hams,” send your date of birth to Charles F. Loud, W1JIS, 40 Beals Court, Rockland, Maine. (Continued on next left-hand page)
"I bought Eimac tubes because I thought they were OK but after using them I KNOW they are..."

F.F. Priest Jr., owner of amateur station W3EMM, uses a pair of Eimac 250TH's in the final and a 100TH as the driver. His transmitter is a de luxe bread board type... RF section built on a home made metal chassis... all stages on the same sub-panel. It runs at 1 KW input "fone" and CW on 10, 20, 40 and 80 meters. Eimac tubes operate efficiently on all bands.

The performance record established by station W3EMM, is not pure luck. Sound judgment in the selection of equipment contributed a great deal to Mr. Priest's success. Neither is it mere chance that most all the leaders among amateur DX stations are users of Eimac tubes.

Follow the lead of these experts and take advantage of the superior capabilities of Eimac tubes. See your dealer for complete data—if he cannot supply you write direct to Eitel-McCullough, Inc. San Bruno, Calif.
"Now It Can Be Told"

At the office one morning last May I was introduced to a special investigator from Chicago who asked if I
could help in an extortion notice apprehension by communici-
ating via shortwave radiophone between an aeroplane and
a ground station. He explained that a certain local elderly
couple had been threatened with death if they did not drop
drop a certain large sum of money from an aeroplane which
was to start from over Independence and circle the city in
enlarging circles, watching for a smoke signal on the ground,
at which point the box of money was to be dropped. We had
a little more than 24 hours to prepare before the time set for
the flight.

The special investigator, Chief of Police of the city, and
myself drove 100 miles to Tulsa, Okla., to engage a plane
equipped with a two-way radiophone and make arrange-
ments for the flight and radio link. I was given a special
low-frequency crystal and told the frequency on which the
plane would transmit. Back home again, I worked until
after midnight tuning the rig for the new frequency.

The morning of the big day was used in testing several
cars equipped with regular broadcast car radio sets adjusted
to tune to my frequency. Several township maps were
divided into numbered zones and the plane and each car,
as well as the radio station, provided with these identical
maps. A car was placed in each of these zones. The special
investigator, two state highway patrolmen, the sheriff of
the county, the chief of the adjoining county, their depu-
ties, and later the F.B.I. and several deputies joined the
set-up. There were seven cars used, manned by two or more
deputies with machine guns, etc.

The Chief of Police, pilot and radioman flew from Tulsa
and were in contact with W9WGW all during the flight. The
plane making the circles around the city would report when
over each zone and the ground station would move each
patrol car accordingly. After the two different flights the
cars were maintained and directed for 24 hours by the
F.B.I. agent. W9WGW was made the headquarters and the
city telephone was put on a secret number known only to a
small group. The station was guarded and patrolled during
the entire time of the activity. There being time for police
here, amateur radio was called upon by the law-enforcing
bodies to assist. Amateur radio worked 100% without a
break. The F.B.I. agent offered to take care of necessary
consequences in getting any special F.C.C. authorizations
for frequency and call used.

-Ralph W. Elliott, WD9WGW, Independence, Kansas

The XYL Club of Phoenix, Ariz., is planning an active
spring season under the leadership of Mrs. G. E. Evans,
president, Mrs. I. W. Brayer, secretary, and Mrs. Art
Thomas, treasurer. This club was organized in 1939 as an
auxiliary to the Phoenix Radio Club. Regular Solo XYL
Meetings are held on the second and fourth Tuesdays each
month. On February 15th a bridge and bunco party was
held to raise funds for the coming Arizona Hamfest, of
which they are hostesses. Many other successful parties
have been held. If any other XYL clubs want to organize
with the view to showing the men how it's done, they are
invited to write the Phoenix group for suggestions and help.

If interested, communicate with Mrs. G. E. Evans, 2001
8th Culver St., Phoenix, Ariz.

It is a long time between QSO's sometimes. On July 22,
1924, W2AEC and W3DK had their first contact. On Feb-
ruary 14, 1940—seventeen years later—they had their
second contact. Both stations are still in operation. Mrs.
Elizabeth, N. J., and Washington, D. C., and have the
original QSL cards for the first QSO.

April 20th, at Fresno, Calif.: The San Joaquin Valley
Radio Club will hold its fourth annual banquet on April
20th in the Fresno New Memorial Auditorium. Elaborate
plans are being made to entertain some five hundred
amateurs and their friends. Activities during the afternoon
will feature outstanding events for the ladies and hams
alike. In the evening a colorful banquet, flower show,
vaudeville and prize awards will be followed by visits to
many of the local ham shacks. Registration fee of $1.50
covers the entire program. Those desiring further informa-
tion should correspond with Erwin S. Martin, WD9HYR,
172 Echo Ave., Fresno, Calif.

(Continued on next left-hand page)
A UNIQUE "Switch Board" TRANSFORMER
DESIGNED ESPECIALLY FOR AMATEUR PURPOSES

The THORDARSON MULTI-MATCH is the only modulator transformer built with the plug-in-jack terminal board. It allows quick and accurate matching of tube loads without soldering — simplifying experimental circuit changes. Check these types listed below.

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Net Price</th>
<th>Cap. Watts</th>
<th>Pri. M.A.</th>
<th>Series</th>
<th>Par.</th>
<th>Mfg. Fig.</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>T-11M74</td>
<td>$ 5.40</td>
<td>40</td>
<td>100</td>
<td>80</td>
<td>160</td>
<td>3G</td>
<td>4 4½ 4¾ 7½</td>
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<tr>
<td>T-11M75</td>
<td>7.50</td>
<td>75</td>
<td>145</td>
<td>145</td>
<td>290</td>
<td>3G</td>
<td>4 4½ 4¾ 9</td>
</tr>
<tr>
<td>T-11M76</td>
<td>11.70</td>
<td>125</td>
<td>210</td>
<td>160</td>
<td>320</td>
<td>3G</td>
<td>5½ 5½ 6 18</td>
</tr>
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ASK YOUR PARTS DISTRIBUTOR FOR CATALOG NO. 400-D.

THORDARSON
Elec. Mfg. Co., Chicago

TRANSFORMER SPECIALISTS SINCE 1895
ELECTION NOTICES

To all A.R.R.L. Members residing in the Sections listed below:
(The list gives the Sections, closing dates for receipt of nominating petitions for Section Manager, the name of the present incumbent and the date of expiration of his term of office.) This notice supersedes previous notices.

In cases where no valid nominating petitions have been received from A.R.R.L. members residing in the different Sections, in response to our previous notice, the closing dates for receipt of nominating petitions are set ahead to the dates given herewith. In the absence of nominating petitions from Members of a Section, the incumbent will continue to hold his official position and carry on the work of the Section subject, of course, to the filing of proper nominating petitions and the holding of an election by ballot or by as many necessary. Petitions must be in West Hartford on or before each of the dates specified.

Due to resignations in the Alaska and Montana Sections, nominating petitions are hereby solicited for the office of Section Communications Manager in these Sections, and the closing dates for receipt of nominations at A.R.R.L. Headquarters is hereby specified as noon, Monday, April 15, 1940.

In Canadian sections nominating petitions for Section Managers must be addressed to Canadian Secretary, also to the address given in the listing of the Sections, care of Messrs. G. A. Woodhouse (resigned) 169 Logan Ave., St. Lambert, Quebec. To be valid such petitions must be filed with him on or before the closing date named.

You are hereby notified that an election for an A.R.R.L. Section Communications Manager for the next two-year term of office is about to be held in each of these Sections in accordance with the provisions of the By-Laws.

The elections will take place in the different Sections immediately after the closing date for receipt of nominating petitions as given opposite the different Sections. The ballots mailed from headquarters will include a list of all eligible candidates nominated for the position of A.R.R.L. members residing in the Sections concerned. These ballots will be mailed to members of the closing dates specified above, for receipt of nominating petitions.

Nominating petitions from the Sections named are hereby solicited. Five or more A.R.R.L. members residing in any Section are suggested to nominate a single candidate for Section Manager for the next two-year term of office. Five or more signers are required. At least one continuous year must be included in the nominating petitions. The closing dates for receipt of nominating petitions are specified above.

The candidates from the Sections listed above have the privilege of nominating any member of the League as candidate for Section Manager. The following form for nomination is suggested:

Comm'm'cations Manager, A.R.R.L.
8 & La Salle Road, West Hartford, Conn.

We, the undersigned members of A.R.R.L., residing in the Section of the Division hereby nominate - - - - - - - - as candidate for Section Communications Manager for the next two-year term of office.

(Five or more signers are required.)

Each candidate must be an A.R.R.L. member and have been a licensed amateur operator for at least one year prior to his nomination or the petition will be considered invalid. Each candidate will be licensed as an amateur operator and file his nomination with the Secretary, and station call of the candidate should be included. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon of the closing date named for receipt of nominating petitions. There is no limit to the number of petitions that may be filed, but no member shall sign more than one.

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

F. E. Handy, Communications Manager

ELECTION RESULTS

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

British Columbia - C. O. L. Sawyer, VE5DD Feb. 15, 1940

INTERNATIONAL RESISTANCE COMPANY

401 North Broad Street

Add Code Practice Stations

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<th>Station</th>
<th>Frequency</th>
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TRANSMITTING TUBES

RK-34
IDEAL FOR 2½ METER FREQUENCY MODULATION TRANSMITTER
RK-34 .......... $3.50
2 RK-49's .......... 2.50
TOTAL $6.00

Kit for Feb. QST
2½ METER FREQ. MOD. TRANSMITTER
RK-34 ......... $3.50
2 RK-49's ......... 2.50
TOTAL $6.00

NEW TETRODE

500 Watts C.C.S. Output
60 Megacycles 4-7 watts drive

NO NEUTRALIZING

Reduced output at 120 megacycles
70 Watt Filament
100% Tantalum and Tungsten internal construction
Heavy Direct Grid Leads

LOW CAPACITIES
C output 4.75 mmf
C input 10.5 mmf
Cgp .36 mmf

RK-65
STANDARD 50 WATT BASE
Ef = 5 volts
If = 14 amps
Ep = 3,000 volts max.
Ip = 250 ma. max.
Plate Dissipation 215 watts max.

$34.50

RAYTHEON PRODUCTION CORP.
NEWTON, MASS • NEW YORK • CHICAGO
SAN FRANCISCO • ATLANTA
On the Ultra Highs

(Continued from page 53)

"Nothing of importance, other than the relay, happened from Jan. 25th until Feb. 14th. During this evening the five-meter band was very much alive for work into the fourth and fifth call areas, as evidenced by very strong harmonics from ten-meter stations in those areas; but, again, no contacts were made because no one seemed to be on Five down there. During the winter months conditions are often right to provide good contacts with W4 and W5 from the ninth area, but activity in the fourth and fifth nearly always seems to be lacking -- so we beseech, entreat, and bawl you fellows out --- all in the same breath --- to get on and give us more contacts with W4 and W5! ... Last minute news: W9RGH has just eased 500 watts into a pair of 100TH's --- it makes a swell signal! So be on the lookout for W9 all. You can depend on it --- when the band opens up we'll be on the job!"

If only this sort of enthusiasm for u.h.f. work were evident in a few other sections of the country! There'd be far fewer "dead nights" on Five for fellows like W5AGJ, W5FYP, W6QZL, W9YK, W9ZJB, W9YWT, and many other die-hards who keep their u.h.f. gear hot the year round, whether any other signs are heard or not!

W9ZJB reports hearing W7ASX on 25,050, calling "CQ UHF Relay" every five minutes starting at 3:30 p.m. Sunday. Vince listened vainly on Five for some sign of the signal, and kept calling him on Five but without success. We, however, had no reports recently from W7. How about it, W7ASX, are you a "voice crying in the wilderness" or have you got 56-Mc. company out there in Washington? Vince heard plenty on Valentine's Day, Feb. 14th, but had the misfortune to blow a transformer just as the band was opening up. He reports hearing some W7's, a fellow on 56,050 located near Camden, some of the boys in Atlanta, and the harmonic of a ten-meter W5. The band seemed to be as hot as summer conditions. DX lasting from 9:30 to around 9 p.m.

INTERNATIONAL NOTES:

There are still some u.h.f. enthusiasts in Great Britain, despite the fact that they have no signals of any description to listen to. GBLY, who conducts the u.h.f. column in the "T & B Bulletin" tells us that if we could definitely have some stations active during weekends between 1330 and 2200 G.T., a few G's would be able to listen. Though there seems to be little chance of transatlantic work by means of F2 Layer reflection, it does seem that a fortunate combination of sporadic-E in the right places might turn the trick.

We suggest that it might be a good stunt to make a practice of calling CQ on c.w. on the hour during these periods. In any case, the more frequent use of c.w. would certainly help to extend our range considerably. We think the idea of using c.w. during Sunday morning workouts would work wonders.

Conditions are frequently better for extended-local work during the morning hours than in the evening, and we know how often the band has opened up for skip around noon or shortly before. And who knows --- with no QRM of any sort, some of the G's might hear us. It's worth a try, in any case.

112 MC.:

Frequency modulation seems to be taking hold gradually among the 112-Mc. enthusiasts. In New England, W1Khk, Weston, Mass., and W1ELP, located at Harvard University, are the first to be believed to be the first two-way contact on 112 Mc. in which controlled f.m. was used at both ends. The rig at W1Khk is a duplicate of the RK-34 job described in February QST, while W1ELP has 100 watts input to a pair of HK-24's tripling. Signals are much stronger than with self-controlled oscillator jobs of similar power, yet they occupy less space on the average receiver.

W1HDF, Elmun, Conn., has a pair of HK-24's tripling to 112 Mc. and will have f.m. shortly. W1IFS, Bristol, is a new recruit. Len has crystal control and is getting set for f.m. at this writing. W1EYM has an f.m. superhet and a rig all set to go when he returns from Florida. At Wilbraham we will have to forego f.m. until we can arrange to triple to 2½ instead of doubling in our T2-40 driver stage, as we do now.

We get a slight transfer of energy into our antennas for Five from the doubler grid, and with a location like ours, (Continued on next left-hand page)
Features You've Always Wanted—

AIR-TRIMMED R-F COILS
Each individually-wound R-F, Mixer and Oscillator coil is provided with its own Align-Aire trimmer. The use of air-dielectric trimmers instead of the micro-compression type greatly improves frequency stability.

ELECTRICAL BANDSPREAD
The special, three-gang, ceramic-insulated tuning condenser has separate tuning and bandspread rotors. Extremely accurate and easy to tune in crowded bands when used with the large dual-drum dial.

MONO-UNIT CRYSTAL FILTER
The Crystal Filter is a complete factory-wired and aligned unit containing input and output crystal I-F, transformers, 45-ke crystal, phasing condenser and cut-out switch. Air-dielectric trimmers.

ALIGN-AIRE 1-F TRANSFORMERS
The finest 1-F Transformers made by Meissner; super-efficient, High-Q windings in large shields, bus-bar lead connections and Align-Aire air-dielectric trimmers for maximum stability and permanence of adjustment.

MONO-UNIT B-F OSCILLATOR
Another complete factory-wired and adjusted unit; includes beat-oscillator coils, air-trimmer, pitch adjustment, oscillator tube socket and associated resistors and condensers. Only three connections.

—and many other unique features!

TIME PAYMENT PLAN
The Meissner Traffic Master as well as many other Meissner products, may be easily purchased on the Meissner Time Payment Plan. Ask your parts Jobber for details or write direct to the address below.

VOLTAGE REGULATED power supply using a VR-150 tube is incorporated.

The best part of this news is the fact that this remarkable receiver is sold as a complete kit—ready for you to build, with a big saving in cost! All the hard work has been done—chassis is all punched—parts are all ready to be mounted. Complete printed instructions are supplied, with schematic and pictorial wiring diagrams. A few interesting hours with soldering iron, screwdriver and pliers will easily finish the job.

WRITE FOR FREE CATALOG
Dozens of other products of interest to the Amateur who values equipment performance are described in the big 48-page Meissner catalog. Send a postal for your free copy today—just address Dept. Q-4.

Haven't you often dreamed of the kind of a "ham" set you'd like to have—the many helpful features you would like to include in its design—all based on your own operating experience?

We have designed just that kind of a receiver for you—not from your individual experience but from that of hundreds of hams all over the world who have told us what they would like to have. The Traffic Master is a big, 14-tube Communications receiver, especially designed to provide maximum operating performance under the severest conditions.

It simply "HAS EVERYTHING!" Pre-aligned Tuner assembly, Crystal-Filter, two-stage I-F, B-F Oscillator, "R" Meter, A\VC switch, Stand-by switch, Phone jack, RF Gain control, Audio Gain control, Tone control, Noise Silencer, Phase-Inverter and push-pull 6V6 output tubes. Most important of all, is the unusual frequency stability designed into the entire receiver.

See your jobber at once or write for further details!
Designed for Application

- The new MILLEN line of MODERN PARTS for MODERN CIRCUITS includes: transmitting condensers, receiving condensers, sockets, QuartzQ coil forms, standoffs, dials, IF transformers, RF chokes, safety terminals, etc., etc.

Catalogue Upon Request

NOISE-FREE RECEPTION

- Major Armstrong's wide-band frequency-modulation system is the latest development in radio reception and transmission. Famous for its freedom from static, it is equally remarkable for its ability to transmit the full dynamic and frequency range of the original program.

- The Browning Frequency-Modulation Adapter offers an outstanding opportunity to progressive service men. It may readily be connected to the audio system of an existing receiver and placed within the console. Or, with the addition of an audio amplifier and speaker it becomes a complete radio in itself. High quality components provide superior performance and thorough engineering makes installation easy. Write for Bulletin 105.

U.H.F. MARATHON

W2MO Wins First Month Certificate

COMPLETE JANUARY REPORT - EARLY REPORTS FOR FEBRUARY

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1 Reports received up to March 7th only.
2 Not eligible for award.
3 Claimed score and distances not included in report.

that means an 89 sig on Five for thirty miles or more. In the meantime, we shall be on 112,008 kc. each Thursday night with amplitude modulation. Tests at W1HDF indicated that, by tripling to 2½ and thus avoiding the use of any circuits tuned to 56 Mc., the signal on Five, which so many of the gang who are using crystal control have noticed, is completely eliminated.

If you are situated behind a hill and have not tried 112 Mc. because you figured you'd not be able to work out, take heart from the story of W3EBC of Somerville, N. J. He reports that in order to work W2HGU in Ridgewood, N. J. (about 40 miles to the northeast), he points his beam at Plainfield, which is practically due east. It looks as though the signals were being bounced off a range of hills which rises between Somerville and Plainfield. W9WX reported some time ago that similar observations had been made in the mountainous country near Denver.

W3EBC says that contacts are being made between several members of the Tri-County Radio Association who were never able to hook up on Five. He lays this to the use of more efficient antennas, as most of the contacts can be

(Continued on next left-hand page)
Only RCA offers all these features...with exceptional performance.

**Dual R-F Alignment**...air-dielectric trimmers plus inductance adjustment assures stable alignment and complete "tracking" of r-f circuits for uniform sensitivity.

**Poly-Styrene Insulation**...used for high efficiency 10 and 20 meter coil forms. High grade Ceramic insulation on range switch, r-f tube sockets, tuning and trimmer condensers.

**Lower Circuit Noise**...through circuit design that gives greater usable sensitivity for weak signals.

**Negative Feedback**...employed in the audio amplifier gives improved fidelity enabling operator to pass accurate judgment on quality of 'phone signals and to enjoy better entertainment reception.

**Stay-Put Tuning**...through use of temperature compensation and voltage regulation for r-f oscillator.

**Uni-View Dial**...slide shutter blanks everything except the calibration for the range in use. No confusion in reading dials.

**Calibrated Band Spread**...for 10, 20, 40 and 80 meter amateur bands.

**Accurate Signal Reset**...you can reset "logged" stations and check frequency closely with vernier index scale on both dials.

**Variable Selectivity**...in six steps through use of crystal filter. A real advantage for C-W telegraph and 'phone reception.

**Improved Image Rejection**...by use of high Q circuits and optimum L-C ratio.

**Improved Noise Limiter**...adjustable to meet local interference conditions.

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made only when high-gain beams are used. Bill reports that several of the gang are using the lcoal-based 7A4 as a 112-Mc. detector. They remove the metal ring from the tube, thereby reducing the capacity to ground. Most of the receivers are separately quenched. In this connection, it has been our experience that the value of a separate quench oscillator goes up with frequency. The separate quench tube seems to offer little improvement on Five. On 2¼ it seems to be an aid to smooth operation; while on 1¼ it is practically a necessity, if any control over super-regeneration is to be maintained.

WSEE at Alexandria, Va., uses an HK-24 to double to 2¼ with his regular exciter. With W3RL at Herndon and W3GLY at Leesburg operating on 2¼ occasionally, and with the growth of interest in 112 Mc. in the area around Philadelphia, we may have some long-distance relays on 2¼ and perhaps some DX, too. Remember, there's a 500-watt rig at W4EDD waiting to see service on 2¼, too.

Out on the West Coast several of the boys got in some nice work during the Relay on 2¼, with W6XVL apparently leading the pack with 19 stations worked and a flock of messages handled for a total of 85 points. Nice work, Bup! The rig at W6XVL (ex-6UP) is a 757 oscillator, cathode-modulated. Receivers are a National 1-10 and an r.c. superhet with 954 r.f.

Several operators report that 2¼ works out much better for portable and mobile use than 56-Mc. equipment used under similar conditions. W6NC's rig is in a town permanently installed in his car and has had many fine contacts; without, in most cases, searching for special locations, but merely using the rig frequently in the course of business trips. The rig was made with plug-in coils and was changed to 2¼ when the regulations required it. The rig is now on Five and deS bestial. We think that the difference in favor of 2¼ for this sort of work lies in the use of more efficient antennas for the higher frequency.

Around Buffalo, N. Y., W9XVL, NOH, OZ, SBI, UDD, TZC, S6X, PMC/S, RT6, and NH, are heard frequently on 2¼. Activity is being sponsored by the Greater Buffalo Five-Meter Club and the Kenmore-Buffalo-Tonawanda Radio Club, according to information furnished by the Western New York S.C.M.

In Denver, Bob Swalund, W9WXY, works W9WTK, W9VGC, and others almost nightly. Bob has also been on 58,000-watt portable to a pair of 809's, but no DX contacts have been made. Stick with it, Bob — plenty of the brothers will be looking for Colorado when skip breaks! WXY plans to have those HK-24's up on Grand Mesa, 10,281-foot elevation, during the Rocky Mountain Division Convention for another try for a new 112-Mc. DX record.

224 Mc.:

W1AH and W1AIY earned themselves a nice bunch of points in the Relay by working each other on 1¼. W1AIY passed along several messages to your conductor by 1¼ to 1¼ and 1¼ when the range of operation begins to stretch out on Five. Contacts have been made over this path on 224 Mc. work in several places. W1GUY, Ludlow, Mass., has an acorn receiver working and a pair of 809's, but no DX contacts have been made. Stick with it, Bob — plenty of the brothers will be looking for Colorado when skip breaks! WXY plans to have those HK-24's up on Grand Mesa, 10,281-foot elevation, during the Rocky Mountain Division Convention for another try for a new 112-Mc. DX record.

Twister Strikes Georgia

(Continued from page 15)

area, he was able to relay to W4GHU, W4ATO, and the outside stations "on-the-scene" messages and information.

Three members of the Tallahassee Fla.) Amateur Radio Club (W4FVJ, W4EIC and W4CJE) took portable equipment to Albany on the 10th and arranged to assist in providing communication from the stricken city. Clarence H. Ratliff, W4CJE, operated W4FVJ's portable

(Continued on next left-hand page)
### 650 PRESELECTOR
The performance of this high gain two stage R.F. pre-amplifier, using 1853 tubes, is truly remarkable in increasing DX and in reducing signal interference. Self powered with exclusive loop arrangement reading directly in degrees of the compass, this important unit of the HOWARD Progressive Series can be effectively used with any type or make of receiver. The master selecting system provides operation with loop or external antenna or cuts out pre-selector for regular operation of receiver. Price complete, but without loop.

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### 437 RECEIVER
Extremely sensitive and selective—is an outstanding performer on all bands. It features 9 tubes, R.F. stage on all 4 bands, two iron core L.F. stages, Noise Limiter, Crystal Filter, BFO, Electrical Band Spread, exclusive HOWARD Inertia Knobs, and all other desirable refinements. Exact Carrier Level Meter shown, an entirely new device for measuring input signal strength in microvolts, can be installed on any HOWARD Progressive model for $12.00.

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(With Crystal—$62.00)

### 660 FREQUENCY MONITOR
Enables you to read directly in frequency, any unknown signal in the amateur bands. Ceramic insulated precision built variable condenser carries an extremely accurate frequency scale. Frequency can be read within one kilocycle on the lower frequency bands and within five kilocycles on the 10 meter band. Highly stabilized, has built in power supply and will operate with any receiver. Complete price

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The Progressive Series Plan incorporates so many interesting and desirable features that we’ve decided to put the complete story in manual form. Contains circuits, detailed engineering specifications, photographs, operation data, etc. We hadn’t planned to give this manual away but if you want a copy and will write us a letter we’ll send it along without charge.
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Polystyrene and ceramic insulation.
Larger units for all stages. Band indicator and interlock sections provide assurance of correct switching sequence in all stages.

Write for Bulletin 900. Full data on push-button xtal selector, switches for a 1000 uses and manually operated band switcher.

The Vermont Section held its Second Vermont QSO Party, February 10th-12th. Stations were required to exchange information as to tube line-up of final r.f. stages in their respective transmitters; 100 points were allowed for each completed contact with exchange of required information and contacts on all authorized bands permitted. The final score was multiplied by the number of different towns and cities within the Vermont Section worked. From the outset the party was a grand success. Old-timers who had not been heard for months and years were on hand, together with the newer lads. The Section, in a spirit of competition, was divided into East and West sides. The East Side amassed the overwhelming score of 272,900 points. The West Side showed general participation, but came a short second with 93,400. In the East W1CBW and W1BNS ran neck and neck, the final count showing BNS 65,100, CBW 62,000. On the West Side W1MJU, one of our newest amateurs, bagged by far the highest score, 36,800, using his FB eco. unit. W1KJG made 20,500. W1MCQ was high in both sides for 'phone operation with 6000 points. Our YL operator, W1LZJ, came in high for YL's with 4200 points. Scores by individual stations were KXL 9900; JRU 8100; BJP 23,800; AD 3000; KVB 8800; LRL 3000; KJG 20,300; KWB 18,000; CBW 62,000; KOO 20,400; KTB 49,400; FPS 8800; LNZ 4200; BNS 65,100; MCQ 6000; MJU 36,800; MMV 1000; CGV 12,000.

Special commendation for their work in assisting in the emergency goes to Ernest L. Morgan, W4FDJ, who probably relayed more traffic than any other station, and Dr. Charles R. McArthur, W4FCW, who served in the dual capacity of relay station while at his home in Cordele and as first-aid surgeon to the hundreds of injured persons during the time he spent in Albany.

In rendering such an immeasurable service to the city officials, the Red Cross, and the friends and relatives of the Albany citizenry, it is interesting to note that several of the most active assistants in the work were newcomers to amateur radio. The would-be amateurs did their part, too, serving as messengers in delivering and collecting traffic. The W4GHIU operating in the 1.7-Mc. band once again proved the worthiness of this always-dependable amateur allocation. By actual count, over one thousand messages were handled by this station on that band!

Once again it has been emphasized that too much time cannot be spent in emergency preparation. Whether you are a member of the A.R.R.L. or not, register your facilities in the League's Emergency Corps and be prepared to serve your community when disaster strikes.
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<td>H6120-X</td>
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<td>4.24 for 7 Mos.</td>
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Everything for the "Ham"
COUNCIL BLUFFS, IOWA
160 to 2½ in One Transmitter!
(Continued from page 55)

as "high power" on 112 Mc., and the efficiency attained is considerably better than might be expected from the same tubes used as a push-pull oscillator.

The plate coils and plug-in mounting for the regular six bands are special versions of the Barker and Williamson "Swinging Link" design, being similar to their standard "TVL" types except for the extra plugs and jumper in the low-frequency units. The special base and coil incorporating these features are designated as Type "TVX."

Driver Stage

The TZ-40 stage shown at the left of the unit is conventional in every way. In our set-up the exciter delivers sufficient output to drive the final direct on the low-frequency bands; so this stage is used only when operating on 28, 56 or 112 Mc. A link switch similar to that used in the exciter is used to permit running the exciter output to either the doubler or final grid coils. The final grid circuit is tuned with a fairly large split-stator condenser (100 µfd. per section) and adjacent bands can be covered with one coil. Thus 112 and 56 Mc. or 56 and 28 Mc. can be covered by merely changing the TZ-40 plate coil and the final plate coil, as plenty of drive for the final is available from the TZ-40 whether doubling or running "straight-through." In our set-up the plate voltage on the TZ-40 is maintained at approximately 700 volts. At this figure there is little chance of exceeding the tube's plate dissipation rating, even when doubling to 112 Mc.

"99"

JEFFERS! I'm supposed to be an Old Timer, and just now have discovered how to get rid of QRM! Here's the dope: I took my 100-watt transmitter which was on 3.5 Mc., wound some coils with 65 turns of No. 24 wire, and plugged 'em in. Hot dog, when I tuned it up she had output on the 1.75-Mc. c.w. band! When I say output I mean output! A 3000-volt condenser in the antenna tank spit fire in the best approved manner. So I hooked a quarter-wave wire, 132 feet long, on one side of the antenna coil. Plate current remained the same and no sign of any soup in the antenna. Signal didn't seem any louder in receiver, and antenna condenser still arced over. So I cut down the excitation, so she didn't arc so much. Stuck neon bulb on antenna and nothing happened. Stuck cat's nose on antenna and nothing happened. Finally held a fishpole with neon bulb tied on the end of it up on the middle of the antenna, and the neighbors started looking up the 'phone number of the local bughouse. Well, not knowing anything else to do, I went on the air and "tested" for couple minutes and signed my call. I'll be hornswigled if half the band didn't come back to me. Yes sir, four stations! Reports ranged from RST 589X 35 miles away to 459X 400 miles away. No QRM! They were all ready for traffic or a chew, and three of them just made the same famous discovery, and their antennas wouldn't tune up either. Hi. The fourth one was 250 miles away and had 3 watts input.

Now this report is titled "99," and that's just what I mean — "Keep Out," fellow! The band is FB and I don't need any more QRM. This is a plea for you misguided guys on other bands to stay where you are with the rest of the QRM and let us guys "in the know" have some real fun on "one-sixty c.w."

W1BNS, O.R.S., R.M., VI.
**Tune Up Your Rig with OHMITE Parts from NEWARK**

*Get the newest from Newark—especially these Ohmite parts that do so much for your rig! Order Today Direct From This Ad. Prompt 4-hour service! Or, include with other parts and sets you need on Newark's New Liberalized Credit Plan!

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**Ohmite Close-Control Model "J" Rheostat**
For variable cathode bias, as specified in Glenn Browning’s E.C.O. Exciter. 2½” dia. x 1¼” deep. No. 0330. 5000 ohms. $2.94

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DAKOTA DIVISION

NORTH DAKOTA — SCM, Anton C. Theodos, WWYL — Please notify my change of QTH and don't forget to send in your renewal to the A.E.C. O.O.'s.

3717.5 and 1904 kc. ZXZ and DNV are doing fine with GLA. The R.C. gang wonder how all QSL's submitted by APT in contest were red (they counted double). SW-V likes e.c.o.'s. WZH has new 600-watt final. HF'S worked the east Club contests. WUU really works all bands, reporting successive QSOs in one day on 28,600, 14,300, 7150, 11676, Dakota in the QSO Party. ADJ is deserting 14 for 28 Mc.

W9YNQ - First off, these have been trying days here. Mrs. Gross, former Emergency Communications Corps. Please keep in mind that the Topeka Amateur Radio Operators Club received a three-way schedule for several days between Big Fork, Minn. (W9FKN), and Grand Forks, N. D., where FKN's wife was in the hospital. It was an eight-pound boy! Congratulations to you and your wife, Harold, from the old gang. OIC has e.o.o., which works 9G for traffic. FAY cabled him up his power, and FAY has gone around in nice style on 1.75-Me., phone. DCM leaves March 16th for Fort Monmouth, N. J., for three months' training with the Signal Corps. He has several 14-Mc. 'phone friends in the area, and he is looking forward to meeting the home folks through them.

ROUL has built a new super. YOB visited Minneapolis, dropping in on QAK en route. YKK is New Rapid City ham. Recruited and sponsored by GLA. The R.C. gang wonder how all QSL's submitted by APT in contest were red (they counted double). SW-V likes e.c.o.'s. WZH has new 600-watt final. HF'S worked the east Club contests. WUU really works all bands, reporting successive QSOs in one day on 28,600, 14,300, 7150, 11676, Dakota in the QSO Party. ADJ is deserting 14 for 28 Mc.

...
nests and traffic. BYV is now O.B.S. CHIJ is active on 1.75 and 7 Mc. AEY joined the A.E.C. OZIN's new QTH is Udal. YYW worked a K6 on 1.75-Mc. 'phone. WGW, our E.C. for Kansas, reports some very excellent work, which will be recounted later. It is an early sign of our W.A.S. party. Traffic: W9AII G 2 3 5 W 27 VQG 255 UEG 116. (Dec.-Jan.: W9GRA 5 WIN 66 VQG 219.) MISSOURI — SCM. Letha Allendorf, W9OUD — R.M. Q8O has been off the air, under doctor's orders, and FYF is rather snowed under 'With extra R.f. work and his regular use of the N.R. at U.S. Army Air Corps. Q8O is now active occasionally on 1.75 Mc. occasionally, after a long time on higher frequencies. ZHB is doing great things on 50 Mc. KP is sporting a signal generated by new HT-9. FOC has a nice signal on 1.75 Mc.; another good c.w. man that finds 'phone as a technical ride. All O.P.S. have been heard from 1.75-Mc. 'phone stations. Occasional 14-Mc. harmonics have been heard on 28 Mc. and 1.75-Mc. harmonics have been heard from 1.75 Mc. occasionally, after a long time on higher frequencies.

Traffic: W9BAZ 128 ARU 38 OHA 37 EDQ 291 CDA 5 EVR 24 BEW 21 J2 27 HZS 732. (Continued on page 104)
Correspondence Department

(Continued from page 68)

Editor, QST:

LUSTY BRAVO YOUR EDITORIAL MARCH QST
STOP ALTOGETHER TOO MUCH OF THIS WIDESPREAD SELFISHNESS

— H. W. Casner, W111E

"NO-CODE" AND "F.M."

742 Central St., Plainfield, N. J.

Editor, QST:

I have read with much interest your editorial in the February issue, about f.m. on the u.h.f. ... Our primary problem is one of occupancy. ... We have cultivated, through the years, a particular type of individual who is chiefly interested in c.w. on the lower frequencies. Anyone with zero interest in code operation but a bona fide interest in u.h.f. phone has been forced to learn the code or drop out. Almost every hobby does everything it can to make it easy for the beginner, but amateur radio made it more difficult at the start. I am not necessarily in favor of abolishing the code test. But can't we, in the interest of adding as many u.h.f. experimenters as possible, give them a year's license after only a technical exam, and then have them later pass a low-speed code test? Amateur radio needs thousands of amateurs on the u.h.f. bands and I am convinced we are never going to get them by the "conversion method" in any quantity.

As one of the first advocates and users of a stabilized rig on 56 Mc., yet as one of the most violent objectors to the new reg on stabilized operation, I can now with very little exaggeration say, "I told you so." The new reg reduced the population of this band to approximately 10% its former population in the New York area. To make it worse, we would now like to try F.M. and can't so on this most logical band of all. Let's have these regs modified so that we can have a really worthwhile population on 56. To the purists who cry QRM: Pish-tush, sez I. Amateurs like QRM, as can easily be proved by the occupancy of the other bands. ... With this thought in mind and with a desire to turn amateur radio really in the direction of something worthwhile while in the F.M. field, why not F.M. on the frequencies 29 Mc. to 30 Mc.? The occupancy there is relatively insignificant now and the QRM that would be created would be just the thing to test these reg's noise suppression and elimination of selective fading would be appreciated by every 10-meter fan. What is most important, we have a large 10-meter population all ready, a portion of which would undoubtedly like to try F.M. under these circumstances. And, what is also important, a little-used bit of territory would become the most logical, least crowded band for amateur radio really do something worthwhile in the F.M. under these circumstances. And, what is also important, a little-used bit of territory would become the scene of some highly important and interesting work. ... — Dana A. Griffin, W2AOE

CAN IT BE TRUE?

1074 West Fifth St., Santa Ana, Calif.

Editor, QST:

Don't be fooled, fellows. There is a c.w. band at 28.0-28.5 Mc.! — S. T. McNeal, W9LDJ

CARRIER CURRENT CAUTIONS

P. O. Box 167, La Canada, Calif.

Editor, QST:

Recent articles in several publications have pointed out the advantages of using carrier current or "wired wireless" equipment in connection with local power lines for control of amateur radio station equipment and for other private remote control purposes. The last issue of QST contained a description of a carrier current transmitter and receiver combination for such use.

It should be pointed out that power companies are using a large number of carrier current installations and their

(Continued on page 110)
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AMERICAN RADIO RELAY LEAGUE
WEST HARTFORD, CONN., U.S.A.
MICHIGAN — SCM, Harold C. Bird, WSDPE —

Michigan Eighties: news in the following:

DGF, QFJ, WZF, CUC and others are organizing to affliate themselves with QMN Net. Luck, fellows, QMN Net frequency 3003 kc. 1HR is trying his hand on T.L. "A." NUV reported lots of fun in A.H.R.L. Party and S3M. LHU is still working 14 Mc. WO is doing missionary work on 112 kc, reports OJ quite coming. KFL is trying for W.A.S. KLF reports lots of activity on 1.75 Mc. with low power. PSF is working 3775 kc., is working 7 Mc. 3JF is on 28-Mc. DX. DSQ is back on 7 Mc. SWF is being heard in New Zealand these days, on 28 Mc. TQJ is doing nice job on QMN. QZV says going is still active around Bay City. RJC is working F.T.M. during day and, QMN nights. RMH is sure handling the traffic, and doing nice job on QMN. QSK is still plugging for that trophy. Nice going. OM. DMY sent flash on hamfest date. SFA got his modulator working and, is on QMN and 1.75 and 3.9 Mc. UQV is trying to improve his signal by improving his e.o.o. FX is working on 36-Mc rack. DPE can be found on QMN any day from noon to 6:30 P.M. PPQ will be on QMN in his spare time. S3C expects to be out more often this year. B.P.L. EHI, PLC, CE sent reports via radio. DAQ made 1.75-Mc. 'phone W.A.S. PPF has new band-switching exciter. RNF reports lots of activity on 1.75 Mc. with low power. Mc. RPL reports lots of activity on 27 Mc. with low power. GXQ is picking up. SKO is trying his hand on T.L. "A." RSU is picking up. SKO is trying his hand on T.L. "A." SAY made the QMN. RPL reports lots of activity on 1.75 Mc. He is going to be R.M. in his area. 1IX also hit the B.P.L. FBE US is new reporter. JUQ is doing his hammering with emergency rig. EGI reports QOJ made a trip from a vibrator supply. BLT is handling along with crystal grinding. FLASH - Hamfest being held at Ypsilanti National Guard Armory, April 28th. Be sure and be there. Meet your old friends of QMN. PFG is working 3775 kc. New O.R.S. has been reorganized. PNJ is on 7 Mc. looking for slow c.w. DXA has worked K4, K6, and 3730, 7192 and 1938 kc. TYH works both coasts with the c.w. TTY. Officers of Toledo A.R.A. were elected: JUQ, pres.; RXR, vice-pres.; RRY, secy.; GJS, treasurer; GJS, QMN Net; A.A.R.S. 395 kc. Net; GAII, District Net Control. HCS' father. ROX stayed in O.R.S. party even when his signal was going on 3775 kc. so that in case of emergency they can contact other Wisconsin stations with the minimum of delay.

Ohio — SCM, E. H. Gibbs, W3AQR —

Ohio Nine: newsy and interesting. APR (Continued from page 101)

Ohio Nine: newsy and interesting. APR (Continued from page 101)
OKLAHOMA — SCM, Russell W. Batter, W6GFT — CEZ is still high traffic man for section, with FOM running close second. FOM made B.P.I. again this month. Nice work. Dore, FSK-4 is operating portable from Camp Jackson, S.C. "Dealing with a building in which I am working, and getting excited about it is doing a half page job with the Model Club bulletin, the "Hoopoe," ERW has been experimenting with different types of oscillators, DTU with HQU is organizing a 1.75-Mc. Net. Phone Net. Anyone interested in joining the net, please get in touch with either of them. AAI received O.R.S. appointment. EMD has the 8th C.A. Caper Buster Club going strong. GER is enjoying work with the e.w. gang in the State of Kansas. 1.75-Mc. Net. Phone Net. as well as the Okla. Section Net. GYV is rebuilding rig. GZT is practicing Morse Code. ABQ received Emergency Coordinator Appointment for Pocen State. CPC received O.R.S. appointment. GZT is acting as net control for 29 states. LJJ is active on 1.75 to 28-Mc. phone and is running 200 watts into a T55 final on 1.75-Mc. Phone Net. operates on 1932 kc. at 7 p.m. daily. AIR is moving transmitter to new QTH.


SOUTHERN TEXAS — SCM, Horace B. Bidly, WSM — HBA and EEX worked all districts on 29-Mc. mobile. DPA has regular 7- and 1.75-Mc. schedules on Sun. and Wed. HNF reports 39 locals active on 1.75-Mc. "phone, also emergency program work being carried out by the club. FAR has 125-O.S. HZS and O.R.S. DX. "phone using 20 watts on 1.75-Mc. and antenna on 28-Mc., phone worked 29 states. IZJ is active on 1.75-, 7- and 28-Mc.; phone and c.w., and has worked 33 states on 28-Mc. with vertical. HED is using 110 watts with Marconi on 1.75-Mc. HJL moved from Houston to Aiken, SC. "phone, using 40 watts on 1.75-Mc. "phone, works regular schedule with old QTH in Iowa. AMX is experimenting with antennas on 14-Mc., and also has Brand new daughter. BHJ is very active on 29 and 14 Mc., with 200 watts and beams. FQK is using 600 watts on 28- and 1.75-Mc.; phone. HYN has 1.75-Mc. portable and also uses 200 watts c.w. on 14 Mc. with vertical half wave. GLS is on 14-Mc., phone with 30 watts and doublet. HQU is busy building. DOM is again active on 7-Mc. GQA is active on 7 and 14-Mc. BKW with 400 watts has regular schedules on 1.75-Mc.; phone. "Phone is active on 28 Mc. with 75 watts and rotary, IOJ works on 28-Mc. and phone some 1.75-Mc.; phone active. IEE likes 7 and 14-Mc. AKN has portable 1.75-Mc. and mobile 28-Mc. HJP using 100 watts is ready for 1.75- and 28-Mc.; phone and c.w. EIB and EUG have Halli­crafters and antennas. PDR has regular schedules and much traffic. CVQ, N.C.S. for A.A.R.S. FPM, managed to keep schedules even though down with flu. GWT moved to new QTH, has private shack and is now O.R.S. M. has a Hetrofil and his rig is working. EPB is a Signal Stuffer to a kw. on all bands and is prepared to handle traffic to KC4USC. JC and FAR are O.R.S. CAP has new NC44A.


ROCKY MOUNTAIN DIVISION

COLORADO — SCM, Carl C. Drummer, W9EHC — R.M.'s: 9EKQ, W9EAL, P.A.M.: 91V7. HFC tops the traffic list this month. 29-Mc. is busy with E.W. work, and GZT and AAI are lining up with the A.E.C. SAX, LJP, GYV, and FSK are getting together on 3.0-Mc. at noon for a round­table. HFC is teaching radio and moving his rig to the Western State College. GZT has traffic on 1.75-Mc. on 29-Mc. 3.5; will we have to shift to over 1.75 Mc. for around-state traffic work? EHF at La Junta has a new HT-9 transmitter. NOD, E.M. for La Junta, has an A.E.C. Net organized, including TVY, JQA, SX1 and 5FU. NCA is Grey's most active station, using 29-Mc. NEY gets on Sundays and odd evenings with a T125 rig. HWH, new amateur, is on 7 Mc. with a T121. FQK has seen results on 14-Mc.; phone using an 807 final. FO tosses 135 watts in for the 1.75-Mc. operation. FO also has 39 locals active on 1.75-Mc. phone for schedule with ZNH. YYH has a 1.5T on all bands.


- Carl, EHC.
Improving the Flying Skywire
(Continued from page 33)

It is also apparent that while some adjustment can be made before flight is attempted, one cannot change the position of the string on the bridle while the kite is in flight. Often with gusty winds the velocity goes through a considerable range. This is the reason for the inclusion of A.W.C. or “automatic wind control” in the kite bridle. Simply by making the lower half of the bridle out of rubber bands, it is possible to change effectively the position of the string on the bridle by the lengthening of the lower part of the bridle due to the stretch in the rubber band. The stronger the wind, the greater the stretch, and the kite consequently flies flatter and offers less wind resistance. When the wind drops, the kite comes back into the wind again. This device helps to a remarkable degree in providing trouble-free flight so that the radio man can tend to his radio and doesn’t have to nurse the kite all of the time. However, there is still some latitude of adjustment in the actual point to which the string is attached to the bridle. In very strong winds the string should be fastened nearer the head of the kite. Experience is the best teacher, and we recommend that a number of test flights be made using heavy string instead of wire. Generally speaking, it is not necessary to put a tail on the kite. A tail adds to the weight that must be carried and is a visible admission that the bridle is improperly adjusted.

A piece of fish line about two feet long should be used for the top half of the bridle. This should be knotted about every two inches both for reference and to insure against slippage of the string on the bridle in flight. A loop should be made in the top end of the bridle cord so that it may be slipped through the slit in the covering and pulled up and over the top of the vertical stick. The latter should be notched half way between the cross stick and the top so that the loop can be held in place. The bottom end of the fish line fastens to two parallel pieces of 1/8-inch square rubber band 18 inches long. The bottom end of the rubber band in turn fastens to a small piece of fish line about 6 inches long which is looped around the vertical stick halfway between the foot of the kite and the cross stick. Generally the “flying” string will fasten on to the bridle a short distance above the junction of the rubber band and the upper piece of fish line comprising the bridle.

As pointed out above, experience will do more than volumes of printed instructions, but the main highlights are listed herewith: First, a tendency to fly to one side all of the time indicates lateral unbalance. Second, the placement of the string on the bridle is all important, as described above. Third, do not attempt to judge performance while the kite is near the ground. The air currents are extremely variable until you reach an altitude of better than 100 feet. Fourth, the wind tends to drop at sundown in many places, making it difficult to put up a kite at that

(Continued on next left-hand page)
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THE AMERICAN RADIO RELAY LEAGUE
West Hartford, Connecticut

With the kite completely under the control of an experienced "airman," we are now ready to get back to the subject of radio once more. We do not have a particularly good answer to the subject of antenna wire. The resistance of any of the alloys of copper mounts so rapidly that their use is prohibited. The best material that we have found is No. 18 hard-drawn copper wire, which runs 200 feet to the pound. A kite as described above will easily lift 1500 feet of this wire unless the breeze is extremely light. If considerable flying in strong winds is expected, it would be advisable to have a length of No. 16 hard-drawn wire available, as the No. 18 wire is likely to break in winds of 30 m.p.h. or more despite care in adjustment of the bridle. The reel on which the wire is wound should not have too great a diameter. Six inches seems about the maximum, since a greater diameter gives the kite an unpleasant mechanical advantage that must be felt to be appreciated. We should like to inject a word of caution at this point. Under no circumstances fly the kite with wire when there is any possibility of its making contact with high tension wires. While you may escape, remember that a fallen copper wire will be extremely attractive to children who won't know it is loaded until it is too late. You can't patrol a 1000 foot wire in the city or suburbs. Another note of caution when flying with wire is to remember that Ben Franklin was right — there is "juice" up there. Often it is present when you would least expect it, such as on clear days. It can give a substantial kick if the wire is left ungrounded for a few minutes. The cure is simple — a short iron stake is driven into the ground and a flexible wire about 20 feet long is attached to it. A clip on the end of this wire is clipped over the kite wire so that the wire may easily run through it. This keeps the static charge down to zero.

With an actual input to the antenna of not more than three watts, we have consistently worked 25 miles on 56 Mc., with the kite approximately 800 feet above the earth. These results were obtained in flat country, and with an additional 600-foot boost from a hilltop the rig has worked over 50 miles with no difficulty. Signals from the high powered 56-Mc. boys that are inaudible on regular antennas come in consistently from 75 and 100 miles away.

As mentioned above, the first tests that were made on the lower frequencies with the kite antenna was on the A.R.R.L. Field Day, at the
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Tri-County station W2GW-3 at Somerville, N. J. As one of five positions, the unit was a complete washout on Saturday night due to a local thunderstorm that made it imperative that the kite be taken down before we got a real shot of Ben Franklin’s elixir. Sunday came along more or less calm and peaceful, and the kite proceeded to justify itself all day long. With 1100 feet of wire at a 60-degree angle, working against ground, the push-pull crystal oscillator on 40 and 80 meters poked out all day long. Inasmuch as reports ranged from S7 upwards and the input was around 15 watts to a relatively inefficient rig, we feel confident that the kite antenna deserves full credit for the successful operation of this particular rig. Five meters also supplied a couple of contacts 35 miles away behind a mountain range, although the kite was “over the top” as far as the hill was concerned.

In conclusion, we believe that every ham interested in portable work and emergency work will find the kite a helpful adjunct to his station. No one has ever successfully refuted the argument that a long wire antenna works fine. The kite makes possible the erection of many sizes of antennas in the best place discovered — free space.

Electronic Keying
(Continued from page 14)

the fingers, as large knurled lock nuts are provided. Adjustments are permanent and no further attention should be necessary.

A slight sideward swaying action of wrist is all that is necessary to send at say 30 or 35 words per minute. Besides making operating more of a pleasure the perfect spacing of characters improves the operator’s straight-key sending ability. Once you have learned to use the automatic dash, you’ll have a tendency, in attempting to use a regular bug, just to hold the dash lever waiting for a dash or dashes to “pop out”!

The electronic key is a new and practical application for the thyratron. It is not within scope of this article to describe all of the technical considerations. The constructor should have no difficulty in duplicating results. The technical man can study the circuits and glean the data that are not included. If you have a better method, let it be known. It’s yours, what can you do with it?

EDITOR’S NOTE: A key of this type has great possibilities in improving the quality of hand sending, but its general application will naturally depend considerably upon cost. It has perhaps occurred to some readers, as it did to us, that mechanical switching could be substituted for the two auxiliary relays. A three-pole double-throw switch is required, and the Yaxley jack-switch seems to be almost made to order for the job. One of the photographs shows a haywire model of such a “key,” which, crude as it is, proved thoroughly practical. Under construction is a more pretentious model which can be built by any amateur who has a few ordinary metal-working tools. We hope to describe it in next QST.
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condensers of these capacities. The very best paper condenser is required for this purpose, leakage of d.c. through $C$ often placing an unsuspected positive bias on the grid of the following tube, a condition fatal to Class-A operation with resistance coupling. Mica insulation is preferable but high capacity condensers with this dielectric are expensive and bulky.

To minimize bass response, to say nothing of transformer hum picked up by the microphone, a small mica condenser of about 0.004 or 0.006 µfd. capacity may be placed in series with $C$, offering fairly low reactance to intermediate and high frequencies but, in a sense, rejecting the extreme lows. It may be shorted by a small switch when full bass response is desired. A 2-megohm resistor in parallel with the switch will avoid switching clicks.

The high-frequency response cannot be affected materially except by choice of tube and care in wiring to reduce stray capacities. As a general thing, the combined grid-to-cathode, plate-to-grid and plate-to-cathode capacities, which effectively by-pass the grid and plate coupling resistances to ground, are less with low-µ triodes and screen-grid tubes than with high-µ triodes. Hence, use of the former materially extends the range of the amplifier into the higher registers.

To reduce high audio frequency gain, a series variable resistor and a condenser may be placed between the plate or grid of a later stage and $B_-$, the condenser being chosen so as to offer low reactance to the intermediate and low frequencies. Usually 0.001 or 0.002 µfd. will be satisfactory. The variable resistor should have a range at least comparable to $R_p$ or $R_b$, whichever it parallels. When all the resistance is in, the high frequencies are saved; when full out, they are bypassed to ground. This combination is the usual "tone control" included in broadcast receivers. In conjunction with the bass control described above, a more or less narrow band of audio frequencies may be passed through the amplifier, concentrating the valuable modulator power into readily intelligible, if not high fidelity, speech components of the transmitted signal.

Transformer Coupling

Transformer coupling is a common method now applied only to medium- or high-level stages, usually with the lower-µ triodes, where the effect of stray magnetic fields of power transformers and chokes may be made negligible and where it is desired to transfer some power. The input and output of the power stage are almost always transformer coupled. The method has the distinct advantage of permitting, if desired, a voltage step-up within the transformer itself and allowing, in many cases, the practical overall voltage gain of a stage to exceed the amplification factor.

(Continued on next left-hand page)
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Regeneration

One of the most annoying “bugs” of high-gain amplifiers is unwanted regeneration, caused by feedback of a signal from the high-level output to the low-level input of the first or second tube. If the voltage applied to the input grid by the feedback is of the order of the voltage required to excite the tube, the amplifier will be regenerative. The gain in amplification may be considerable, which might at first be thought advantageous. Unfortunately the regeneration is not uniform over the desired portion of the audio spectrum and, if too marked, will cause distortion. If the regeneration reaches too high a value, the amplifier will oscillate, resulting in the familiar howls and squeals.

Occasionally an exceptionally high incoming signal voltage, or a current surge in some stage, will feed back a sudden high amplitude signal to the input. Grids all along the line then may be driven off the linear portion of their characteristics, and even positive, and plate currents will surge upward. The final amplified signal again is fed back to the input, and so on, and the amplifier finally becomes uncontrollable. A “putt-putt” sound, considerably like the sound of a single-cylinder motor boat, may emerge from the output; hence the term “motor boating.”

The cure for unwanted regeneration and for motor boating is normally as complete electrical isolation of the plate supply of the last stage from that of the earlier stages as possible. If a common plate supply is used, its impedance common to all
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THE A.R.R.L. EMBLEM
Insignia of the Radio Amateur

In the January, 1920, issue of QST there appeared an editorial requesting suggestions for the design of an A.R.R.L. emblem — a device whereby every amateur could know his brother amateur when they met, an insignia he could wear proudly wherever he went. There was need for such a device. The post-war boom of amateur radio brought thousands of new amateurs on the air, many of whom were neighbors but did not know each other. In the July, 1920, issue the design was announced — the familiar diamond that greets you at the top of this page — adopted by the Board of Directors at its annual meeting. It met with universal acceptance and use. For years it has been the unchallenged emblem of amateur radio, found wherever amateurs gathered, a symbol of the traditional greatness of that thing which we call Amateur Spirit — treasured, revered, idealized.

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AMERICAN RADIO RELAY LEAGUE
West Hartford, Connecticut

MISCELLANEOUS SUGGESTIONS

Shielding of at least the first two stages of a speech amplifier is quite essential if the amplifier is to be used within the field of even a low-power transmitter. Usually the problem can be solved once and for all by completely enclosing these stages in a grounded metal compartment and providing adequate r.f. filtering of all incoming leads. A shielded r.f. choke should be located at or very close to the grid of the first tube in series with the "hot" microphone lead, and the grid by-passed to ground through a shielded mica condenser of 0.00005 to 0.0001 µfd. capacity. The incoming microphone lead should be well shielded and the shielding connected firmly to ground through the microphone jack. The incoming B+ may also require an r.f. choke and a mica by-pass condenser. Because of their construction, electrolytic condensers cannot usually be depended upon to furnish low-impedance paths for r.f. Normally all audio leads, coupling condensers...
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and the tubes should be shielded as well as enclosed in the compartment. A little extra thought and care here will pay dividends in trouble-free operation later on.

The speech amplifier is easily disabled during stand-by periods merely by shorting, with switch or relay, the grids of the driver stage if they be of the low impedance type as is usually the case. Opening the B- or B- to any of the stages usually introduces considerable current surge and, in sensitive amplifiers, may cause motor boating in spite of filters.

So many excellent tried and proved circuits are available, utilizing the principles suggested above, that it is unnecessary to continue further. In general, the amateur who is approaching the problems of 'phone operation for the first time will be wiser to select a simple straightforward circuit with inexpensive tubes and a minimum of tricks, and study it carefully before starting to build, until he is familiar with the function of every part and its value. Inclusion of a good method of automatic gain control should be given consideration, to minimize the possibility of interference caused by overmodulation.

1 MacFarland, "Peak Limiting Amplifier for Amateur Use," QST, April, 1939.

Correspondence Department
(Continued from page 108)

use of carrier equipment is being extended and enlarged rapidly. In a great many instances carrier current is now being used for relay protection and alarm circuits on low-voltage distribution lines, particularly between substations operating on 11- and 16-kv. loop systems. Therefore, it is possible that amateurs attempting to place carrier current equipment in operation on power circuits may seriously interfere with the correct operation of the very important relaying and remote alarm systems already in use by local power companies.

It would be advisable, before placing such equipment in service, for the amateur to consult his local power company on the matter in order to make sure he will not cause interference to carrier circuits already in operation. The results of such interference might well be disastrous and a check-up beforehand may save the ham considerable grief.

— K. S. Williams, W6DTY

(Continued on next left-hand page)

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**MORE "S"-SCALE COMMENT**

Editor, QST:

The correspondence in the January and March issues of QST in regard to conventional signal reports has inspired me to contribute my bit. I have worried a good deal about little numbers and hope that we can arouse enough discussion to make them more honest and useful.

According to the reports of psychologists in the field of educational testing it is useless to have as many as nine units in a scale determined subjectively. If, for example, students are asked to explain briefly the theory of an oscillating vacuum tube, an instructor can probably separate the answers into five groups or grades with a reasonable degree of reliability. Reliability is a question with which the same answer would get the same grade at different times. (I am assuming that the answer is not expected to include a specific number of facts each affecting the rating.) Any more than five grades leads to the same difficulty that we have in really using nine units to report strength and tone. I have often thought of this when trying to give an RST report. The "Q" signals give QSA a rating of 1-5 and the army reports "S" the maximum "5S" and "T". I would prefer to keep the "R" scale as is. Perhaps "readable with some difficulty" and "readable with no difficulty" are sufficient for a casual ragchew but it seems to me that scheduled traffic handling requires more. When sending traffic I would like to know whether the other fellow is hearing every dot and dash with no difficulty or is having to work a little hard to get me "solid." In the first case he should give me "R5" and in the second "R4." If he misses occasional letters it would be "R3" and if he misses whole words "R2." Then "R1" would be left for the scheduled contact when you can hear the other fellow enough to know he is there but cannot read him. I think that at present we overwork "R5," using it to include both "4S" and "5S" and we say "R4" when we mean "3S." Probably the "S" report should be "R4" which means (A.R.R.L.), "readable with practically no difficulty," and (Army), "good, readable, plain language or code once."

I am sure that I disagree with WILAU and the others in the suggestion to make the "S" scale dependent upon the condition of the band. What shall be the report when we work 160 meters at noon and can hear only one station? Surely a report of "fair signal strength" when the band is nearly dead is nothing to be ashamed of. When based on 1-5 rather than 1-9, it should be easy to report signal strength which is what "5S" is supposed to stand for. Sometimes I think we take "3S" unconsciously as a personal rating of our ability to adjust and operate our transmitter. How many of us have the experience of being a little generous with the "S" report only to find that the other fellow is running 6 watts to a single receiving tube! He is either dunce or has lost faith in the rest of your report. A report is worse than useless unless it is given as honestly as possible. Of course it is perfectly legitimate to call "SSS" the strongest signal on the band at the time and to base our other ratings on it. But I am afraid that we would run into the trouble mentioned above and that we would have further difficulties when a band is changing rapidly or a lot of stations are just coming on the air as happens about supper time. Furthermore, if I receive the maximum report on the "S" scale I would like to know that I am pounding in, and not have to wonder what the band is like in the other fellow's receiver.

While on the subject, I would like to question the use of "x," meaning "crystal characteristic noticed." At the present time there are not many signals which could not have been emitted by a crystal oscillator. The only difference between a chirpy crystal and many e.e.'s is that the crystal begins to chirp on the same frequency each time. Why not a symbol for that? Perhaps "C" to indicate the presence of a definite chirp? Thus "RST 444" would mean that you had good readability, were moderately strong, had a slight ripple (not unusual), and that you were practically crystalless.

Whatever nips hang scale is used, the ratings must have specific meanings understood by both sender and receiver. There will always be borderline cases but their number is directly proportional to the number of border-lines. In emergency operation it may be important to form another station briefly and intelligently of receiving conditions. "R" and "S" reports plus QRM and QRN can make (Continued on next left-hand page)
Where to buy it

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

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A pretty complete picture. It might even be worth while to adopt 1-5 scales for QRZ and QRN, similar to the Army procedure. The numbers would have the same meanings as for the "S" scale so there would be nothing new to learn except to recognize such a report as a "75, cut"." boys. In the first place, this fellow may be pressed for time. He may be just home for lunch, and a short five or ten minutes at the rig. He has a perfectly ethical and moral right to stay on the air for a brief greeting, an exchange of reports, a "75 cut," and back to the office again. What's wrong with that? Absolutely nothing, of course, but a certain group of hams immediately look down their noses at him because he wouldn't stick around for an hour and a half and discuss the weather, his habits of living, and the facts of life in general.

In the second place, those of the "long-rag-chew-or-nothing" school should remember that this fine hobby of ours embraces a wide variety of special interests, all of which are worthy of including DX, traffic-handling, experimentation and many others, in some of which a long-winded, endless rag-chew is not always in order. To illustrate, suppose Johnny Q. Ham is making an intensive study of directive antenna arrays. He has just put up a nice, fixed beam in preparation for some contact or other, has maybe an hour's time to spend on the air and is anxious to know whether or not his new beam is really "beaming." This calls for a number of contacts in different directions and localities so that a study can be made of reports received. But no, if he is to be a good fellow, he will devote at least an hour to the first contact he makes and have it last that last winter's Blizzard that he likes to eat for breakfast, and to h—— with that data he wanted to gather on this new antenna array. Phoebus! This may sound like I am dead against rag-chewing, but that is definitely not the case. I am absolutely for rag-chewing, particularly when there is someone interesting on the other end of the line. But I do not take the stand that many seem to do, that anyone who refuses to indulge in a long-rag-chew is a plain vanilla guy. If you hook a guy who doesn't go in for two-hour rag-chews, let him go, and throw out your bait again.

There are thousands of potential rag-chews on the bands just around the corner — any corner. Go ahead and enjoy them, and try not to condemn the other fellow if he's in a hurry. Who knows? He may be about to catch a train.
HAVING made no investigation of the advertisers in the classified columns, the publishers of QST are unable to vouch for their integrity or for the grade or character of the products advertised.


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TMA200D, Supreme 535 oscilloscope, Triplett 1200-C. List. Two modulators 150 and 40 watts. Must sell. W5HXC, Black–DOUGLAS modulation transformers. Match all tubes in Class W8SBI.

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BARGAINS: Again W1CPI builds a brand new layout — This means plenty of bargains in good, used parts. Write now for complete list at give-away prices. For example, a Harvey UHX-55 all-band CW and phone transmitter with power supply, $80.; also a Meissner Signal Shifter going for $25. Address W9ARA, Butler, Mo.

CUSTOM-built RME-69 with DB20 preselector, OA1 oscilloscope amplifier, LS-1 noise silencer, 3 inch RCA oscilloscope, and signal push 6L6 audio with variable impedanc centers for 4 speakers or recording head. All built into beautiful 5 foot enclosed rack, aluminum panels, gray crinkle finish. Plenty of room for transmitter to be built in same rack. Scope gives modulated envelope or trapezoid pattern. Cost over $400. Must sell and will sacrifice for $250. F. Wingard, Rock Island, Ill.

RECONDITIONED guaranteed receivers and transmitters. Low in many all models cheap. Save as much as half. Ten day free trial. Terms. List free. New SX-25's, $89. (regular new price is $115.50) W9ARA, Butler, Mo.

SACRIFICE — Panel 300 watt output, phone, CW, complete $185. Photos, Hallcrafters SX16, $60. All guaranteed. W3ARA. A. Adamo, 330 Lundle Ave., Vineland, N. J.

QST's wanted prior to 1923. Floyd Norwine, W9EFC.

MUST sell my Meissner Signal Shifter, voltage regulator, coils for 20, 40, 160. $33. W6FEV.

WANTED: modern high frequency equipment. W8BZC, 716 W. 17th Pl., Chicago, III.

PAIR T-200's, age two, $20. WLVQ.

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

<table>
<thead>
<tr>
<th>City</th>
<th>Company</th>
<th>Address</th>
<th>Contact Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Burstein-Applebee Company</td>
<td>1012-14 McGee Street</td>
<td>&quot;Specialists&quot; in supplies for the Amateur and Serviceman</td>
</tr>
<tr>
<td>KANSAS CITY, MISSOURI</td>
<td>Radiolab</td>
<td>1515 Grand Avenue</td>
<td>Amateur Headquarters in Kansas City</td>
</tr>
<tr>
<td></td>
<td>Radio Parts Company, Inc.</td>
<td>538 West State Street</td>
<td>Complete stock Nationally Known products</td>
</tr>
<tr>
<td>MILWAUKEE, WISCONSIN</td>
<td>Lew Bonn Co.</td>
<td>1124-26 Harmon Place</td>
<td>W9BP, W9TLE, W9ZXX, W9DKL, W9VED</td>
</tr>
<tr>
<td></td>
<td>Northern Radio Company</td>
<td>2208 Fourth Avenue</td>
<td>W7AWP, W7MB, W7VP, W7XL, W7XX, W7CR to serve you</td>
</tr>
<tr>
<td>ST. LOUIS, MISSOURI</td>
<td>Van Sickle Radio Company</td>
<td>1113 Pine Street</td>
<td>Owned and operated by W9OWD, W9TIC, W9KEH</td>
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*
NEW De Luxe GRID-CATHODE TRANSMITTER KITS

**SC-101**  
GCM PHONE — C.W. TRANSMITTER KIT

The UTC Type SC-101 kit is a complete, crystal controlled, 'phone C.W. unit of modern design. This transmitter is capable of 50* watts 'phone, 100* watts C.W. operation on all bands (10-160 meters). Band changing is effected through standard plug-in coils. Keying is accomplished in the cathode circuit, thus permitting break-in operation. A rugged power supply with a multi-section filter system furnishes power to the RF and audio stages.

The entire transmitter is mounted on a single chassis, and is housed in a modern cabinet provided with a safety interlock switch to prevent injury to operator. The output circuit consists of a link terminated to two Isolantite feed-through insulators at the rear of the chassis.

The Type SC-101 kit includes chassis, cabinet, panel, condensers, coil assemblies, resistors, 3" METER, etc., all completely mounted ready to wire. Crystals and tubes not included. Tubes: 1-807, 1-812, 1-6SJ7, 1-6S6, 1-523, 2-866. Size: 12" x 12" x 20"; Weight: 80 lbs.

Amateur net price __________ $57.00

* ACTUAL CARRIER OUTPUT UTC ratings are conservative and based on antenna output, not the customary class C input. For example, on C.W., the class C input of these units is 160 watts.

**SC-100**  
BAND SWITCHING GCM PHONE — C.W. TRANSMITTER KIT

The UTC Type SC-100 transmitter kit is a complete 'phone and C.W. transmitter of modern design capable of a carrier output of 50* watts 'phone, 100* watts C.W. Operation on all bands (10-160 meters) is obtained by means of BAND SWITCHING coil assemblies (and crystal switch for four [4] crystals). Keying is accomplished in the oscillator cathode circuit, thus permitting break-in operation. A rugged power supply with multi-section filter system furnishes power to the RF and audio amplifiers. The entire transmitter including RF, speech amplifier, Cathode-Modulator, and power supply is mounted on a single chassis.

The output circuit of the SC-100 consists of a link terminated at two Isolantite feed-through insulators at the rear of the chassis.

The SC-100 kit includes chassis, cabinet, panel, condensers, coil assemblies, resistors, 3" METER, etc. all completely mounted ready to wire. Crystals and tubes not included. Tubes: 1-807, 1-812, 1-6SJ7, 1-6S6, 1-523, 2-866. Size: 12" x 12" x 20"; Weight: 88 lbs.

Amateur net price __________ $96.00

First in Cathode Modulation — UTC now presents 5 new Universal Transformers for GRID-CATHODE MODULATION

- Primary designed to match all popular tubes.
- Secondary provides a wide range of impedances for GCM applications (1000 to 10,000 ohms).
- Separate tapped tertiary grid winding to facilitate exact grid matching.

<table>
<thead>
<tr>
<th>Transformer</th>
<th>Impedance Range</th>
<th>Audio Output</th>
<th>Net Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCM-1</td>
<td>200 or 500 ohm</td>
<td>30 watts</td>
<td>$4.80</td>
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<tr>
<td>GCM-2</td>
<td>15 watts</td>
<td></td>
<td>$3.00</td>
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<tr>
<td>GCM-3</td>
<td>30 watts</td>
<td></td>
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<tr>
<td>GCM-4</td>
<td>60 watts</td>
<td></td>
<td>$6.90</td>
</tr>
<tr>
<td>GCM-5</td>
<td>200 watts</td>
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<td>$13.50</td>
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</tbody>
</table>

UNITED TRANSFORMER CORP.

QST for April, 1940, CENTRAL Edition
The numbered parts shown below are as follows:

1. CHT and CHV Crystal Holders
2. R-100 RF Choke
3. HRO Dial, Type 10-0
4. UM and ST Condensors
5. XR-6 Coil Form with Socket
6. BM Dial
7. 6-prong Socket
8. FXT Fixed Tuned Exciter Tank
9. O Dial, Type 0-100
10. XM-10 Transmitting Socket
11. TMSA-50 Condenser
12. UR-13 Buffer Coil Form Assembly

When building or remodeling your transmitter, remember that National parts have no superior in quality or value. They will insure better performance in the old rig and peak operating efficiency in the new.

The group of parts illustrated above would combine to make an outstanding exciter. From crystal holder to buffer coil form, each unit is particularly suited to its job. It is parts like these that make the NTE Exciter such a fine performer.
LESS THAN ONE TYPE IN TEN of the 470 types of radio receiver tubes now on the market is actually needed to design practically every type of radio receiver at the lowest ultimate cost. RCA has outlined a list of 36 RCA Preferred Type Tubes which adequately cover every function for any type of receiving set circuit.

MR. HALLIGAN’s comment on the RCA Preferred Type Tubes Program is highly significant because of his wide knowledge of radio and its problems. He agrees with the many other leaders in all phases of radio who have expressed approval of this plan to simplify the radio tube situation. This program was “planned in the interests of everybody in radio.” And we at RCA are bending every effort to see that it is carried out in the same spirit with which it was conceived.