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The American Radio Relay League

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

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

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

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WE HAVE a birthday! Fifteen years ago this month, when the American Radio Relay League was only a year and a half old, the first issue of QST was brought out. Published privately by Hiram Percy Maxim and Clarence D. Tuska, the founders of the League, in response to the need which had been found for some sort of regular bulletin, its object was “to help maintain the organization of the A.R.R.L. and to keep the Amateur Wireless Operators of the country in constant touch with each other.” That has been its aim ever since.

There is just one copy of this precious first issue at Headquarters. We dug it out of the infiles today and had a look at it for the first time in years. Old and battered, what joyous memories this little blue-covered booklet of twenty-four pages brought back to us! Your present editor was a young lad half in Illinois in those days, struggling with the intricacies of “wireless” and rapidly getting nowhere at all. QST came as manna from heaven. And did we know whether we wanted to subscribe or not! The publishers hoped that after financing three issues the magazine would find enough response to carry itself. They advertised that “Every amateur will help himself and help his fellows by sending in twenty-five cents for a three-months trial subscription.” Our two bits, we remember, started for Hartford that same day, and there were enough others who thought the same way to carry QST on to its present indispensable position in our radio lives.

How we realize our venerable age when we let it sink in that all that was fifteen years ago! And what perfectly tremendous changes there have been since then! Those were the toddling days of amateur radio, when all transmission was by spark, with the rotary gap gaining favor, when most reception was on crystal detectors, with a few fortunate amateurs owning “audions.” Let us pause and shed a tear for those childhood days when life was simpler. Honestly, they were swell in many ways!

The first issue of QST had ten pages of reading matter and seven pages of paid advertisements, with the rest given over to data and notices. The war was on in Europe and the United States was becoming national-defense conscious. We find the President of the League writing to the Secretary of War and the Secretary of the Navy, offering the facilities of the League. Editor Tuska comments that “The great possibilities of the American Radio Relay League, with its organization of over six hundred relay stations in nearly every state of the Union, are bound to attract prominent attention.” In that first issue, too, QST started its campaign for “precise, orderly and efficient” traffic handling. “Reliability & Celerity” was a slogan of the day — only the printer spelled it “celebrity.” Regular hours for working were stressed by the editor, for, “unless the other man is a regular nighthawk and sits up half the night every night in the week, he misses him.”

The leading (and the only) technical article in this issue was “Pictured Electro-Magnetic Waves,” by Clarence D. Tuska, Assoc. I. R. E., who was our first secretary and editor. Talk about technical, you fellows who think QST is “too technical!” It started out that way. This article was very much too technical, with all those queer pictures of electro-magnetic and electro-static strain lines around a vertical antenna — you know, those funny diagrams we never could understand. There was other technical material, too, in the way of photos of several stations of members. Three pages were given over to a list of new members of the League, every one with call letters but a few of them still self-assigned initials, for the radio law was not yet operating in remote sections of the country. Members in those days had to fill out a two-page questionnaire in making application. DX was but a few miles and a man’s equipment had to be known before his desirability as a relay station could be deduced. Applicants had to describe their aerials, including “number of wires in aerial and space between,” and answer “Do you use a spark coil or transformer?” and “Is your spark gap rotary, fixed or quenched?” The League advertised for sale its “List of Stations Book,” tabulating the relay stations of the A.R.R.L. This book “shows what relay stations are within your range; gives name of owner, complete address, call letters, sending power, kind
of gap used, number of words can receive per minute, listening-in hours, what license is held, telephone connection or not." That, folks, was the forerunner of the Handbook.

But the "ads" in that first number! You youngsters who know amateur radio only in terms of high-frequency tube transmission and screen-grid detection and are bored stiff with any DX under ten thousand miles really missed a lot, and don't you forget it. What grief the old-timers encountered, what a rotten ratio of dollars-per-mile their investments gave them! But what real thrills were theirs when the old junk-pile did percolate and they clicked with another equally thrilled chap at the tremendous DX of 278 miles! Believe it or not, it all happened. So in this first issue of QST we find advertisements of the apparatus of the day. Prominent is the rotary gap, "required in every transmitting station by the Federal authorities" because "this type of gap produces a pure wave of low damping decrement," a note that "cannot be mistaken for static."

Hi! And do you remember the very essential double-pole double-throw switch to short the 'phones while sending, to keep from burning your ears off? Then there was a Universal Detector Stand, "capable of holding crystals up to and including 34." No, not quartz plates, but rectifying crystals for detectors. This one was a complicated gadget with a hollow standard, a ball, a spring, a thumb-screw, an arm, a set-screw and a few more jiggers, so made that it "remains permanently in adjustment under jars and vibrations of every description." You poor moderns who never had a real hot argument as to whether it was better to use a silicon detector with a hard blunt point or a galena crystal with a cat-whisker made of a strand of iron wire taken from a piece of what used to be called "picture wire" — you missed a really precious part of amateur life.

There were many other interesting ads, too: Duck's Big Wireless Catalog, on which so many

A newspaper write-up on a BCL set mentions the fact that it has a total of seven tubes, including the photocell tube. Evidently the Milkitron has found a commercial application already!

An interesting booklet entitled "The Photoelectric Cell" is being published by the Photoelectric Division of the Arcturus Radio Tube Company, Newark, N. J. There are five chapters, devoted to discussions on photo-electric phenomena, present-day photo-electric cells, the photolytic cell, the light source, and amplifiers. The price is twenty-five cents.

W3LA wants to know when the broadcast stations are going to have automatic power controls 180 degrees out of phase with natural fading!
A Two-Tube A.C. Receiver

By George Grammer, Assistant Technical Editor

Those who follow the trend of amateur radio in QST cannot help but be conscious of two important developments in receiver construction. We refer, of course, to the a.c.-operated receiver and the screen-grid detector. Several times in the past year the thorough practicability of the a.c. receiver has been pointed out; and the testimony of Rydberg, Doty and other experimenters, as well as the graphical study by Robinson, certainly must have convinced the most skeptical that the screen-grid detector is capable of greater sensitivity than the triode.

Some experiments in the QST laboratory with screen-grid detectors convinced us that, for c.w. reception at least, a two-tube receiver will give all the sensitivity and volume that the average amateur requires—speaking, of course, of the man who prefers to wear 'phones instead of receiving via the loudspeaker. Admittedly more care is needed in stringing the receiving antenna and adjusting it for best results when the detector is not isolated from it by a coupling tube; but the chap who is willing to give the antenna question a little attention will have few difficulties.

Aside from the greater sensitivity of the Type '24 tube as a detector and the consequent desirability of using it with any type of receiver, there is a great deal of satisfaction in being able to plug into a light socket to get power to run the set — and know that there is no battery to be charged after several hours of continuous operation.

We must confess, however, that there is one thing lacking in the receiver. When planning the set a means of controlling volume was not given a thought, since it was not expected that two tubes would give more than comfortable signal strength. It should have been incorporated, however, because the set really needs one. The "sock" of many ham signals is too great for real comfort, especially with a good receiving antenna.

The circuit is the "old standby" regenerative detector and one stage audio, capacitively coupled to the antenna, and with such modifications as are necessary or desirable for a.c. tubes. Most amateurs need no introduction to this arrangement, having used it at one time or another in their "ham" experience. A diagram is shown in Fig. 1, and the various photographs show the arrangement of the apparatus.

The panel is a piece of ¼-inch sheet aluminum, 7 inches high and 12 inches wide. On it are mounted the drum dial which controls the tuning condenser, the regeneration control resistor, and the "B" cut-off switch. The remaining apparatus is mounted on the sub-panel, which is also sheet aluminum, 12 inches wide and 6 inches deep. The sub-panel mounting brackets (Silver-Marshall) are one inch high. The sub-panel method of construction is used for several reasons, chief of which is the desirability of separating the r.f. and power wiring as much as possible and shielding them from each other. The metal sub-panel accomplishes both these things. In addition practically all wiring is concealed, with the result that the receiver presents a neat appearance when being exhibited to visitors.

Three five-prong sockets are required, one for the plug-in coils and two for the tubes; the variety used in this particular set are sub-panel sockets of the type widely used by broadcast-receiver manufacturers. It is not necessary to use the same style, of course, although they lend themselves nicely to sub-panel wiring and are inconspicuous. Some of the mail-order houses carry them if they are difficult to obtain locally. However, substitution of the garden variety of socket will add few difficulties to the construction and will affect the performance not a whit. As a matter of fact, the same is true of most of the other apparatus in the set; parts that are incorporated in it, with the exception of only one or two items, were used simply because they were available or because they had a pleasing appearance — worthy enough reasons for any constructor, but...
having very little to do with the actual electrical performance of the set. On the other hand, a different tuning condenser and a dial not of the drum type will probably necessitate an entirely different layout for the receiver. The same constructional principles will apply in any case; so that even though a radical change in the layout is made there need be no sacrifice of efficiency.

The tuning condenser is a National Type SE-100 with several plates removed for band-spread-

and tuning condenser. The mounting for the coil socket is made from a piece of 1/16th-inch aluminum 2 inches by 2 3/4 inches, supported at each corner by brass sleeves 1 3/8" long bolted to the sub-panel.

The antenna coupling condenser is mounted on a 2-inch strip of bakelite which is supported above the sub-panel by two spacers sufficiently long to give ample clearance for the screws holding the condenser and antenna binding post. The con-

The drum dial is a National Type HS, which is the projector dial with special mounting brackets for the Type SE condenser. To the right of the condenser, as shown in the top view of the receiver, is the mounting for the coil socket, and just behind the latter is the mounting for the antenna coupling condenser and the antenna binding post. The reason for these two special mountings is obvious when it is remembered that the sub-panel is metal. There are really several reasons for the special coil socket mounting, however. First of all, with the type of socket used all the connections would have had to be made inside the sub-panel if the socket had been mounted directly on it; this was undesirable because all r.f. wiring should be above the sub-panel, insofar as possible, to isolate it from the other wiring. Raising the socket keeps the r.f. wiring above the sub-panel, and in addition makes possible short, direct leads between coil socket

denser itself consists of two strips of thin brass about a half inch wide, bent as shown in the photograph. One strip, a simple right-angle bend, is held in place by the antenna binding post; the other is fastened to the bakelite strip by a small machine screw and nut. This piece is bent around the vertical portion of the other strip in the form of a narrow “U.” The separation between the two is about 1/16th inch. Greater or less coupling may be desirable in certain cases; the larger the capacity of the condenser the greater is the signal strength, within limits, but as the capacity is increased the selectivity decreases, so that a compromise between signal strength and selectivity is necessary to suit individual tastes. In general, with a good-sized receiving antenna the condenser should be small; with a short indoor antenna more capacity is allowable. The size shown is satisfactory for a medium-sized antenna (length about 50 feet).
spreading the bands

To spread the various bands satisfactorily the capacity ratio of the tuning condenser must be adjusted for each band so that stations will not be unduly crowded. With a high-ratio vernier dial it is not altogether advantageous to spread the bands over too great a portion of the scale; beyond a certain point there is no gain in ease of adjustment, and the amount of time required to tune over a band is out of proportion to its width. This particular condenser and dial are designed for 270-degree rotation, with a 150-division scale. A spread of 50 to 75 divisions is ample for easy tuning — covering a band after a dial it is not altogether advantageous to spread adjustment, and the amount of time required to adjust for each band so that stations cause of the high vernier ratio of the dial — and division scale.

This type of tuning condenser is a particularly easy one to alter for band spreading, since the stationary plates can be removed without difficulty. The nuts holding the stationary plate assembly to the insulating strip on the front of the receiver should be removed; then the two screws holding the rear strip to the frame should be taken out and the stationary plates can be lifted out. The condenser as revamped for this receiver has two stationary sections insulated from each other. One consists of one plate alone may be used, or the two sections may be connected in parallel. With the single-plate stator only, the 7000- and 14,000-kc. bands will be amply spread on the dial scale, while with the two sections in parallel the 1750- and 3500-kc. bands will cover a goodly portion of the dial. The change from one condenser section alone to two in parallel is made automaticly by connecting a jumper between the coil-form prongs which connect to the two stator sections of the tuning condenser when the coil is placed in the socket.

The grid condenser and leak are mounted directly on the tuning condenser. This is done by removing one of the small 6/32 screws from the fixed condenser and fastening the condenser to the frame of the tuning condenser by one of the screws which holds the single stator-plate section in place.

SUB-PANEL WIRING

The detector tube socket is just behind the tuning condenser in the top view of the receiver. This tube has an individual tube-shield can. The audio amplifier socket is to the left of the drum dial, and the coupling unit is mounted on the sub-panel behind it. All connections are brought out to a

![Diagram](image_url)

FIG. 1.

Coil Data

<table>
<thead>
<tr>
<th>Band</th>
<th>L1</th>
<th>L2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1750</td>
<td>70 turns No. 32 s.c.c.</td>
<td>10 turns No. 38 s.c.c.</td>
</tr>
<tr>
<td>3500</td>
<td>32 &quot; No. 32 s.c.c.</td>
<td>&quot; No. 30 s.c.c.</td>
</tr>
<tr>
<td>7000</td>
<td>19 &quot; 4 &quot;</td>
<td>4 &quot;</td>
</tr>
<tr>
<td>14,000</td>
<td>3 &quot; 4 &quot;</td>
<td>4 &quot;</td>
</tr>
</tbody>
</table>

All coils are close-wound except the 14,000-kc. grid coil. The spacing between turns on this coil is adjusted until the band is covered. Spacing is approximately half the diameter of the wire.

The connections between the condenser and the coil socket are made as shown in Fig. 3. The single plate alone may be used, or the two sections may be connected in parallel. With the single-plate stator only, the 7000- and 14,000-kc. bands will be amply spread on the dial scale, while with the two sections in parallel the 1750- and 3500-kc. bands will cover a goodly portion of the dial. The change from one condenser section alone to two in parallel is made automatically by connecting a Yaxley cable socket, upon which are also mounted tip-jacks for the 'phones.

The arrangement of the parts and wiring underneath the sub-panel is shown in another photograph. All connections are made with flexible braid-covered "hook-up" wire, and it will be noticed that no attempt has been made to make the wiring "look pretty." The parts are so arranged that the few r.f. leads which come below the sub-panel are as short and clear of other wir-
ing as possible, and the leads to the heaters of the tubes and the dial light are as far from other wir­
ing as the necessary placement of parts will permit. These leads, carrying 2.5 volts a.e., are twisted to reduce hum troubles from stray a.e. fields.

The end view of the receiver shows two wires from the coil socket going through the sub-panel. These are the tickler leads, and they may be seen at the left in the bottom view. One, the B plus
side, goes to the plate by-pass condenser; the one below the detector tube socket in the screen-grid by-pass condenser. The r.f. choke is in the center. The cathode resistor for the '27 is at the extreme right, held in place by a home-made bracket. The by-pass condenser across the resistor is mounted between the r.f. choke and the front panel. The metal piece behind the r.f. choke is a bracket which rests on the table and serves as a mechanical support for the sub-panel.

under the sub-panel

The center-tapped resistor for the heater leads is mounted directly under­­neath the ground binding post. The small condenser to the left in the plate by-pass condenser; the one below the detector tube socket is the screen-grid by-pass condenser. The r.f. choke is in the center. The cathode resistor for the '27 is at the extreme right, held in place by a home-made bracket. The by-pass condenser across the resistor is mounted between the r.f. choke and the front panel. The metal piece behind the r.f. choke is a bracket which rests on the table and serves as a mechanical support for the sub-panel.

at the left in the bottom view. One, the B plus
side, goes to the 200-µfd. plate by-pass condenser,
and the other goes directly to the plate
terminal on the detector tube socket.

Aside from these two r.f. wires and the heater
leads, the arrangement of the parts and the other
wiring is largely a matter of getting things to fit
in. There are no particular precautions to be
observed in laying out the audio frequency
equipment and wiring or the “B” leads.

coil adjustments

The coils are wound on 5-prong manufactured
forms 1 1/2 inches in diameter. The specifications
given are not to be followed too religiously, be­
cause undoubtedly there will have to be cutting
and trying to get the bands to come within the
desired limits on the dial scale and to get smooth
control of oscillation. Probably the best plan to
follow is to wind each of the coils with two or
three turns more than specified; then, with the
detector tube and antenna which will be used for
regular reception, adjust the size of the antenna
coupling condenser for best results; following this
the coils themselves may be operated upon, if
necessary. Since the size of the tickler coil
affects the tuning range to some extent, it is well
to get the tickler fixed up first, after which small
adjustments may be made to the grid coil to get
the band on the dial. The coils should be adjusted
so that the center of each band comes at about the
center of the dial scale.

The adjustment of the tickler size is important
if maximum signal strength is to be secured. A
Type '24 screen-grid detector gives the best
signals when the actual voltage on the screen is
approximately 22. Therefore every effort
should be made to so adjust the tickler
that the voltage on the screen will be 22
and not 10 volts or 40 volts. This is
most easily done by first putting on a few
more turns than will be needed; then,
with the screen-grid lead connected to the
22-volt tap on the “B” battery or
eliminator (if the latter make sure that
the voltage is actually 22), take off tick­
er turns one at a time until the tube just
oscillates with the regeneration-control
resistor set so the resistance is all cut out.
This adjustment should be made with
the antenna and ground connected to
the set because more screen-grid volt­
age is required to make the detector
oscillate when the antenna is connected,
and the object is to find the correct num­
ber of tickler turns to use under normal
operating conditions. Then with 45 volts
on the screen-grid tap the regeneration
control resistor will be at about half scale
for oscillation.

The size of the grid leak will have some
effect on the smoothness of oscillation.
In general, louder signals and smoother oscilla­
tion control will result if the resistance of the
leak is as high as possible. 10 megohms is a good
value; with less than 5 megohms the signal
strength may drop off somewhat and the tube
is likely to go into oscillation with a thump instead of
“sliding” in.

the audio amplifier

Because of the high plate impedance of the
screen-grid detector ordinary audio coupling
transformers cannot be used, nor can the ‘phones
be placed directly in the detector plate circuit
without satisfactory results. The National Screen­
Grid Coupler used in this set is excellent for the
purpose. Resistance coupling may be used, of
course, in which case the resistor in the plate
circuit of the detector should have a value of
about 200,000 ohms. The signal strength will
usually be greater with impedance than resistance
coupling, and less plate voltage is required be­
cause of the smaller voltage drop through the
impedance. The values of Rs and Rs will be the
same with either resistance or impedance coup­
ing. A good coupling impedance for the plate
circuit of the '24 may be made by connecting the
primary and secondary of an audio transformer
in series; if this is done a good-quality transformer should be used. Peaked amplification may be used as well, substituting a tuned impedance for \( L_a \) — a manufactured peaking device such as the Aero Hi-Peak will function satisfactorily. A peaked amplifier will help out considerably in reducing hum if hum is noticeable.

Automatic bias, supplied by the resistor \( R_b \) in series with the cathode of the Type '27 amplifier, maintains the grid of the amplifier at the correct operating point. \( R_b \) does not seem to be very critical, and 2000 ohms is a good value. The audio by-pass condenser, \( C_{by} \), across the bias resistor may be omitted if desired, although its use increases the signal strength noticeably. It also increases the hum level in the same ratio, however.

The size of the r.f. by-pass condenser, \( C_{by} \), is likely to have a considerable effect on the signal strength. The reactance of a condenser of even .001-\( \mu \)fd. capacity (a common size of r.f. by-pass condenser) is low enough, compared to the impedance of the coupling device, to shunt a considerable portion of the audio energy away from the grid of the amplifier. \( C_{by} \) should not be larger than 250 \( \mu \)fd.

The shield about the detector tube requires some explanation, since it is not required for any reasons of receiver efficiency. When the set was first built a quite strong “induction” hum (distinctive as compared with filament hum because of its high pitch) was present — not a hum caused by a.c. operation of the tubes, since it was just as strong when the receiver was entirely d.c. operated. A little experimenting uncovered the cause. The house wiring itself set up a strong field to which the receiver was of course subjected. So long as the grid of the detector was connected to the filament through a high-resistance leak the induction hum was strong, although on shorting out the grid leak it disappeared. Naturally the hum could only be present when a difference of potential could exist between grid and filament, and the logical way to bring both to the same potential — with respect to the induction field — was to connect the grid directly to the filament, which obviously could not be done, or to shield the tube. The latter was done and the induction disappeared almost entirely. The only point of pickup at present is the short length of grid lead from the grid condenser to the cap of the tube. The pickup from this lead is so small that it was not deemed necessary to shield it.

ANTENNA EFFECTS

There are a few disadvantages resulting from coupling the detector tube directly to the antenna, most of which can be overcome with care. One of these is the effect of the antenna on receiver tuning. Unless the antenna is tightly strung and rigidly supported there will be a wavering in incoming signals when the antenna swings in the wind. This is unlikely to happen with an indoor receiving antenna. A change in antennas will almost certainly change the calibration of the receiver, even though the bands may still be entirely within the limits of the dial scale. If the antenna coupling condenser is fairly large the selectivity of the receiver may suffer. For distant reception with an oscillating detector this is no disadvantage, but it is important with ‘phone reception when the detector is not oscillating or if there are stations nearby whose signals are likely to “blot out” part of the band.

These things may be overcome in the receiver itself by the addition of an antenna coupling tube. On the other hand, the coupling tube adds comparatively little to the signal strength, and if the precautions with regard to the construction of the antenna and the coupling condenser are kept in mind little trouble will be experienced.

The question of “dead spots” is also important. If the fundamental or a harmonic of the antenna happens to resonate at some spot within the tuning range of the receiver it may be difficult, if not impossible, to make the detector oscillate in the vicinity of such resonance points. Lowering the capacity of the coupling condenser will generally help, although this often results in loss of signal strength on either side of the dead spot. The best remedy is to change the length of the antenna so that dead spots do not appear on any of the amateur bands. No exact specifications can be given, but a little experimenting with different antenna lengths will usually result in determination of a satisfactory length. When this has been done the regeneration control need hardly be touched to cover any one band unless it is desired to keep right on the very edge of regeneration.

While the set is built primarily for a.c. operation of the filaments, either batteries or “B” substitutes may be used for the plate and screen-
oddly enough, the amount of audible hum seems to be almost entirely a function of the entirely adequate for broadcast receivers or audio amplifiers, fall down miserably when used with short-wave receivers with oscillating detectors. This receiver works well with 135 volts of "B" batteries, and since the total current drain is only of the order of 5 or 6 milliamperes, the batteries will last a long time. In fact, the signal strength with only 90 volts on the detector plate is only slightly less than with 135. Some "B" substitutes give excellent results — if a well-filtered one is available a quick trial will show whether or not it is suitable. In one instance the hum with a particular "B" substitute was less than when batteries were used for the plate supply — probably due to some "hum-bucking" effect. One difficulty with "B" substitutes, however, even though they may be entirely satisfactory from the standpoint of hum elimination, is that variations in the line voltage may cause the signals to waver in the same way as a swinging antenna.

The amount of filament hum in the receiver seems to be almost entirely a function of the detector tube. Ordinarily the audio amplifier introduces no appreciable hum — if the audio tube alone hums it is a sign of a defective tube or wrong connections in the set. The center-tapped resistor across the heater leads eliminates most of the hum very effectively.

Detector tubes, however, will probably be found to vary considerably. With a good one the hum will be so low in volume that the 'phones have to be pressed tightly to the ears to hear it at all; with others it may be strong enough to be annoying. With average tubes the hum is usually so far below the signal and background level that it is not noticeable — in fact, it is usually necessary to disconnect the antenna to hear it with the tube oscillating. With some detector tubes it will be found that although a very weak hum may be heard with the tube not oscillating, this disappears entirely as soon as the tube goes into oscillation. With other tubes the reverse may be true. Since tube manufacturers are constantly striving to improve their product, it is reasonable to expect that less difficulty with hum will be experienced as time goes on. With only a small percentage of '24's will the hum be sufficiently strong to be bothersome unless the operator is excessively critical. The worst feature of a poor tube is the modulation it puts on the incoming signals. With such a tube no signals will be pure d.c.; if such is the case it is a sure indication that the tube is a "modulator" as well as a detector. Oddly enough, the amount of audible hum seems to be unrelated to signal modulation; a "modulator" tube may be perfectly quiet, and on the other hand a tube with a comparatively high hum level may not modulate the signals at all.

With this particular receiver, there was also a difference in the amount of hum either with or without a ground connection, so long as the center-tap of the filament resistor was connected to the metal frame of the set, to which the negative "B" is also connected.

The switch in the negative "B" lead is a practical necessity if a transmitter is used and the operator does not care to have his ears deadened every time the key is pressed. A filament switch would be of little value, since the tubes continue to operate for some time after the filament current is turned off, and the time required for them to heat to an operating temperature after the current is switched on would make practical communication impossible.

In conclusion, we can say without qualification that the signal strength with a simple set of this type will surprise anyone not familiar with the results obtainable with screen-grid detectors. Many amateurs claim that a screen-grid detector and one stage of audio amplification is the equal of a detector and two audio stages using Type '01-A tubes. Even if the gain is not so great as that, it is certain that two tubes in such a rig will give much louder signals than the corresponding "detector and one step" — with a much greater gain in sensitivity to the weaker signals.

**Strays**

W9FUR informs us that a very good map of the world can be purchased from the National Geographic Society, Washington, D. C., for one dollar. It is laid out in such a way that DX measurements are easily made.

The following was sent us from the *Erie Dispatch-Herald* of February 23, 1930, by Raymond Wagner:

"Sale — Aero call short-wave converter, must be water-heater; gent's bicycle, 30-inch wheels, child's auto, large wheels, an old-fashioned bed, Freid-Eisman radio and speaker."

Someone, please page Warshawsky.
Amateur Radio at Eastern States Exposition

By Clinton B. DeSoto

WHAT about that d.c. signal signing W1ESE you heard during the week of September 14th-20th last fall? It wasn’t listed in any call book and... you’re right! There’s a story behind it all. Here it is:

The call W1ESE derived both its initials and its existence from the Eastern States Exposition, “America’s premier industrial and agricultural exhibition.” The station, which was part of an extensive program of cooperation between Junior Achievement, Inc. and the A.R.R.L., was set up in a booth in Junior Achievement Hall, on the exposition grounds at West Springfield, Massachusetts.

Junior Achievement, as many of you may know, is a national organization that provides programs of work for boys and girls of cities and towns, along lines of industry, commerce and homemaking. The work it does for urban boys and girls is similar to that done in rural areas by the national 4-H Club groups. With these aims, and because of its extended field of activity, the inclusion of amateur radio as one of its constructive programs was logical, and the details of cooperation with the League together with a plan for development were first begun in April and May of this year, when Assistant Secretary A. L. Budlong and Mr. Frank W. Barber, Counselor in Field Service of Junior Achievement, held a series of conferences.

The other principal part of this program was the instruction of a selected class of boys gathered from all the Eastern states, between the ages of fourteen and twenty, in the art of amateur radio; teaching them the code, and delivering a planned series of talks by members of the Headquarters staff on the different portions of the course of study.

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WIESE AND THE OPERATING STAFF

Left to right: Phillip Gould, W1ALZ; John R. Blum, W8CKC, chief operator; Howard Barton, W8IH; Robert H. Peterson, W1LI; and the author. The big variable condenser in the lower right-hand corner is used in the tank circuit of the modulated final stage of W8IH, high-powered telephone at LeRoy, N. Y.
removal of the exhibit of which it formed a part, installed for the edification of such of the 300,000 people attending the Exposition as passed by our booth.

THE STATION IN DETAIL

WIESE was of necessity a low-powered affair, since its purpose was not only to supply an exhibit to arouse the interest of passerby and handle messages filed by them, but also to demonstrate to Junior Achievement members and leaders the simplicity and economy with which such apparatus could be effectively constructed. The equipment used was admirably suited for this.

The transmitter was the low-power push-pull set using receiving tubes built by George Grammer, Assistant Technical Editor, and described by him in the November issue of QST. Its output was fed into a Zepp antenna 132 feet long, strung between flag poles on diagonal corners of the roof of the building. The height was such that the vertical 45-foot feeders just reached the stand-off insulators on the transmitter to which they were attached.

The receiver was the little two-tube set designed by Ross Hull, altered according to the description which appears in the new 7th edition of the Handbook. Type '30 tubes were employed, their power being derived from two dry cells and one standard "B" battery. The ultimate in simplicity, wasn't it?

This receiver, while fully capable of bringing in signals at a comfortable volume when one of the Zepp feeders was switched in for an antenna, was needed for demonstrations, and was replaced in the station by W1LI's receiver, which had two audio stages and used Type '01-A's. Receiving conditions were quite terrible, of course. Our neighbors were the three ops retired to the dormitories provided by Junior Achievement, and the thousand and one other details of which it formed a part, installed for the edification of such of the 300,000 people attending the Exposition as passed by our booth.

With him was Howard C. Barton, W8IH, of LeRoy, N. Y. Robert H. Peterson, W1LI, came from Worcester, Mass., for the week, while Phillip C. Gould, W1ALZ, was down from Bangor, Maine.

These men came in response to a hurried call for volunteers sent out just before the event, after we had learned from Mr. Barber that he desired such assistance, and the localities from which he wished it to come. They did splendid work; each of them was a fine operator, and the way they handled WIESE, the remainder of the exhibit, and the thousand and one other details with which they were confronted, is worthy of commendation and hearty thanks.

The Exposition opened on Sunday, September 14th, at 2:00 p.m. On Saturday Ralph Beaudin and the writer loaded all the components of the station, a lot of Handbooks and other League supplies, into the w.k. flyer and set out for the grounds near Springfield, Mass. Clouds hung low and heavy in the sky; rain threatened momentarily; and after pleading hastily with a watchful traffic cop we parked and unloaded the equipment. That Zepp was put up in record time, with the clouds almost encircling our ears on top of the roof. As soon as it was all up the weather cleared away nicely.

The station was completed that afternoon, but there was time left for no more than two half-hearted and intellectural calls. On Sunday things opened brightly and continued so. Long before the official opening time the aisles were filled with people, and the amount of interest displayed in the exhibit was intensely gratifying. About the middle of the afternoon W8CKC and W8IH strode in, and were promptly set to work at the operating position. A little later Bob Peterson showed up, and stations were being worked. WIESE was on the air!

That evening at 10 o'clock the three ops retired to the dormitories provided by Junior Achievement, and proceeded to become children again — for a night! Cast ruthlessly into a wild, howling mass of hundreds of energetic boys between the ages of twelve and twenty, they settled down on their beds amid the demoniac din which reigned only to become targets for apples, tomatoes, numerous other sometime edibles, wet paper balls, soap and all the other playful gestures of friendly American boys, for an endless eight hours. The next night they moved!

Phil Gould might also have been in evidence that first night, but sad to state, calamity befell him, and it was not until the next day that he did stagger in. As has been said, our call to these, and other men was a belated one, and W1ALZ had not received the instructions he required to direct his activities upon arrival. As a result he wandered over the entire 175-acre Exposition grounds vainly searching for us all that night and part of the next day.

DECEMBER, 1930
A DISCUSSION ON CRYSTAL CONTROL

It was this same Gould of W1AZ who told us of a visit paid the radio shack on one of the Navy destroyers (name withheld by request!) and the ragchew with the op that followed. Gould gazed intently at various parts of the equipment, and then, pointing to the big transmitter, asked, "Do you use a crystal in that?"

The op replied indulgently. "Oh, no, we haven't used crystals for years. You won't find one in a Navy receiver anywhere!"

Gasping, but determined, Phil tried again. "I mean in the transmitter."

Clyde J. Houldson, Technical Information Service, outlined the use, construction, and operation of receivers, taking care also of the many other duties encountered during each day.

On the succeeding days transmitters, elementary theory and operating practice were gone over with the remnant of the class, and some of the preliminary work reviewed for a newly arrived group. The procedure of the organization provided for separate groups of boys and girls to be in attendance each half week, and this rendered the organizing of the course more difficult. All of the fellows reached are going to become splendid amateurs very shortly, though, and will help us immensely. Each of them returned to his club filled with enthusiasm for amateur radio, and it won't be much of a task for them to communicate that enthusiasm to their clubmates and neighbors.

Several New England amateurs stopped by the booth each day, and some very interesting personal contacts resulted. We had the pleasure of meeting W1AJJ on Saturday, a YL well known in New England who recently joined forces with W1AZW in a life QSO. Dozens of old-timers now off the air, stopped by, and so great was their interest in the little transmitter that many of them expressed their intention of getting back on the air soon.

While speaking of the transmitter, we can't (Continued on page 72)
Standardization in the Field of Radio Engineering

By Beverly Dudley*

The necessity of making, adopting, and using standards may be readily observed in everyday life, for standards and standardized products contribute materially to the wealth, convenience, and simplicity of our already-complex lives. The statement that a piece of paper is nine inches wide and twelve inches long immediately conveys a definite impression of a particular size of sheet to all those who hear the remark and who are familiar with the English units of measurement. The statement that a piece of paper is nine inches wide and twelve inches long immediately conveys the impression that the length of the inch does not vary, and that it is universally accepted, at least in English speaking countries.

A standard may be defined as "that which is established by authority, custom, or general consent, as a model or example," and there are a number of different kinds of standards. Standard weights and measures are perhaps the most common although standards may also be originated on nomenclature, uniformity of dimensions, methods of test, test procedure, safety precautions, etc. But whatever the type, in order that it be a true standard, it must be accepted and recognized as such by everyone having occasion to use the particular "standard."

In the field of radio engineering standards are as important — if not more important — as in any other technical or engineering field because of the complexity of the subject. Readers of QST who glance over a copy of Wireless Weekly or Experimental Wireless and the Wireless Engineer will immediately notice the unfamiliar terms such as "valve" for vacuum tube, "reaction" for regeneration, and "note magnification" for audio amplification, which are in common use in England. But it is not necessary to go to English publications to find terms that are unfamiliar, or whose meaning is obscure. Such terms as "power detector" and "linear detector," for instance, may have a very definite and limited meaning to a certain group of radio men; it may represent an absurdity to another group. A few terms, such as "microsynchronize" for instance, may mean nothing at all, except to the originator of the term, and even this is doubtful. To make system out of chaos and to assure that engineers and other technical men engaged in the radio field will all speak the same "shop language," it is necessary to use standard nomenclature and definitions and provide for standard tests and test procedure.

The necessity of standardizing nomenclature was early recognized by the Institute of Radio Engineers and in 1913 their first "Report of the Committee on Standardization" was published. This was followed by subsequent reports issued in 1915, 1922, 1926, and 1929, and at the present time the standardization project is progressing rapidly. Standardization is dynamic — not static — and it is continually necessary to revise and enlarge the scope of standardization reports to include new developments. Several years ago there was no necessity for including in the standardization report such terms as "photo-electric tube," "television," "tetrode," or "megacycle;" to-day these terms are frequently used.

The mechanical structure of the present standardization committees is given in Fig. 1, from which it will be seen that the standardization set-up is a fairly complex but entirely complete system. The structure may be divided into two parts, representing the two types of standards published. The left half of the diagram deals with the standards of the Institute of Radio Engineers; the right half of the diagram deals with "American Standards" as published by the American Standards Association. While this diagram would seem to indicate that there are in reality two radio standards, this is not actually the case; in the final analysis there is only one set of "American Standards," as explained below.

The Committee on Standardization, appointed by the Board of Direction of the Institute of Radio Engineers, has the power to make all Institute standards, subject to the approval of the Board. It is composed of men in all branches of the industry and in various parts of the world who are responsible for the Institute standards. The Committee is headed by Dr. J. H. Dillinger, Chief of the Radio Section of the National Bureau of Standards, who as Chairman of the Committee on Standardization is largely responsible for the work of the widely scattered Committee. The Committee as a whole, consisting of forty-six members in six countries, does not itself originate much of the work; several sub-committees, known

* Assistant Secretary, Institute of Radio Engineers, 33 West 39th Street, New York, N. Y.
as Technical Committees have been appointed to consider the technical points and to create the standards on four phases of radio communication: receiving, transmitting, vacuum tube, and electro-acoustic, devices.

The four Technical Committees are composed of a smaller number of men — usually about a dozen — than the main Committee on Standardization, and in general, the members of the Technical Committees are picked because of their specialized training and experience along definite lines. The Technical Committees gather, originate, determine and prepare the standards in their respective fields of activity, as well as in any related field of activity that may affect them. There is, naturally, some overlapping of the work of these Technical Committees, and a single subject, such as a vacuum tube oscillator for instance, may be considered and defined by two or more Technical Committees, each from a different point of view. The reports of the four Technical Committees are forwarded upon completion to the Committee on Standardization for rejection, criticism, comment, revision or acceptance. The Committee on Standardization correlates the work of the four Technical Committees, prevents duplication, makes sure that the definitions and standards are uniform and consistent within themselves as well as with those proposed by other Technical Committees, and circulates these tentative standards for comment and criticism. When the Committee on Standardization is assured that its recommendations represent a true consensus of engineering opinion, its report is brought to the Board of Direction for approval and for publication in the I. R. E. Yearbook as the standards of the Institute of Radio Engineers.

On the right half of Fig. 1 is the diagram showing the mechanical structure of the various committees for the generation, preparation and adoption of an "American Standard," under the direction of the American Standards Association. "The A. S. A. is a federation of forty-three national technical societies, trade associations, and governmental bodies whose chief purpose is to bring together manufacturers, distributors, consumers, technical specialists, and any others directly concerned with a particular standardization project; to assure that a preponderance of these interests wishes to have a national standard; to bring about the organization of a technical committee composed of official delegates of all important bodies interested to formulate the standard; and finally, when such a committee has prepared the standard and given it substantially unanimous approval, and the American Standards Association is definitely assured that the standard represents a real national consensus, to make it an "American Standard." A chief function of the American Standards Association is the judicial one of determining whether a national consensus has been reached.

Having determined that national standards on radio communication were desirable, and following requests from a number of radio organizations, the Bureau of Standards organized a conference on January 12, 1923, the result of which was agreed that the American Standards Association form a Sectional Committee on Radio. The Institute of Radio Engineers and the American Institute of Electrical Engineers were appointed by the A. S. A. sponsors for this standardization project in the field of radio engineering. The Sectional Committee is composed of representatives accredited for the purpose by various organized groups concerned with the project. The members of the Sectional Committee on Radio represent the following organizations:

American Institute of Electrical Engineers.
American Radio Relay League.
American Railway Assn. (Telephone and Telegraph Section).
Bell Telephone System.
Department of Commerce.
Department of Interior.
Institute of Radio Engineers.
Inter-Department Radio Advisory Committee
(Gov. Depts.).
National Assn. of Broadcasters.
National Electrical Mfrs. Assn. (Radio
Division).
National Electric Light Assn.
National Fire Protection Assn., and Under­
writers' Laboratories.
Navy Dept.
Radio Corporation of America.
Radio Manufacturers' Assn.
War Department.

It will be observed that this list includes bodies representative of practically all of the larger organizations likely to be interested in the standardization project on radio engineering.

Sectional Committees are made up of representatives, designated by various bodies concerned with the project assigned to the committee, and of additional specially qualified individuals. The Sectional Committee on Radio is, in general, concerned with the formal adoption of standards on radio matters and it may — and does — assign its work in whole to Technical Committees. It is essential that the completed work of a Sectional Committee shall be considered by all of its members and that their individual decisions shall be recorded and exhibited.

Four Technical Committees of the Sectional Committee on Radio, which correspond in name and function to the Technical Committees of the I. R. E. Committee on Standardization have been appointed to originate, gather, and prepare standards. The Sectional Committee on Radio is concerned with guiding and directing the work, and to a greater extent, of approving or rejecting the recommendations of the Technical Committees. The work of preparing the standards is carried on freely and simultaneously by the Technical Committees (and all other interested bodies) in order that the differing viewpoints of the several groups may be fully utilized and the most broadly suitable standards produced.

Although the diagram shows two distinct sets of standardization committees and two sets of standards — the I. R. E. and the A. S. A. — it should not be assumed that there are actually two independent and unrelated standardization reports. The I. R. E. standardization report relates specifically to the engineering side of radio communication and consequently is generally technical and somewhat limited in scope. The standards accepted by the A. S. A. must be acceptable to the representatives of the organizations as a whole, and the A. S. A. standard must represent a consensus of opinion of the greater portion of those actively engaged in the radio field before it may become an American Standard. But insofar as the standards relate to radio engineering, the A. S. A. standards are essentially the same as the I. R. E. standards and the A. S. A. looks to the Institute of Radio Engineers and the American Institute of Electrical Engineers, as sponsors of the radio standardization project, to vouch for the technical qualifications of the proposed standards. The A. S. A. standard is the final authority on commercial and engineering standards in this country (but should not be confused with the National Bureau of Standards which is the final authority on legal standards in the United States) and because its standards represent the consensus of a larger and more general group than the I. R. E. standards, there is more time required for an A. S. A. standard to be adopted and published than for an I. R. E. standard. The formulation, acceptance, and publication of the final standards applying to radio engineering are, therefore, seen to be somewhat long and drawn-out processes. While at first this might seem to be a decided disadvantage, in reality it is a most important advantage. Standardization can be carried out too quickly or too prematurely, and if this is done, more harm than good is done, for faith is lost in the standardization project.

And now that we have given an outline of the general method of formulating and adopting standards for radio engineering, let us inquire more into their use. The importance of standards is not fully appreciated by those having little occasion to refer to them, and for this reason, their importance is likely to be belittled by the vast majority who need them most. The reports of the Committee on Standardization of the Institute of Radio Engineers are available without cost to its members, and at a nominal cost to non-members. This report, issued every few years, is widely used by radio and communication engineers. It may have little direct importance to the amateur who is interested only in the proper design and operation of his station, but it does affect his station and operation, indirectly at least, for the technical articles appearing in QST frequently use these reports for obtaining exact wording and specifications for test methods. A practical example of this occurs in connection with "The Modulometer" in the August, 1929, issue of QST where the I. R. E. definition for modulation factor is employed. Frequent reference is made to the I. R. E. report even though no footnote calls attention to the source of information.

But in another way the amateur affects these standardization reports and is in turn affected by them, for the American Radio Relay League is represented in a number of subcommittees, Technical Committees, as well as in the Committee on Standardization and the Sectional Committee on Radio. The connection between the League and the Institute on the various committees pertaining to standardization is mutually beneficial, even though the direct and indirect effects may not be readily apparent to the general membership of the two organizations.
The Doublet Antenna
A Hertz Antenna With Two-Wire Matched Impedance Feed

By Clyde J. Houldson, W1KP*

JUDGING by the number of letters that come to the Technical Information Service desk, many amateurs are experiencing difficulty in coupling the push-pull transmitters— which have been described from time to time in QST—to the Hertz antennas that are generally used and really load each tube equally, which is the ideal condition when using tubes connected in push-pull. About the only suitable type of coupling that has appeared is the one which employs the "split" antenna coupling coil, as shown in the article "Advanced Transmitter Design" in June, 1930, QST. The single-wire fed type of antenna described by WSGZ in September, 1929, QST was an ideal one for use with a single tube in the output stage, but difficulty is experienced in coupling a push-pull transmitter to a single wire feeder.

The antenna system to be described uses a two-wire matched impedance feeder system which is quite suitable for use with push-pull transmitters, and is known as the "doublet" antenna system.

Success of this antenna system depends entirely on three important dimensions (referring to Fig. 1) namely the value C or coupling, E known as feeder clearance, and L, the length of the antenna. All three of these must be correct for the particular operating frequency and the only adjustment remaining is varying the taps on the plate tank inductance to secure the right load conditions.

HOW IT WORKS

The antenna proper is our old friend the Hertz. It is fed by a two-wire transmission line of any desired length and which is untuned. There are no standing waves; consequently there is practically no radiation or leakage from the feeders.

The feeders do not connect exactly at the current loop (center of antenna) but are tapped on slightly off the point where the current is a maximum. The purpose is to make the impedance across the output of the feeder system match the impedance of the transmission line, thereby securing maximum power transfer and at the same time eliminating radiation by the feeder system.

The adjustment of a transmission coupling to the antenna requires an understanding of simple single-phase transmission line phenomena. Any transmission line has a characteristic surge impedance which depends upon the size and spacing of the conductors composing it, and also upon the impedance of the terminating network. When the proper adjustment of the line is secured (at radio frequencies) it will act as a pure resistance connected across the output of the last stage of the transmitter.

As a rule the transmission lines used for radio frequencies have a characteristic impedance of 500 to 800 ohms. Generally, however, a 600-ohm line is most used, especially in commercial work.

For amateurs who wish to calculate the impedance of the transmission line in use, the following formula can be used and will give quite accurate results for an outdoor open transmission line:

\[ Z_0 = 276 \log_{10} \frac{2D}{d} \]

Where \( Z_0 \) is the characteristic surge impedance of the line in ohms; \( D \) is the distance between the center of the two conductors composing the transmission line; and \( d \) is the diameter of the conductors.

In using this formula distance between conductors and wire diameter must be in the same units (i.e., in inches or millimeters, etc.).

* Technical Information Service, A. R. R. L.

It can be said generally that the proper termination of a transmission line is one of the most important adjustments of the entire transmitting system, and will have a great influence on the efficiency of the station, affecting both the range and the quality of the signals.

By following the formulas very closely, the correct values can be obtained and perfect matching of impedances can be very nearly approached, leaving only the adjustment of the antenna coupling clips on the plate tank coil to complete the matching process.

The antenna coupling clips are connected an equal number of turns either side of the center of the plate tank inductance. To load the set the clips are moved along the coil (from center) until the tubes draw the normal plate current recommended by the manufacturers.

**CONSTRUCTION AND OPERATION**

After deciding on the frequency at which the system is to operate, the length of the antenna is determined. In order to secure maximum power output for a desired frequency the formula below can be used.

\[
L (\text{feet}) = \frac{492,000}{F} \times K \quad \text{or} \quad L (\text{meters}) = \frac{150,000}{F} \times K
\]

Where \( L \) (Fig. 1) is the antenna length in feet or meters for a desired frequency \( F \), and \( K \) is a constant depending on the frequency band. For frequencies below 3000 kc., \( K \) is 0.96

- between 3000 and 28,000 kc., \( K \) is 0.95
- above 28,000 kc., \( K \) is 0.94

\( F \) is the frequency in kilocycles.

The coupling or value \( C \) (Fig.1) must also be determined:

\[
C_{\text{test}} = \frac{492,000}{F} \times K_1, \quad \text{or} \quad C_{\text{meters}} = \frac{150,000}{F} \times K_1
\]
\( K_1 \) has different values for the various frequency bands.
\( K_1 = 0.25 \) for frequencies below 3000 kc.
\( K_1 = 0.24 \) " " between 3000 and 28,000 kc.
\( K_1 = 0.23 \) " " above 28,000 kc.
\( F \) is the fundamental frequency in kc.

The other remaining value is the feeder clearance \( E \) (Fig. 1), and it is important that this clearance be maintained when constructing an antenna of this type.

\[
E_{\text{test}} = \frac{492,000}{F} \times K_2
\]

\[
E_{\text{meters}} = \frac{150,000}{F} \times K_2
\]

\( K_2 = 0.30 \) for all bands and \( F \) is the frequency in kilocycles.

The above equations, as stated before, are for feeders having a characteristic (surge) impedance of 600 ohms and will not apply to feeders of any other impedance. An impedance of 600 ohms is standard in commercial work and is convenient and quite satisfactory for amateur use. The proper spacing of the wires composing the feeder system for a 600-ohm transmission line can be computed to a very close approximation by this formula:

\[
D = 98 \times d.
\]

Where \( D \) is the distance between the centers of the wires composing the feeder system and \( d \) is the diameter of the wire. If the diameter of the wire is in inches the spacing of the wires will be in inches, and if the wire diameter is in millimeters the spacing will be in millimeters.

For the convenience of both U. S. and foreign readers, the diameters of the various sizes of wire most used will be found as follows:

<table>
<thead>
<tr>
<th>B. &amp; S. Gauge</th>
<th>Diameter in inches</th>
<th>Diameter in millimeters</th>
<th>Nearest Equivalent British S.W.G.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 10</td>
<td>0.1019</td>
<td>2.58</td>
<td>No. 12</td>
</tr>
<tr>
<td>&quot; 12</td>
<td>0.080</td>
<td>2.03</td>
<td>No. 14</td>
</tr>
<tr>
<td>&quot; 14</td>
<td>0.064</td>
<td>1.63</td>
<td>No. 16</td>
</tr>
</tbody>
</table>

The wires composing the feeder system can be any convenient length that suits the particular location, successful operation with feeders 1200 feet long being quite common. Since the majority of amateurs reside in cities, where space for an antenna is usually at a premium, it is not expected that many amateurs will have to exceed this length.

The formulas are practically self-explanatory — but probably one example would help. Suppose the antenna's fundamental frequency is to be 3500 kc.

First it would be necessary to solve for the antenna length.

Substituting the proper values in the formula,

\[
L(\text{test}) = \frac{492,000}{3500} \times .95
\]

\[
= 133.54 \text{ ft.}
\]

Next we would need to solve for the coupling \( C \) for 3500 kc.,

\[
C(\text{test}) = \frac{492,000}{3500} \times .24
\]

\[
= 33.73 \text{ ft.}
\]

Next would be the feeder clearance:

\[
E(\text{test}) = \frac{492,000}{3500} \times .30
\]

\[
= 42.17 \text{ ft.}
\]

In this example, we will use No. 12 B & S enameled wire, which has a diameter of 0.080 inches. Therefore the spacing of feeders should be

\[98 \times 0.080 = 7.84 \text{ inches}\]

Therefore you have the complete data for an antenna suitable for operating on 3500 kc. Re-
SPVPractical diagrams are given in Fig. 1 showing the necessary where the circuit plate-filament capacity is hardly necessary with a Type 52 tube (which has a negligible plate-filament capacity) but should be used with tubes having appreciable circuit plate-filament capacity — including socket and wiring capacity. A capacity of about 10 µµfd. or so will usually suffice.

Fig. 3 shows the connections when using two tubes in push-pull as the final stage. In both cases the positive high voltage is fed in at the center of the plate tank inductance and the usual r.f. by-pass condenser is connected there. This places the center of the tank coil at ground potential with respect to the r.f., both ends of the coil being "hot."

In all diagrams the antenna blocking condensers have a capacity of 2000 µµfd. These fixed condensers should have a voltage rating which is somewhat higher than the plate voltage used on the output stage. This is advised for several reasons. As a rule the negative high voltage is grounded; therefore, if the transmission line should become grounded or the insulation of the antenna system fail, condensers having a low voltage rating would invariably blow and thus short the d.c. power supply. The use of the condenser is not only a safeguard to the station equipment but also to life, because if the condensers were omitted, anyone coming in contact with the transmission line or antenna would probably receive the plate voltage used on the last stage, through his body to ground. On high power installations this might result in very severe shock or even death. By using the condensers, r.f. only exists on the transmission line while the transmitter is operating. This is not as dangerous as the high-voltage direct current used at some stations. The use of the coupling condensers is especially recommended to amateurs who live in apartment buildings, where the transmission line as a rule must take a long circuitous path to reach the roof where the antenna is located.

Fig. 4 illustrates the method of connecting this type of feeder to the output of a transmitter when it is impossible to arrange the plate tank circuit to give the required balance. The feeder tank circuit will be similar in construction to the usual transmitter tank circuit. As with the other arrangements, the clips are adjusted symmetrically on either side of the inductance center until the maximum power is being transmitted to the antenna. This will occur, of course, when the impedance across the feeder input is equal to the surge impedance of the transmission line.

As stated before, best results will be obtained when each tube draws an equal value of plate current. This condition is desired particularly when operating two tubes connected in push-pull in a radiophone transmitter. The arrangement shown in Fig. 5 will easily accomplish this. An extra filament transformer (or winding) will be necessary. A milliammeter to measure the plate current of each tube can be used or a jack can be
placed in each negative return circuit so that the current of either tube can be read merely by inserting the milliammeter plug into either jack. This will require only one plate current milliammeter. The use of two meters is of course the ideal method; but the plug and jack method can be used to accomplish the same thing (i.e.) balance the plate current drawn by each tube. Grid current meters also may be connected in the grid circuit as shown in Fig. 5. This helps a great deal in the adjustment of the grid excitation dips which connect to the tank coil of the preceding stage. The excitation can be adjusted until the grid current for each tube is identical.

When the grid current has been balanced, the plate voltage can be applied to the last stage. Then the antenna coupling clips are adjusted until an equal value of current is flowing in each plate circuit, indicating that the load is balanced and that each tube is carrying its share of the load.

For an arrangement of this sort, it is essential to use "matched" tubes or tubes which possess identical characteristics. If this is not done, trouble will be experienced in balancing the plate input to each tube, even though the grid excitation of each is the same. This arrangement is usually termed a "balanced push-pull amplifier" and is especially recommended for use in the Class B linear amplifier stage of a 'phone transmitter. It is also quite suitable to use in the final stage of the better class of code transmitter.

A FEW PRECAUTIONS

Certain factors must be kept in mind when designing a Zeppelin or single-wire fed Hertz and the same holds true for the doublet antenna. These important factors have been pointed out in the discussion and it is urged that they be adhered to or else the system will not operate on the desired frequency or fail to operate entirely.

As shown in Fig. 6 the feeder system should never follow the antenna back to the point where it enters the "shack." It can be safely said that nine out of ten of the amateurs experiencing difficulty with the single-wire fed Hertz and writing into the Technical Information Service were using the general arrangement shown in Fig. 6. This is not recommended under any circumstance. The feeder should run straight away from the antenna for at least 30 percent of one-half wavelength as shown in Fig. 7. From there the feeder can continue in any direction to the shack and transmitter. The same applies to the doublet antenna, and the arrangement shown in Fig. 8 is not recommended. It is very important that the feeders run the required distance as shown in Fig. 9. This is to prevent interference of the feeder with the radiation of the antenna, and vice versa.

Many amateurs who live in cities are constantly writing in saying that they are pressed for room to erect a half-wave Hertz antenna for operating on 3500 kc, and that they desire to use a bent type of antenna. This is all well and good as many city apartment dwellers use the bent type and secure very good results. However, if you find it necessary to employ the bent type at your location because of lack of room, remember it is always best to steer clear of sharp angular bends in the antenna. If bends are absolutely necessary make them well rounded ones. However, the best results will be obtained if the horizontal part of the antenna is one straight run. The bent type should be used only where the space available does not permit the straight-run type.

Although this type of antenna system may be operated at harmonics of its fundamental frequency with some degree of success, its characteristics are more particularly suited to operation at its fundamental frequency only.

When designing a system of this type it is urged that one of the wire sizes that is shown be used. Also use the spacing of feeders, coupling, feeder clearance, etc., that are correct for the desired operating frequency.

This type of antenna has been used by a number of amateur stations and also is used with success in several commercial high-frequency communication systems.

Strays

W9DOS sends us one of those "Believe it or not" cartoons showing a century plant which grew 30 feet in ten weeks out in San Diego. He wants to know where to obtain seeds for such a plant. So do we. Any of you Californians have any dope on this? We want to raise some masts.
The old familiar heading reappears after many years. While not planned as a monthly department, from time to time QST will present brief sketches of some of those amongst us whose activity in amateur radio has made them of general interest to our readers. We have pleasure in presenting this month two members of the Board of Directors of the A.R.R.L., and it just happens that they are the oldest and the youngest members of that body. Permit us:

Allen H. Babcock, Consulting Electrical Engineer of the Southern Pacific Company with offices in San Francisco, is the Director of the Pacific Division of the A.R.R.L. He was first elected to the League's Board in 1923 and has been constantly returned to that body by his members ever since. He lives in Berkeley, across the Bay from San Francisco, where he owns and operates W6ZD.

Mr. Babcock was born at Buffalo, N. Y., August 12, 1865. His education was received in the public schools of Oakland, Calif., at Phillips Exeter Academy, the University of California and Lehigh University. He has had a long career in electrical engineering, commencing in 1891 with the Thompson-Houston Electric Co. at San Francisco.

Louis R. Huber, retiring director of the League's Midwest Division, was born at Tipton, Iowa, on January 10, 1908, and his age is therefore exactly that of the average of League membership.

His start in radio came at the age of eight, gathering bits of wire, à la Skeezix, while the telephone men were at lunch. The inevitable half-inch spark coil was acquired at the age of ten, fond parents giving the use of the barn for station purposes if Marconi would promise not to bore too many holes in the wall. The invitation was accepted, the promise as inevitably broken. Three years later the government licenses were secured and 9DOA was on the air with a ½ k.w. Packard and rotary, only to be displaced in 1922.

(Concluded on page 78)

(Concluded on page 88)
A New Type of Crystal Holder

By C. W. Klenk, W9AAU-W9ZK*

SOMETIME ago, when it was decided to adopt crystal control on the transmitter at W9ZK, difficulty was experienced in finding a suitable device to hold the crystal properly and at the same time to allow changing the crystals by the “plug-in” method. Nothing on the market was found to be quite satisfactory. Therefore it was necessary to devise a holder that would meet the conditions. With the aid of my dad, Dr. C. L. Klenk of W9AAU-W9ZK, a device was evolved which was in every way satisfactory. Because it worked out so well the writer desires to pass the idea on to the amateur radio fraternity.

The holder, plugged into the mounting, is shown in a photograph. As the mounting base

was made to conform to certain specifications peculiar to the equipment at W9ZK, the writer will not waste space or time describing it. The pictures give an idea of its appearance anyway.

This mounting is ideal in that it is possible to secure a micrometer adjustment of tension on the crystal. Also it is possible to adjust to allow an air space between the upper plate and the crystal which is ideal for shifting the frequency a slight amount. The crystal is protected from dust and dirt and remains permanently adjusted. The holder is rugged enough to allow dropping, but since the crystal is quite fragile it is not advisable to make a habit of this.

One photograph shows the holder with its parts disassembled. In Fig. 1 is a detailed assembly drawing showing a plan view and a cross section of the elevation as well as the complete specifications.

The holder comprises a bakelite base, an inverted “U” bracket, two pieces of felt, two ground brass plates, a thumbscrew and lock nut for adjustment, a piece of bakelite tubing, a bakelite cover, and two G. R. plugs. The base is machined in a lathe from half-inch sheet bakelite, rounded and hollowed out to take the end of the short piece of tubing. This tubing is cemented in place. Into the bottom of this cup is placed a piece of good quality felt cut to conform to the inside diameter of the tubing. Over this felt is placed a disc of brass of the same diameter, which has been turned out and cut to size, the top surface having been ground flat and smooth. On this brass plate is placed another piece of felt of the same size and quality only it has a hole cut

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† For details of this feature see “QSY With Crystal Control,” QST, September, 1930.
in the center to provide space for the quartz crystal. The hole should be cut slightly larger than the actual dimensions of the crystal to allow for sideward expansion of the felt when it is subject to the compressive force of the thumbscrew. Over the crystal and part of the felt is placed the top plate, made of brass with the under surface ground perfectly smooth. The top of the plate tapers from the edges to the center and in the center a recess is made to take the tip of the thumbscrew. The bakelite cover (with a hole cut through the center to allow passage of screw shank) is then placed snugly on the top of the bakelite tube. The inverted "U" bracket is fastened to the base of the holder. The screw is placed through the threaded portion of the bracket and turned down until it engages with the recess in the top of the upper plate. Following this the screw is tightened until the crystal is properly held in place. The lock nut prevents the thumbscrew from loosening and allowing the crystal to get out of adjustment.

The two G. R. plugs are fastened under the bakelite base. One is connected directly to the brass bracket which makes a connection to the upper plate. The other is connected through the base by a flexible lead to the lower plate.

The piece of felt surrounding the quartz plate regulates the amount of tension. Turning down the thumbscrew compresses the felt and brings the upper plate nearer to the crystal. Turning the screw in the opposite direction releases the tension on the felt and it expands, pushing the upper plate away from the crystal. By this method the desirable air space between the crystal and the upper plate can be obtained with very close precision. The felt placed under the lower plate acts as a cushion for the whole assembly and also tends to keep the surfaces of the two plates parallel to each other. Any small inaccuracies as the result of grinding are compensated by this means.

In building this type of holder extreme care must be taken in getting parallel surfaces on the upper and lower plates. Accurate machining and then careful grinding are absolutely essential in securing the desired results. The two plates may be ground by hand, rubbing them together and using fine valve grinding compound as a grinding medium. After the grinding is completed the plates are polished with jeweler's rouge. Then each part of the holder must be cleaned thoroughly to remove all traces of grease and moisture, especially from the surfaces of the ground plates. It is advisable also to clean the felt pads thoroughly. A very convenient cleaner is carbon tetrachloride, commercially known as "Carbona." It is a non-combustible, quick drying liquid which can be obtained in nearly all drug stores for about forty cents a pint.

This type of holder has only one drawback; it does not readily lend itself for use in a thermostatic oven which is used to keep the crystal at a constant temperature. Unless the frequency is close to a band limit, however, fifteen to twenty degrees variation in temperature does not cause a serious change in the frequency at which the crystal vibrates, at least as measured by the change in dial setting on the average short-wave receiver. The advantages of this mounting are so numerous as to overcome this one small drawback. However, we are working on a crystal holder for use in a constant temperature oven and as soon as we have successfully completed it we shall present a description of it to the amateur fraternity.

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**Changes in Regulations**

THE Federal Radio Commission on September 22d last made two amendments in its General Order No. 84 which contains the regulations for amateur stations, as published in QST for May 1930, page 16.

The first of these is of no importance, being the transposition of paragraphs (f) and (g) of Section I.

The other change eliminates the text of Section IX, providing for the routing administration of amateur stations by the Radio Division of the Department of Commerce, acting in the name of the Commission. It substitutes the following new text: "These regulations shall be administered in

(Continued on page 84)
THE present W1MK is relatively well known to League members everywhere in view of its regular operation and prominent part in different A.R.R.L. activities. This was not so with the modest station to represent Headquarters which went on the air about six or seven years ago for the first time. At that time the League was located in the downtown business section of Hartford at 1045 Main Street and this early station was situated in the old Traffic Department office.

The first set-up, while an example of satisfactory design for the day and time, would fail to meet a number of the present-day requirements. Four UV-202 tubes were paralleled in a Hartley rig. An edgewise-wound coil of copper strip ten or more inches in diameter was used. With the tuning condenser practically "out" the set got down to about 77 meters. An m.g. power supply and an antenna well in the cellar were the bright spots in this arrangement. Of course the frequency stability was nothing like what we can get in modern transmitters but it sufficed for pre-historic times—or at least no criticism was offered. This outfit

![Image of ARRL HEADQUARTERS STATION W1MK]

The receiver and an accurate synchronous electric clock are directly in front of the operating position. The key and all control switches necessary for full operation of the station are just at the right, together with the telephone and the listening monitor. Messages are filed in the box at the left so that they may be located without interrupting the keeping. The two transmitters shown at the left may be keyed simultaneously in sending information addressed to all League members, or they can be worked separately.

The L.P.G. transmitter on top of the table normally works on 3675 kc., although interchangeable coils are provided for operation in other bands. The large indelible panel which shows up prominently in the foreground is the new oscillator-amplifier transmitter usually operated crystal-controlled and capable of 800 watts output with a high degree of frequency stability. This transmitter is used for 7600 and 14,000-ke. work.

The temperature control box for the crystal is located on a shelf below the table just to the right of the new transmitter. The General Radio precision frequency-meter is at the extreme right.
was operated by volunteer staff-member operators during the noon hour each day.

The reason for the establishment of this station was the growing need for collecting Hartford-bound radiograms which must otherwise be mailed in from outside points. At that time 3500 kc. was comparatively new territory so there was ample daylight operation on this frequency. No one at Headquarters was much interested in the DX possibilities of this makeshift equipment so there was practically no operation outside the noon-hour period. Nevertheless, this low-power 77-meter station got across to a fellow ham in the Netherlands for at least one satisfactory contact before the set was dismantled — not a bad record for the power and frequency used, even today. (The experience is well-remembered by the writer since it was necessary to show the Dutch QSL to some of the skeptics about the office.)

When Headquarters moved into larger offices at 1711 Park Street in April of 1928 the little set went along too. However, it was soon to be supplanted by a more powerful outfit using two fifty-watt tubes. This in turn was replaced by a single 250-watt tube with self-rectified power supply. These transmitters were allotted space in the Circulation Department. The location was such that visitors and clerks often yielded to the temptation of twisting dials, thus throwing the outfit out of adjustment — or worse, off frequency, although this did no damage since the antenna was invariably off-tune. The transmitter received unintentional jolts and jars from the nearby addressing machinery and from handling of heavy bundles of QST's and often went haywire because of experimentation. The operating desk was in a conference room somewhat removed from the transmitter. When the keying relay would stick, the unlucky operator might frequently have been seen dashing wildly across the corridor, slamming doors and getting at the set in the Circulation Department to correct the difficulty.

Several volunteer operators, each keeping once-a-week "tricks," kept this station on the air for a considerable time. Evening schedules were attempted in addition to the noon-day shifts. To assist neighboring broadcast listeners who had the infamous single-circuit receivers two score or more wavetaps were distributed with effective results and a fixed cooperative policy was established. The location was nevertheless impractical for satisfactory communication work. Interference from buzzers, dial telephones, dictaphone motors, street cars, a theater sign flasher, battery charging station, some beauty-parlor violet-ray generating equipment, and other equally incurable interference sources made operating unpopular and sometimes well-nigh impossible. It was hard for amateurs in radio contact with Headquarters to believe the interference was as bad as indicated by the operator, but listening in to-day will still show a remarkably high noise level.

The Board of Directors reviewed the whole matter of Headquarters' Station operation at its 1927 annual meeting, considering the existing makeshift equipment, the unsatisfactory location and determining the policy to be followed. The Communications Manager was ordered to proceed with the installation of a powerful station in a suitable location where it might be operated effectively and be of genuine service to the amateur fraternity as well as a credit to Headquarters. It is a result of this Board order that we have the fine equipment and installation that has become so well known since it was placed in operation in February, 1928.

Several possible locations were examined and rejected before a location at Brainard Field, Hartford's airport and one of New England's best flying fields, was chosen. The existing apparatus was taken down and the inferior parts discarded. Wherever possible, parts were set aside to be built into the new station. The best quality procurable in all kinds of equipment was desired but the size of the installation job made economy an important consideration. A good friend of amateur radio who had long desired to see a top-notch station on the air at Headquarters donated a substantial part of the power supply equipment, the three-unit Esco motor-generator that has given such a good account of itself. This machine consists of a two-h.p., two-phase, 220-
volt motor, a 2000-volt 750-milliampere generator, and a 15-volt exciter which furnishes both field current for the generator and filament current for several Type '04-A tubes.

A three-section telescoping wood mast with a ladder-like main section to facilitate climbing was put up to support the far ends of the antennas. The height of the mast was made the maximum permitted by the "gliding angle" which must be maintained to permit landings without danger at every flying field. Two horizontal Hertz-type antennas were erected, both well in the clear, one supported at the near end on a brick chimney and the other supported at the near end on a short mast on the Communications Section building. One antenna is a half-wave 3575-ke. affair, the other a full-wave 7150-ke. antenna. These frequencies were chosen in harmonic relation, the 3575-ke. frequency as a "marker" or beacon to assist radiophone amateurs in complying with the regulations and locating their transmissions in the assigned 3500-3550-ke. phone band. Two-wire voltage (Zepp J feed is used to both antennas, the feeders in each case being a single quarter wave-length in length. A separate receiving antenna is provided to facilitate break-in when conditions permit and to eliminate the necessity for changing antennas on the receiver.

POWER SUPPLIES

Within certain limits radio equipment can be accommodated to different building arrangements. Once a satisfactory location is found where there is room for antennas to be erected in the open and the noise level is low enough to make good reception possible, a study of the physical arrangement is unnecessary. One should separate the transmitters and power supply equipment from the receiving and operating location as much as practicable. Remote control would be ideal where break-in operation is desired but since the best of apparatus sometimes breaks down the transmitters and power supplies must be within a moderate distance. In our particular station space considerations have almost dictated the placement of apparatus.

Two rooms were available for all equipment. Only one had enough light and offered enough space for the operating position, so from the first it was evident that generators, batteries, relays and all messy or noisy power supply or auxiliary equipment should be relegated to the smaller back room. This room was not large enough to take care of the transmitters, as was desired, to get them away from the receiving tuner; in addition the proposed equipment for our 1928 station had to be accessible so that the frequency of one or both transmitters might be changed at will, both from band to band and slightly to avoid interference. Thus our transmitters were placed on the bench with the receiver, though with some trepidation in view of the power involved.

To insure continuity of operation two different types of power supplies were installed, one to be used with each transmitter normally, but either capable of handling both sets simultaneously in case of need. Although the photograph which shows the power room and apparatus is not a recent one it gives a good idea of the equipment. Above a cabinet for supplies is the charging panel for the batteries which operate the receiver, monitor, and several different six-volt relays. The light radio-type storage cells have been replaced by husky banks of Willard stationary-type glass-encased cells which stand up better in heavy-duty service. Cabinet, charging panel, and high voltage generator are supported on a heavy steel frame. The rotating machinery is supported on cork to absorb vibration, and is mounted well above the high-water mark reached by our last New England flood. At the left is the switch which throws 220 volts on the driving motor for the high-voltage machine when actuated by the six-volt relay mounted in the same box. The large
metal box mounted on the wall is of 1/4" steel. This cabinet is full of high and low voltage fuses, switches, six-volt relays, keying filters, center-tapped resistors and numerous other auxiliaries indicated in the power supply diagram, in addition to its main purpose, which is to house the mercury-arc rectifier, all its auxiliary keep-alive circuit equipment, the "bleeder" resistance and several component parts of the filter system.

During 1929 a pair of Type '72 rectifier tubes were added and used for a time. These could be used interchangeably with the mercury-arc rectifier equipment and offer certain advantages in neatness, quietness in operation and compactness, but it became apparent that once the initial investment in accessory equipment for the mercury-arc circuit had been made, replacement of the Tungars in the keep-alive circuit and of the arc itself could be made at a lower cost. Because of this operating economy the original arc-rectifier equipment is still in use.

Many amateurs have found a common difficulty in the use of mercury-arc rectifiers to arise from the "hash" set up by inductive kicks due to the interruption of the current in keep-alive circuits which makes reception impossible unless the arc and transmitter are some distance away. At W1MK there is none of this trouble since the arc is 100% shielded in the grounded iron cabinet, and even the control leads run through about sixty feet of conduit, also grounded. It is impossi-

![Diagram](https://example.com/figure1.png)

**FIG. 1. — POWER SUPPLIES AND CONTROL EQUIPMENT**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>Filament transformer for '04-A's</td>
</tr>
<tr>
<td>T₂</td>
<td>1-kw, transformer with tapped secondary for regulating primary voltage on high-voltage transformers</td>
</tr>
<tr>
<td>T₃</td>
<td>2-kw, transformer, 110-2200 volts</td>
</tr>
<tr>
<td>T₄</td>
<td>Filament transformer; for '72's</td>
</tr>
<tr>
<td>T₅</td>
<td>Keep-alive transformer, secondary voltage 60, center-tapped</td>
</tr>
<tr>
<td>L₆</td>
<td>30-henry choke</td>
</tr>
<tr>
<td>L₇</td>
<td>Solenoid for tapping arc</td>
</tr>
<tr>
<td>L₈</td>
<td>Keep-alive choke, 2 henrys</td>
</tr>
<tr>
<td>L₉</td>
<td>Keying choke, 13 henrys</td>
</tr>
<tr>
<td>C₁</td>
<td>5-mfd.</td>
</tr>
<tr>
<td>C₂</td>
<td>2-mfd., 1000-volt condenser</td>
</tr>
<tr>
<td>R₁</td>
<td>Generator field rheostat</td>
</tr>
<tr>
<td>R₂</td>
<td>Filament rheostat for '04-A's</td>
</tr>
<tr>
<td>R₃</td>
<td>Center-tap resistor, 75 ohms</td>
</tr>
<tr>
<td>R₄</td>
<td>2000 ohms</td>
</tr>
<tr>
<td>R₅</td>
<td>30 ohms, adjustable by clip</td>
</tr>
<tr>
<td>R₆</td>
<td>15-ohm rheostat</td>
</tr>
<tr>
<td>A₁</td>
<td>0-4 amp, d.c. ammeter</td>
</tr>
<tr>
<td>B₁</td>
<td>Starting relay for generator</td>
</tr>
<tr>
<td>B₂</td>
<td>Line relay for power transformers</td>
</tr>
<tr>
<td>B₃</td>
<td>Line relay for keep-alive transformer or '72 filament transformer</td>
</tr>
<tr>
<td>B₄</td>
<td>Keying relay and spare</td>
</tr>
<tr>
<td>B₅</td>
<td>Solenoid relay for arc-starting mechanism</td>
</tr>
</tbody>
</table>

During 1929 a pair of Type '72 rectifier tubes were added and used for a time. These could be used interchangeably with the mercury-arc rectifier equipment and offer certain advantages in neatness, quietness in operation and compactness, but it became apparent that once the initial investment in accessory equipment for the mercury-arc circuit had been made, replacement of the Tungars in the keep-alive circuit and of the arc itself could be made at a lower cost. Because of this operating economy the original arc-rectifier equipment is still in use.

Individual capacity units in the filter system can be removed by operating the "disconnect" switches that are in series with each condenser. On occasions when there have been troubles in the filter system this has made it possible to remove quickly the defective unit without any great delay in normal operating schedules. All equipment in a station like W1MK gets severe service and must be rated for continuous operation. We prefer to service the equipment and locate troubles outside of operating hours and have therefore
installed plenty of fuses and "disconnect" switches for the isolation and ready location of trouble which is always sure to crop up sooner or later where many circuits and parts must function simultaneously.

Two 50,000-ohm 44-watt resistors in series across the 2000-volt filter system improve the regulation and protect filter condensers from ripples and transients, at the same time protecting the operator from some deadly "jolts" by draining the charge off the condensers at the instant the high-voltage transformers are taken off the line.

Three two-inch conduits contain all the wires connecting the power-supply equipment, low, high, and intermediate voltages, to the apparatus in the operating room.

STATION EQUIPMENT

The best obtainable electrical and mechanical construction was desired in the transmitter for the new station made possible by the Board's action. The main unit must be capable of working in different amateur bands; it must meet certain further specifications, as must also the second transmitter or auxiliary, although the requirements for these were easier to meet.

The t.p.t.g. transmitter shown in the photograph, using two Type '04-A tubes, was obtained as the best answer to the first problem. This set is extremely flexible and with a little experience any amateur can change frequency from band to band quickly and easily once the proper settings have been determined. Ruggedness in construction insures long useful life. Electrically self-controlled, the circuit (shown in Fig. 2) is very simple as well as immune from most of the troubles which may be expected with a multi-stage transmitter. Such a set is ideal for quick frequency changing, break-in operation, etc. Equipped with adapters for Type '52 tubes it can be made to work at 14 mc. The limitations of '04-A's make it desirable not to attempt operation on frequencies higher than 7 mc., since the circuit will become unstable in the vicinity of 14 mc. unless special precautions are observed, and in any case tube life may be shortened.

When this t.p.t.g. transmitter was first placed in operation at Headquarters one unusual trouble was noted. Good results were obtained except that at 3575 kc. after the first few dots and dashes had been transmitted the note became a perfect 500-cycle modulated affair. Everything was overhauled from power supply to filament bypass condensers, without result. The transmitter was suspended on cushioned shock absorbers—still no result. Finally, in desperation, after some weeks of looking for the "perfect d.c." it was found that insertion of rubber strips between each turn of both the plate and grid coils effected an absolute cure. Some wooden clamps were procured and provide the permanent remedy to this day. Apparently the interaction of the fields of the plate and grid coils was sufficient to start a mechanical vibration, which occurred only with the multi-turn coils used for the 3575-ke. frequency. Of course this would never have been noticed with a modulated power supply. For a simple difficulty it occasioned quite a lot of frantic trouble-shooting!

An auxiliary transmitter, a simple High-C Hartley circuit using one Type '04-A, was constructed and placed permanently on 7150 kc. for use mainly during simultaneous transmissions of general information for members.

A completely rebuilt receiver was installed at the new station and served for most of 1928 operation. It was partially but not completely shielded. As one visitor tactfully put it, "the r.f. from the transmitter didn't do it any good." But though the tube life may have been short, the sensitivity was good and many successful contacts were put through with its use.

A General Radio Precision Wavemeter was added to other equipment as a practical necessity for keeping the station on frequency.

PROGRESS

In any station the best of equipment will wear out or become obsolete. Modern stations will remain modern only if those behind the station exert themselves. The history of this station, like that of most every really worthwhile amateur station, is a story of continuous improvements.
In most amateur stations it is a simple matter to shut down to rebuild or experiment. Not so with W1MK. The station has very definite responsibilities to the membership and every effort has been made to make operation every scheduled night go off just as per schedule — with a few extra nights of operating thrown in for good measure. At the same time constructional projects have not been neglected by any means.

FIG. 3 — W1MK RECEIVER

A listening monitor and a new receiver were recognized as necessities of the first water. These were built by the writer and by “RP” respectively and placed in operation in the station early in 1929.

The circuits of both monitor and receiver are shown. Both instruments are built in aluminum cabinets. The monitor consists of a detector and two-stage amplifier, and is provided with a regeneration control. It is in reality a rather complete receiver, lacking only an antenna coupling coil. External batteries are normally connected for operation of the listening monitor by the Yaxley cable-plug which is located in the rear center. Additional “A” and “B” dry-cell batteries are fastened to an aluminum shelf inside the monitor with brass straps and may be used for operation as a 100% “portable” monitor or receiver, and are connected in the circuit by throwing two double-pole double-throw switches. A single additional tube is provided in a crystal oscillator circuit, and a shelf with switch-jaw elements makes it possible to plug in a crystal for monitoring or measuring purposes.

The new receiving set requires little explanation. It is completely shielded and all power supply leads are by-passed, which results in very low r.f. pick-up from the powerful transmitters which are adjacent. A noticeable improvement in tube life, and more important, a reduction in noise level, resulted from the installation of the new receiver. As shown in the diagram, transformer-coupled audio amplification is available, or “peaked” amplification to improve selectivity is provided at the throw of a switch. Three 1000-turn honeycombs tuned with a .01-pfd. paper condenser are plugged in permanently, or may be replaced by the primary of 712 transformers or other peak-producing combinations if desired. A stage of 22 untuned r.f. amplification precedes the detector and recently this has been made into a tuned radio-frequency stage, appreciably boosting the signal level. An ample number of coils is provided for all the amateur and expedition bands, and a plug-in midget condenser can be placed across the regular two-section band-spread condenser to boost coil ranges to almost any frequency that may be required. Possibly an a.c.-operated receiver may supplant the present model at some future date but other jobs loom ahead of that in importance.

THE NEW TRANSMITTER

Excellent results were obtained with both t.p.t.g. and auxiliary Hartley transmitters from the date operation of the new W1MK commenced. However, difficulties were encountered because of tube troubles and certain limitations applying to any self-controlled transmitters made themselves felt.

Satisfactory frequency stability has always been obtained on the 3557-ke. frequency. One trouble that could not be overcome was a certain frequency drift that would invariably occur during transmission on the higher frequency bands because of changes in the spacing of the tube elements (‘04-A’s) with even small temperature changes. The transmitter, while steady and easy to copy, would “climb” gradually to a slightly different frequency, the change being of the order of several kilocycles with inputs 75% normal, so it was necessary for receiving operators to re-tune slightly for the signal after an interval
of no transmission. Reducing plate voltage and current might limit the amount of change but would not get around the trouble altogether.

Therefore it was decided that a new main unit for the station, to have excellent frequency stability as its goal, and using modern high-frequency tubes, must be constructed. The t.p.t.g. set must continue to "hold down" 3575 kc, where its performance left little to be desired, but a new transmitter should be added for all work in the 7- and 14-mc, bands where it is hardest to maintain a station on a single channel. Space limitations made it difficult to see where any amount of apparatus could be installed, but it finally appeared that the best location for the new transmitter would be in place of the superceded auxiliary unit beneath the operating table. A shelf and drawer were removed to make the space available and a design as compact as possible worked out after preliminary experiments to determine the best possible set-up. While no amateur will have occasion to duplicate the exact arrangement or combination of equipment about to be described, it is believed that many of the features involved can perhaps be modified and included in stations of various size where oscillator-amplifier transmitters are being considered in the interest of improved frequency stability.

The new high-power unit had to be adjusted to work from the existing high-voltage plate supplies, for economy's sake if for no other reason. The oscillator must operate as a frequency control with plate voltage as low as practicable to keep temperature changes in the tube and in the crystal itself (when used) to an absolute minimum. A number of amplifier stages and doubler stages to supply adequate excitation to the high-power end in spite of low voltage on the control end must be incorporated. Shcllding must be used in low-power and intermediate stages to eliminate undesired feedback, especially where the equipment must be confined in a small space. Separate power supplies for low- and high-power ends on the new transmitter were desired not only to prevent coupling between stages through the power supply but to avoid unnecessary losses in resistors and fluctuations in plate supply voltage that would endanger the equipment and make adjustment of the low-power end unduly difficult because of poor voltage regulation. If and when crystal control was to be used it should be possible to shift from one crystal to another at the will of the operator. Also, in a drafty room subject to wide temperature variations the crystal must be protected from physical changes from any source, and preferably housed in a mounting held at constant temperature to minimize frequency changes as much as possible. A plug-and-jack metering system was considered desirable both to eliminate the necessity for a large number of meters and to make it possible to quickly adjust each stage, to locate troubles, defective tubes, etc.

In the high-power stages it was decided to use Type '60 and Type '61 tubes, these tubes being as readily available as any high-power, high-frequency tubes, and being screen-grid "bottles" the necessity for neutralization might thus be avoided and undesired feedbacks and instability kept at a minimum. The problem was to plan a circuit layout giving adequate gain, providing the necessary doubling and quadrupling of frequency, and sufficient excitation for both 7- and 14-mc. operation, all without too much difficulty in changing frequency.
Preliminary experiments indicated that three Type '10 tubes might be controlled by a 3500-ke. crystal and arranged in doubler-amplifier or doubler-doubler combinations for 7-mc. or 14-mc. operation. However, a single '10 tube gave a mighty low output at 14 mc. although perhaps satisfactory from the 7-mc. operating standpoint. It was useless to attempt to increase 14-mc. output by adding another '10 in parallel: this was tried but the inter-element capacity of the tubes, another Type '10 tube which may be operated either as a 14-mc. doubler or as a neutralized amplifier on 7 mc. The output of this tube excites a push-pull amplifier using two Type '10 tubes which may be operated on either 7 or 14 mc., giving sufficient output to fully excite the '60 on either band. All the amplifiers following the crystal tube are neutralized, even when operating as doublers, to prevent undesired feedback between stages and to allow the transmitter to be shifted from one band to the other with a minimum of adjustments.

Since the maximum of flexibility is necessary in a transmitter which must be shifted rapidly from one frequency to another and from one band to another to meet schedules (and avoid QRM, when necessary), the tuning condensers on each stage except the last are made sufficiently large to cover both 7 and 14 mc., thereby eliminating the necessity for plug-in inductances. The crystal oscillator and the first doubler are permanently tuned to 3.5 mc. and 7 mc. respectively. The only coil changing necessary is in the tank of the '61 stage. The neutralizing systems employed on the low-power stages are designed to permit wide changes in frequency without necessity for readjustment of the neutralizing condensers. The screen-grid tubes in the two final stages do not require neutralization. The tank circuits are Low-C on 14 mc. and fairly High-C on 7 mc.

The second doubler output tank is fed d.e. in the center, locating the voltage node at that point fairly high in the first place, added when the tubes were paralleled, effectively by-passing what little grid excitation could be obtained. After much experimenting with different tube combinations to build up the 14-mc. energy to a value sufficient to fully excite the Type '60 amplifier, the line-up shown in the transmitter diagram, Fig. 5, was decided upon as being the most suitable. A Type '10 oscillator on 3575 ke. is followed by a 7-mc. doubler, which in turn feeds into...
since a direct connection of one end of the push-pull tank to the filament of the following tube (or coupling at this end through a condenser) would place one end of the tank at ground potential with respect to r.f. and unbalance the amplifier. It was found that the excitation was ample with the grid connection to the '60 taken off one end of the push-pull tank, leaving the other end of the tank free. The push-pull stage was highly desirable because in it the tube capacities are in series, which eliminated the objection to two tubes in parallel mentioned previously.

During the preliminary testing of the transmitter after the constructional work had been finished a rather unusual condition made itself apparent. There was evidence of a strong parasitic oscillation in the push-pull stage which absolutely wrecked the frequency stability and quality of the signal. The usual remedies for such parasitics were tried without result — furthermore it was impossible to determine the frequency of the parasitic, even though frequency meters which would go down to three meters were available. The answer was finally found to be in the r.f. choke coils which were in the d.c. plate and grid leads. Evidently the two chokes (ordinary commercial plug-wound chokes) acted as the plate and grid coils of a tuned-plate, tuned-grid transmitter, and a low-frequency oscillation was set up. The grid and plate tank coils on this stage offered practically no reactance to low frequencies, with the result that there was a vigorous oscillation. Removal of the plate and grid chokes in the push-pull stage completely eliminated this trouble.

The keying system used with this transmitter is one which departs somewhat from usual amateur practice, although often employed in commercial transmitters. It is a form of "blocked-grid" keying, utilizing a voltage-divider across the high-voltage plate supply so arranged that when the key is up part of the plate voltage on the last two amplifiers is applied between the grids and filaments of the tubes so that the plate current on both is reduced to zero. It is a very effective form of keying, and one which gives complete cut-off of power output. As shown in the transmitter diagram, resistors to the value of 225,000 ohms are connected across the 2200-volt supply, with a tap brought out at 75,000 ohms from the negative end. The negative terminal is connected to the positive side of the "C" bias batteries, while the 75,000-ohm tap is connected to the filament center-taps of the '60 and '61. The key is connected directly across the 75,000-ohm resistor, and when closed short-circuits it. When the key is open the drop across the 75,000-ohm resistor [560 volts] acts as additional bias for the last two amplifiers. The Type '10 tubes in the transmitter are not keyed, but run continuously during an entire period of transmission.

One other feature of the transmitter is worthy of some comment. The desirability of a plug and jack metering system has been mentioned previously, and in order to measure plate current in each stage a separate jack is provided in the plate circuit of each tube. If common filament supply had been used for all the Type '10's in the transmitter these jacks would have had to be placed in the positive high-voltage lead to each tube, which would have meant that the jacks on the panel would be at a rather high d.c. potential above ground and the operator would have to be extremely careful in handling the plugs. To bring each jack to ground potential, therefore, it was necessary to have a separate filament supply for each tube so the jacks could be placed in the negative leads. A special transformer was built for this purpose, employing the core and primary winding of an old transformer of suitable power rating. Separate filament windings were put on this transformer for each of the Type '10 tubes and also the Type '60, the latter of course requiring a higher filament voltage. An entirely separate transformer furnishes filament power to the '61. A slight correction of plate-current readings is necessary to take grid current and screen-grid current into account with this method of connection. This is important only on the '60 and '61.
FIG. 2—THE CRYSTAL-CONTROLLED 7- AND 14-MC. TRANSMITTER

La — 8 turns of 5/16" copper tubing 3/4" inside diameter
L2 — 7000 k., 9 turns 5/16" copper tubing 3/4" inside diameter
L3 — 5 turns on R.E.L. 80 meter transmitting inductance form
L4 — 6 turns No. 14 enamelled wire on R.E.L. receiving coil form
L5 — 10" 114-hour choke
L6 — 80" 114-hour choke

C6, C7 — Cardwell 440-µfd., transmitting condenser
C8 — R.E.L. 100-µfd., 5000-volt condenser
C9 — Cardwell 440-µfd., transmitting condenser
C10 — 250-µfd. variable condenser, receiving type
C11 — 100-µfd., 5000-volt condenser
C12 — 500-µfd.
C13 — 1 µfd.
C14 — 500 p.d.
C15 — 200-µfd., 5000-volt condenser
C16 — 0.1 µfd.
C17 — 2.00 µfd.

R1 — 0-15 volt, 175-watt filament transformer
R2 — Thorndike T-2960 transformer, 675-675 volts, 300 ma.
R3 — 12 volt, 175-watt filament transformer
R4 — Thorndike T-5050 filament transformer for 66's
RFC1 — 1%" winding of No. 30 a.c.e. wire on 1/2" form
RFC2 — Silver-Marshall Type 227 chokes
RFC3 — 3/4" winding of No. 30 a.c.e. on 1/4" form
RFC4 — 3/4" " No. 30 " 3/4"

A1 — 0-50 d.c. milliammeter
A2 — 0-900
A3 — 0-9 amp. r.f. ammeter (shunted)
V — 0-16 a.c. voltmeter
stages, where the total space current may differ considerably from the plate current.

Although the oscillator is designed primarily for crystal control, it may be made self-controlled by switching over to a resonant grid coil in place of the crystal, thus allowing the transmitter to be set on any frequency desired within the amateur bands. It is usually operated, however, with the crystal in the circuit.

The following table shows the actual measured values of plate voltage, plate current and grid bias on each of the tubes in the transmitter under operating conditions:

<table>
<thead>
<tr>
<th>Component</th>
<th>E&lt;sub&gt;p&lt;/sub&gt; (volts)</th>
<th>I&lt;sub&gt;p&lt;/sub&gt; (ma.)</th>
<th>I&lt;sub&gt;g&lt;/sub&gt; (ma.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oscillator, Type '10 .......</td>
<td>220</td>
<td>36.5</td>
<td>-22 (leak)</td>
</tr>
<tr>
<td>1st doubler, Type '10 ......</td>
<td>580</td>
<td>49</td>
<td>-75</td>
</tr>
<tr>
<td>2nd amplifier or doubler,</td>
<td>580</td>
<td>69</td>
<td>-85</td>
</tr>
<tr>
<td>Type '10 ..........................</td>
<td>1580</td>
<td>100 (total)</td>
<td>2-70</td>
</tr>
<tr>
<td>Push-pull amp., Type '60 ....</td>
<td>2200</td>
<td>200</td>
<td>-370</td>
</tr>
<tr>
<td>Power amp., Type '61 ......</td>
<td>2200</td>
<td>300</td>
<td>-90</td>
</tr>
</tbody>
</table>

The bias on the '61 is not at all critical, and 45 to 135 volts may be used under the operating conditions. With higher plate voltage, however, more bias would be required. The tube is being run well under its normal rating in this transmitter, both to prolong its life and to utilize the present 2200-volt power supply without adding expensive equipment for higher voltages. The total bias on the Type '60 tube, 120 volts is supplied by the 60,000-ohm leak, and the remainder by batteries.

**THE TEMPERATURE-CONTROL BOX**

Real frequency stability, even with crystal control, is not attained unless the crystal is maintained at constant temperature. The low plate voltage used on the crystal tube is advantageous because the crystal does not heat from too-strong mechanical vibration when the transmitter is operating. The remaining problem is to keep the crystal temperature constant in spite of the wide variations in room temperature which are encountered at our location. The temperature-control box shown in the photograph is designed to take care of this factor.

The outside box, made of quarter-inch wood stock, is 9 ½ x 14 ½ x 14 ½ inches. The inner aluminum box is of riveted construction and is large enough to contain three crystals and their holders on the bottom floor. Between the crystal chamber and the heaters is an attenuation layer of asbestos wool 3/32” thick, and a ½” transite box. The heaters are mounted on each face of this box. Eight ½-ampere Ohmspun heaters are used, one each on the top, bottom and ends, and two each on the front and back. This unit sits in the center of the outer box.

Transite is necessary for mechanical rigidity of the inner hinged box shown in the photograph, but asbestos millboard (which is poorer mechanically, but a better heat insulator) is the material used in the outer-box construction.

¾-inch slabs of Transite are used for partitions and double air spaces, two in series between the inside chamber and the outer wall, built into the sides and bottom. Wood stock is used for the outside container and for the different supporting corner posts and cleats for holding the Transite partitions.

Since this temperature-controlled box is designed to remain connected across the 110-volt a.c. line continuously, heat insulation is impor-

![The Temperature-Control Unit](image)
and under fair conditions a temperature control of plus-or-minus one degree Centigrade is obtained. Of course the inner box maintains the crystal at a temperature much more constant than this, which is the variation which obtains in the air chamber. The crystals at W1MK are held at 45° C. While the precision of the regulator itself is not so great as may be obtained with mercury-type thermostats, the fact that these require a relay and an auxiliary battery (since the mercury column cannot handle much current) make them less desirable for most amateur installations. To handle over 300 watts a relay is recommended for use with even this type of regulator, but the contacts will handle that amount of power supplied at 110 volts with just an occasional cleaning.

Good circulation of air is essential in a temperature-control box to insure uniformity of temperature in all parts. The thermostat must be installed where the circulation of air is most rapid to secure best results. A .25-µfd. condenser is used across the contacts to reduce sparking, and a small pilot lamp is connected across the contacts to show that the device is in operation.

Operation and Personnel

The present station is operated several hours daily (except Wednesday and Saturday) on 3575 or 7150 kc., and has been on the air regularly since February, 1928. Many hundreds of contacts with amateurs and members have been recorded. Certain periods are provided exclusively for schedules. General operation in other published periods permits communication with the many who wish occasional contact with Headquarters for any reason. Information of general interest and timely character is addressed to A.R.R.L. members twice each evening of operation. Reports indicate that such special and official broadcasts are copied by a large “audience.”

The traffic records of the station speak for themselves as well as the performance in such special communication problems as the cooperation with “The Arctic Patrol” (Army Air Corps flight January, 1930), work with WSBS, DAV and other plans of lesser magnitude.

For regular operation at W1MK ability of several kinds is required. The operator must be able to send slowly or speedily as a situation demands. Patience, tact, accuracy (above all), and initiative in building up traffic outlets properly distributed geographically—all these and other qualities are needed. The keeping of schedules and handling of traffic must be understood thoroughly. The operator must be able to set an example in every department of operating procedure. The discipline of the commercial operator together with the viewpoint of the ideal amateur is required. How fortunate we were in securing this sort of an operator is well known: Robert B. Parmenter, formerly of W9TW, KUTZ, W9OX-W9WR came to Hartford in February of 1928 just as the installation was receiving the finishing touches. “RP” as he is familiarly known, has kept W1MK on the air ever since. Other operators visiting the station sit in for a twirl at the dials occasionally. Members of the Headquarters staff may be recognized when they operate by their personal “sines” which are listed in every issue of QST. In times of emergency which require that the station be on the air continually EV, AH and FH will usually be found to be the members doing volunteer duty behind the key.

Our Headquarters’ Station often has to account for itself on extremely short notice. Since equipment has certain definite limitations, the facilities have sometimes been overloaded by overlapping operating programs dictated by circumstances of the moment. Suffice to say that the station must cater to many different types of operating activities dedicated to the interest of League members. The many schedules and obligations of the station make operating at W1MK a real job.

Much could be said about operating practices, observation of trespassers in and out of our bands, policy of acknowledging every QSL, adherence of different stations we schedule to the given frequency and time, transmission conditions in different bands and seasons, and like subjects, but these things make another story. Our present purpose has been simply to record the work of the station and to touch on the various parts of the equipment in a general way.
THE early morning hours of November first, with but a few DX hounds as witnesses, saw the completion of the A.R.R.L. Standard Frequency System's organization program. Right on the tick of 4:00 a.m., P.S.T., the new West Coast station, W6XK, opened up with its first scheduled transmission. We knew that Harold Peery and his assistants had made a good job of it because the signals rolled in a good QSA 5 here in Hartford, with a good d.c. note and right on frequency.

A special call for the standard frequency transmissions had been assigned to the Elgin station. It is W9XAN. The Round Hill station will continue to sign WIXP. The description of the standard frequency equipment at the latter station, which was tentatively scheduled for this issue of QST, will appear in the January issue instead. The article is by Howard Chinn and is packed with information on frequency measurement and the method of transmitting standard frequency signals as well as a wealth of constructional data.

The three stations are on for all scheduled transmissions. Unfavorable conditions and skip-distance effects will account for failure to hear transmissions on some frequencies at certain distances and must be taken into account. QRM continues to be a serious handicap and many amateurs have suggested that those amateur stations operating on the frequencies used during a standard frequency transmission stand by while their frequency is being transmitted. This would require only an eight-minute "QRX" and would mean a lot to the fellows who are trying to use the s.f. signals. Let's have a little more operation and a reduction in QRM.

Here are the schedules for December and January. The schedules for December are the same as published in November QST with the exception that W9XAN's Schedule BX on December 6 has been eliminated. This early morning schedule will be transmitted once every four weeks by W6XK, however.

<table>
<thead>
<tr>
<th>Standard Frequency News and Schedules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>W1XP, W9XAN and W6XK in Regular Operation—Special Calls Assigned to S. F. Stations</strong></td>
</tr>
</tbody>
</table>

**DATES OF TRANSMISSION**

<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule</th>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec. 6, Friday</td>
<td>BB</td>
<td>W6XK</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>W1XP</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>W9XAN</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>W6XK</td>
</tr>
<tr>
<td>Dec. 7, Sunday</td>
<td>BB</td>
<td>W9XAN</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>W6XK</td>
</tr>
<tr>
<td>Dec. 12, Friday</td>
<td>C</td>
<td>W1XP</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>W9XAN</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>W1XP</td>
</tr>
<tr>
<td>Dec. 14, Sunday</td>
<td>B</td>
<td>W9XAN</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>W6XK</td>
</tr>
<tr>
<td>Dec. 19, Friday</td>
<td>A</td>
<td>W6XK</td>
</tr>
</tbody>
</table>

**STANDARD FREQUENCY SCHEDULES**

<table>
<thead>
<tr>
<th>Time (p.m.)</th>
<th>A (kc.)</th>
<th>B (kc.)</th>
<th>C (kc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00</td>
<td>3500</td>
<td>7000</td>
<td></td>
</tr>
<tr>
<td>8:08</td>
<td>3550</td>
<td>7100</td>
<td>14,000</td>
</tr>
<tr>
<td>8:16</td>
<td>3600</td>
<td>7200</td>
<td>14,200</td>
</tr>
<tr>
<td>8:24</td>
<td>3700</td>
<td>7300</td>
<td>14,300</td>
</tr>
<tr>
<td>8:32</td>
<td>3800</td>
<td>7400</td>
<td>14,400</td>
</tr>
<tr>
<td>8:40</td>
<td>3900</td>
<td>7500</td>
<td></td>
</tr>
<tr>
<td>8:48</td>
<td>4000</td>
<td>7600</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (a.m.)</th>
<th>BX (kc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4:00</td>
<td>7000</td>
</tr>
<tr>
<td>4:08</td>
<td>7100</td>
</tr>
<tr>
<td>4:16</td>
<td>7200</td>
</tr>
<tr>
<td>4:24</td>
<td>7300</td>
</tr>
</tbody>
</table>

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

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

TRANSMITTING PROCEDURE

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

2 minutes — QST QST QST de (station call letters).

3 minutes — Characteristic letter of station, interrupted by call letters and statement of frequency. Characteristic letter of W1XP is "G," of W9XAN is "D," and of W6XK is "F."

1 minute — Statement of frequency in kilocycles and announcement of next frequency.

2 minutes — Time allowed to change to next frequency.

THE TRANSMITTING STATIONS

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


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

Do not forget to QSL the transmissions. All reports should be sent to the A.R.R.L. Standard Frequency System, Hartford, Conn. A record will be made at Headquarters and the report will be then forwarded to the proper station. S. F. report blanks can be obtained from Headquarters, free and postpaid, upon request.

QRX for Standard Frequency Transmissions.

Corrections

An error in the diagram of W7GP's receiver on p. 47 of the October issue put 45 volts on the filament of the peaked audio tube, with the result that there was no screen-grid voltage on the two Type '22's in the set or plate voltage on the last audio amplifier. The corrected diagram appears herewith.

In the description of the new Ward Leonard plaque resistors on p. 40 of November QST, substitute the word "possible" for "impossible" in the third line above the photograph.

The left-hand term of the equation in footnote 3 on page 28, November QST, should have been (2πf)^2 instead of (2f)^2.

In the article on "Volume Level Indicators," November QST, the circuit diagrams of Fig. 2 and Fig. 5 should be transposed. This will be immediately apparent to anyone familiar with the Modulometer.

The author has since written us that it might be better to use a volume-indicator coupling transformer of higher primary impedance than 500 ohms in Figs. 4 and 6, since a low-impedance primary will absorb too much power from the circuit. An ordinary audio transformer with the primary connected to the output of the speech amplifier should work well and draw negligible power.

The name "Pyrex" is applied to several varieties of glass made by the Corning Glass Works, chief of which are the "chemical-resistant glass" and "electrical-resistant glass." In order to avoid clumsy wording, "Pyrex" will be used in QST to refer only to the electrical-resistant glass unless otherwise stated.

Louis S. Miller, Brockton, Mass., and W1ASZ, Pawtucket, R. I., have both written us suggesting that the insulating plugs on Ford transmission covers make excellent stand-off or lead-in insulators. The spring should be removed and a bolt inserted through the hole after the fashion of G.R. insulators.

A tip for the fellows who are too much inclined to "nerve sending" with the finger tips and who tire out trying to send a continuous message of any length: Try operating with the nails and knuckles of the first two fingers lying on top of the key with the thumb coming up under the edge of the flange to aid in making characters. The bent-over knuckles form a natural spring which relaxes easily after each pressure, with the result that there is less stuttering and balling-up of characters, and a long message is easier to send even at a good clip. There is no effort of hanging onto the key all the time.

— W9FO
Converting the Four-Tube Receiver to A.C. Operation

Ry w. K. McCulla, W9AE-W9BTU *

It would appear from the number of photographs in QST and from the personal experience of the author, that there are many of Hull's four tube plug-in coil and condenser receivers in operation among the gang. 1

The following is a brief description of one of these receivers which has been successfully converted to a.c. operation, making use of plate two plates spaced approximately 3/4 inch apart. The purpose of this condenser is to vary the beat note on a received signal without touching the main tuning control of the receiver.

The condenser C4, normally a grid condenser, in this particular circuit merely acts as a blocking condenser. Grid bias for the detector tube is supplied by a small 22½-volt "C" battery mounted in the set. The positive was connected to the ground, negative connected to the grid through a Hammarlund radio-frequency choke.

The regeneration is controlled by a 200,000-ohm resistor in series with the screen-grid lead to the detector tube.

Rectification in the detector circuit, or as the broadcast fraternity call it, "linear power detection." The circuit is shown in Fig. 1.

In place of the 10,000-ohm resistance in the antenna circuit a four-prong socket was mounted on the sub-panel and a semi-tuned antenna inductance was substituted for the resistor. "C" bias for the first '21 is secured by a 1½-volt dry cell shunted by a radio-frequency by-pass condenser, also mounted on the sub-panel.

In this particular receiver, no changes were made in the coil and tuning-condenser assembly with the exception that C3 was added. This was a small Pilot condenser in which all plates but one stator and one rotor were removed and those

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* 148 S. Gennessee Street, Waukegan, Ill.
1 Described in November 1928, QST and in the Handbook.

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**FIG. 1**

- **La** — Antenna coils wound on old tube base
  - 3,000 kc. — 30 turns No. 30 s.w.g. wire
  - 7,000 kc. — 30 turns No. 16 s.w.g. wire
  - 14,000 kc. — 16 turns No. 30 s.w.g. wire
- **L1** — Same specifications as in original set
- **L2** — Feed coil secondary without core
- **C1** — 1 µfd.
- **C2** — Tuning condenser same specifications as in original set
- **C3** — Beat note condenser described in text
- **C4** — .01 µfd.

The heaters of the tubes are connected in parallel and supplied from a 6.3-volt transformer. Heater wiring is not shown in the above diagram.
75,000 ohms was the most workable compromise and was therefore used.

If the receiver shows a tendency to have a bad fringe howl it can be eliminated by changing the value of the resistance $R_4$. In this particular case $R_4$ had a value of two megohms.

The purpose of the switch in the B minus lead is to afford a means of taking the plate voltage off the tubes during transmission periods.

It will be noticed that the cathodes of all tubes operate at ground potential. It is the custom in most broadcast receivers to supply the grid bias

Judicious use of by-pass condensers aids in maintaining proper radio frequency paths. The lead from the condenser $C_4$ to the tube is encased in a Carter screen-grid lead shield. No other shielding is used in the receiver.

Because of an unusually poor location, it is impossible at W9AE to hear any amateur stations other than those within the limits of the United States. It might be said, however, that an audio frequency volume increase of about two to one over the previous performance of the d.c. set resulted from the conversion to the circuit shown.

Some trouble was experienced with bad “bubbling” in some of the Type ’24 tubes tried. This noise can be cured by placing them across a 6-volt battery for five minutes with no plate voltage on.

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**A CHOKELESS HARTLEY CIRCUIT**

“A short time ago I set for myself the problem of devising a short-wave transmitter which would not require any radio-frequency choke, and which would yet be more simple than the Hoffman balanced Colpitts or the t.p.t.g. I took a pencil and paper and drew all the simple sending circuits with which I was acquainted and tried to alter them so as to eliminate the radio-frequency choke. I soon hit upon (b), Fig. 2, which is electrically the same as the ordinary Hartley circuit (a). However (b) still has a radio-frequency choke, but it is now in the grid circuit because the positive plate supply is connected at a point of zero r.f. voltage, while the grid leak cannot be connected at such point without splitting the coil as in (c). But let’s look at our grid leak before discarding (b). Yes, it’s made just like we suspected it was, out of a very large number of turns of very fine resistance wire wound on a porcelain tube. Why cannot it be used as a grid leak and grid r.f. choke rolled into one? There is no good reason why it cannot and at least one good one why it should be, for its high distributed resistance quite effectively keeps it from resonating at some frequencies and absorbing power.

“A 14,000-kc. transmitter was immediately built to test out this idea. It used a Type ’10 tube as an oscillator and a wire wound 10,000-ohm resistor which cost 25 cents at the dime store in the role of grid choke and leak. The plate voltage was between 600 and 700 volts and introducing a plate r.f. choke did not change the plate current at all. A grid choke was not tried because the mere fact that the tiny grid leak did not burn up proved that it could not be carrying an appreciable amount of r.f.

“This circuit adjusts exactly like the standard Hartley circuit and requires fewer parts than any of the other ‘chokeless’ circuits with which I am familiar. The only precaution is to see that the grid leak is of a type which has inductance and to be sure that the grid condenser will stand the full plate voltage. The first layout that I built works...
so beautifully that it is now the only transmitter in use at my station."

"Having read Mr. Boyd Phelps' article on QSY with crystal control in the September issue of QST, I am prompted to write about the method in use at W9CIR. There is considerable satisfaction in being able to QSY to any part of the band in spite of the fact that only one crystal is in use.

"As is well known, in grinding a crystal a condition is often met where hundreds of parasitic oscillations are set up on each side of the main frequency. As an experiment the writer decided to try to build up the strength of these oscillations so they could be used to excite a buffer amplifier.

"A coil was placed in the grid circuit of the crystal stage to produce regeneration. This gave the desired results, and sufficient excitation was obtained to swing the grid of a buffer. The grid coil was then tapped at every turn, and this enabled the proper harmonic to be picked up and amplified. Later, a variometer was substituted for the tapped coil, and QSY was then possible over the entire 3500-kc. band.

"In shifting frequency it is only necessary to turn the variometer to a pre-determined setting and bring the tank circuit into resonance, returning the amplifier tanks, of course. The entire operation takes but a few seconds, and the crystal has at no time shown a tendency to jump to any other frequency."

"Just a line for the sake of those poor 'hams' who, as I, have d.c. in their homes and can't afford an m.g. or dynamotor, and who would at least like to QSY an adjacent district instead of being limited to that in which they live. 'B' batteries are always possible as a means of getting a little voltage for a plate supply, but they cost plenty and don't last very long. So one must resort to the house current.

"Now, it's easy enough to connect the plate to the positive and the filament center-tap to the negative; the problem arises in getting sufficient voltage to work something more than just locals. In most d.c. equipped houses this is done easily enough by drawing 220 volts from the line. Sounds impossible that 220 volts can be drawn from a 110-volt line, but it is done in this manner:

"Test the plug nearest the back of the house by sticking the two wires about 1½ inches apart in a potato. The one which turns the potato slightly green is the positive. Take this wire and test for ground (to find out which terminal of your line at this point is grounded) by placing the middle terminal of an ordinary electric-light bulb on a place of good ground and touch the other terminal with one of the wires from the socket that you just tested. If the bulb lights when you touch it with the positive terminal, for example, then it stands to reason that the negative terminal is grounded. The same procedure is gone through for one of the sockets in the front of the house. It will usually be noted that the opposite terminal to that in the back is grounded. I say usually; because, knowing practically nil about house wiring, I don't know much except that my house and a couple of others that I have tested are wired this way. That is to say that if in the front the positive is grounded, the negative will be grounded in the back; or vice-versa.

"The rest is easy. Just take those two ungrounded terminals, one from in front, and one from in back, attach them to the transmitter at the correct places; and, Presto! you have 220 where you had before 110 volts.

"Any house line may, and probably will, have a slight commutator ripple. This gives a more or less good r.a.c. note, and if a pure d.c. note is desired, a choke of about 150 or 200 turns of No. 24 to 30 wire wound on an iron screw or some such will effectively eliminate the ripple. I have been using 150 turns of No. 28 wire on a ½ inch screw and when the transmitter is tuned properly I get xtal reports consistently.

"With this rig and the xmitter circuit shown in December, 1929, QST I have worked all districts but the 6th and 7th. I hope to work them this winter by putting two Type '01-A's in parallel, instead of just the one tube.

"If this system of plate supply is used, it would be as well to get a couple of one-ampere fuses to put in the two line leads. Also, don't try any form of direct coupling because if the antenna is not perfectly insulated it is likely to form a short circuit between ground and one of the plate-juice leads. If you use one of those trick antennas wherein the feeder is supposed to be 9 feet off center, couple it to the tank coil by putting a fixed condenser in the feeder somewhere. This will not affect the signal as far as decreasing QSA goes and may help in giving a steadier, better note, depending on various conditions. At any rate, be mighty sure your antenna does not swing because there is a large capacity between antenna and ground, caused by the fact that the normal opposite pole of either of your plate leads is grounded. The least swing, therefore, is very noticeable. To eliminate a slight swing that I got whenever the people in the houses opposite me put out clothes to dry (my antenna is attached to the pole there) I put one of those five-cent screen-door springs between the antenna and this pole and now have very steady signs; even on Mondays!"

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Some trouble can be saved in determining whether or not it is possible to get 220 volts from the house line by inspecting the service meter. If there are three wires coming into it the 220 is available, and may be taken directly from the two ungrounded terminals (on the house side of the meter, of course) or from sockets at different parts of the house as described above. Ninety volts of heavy duty "B" batteries in series with the 220 so obtained will make quite a respectable power supply for a Type '45 tube — or two of them in a rig such as was described in last month's QST.

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THREE-BAND TRANSMITTING ANTENNAS

The problem of fitting an antenna for the three most popular bands into a limited space is always a puzzling one for the beginner, or for that matter for the advanced amateur as well. One suggestion was made in the January, 1928, issue of QST; we present hereewith a few more from various sources.

The first of these is explained in the following letter from Don L. Spender, W1HD:

"A new antenna system for efficient operation in the three principal amateur bands (3.5, 7 and 14 megacycles) was recently installed at W1HD. It is suitable for erection in the limited amount of space available to the average amateur, and permits quick and easy shifting from one band to another. It has proved to be so eminently satisfactory in operation that it was decided to set forth the details for the benefit of any brother amateur who may be cramped for antenna space, as is the case at W1HD.

"The system consists of a fundamental Hertz antenna, of a length suitable for operation in the 7-mc. band. A length of 65 feet is usually about right. This is fed at the near end by a 16-foot Zeppelin feeder. The system as it now stands is suitable only for operation in the 14-mc. band.

"By cutting into the feeder two matched loading coils as shown in Fig. 3, wound in the same direction, of such proportions that the feeder will tune to 7 mc., the antenna may be operated in this band with practically the same efficiency as the usual 7-mc. Zeppelin antenna with 25- to 30-foot feeders. Then, by cutting out the loading coils, tying the feeders together and adding a separate wire (a so-called 'counterpoise') long enough to allow fundamental operation in the 3.5-mc. band the system will work in the latter band with good efficiency.

"The usual 7-mc. Zeppelin antenna may of course be operated with a counterpoise, in the 3.5 megacycle band; but the system described is probably more effective, because the feeder is only of the order of 16 feet or so in length; hence, when used with a counterpoise, the transmitter is coupled at a point much closer to the voltage node than can be the case when using 25- to 35-foot feeders.

---

The loading coils used at W1HD are 12 turns each of 12 gauge wire, space-wound on 2-inch bakelite tubing; the coils are wound in the same direction, and are set up parallel to each other a distance apart about equal to the spacing between the feeder wires. The number of turns on these coils was determined by reference to a thermomometer placed in the center of the antenna, with the transmitter operating at constant frequency and input in the 7-mc. band.

"The counterpoise used with the system here is 55 feet long; this length may vary slightly with different installations."

---

Southeastern Division Sections Consolidate

At the suggestion of E. W. Mayer, K4KD, the Porto Rico-Virgin Islands Section of the Southeastern Division has been combined with the Georgia-South Carolina-Cuba-Isle of Pines Section operating under SCM Alexander, W4RZ. The amount of activity and number of stations reporting in Porto Rico and the Virgin Islands was deemed insufficient to warrant a separate section. Amateurs who previously reported their activities to former SCM Mayer should now report to SCM M. S. Alexander, W4RZ, 47 Second Avenue, S. E., Atlanta, Georgia.

---

Strays

A Pyrex test tube coated on outside and inside with tinfoil makes an excellent high-voltage blocking condenser which tests OK at 3000 volts.

--- W6BRI

W7II suggests using a variable resistor in series with the negative high-voltage and center-tap of the filament transformer for obtaining "C" bias for a modulator tube. A separate filament winding is required for each tube so supplied. When the resistor is used, separate "C" batteries are not required, but it must be kept in mind that bias so obtained reduces the plate voltage by the amount of bias voltage.
ONE of the most important questions affecting amateur operating procedure is always one for which a comprehensive, definite and determinate answer has never been secured, namely, the exact status of amateurs regulations in all the countries of the world.

As previously reported in these columns, one of the resolutions passed at the Antwerp Congress in July was concerned with this problem. It embodied a request to I.A.R.U. Headquarters to prepare a pamphlet containing data to be submitted by various sections giving the laws governing amateur radio in each country. This request was referred to Union member-societies in Calendar No. 4, and it is hoped that all members will cooperate to the extent of supplying copies of the amateur regulations existing in their respective countries.

This provides for only eighteen of the principal nations of the world, out of a possible total of seventy-odd countries wherein are located amateur stations. It is therefore that this present means is taken to request the amateur society of each country, colony, protectorate, or political land area, possessing individual regulatory codes, to forward to Union Headquarters at the earliest possible moment copies or translations of all laws affecting amateur operation. Other pertinent information concerned with licensing, numbers of active transmitters, memberships, etc. will also be appreciated. Where no active society is in existence, individual amateurs are requested to supply the needed information, in the interests of international cooperation and to further international understanding.
the granting of as great a percentage as possible of the amateur privileges as set aside by the International Radiotelegraph Convention to amateurs in their own countries, and at the same time an eye should be kept turned toward future conferences empowered to alter the international code.

The primary step toward these goals should be acquainting the people of your nation, the officials of your government, with the value of the work which brings to mind the unusual success enjoyed by New Zealand amateurs in hearing United States stations on the 3.5-mc. band, during the autumn months. According to reports eighty meters has been "hot" down at the Antipodes this year.

We record with pleasure the issuance of another WAC for 'phone certificate. This time it is to Frank R. Neill, G15NJ, of "Chesterfield," Whitehead, Belfast, Ireland. His is the fourth WAC for 'phone extant; the second in the British Isles.

One of the many interesting points brought out by amateur experience in connection with the study of wave propagation is the apparently intense strength of North American signals in Iraq, and the relatively great difficulty experienced in receiving YI signals on the American end of the circuit. This could obviously be due, in the main, to the numbers of stations on this side and the resulting difficulty in hearing any foreign signals reliably, but experience seems to point out even more attenuation than can thus be accounted for.

Nevertheless, a surprisingly large percentage of U. S. WAC Club members have obtained their Asian contact through some one of the many enterprising stations located in Iraq.

AUSTRALIAN REPORT

By W. G. Sones, Dir. Fed. Publicity, W. I. A.

Mention has been made previously of the temporary concessions which Australian amateurs have enjoyed in regard to telephone operation between 1715 and 1200 kc. (150 to 250 meters) and also for operation in the 3.5-mc. band.

The most important item of news this month is a further extension of the concessions until January 31st, 1930. The use of the band is of course subject to non-interference with other services and there are very definite hours of working during the week-ends, particularly on Sunday between 10:30 a.m. and 12:30 p.m., 3:00 and 4:30 p.m. and 6:00 to 6:30 p.m. being prohibited. The hours have always been observed as a silent period, however, because of interference with B.C.L.'s, so that this is not in the nature of an additional restriction. Instead, it is regarded as a concession,

(Continued on page 64)
Correspondence

The Publishers of QST assume no responsibility for statements made herein by correspondents.

Washington Licenses

FEDERAL RADIO COMMISSION
WASHINGTON, D. C.

September 22, 1930.

My dear Mr. Maxim:

As you know, the Radio Act of 1927 makes the Federal Radio Commission responsible for the issue of radio licenses, including those of amateurs. Early in the existence of the Federal Radio Commission the duty of administering licenses to amateurs was delegated to the Radio Division, Department of Commerce, for reasons that existed at that time.

Since the Federal Radio Commission has now been provided with adequate facilities as regards office space and personnel, there is no longer any reason why the provisions of the Act should not be carried out by the Commission. Steps have been taken this day by the Commission to bring this about. A copy of the order is inclosed. [See article, "Changes in Regulations," in this issue. — Ed.]

As you know, the Commission has always been interested in the amateurs of the country and appreciates the good work which has been done by them. The Commission desires that all matters connected with the administration of amateur licenses be carried on in the most efficient and satisfactory manner. Any suggestions from you as to improving the procedure in the issue of amateur licenses will be gladly received by the Commission.

Yours very truly,

C. McK. Saltzman
Chairman.

VOQH

East Greenland Expedition for Museum of American Indian Heye Foundation

Editor, QST:

You have no idea what a source of comfort and relief it was to have the amateur radio men and girls in America and Europe come to our call, taking our messages back and forth to loved ones. After all, they are the ones who appreciate it more. We wish it could be possible to give all the amateurs a trip to the land of polar bears, musk oxen, icebergs and continuous days. The only thing we can do however is send our warmest thanks and best wishes to all the amateurs.

— R. A. Bartlett

Technical Articles

Worcester C. P., South Africa

Editor, QST:

Relative to your editorial in the August number, it is strange that out here with our S.A.R.R.L. effort the editor is asked why he does not furnish more technical articles. The reply is that our magazine “QTC” is more or less of a family magazine and too — technical articles are out of place; while we all get QST, or should.

And so while we sympathize with the complainants we hope that with your resources you will continue your present policy in the matter of technical articles.

More power to your elbow.

— S. H. Walters, ZU1D

Lids or Beginners?

Thomasville, Ga.

Editor, QST:

A short time ago I became interested in radio. To be exact I put my first transmitter on the air in 1910, just twenty years ago, not long enough for me to forget that I was not born with my knowledge of radio. I have always believed in listening to the other fellow instead of doing the talking myself.

I have been reading QST some ten years and this is my first letter. The reason for this epistle is the letter from A. D. Middleton, WSUC and W8AKA, in the October issue — page 50.

Every man has a right to his opinion. The fact that it does not conform with our own does not alter that right. I wish to take issue with WSUC on the last part of his letter, wherein he refers to the numbers of “lids” on the air to-day.

From my observation there is a greater interest in amateur radio to-day than at any other time since the little unpleasantness across the pond. This increased interest has given us an unusual number of beginners. These beginners are the only material from which to make the amateur and commercial operators to pound the brass when our ears are dulled and our fists will no longer separate the dots and dashes.

I may be mistaken, but I think most of this interference in our bands comes from the beginners, caused not through malice but ignorance. Brother, don’t call them “lids” until you know they are. Look up their records. If they have “been on” a sufficient length of time to know
Why Not Go Round the World...

Let RADIO Pay Your Way

Radio needs more men like you today... positions now open for "radio fans" who want to get somewhere in radio... men who think radio... who are radio minded... men who play and work at radio. Why not use the knowledge you already have as a stepping stone to success in radio? All you need is the practical up-to-the-minute training that RCA gives you. RCA Institutes actually trains you for success in radio... you learn under the direction of RCA experts. You get the practical as well as the theoretical knowledge... the "how" as well as the "why" of radio. You, too, can make good in radio... so, why not start today!

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better then they are "lids" and I have no sympathy for them.

In all my career I have never been too learned or too busy to explain in understandable language anything that a beginner asked, even though he could not converse in terms higher than "two turns on a two-inch coil."

Here is my conception of a drive against the "lids." Make contact with him; find out whether he is a beginner or a "lid." If the first, tell him what is right and wrong — if necessary write him a letter. If he proves to be a genuine "lid" tell him where to get off. If he persists in malpractice advertise him to other hams. Nature will take its course.

Amateur radio has been my greatest hobby, commercial operating my vocation and taking sides with the beginner my greatest weakness and pleasure. I never expect my name to blaze on memorial tablets for great achievements, but if when it appears in QST under "Silent Keys" some ham says "Bless his memory, he helped me over some rough spots," then I will stand by in peace.

Yours for better conditions.
— Ellis E. McBride, W4KKX

Tolerance

Tallahassee, Fla.

Editor, QST:

It was with much amusement that I read the letter by Mr. A. D. Middleton in the Correspondence Section of October QST. He seems to have a grievance against the world in general, and against the poor hams in particular. Of course, we all cannot sop up all the dope that is published in QST, while it seems that W8UC thinks that is the main requirement.

I must admit that I agree with him in reference to these birds who sit on their keys and forget to get up. But if he has never served in any branch of the commercial racket or the Government radio business, he has never heard any QRM. I served on board the U.S.S. North Dakota, and when we were stationed in Cuba or down around South America, the Old Man didn’t take the QRM as an excuse for not getting N.A.A.’s press schedule every night. Many days we had to stand watch with lightning pounding down in the sea all around us. QRM? QRN? You ain’t heard nothin’.

As to a man sending hash — what does this amateur game amount to anyway? I am new in the ham game, only having been on the air since last June, but I will say that all my QSO’s were with fine fellows, and while our topics of discussion were only things concerning WX or radio or something on that order, I cannot consider that as hash. I am just as proud of those QSO’s as if I were still serving Uncle Sam and all were important messages. I am in this game for the fun that I can get out of it, and while there is no excuse for a man holding down his key any longer than necessary, I believe it is all in the game.

Here’s hoping that WSUC-WSAKA gets a
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Director of University Extension, Massachusetts Department of Education

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GST-12-30

different view on life, and that he will answer a few of these long CQ's and work the man to the bitter end.

— S. M. Douglas, W4ACB

Suggestions

1928 Lewis Ave.,
Long Beach, Calif.

Editor, QST:

I would like to offer a couple of suggestions for improvements in operating practice. Both ideas have been used at W6DZK for several years, and they work well — when the other operator understands them.

The first is this: Why not, at the end of each CQ, sign TOP, or BTM, indicating at which end of the band you intend to start listening. Thus, if the other operator hears you sign BTM, and his wave is near the bottom, then he knows that he need only give you a short call.

The second suggestion is merely to alternate the end of the band at which you start listening. This practice would probably eliminate such statements as: "I can't raise him; he always starts listening at the top of the band and my wave is at the bottom," etc. A good station nearly always hears one or more answers to calls before covering the width of the band.

Possibly these ideas have been submitted before, but I failed to notice them. At any rate, please take them for what they are worth.

— Orin C. Lewis, W6DZK

The suggestion is a good one but may lead to confusion unless we define the "top" and "bottom" of a band. In spite of QST's many adjurations to hams to think in terms of kilocycles instead of meters, there are many to whom the high-frequency end of a band is the "bottom" and not the "top." Maybe some sort of system using the words "high" and "low" instead of "top" and "bottom" would overcome this — or better yet "hf" and "lf." — Editor.

Commercial Operating

M.S. Pacific Sun

Editor, QST:

As to your query, "Do tankers have port holes," I am taking the liberty of presenting my views on commercial operating in verification of as well as in contradiction to the letter from Mr. M. R. Rathbone.

I have followed the sea as a commercial operator for over five years and have been on passenger ships, freighters and tankers. I feel that I am in a position to give an unbiased view of living conditions as well as of the moral association into which the average commercial operator is thrown.

I have at no time ashore found men so willing to be of assistance, men so willing to go out of their way to do you a favor as the larger percentage of seagoing mates and engineers. I have found them at all times willing to give a hand to the man who comes on board a vessel to assume his duties as radio operator for the first time. Mr. Rathbone has assumed a most unfair as well as
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(Print)

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

narrow view with regard to the official personnel of our American Merchant Marine, and I am sure that he has had time to regret his statement. As for the education of the present mate or engineer, has Mr. Rathbone taken into consideration the three or more years he has had to work and study to be able to procure his license? Not in a nicely lighted and heated college but in a school of hard knocks, in a battle with the elements, wind, sea, heat and cold as well as a necessary course of study. Is not that in itself a liberal education?

As for the morals of our Merchant Marine as a whole, I think they are above reproach. Did Mr. Rathbone stop to consider the position into which the average sea-going man is thrown? If he had, I believe he would have been more lenient with his condemnation. I have at no time found men more respectful and solicitous of the companionship of a good woman than a sailor. To prove my statement, take the YL's on any merchant vessel and see for yourself the courteous treatment which they will receive. I doubt if it can be surpassed by any body of men ashore.

As for the actual living conditions, I heartily agree with Mr. Rathbone. Many operating berths are decidedly inadequate due to meagre accommodations and to their placement. Steamship companies lose hundreds of dollars each year because of the continual change of operators on these undesirable vessels. It would be well if the owners would take the interests of the operator to heart when designing the radio room and his living quarters. The meals on board vessels of the American Merchant Marine vary in accordance with the allowance per day per man but more so with the ability and knowledge of the steward's department on each vessel. On passenger ships meals vary mostly with the size and run of the vessel and quite a variety of edibles can be expected which should be more than satisfactory to suit the most fastidious operator.

As for the romantic and adventurous side of operating, Mr. Rathbone seems to be something of a cynic. After five years of operating, I find I still enjoy a visit to a foreign port or a trip up the Mississippi. From an educational point of view, I believe a trip to Europe, the museums and art galleries of Brussels, Amsterdam, Antwerp and many others too numerous to mention will more than repay the average operator for the time expended in procuring his ticket.

At the present writing, there is more than a surplus of operators and any berth is not to be overlooked. Runs cannot be picked at random and the new operator should not be discouraged if his first ship contains all the disadvantages that can be expected from an operating standpoint.

— L. E. Littlejohn, Ex-3NE, WQDL

Some Heavy Traffic

75 New Haven Ave., Milford, Conn.

Editor, QST:

I am writing this as an open letter of appreciation to those stations on 3.5 mc. who helped
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Prepared by Official Examining Officer
The author, G. E. Nierling, is Radio Inspector and Examining Officer, Radio Division, U. S. Dept. of Commerce. The book has been edited in detail by Robert G. Arner, for five years Technical Editor of QST, the Magazine of the American Radio Relay League, now Radio Consultant. Many other experts assisted them.

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Saving the Wrist

Iota, La.

Editor, QST:

This may be of interest to many hams, as the scientific wonder I will unfurl before them is a boon never dreamed of in this great amateur game. I have invented a machine for a great many of the amateur fraternity which will be known to them as the "CQ es CALL BLURRER." This machine is the wonder of wonders, and is designed to save certain hams from a "CQ wrist." A "CQ wrist" is one that cannot stop until thirty or forty are made and then the wrist is so tired that it is unable to make the sign, making only a slur.

This machine has a minimum of thirty and a maximum of two hundred CQ's. Of course the setting most used is between thirty and forty before signing. The machine also makes your call, as the manufacturer puts that in when the machine is ordered.

It has one knob which controls the amount of CQ's to be emitted thereby enabling the ham to set it at the desired speed and amount of CQ'ing to be done. It also will make a clear sign three times or slur just once at the operator's pleasure.

Utopia at last has arrived for the terrible CQ hound and he can easily purchase one of these wonderful machines, direct from the manufacturer, "CQ es CALL BLURRER" Machine Co., Inc.,
A SAFE GUIDE

in the selection of insulation for Radio Transmitting and Receiving Sets

OVER 300 broadcasting stations, leading radio telegraph systems, the United States Army, Navy, Air Mail, Coast Guard and Ice Patrol Services, explorers like Commander Byrd, and exacting amateurs everywhere have utilized PYREX Insulators in many spectacular achievements.

Regardless of whether you are sending or receiving — on land, sea or airplane — you should be thoroughly familiar with the PYREX Antenna, Strain, Entering, Stand-off and Bus-bar Insulators that are helping these leaders to make radio history.

The new PYREX Radio Insulator booklet lists all types and sizes with data that you will want for ready reference.

Return the coupon for your copy, and if you want further advice on any insulation problem, our Technical Staff will answer your questions promptly.

Send the coupon for your copy

CORNING GLASS WORKS
Corning, N. Y.

Gentlemen:

Please send me copy of your new bulletin on Radio Insulators.

Name

Address

QST 12-20

CORNING GLASS WORKS

Corning, New York, U.S.A.

Send the coupon for your copy
PROOF POSITIVE » » of TRIAD SUPERIORITY » » the new T-210 Tube!

A new TRIAD T-210 tube! Functions equally well as power amplifier and oscillator. Assures longer life and far better service than ever before. Has thoriated tungsten filament — can be easily reactivated. Molybdenum construction (instead of nickel) — eliminating grid and plate emission which is the chief cause of noisy tubes.

Here is another actual proof of TRIAD'S superiority — and of the progressive spirit which has won national recognition for TRIAD Engineers.

Send now for Triad bulletin T-210 and for information regarding the remarkable improvements that have been carried out throughout the entire Triad line. A special price is extended to Licensed Amateurs and Members of A.R.R.L.

TRIAD Tubes are fully licensed under all R.C.A. General Electric and Westinghouse Electric Mfg. Co. Patents

Triad Manufacturing Co.
Pawtucket, R. I.

of this city, for the modest amount of $44.50, prepaid.

There's hoping that the amateur fraternity will greatly appreciate my marvelous invention and that I may secure many orders for this wonderful instrument (postage prepaid).

— R. L. Tomps, W5MH

Re: Traffic CQ's

Editor, QST:

We read with much interest the letter from Roy R. Wallace, W6ERU, in the September issue.

While W9EBO is not purely a traffic station, we have handled as many as three hundred messages in one month and are always glad to QSP any time to any place.

We too have tried directional CQ's without much luck, so as an outcome of this experience are much in favor of the set of CQ signals as outlined by W6ERU, as we firmly believe that this system would do away with a lot of needless QRM by letting the other fellow know just what is wanted by our CQ.

A practice which we have always used here is to never answer the ham who sends his CQ 15 or 20 times and then signs. There is only one right way to do anything and if any ham cannot send his CQ in the proper way, he is merely admitting to the rest of the gang that his station is poorly operated.

We are with you, W6ERU. Constructive criticism is always welcome — let's hear from more of the gang.

— M. F. Whitton, W9EBO

Getting S. F. Transmissions

Editor, QST:

It is common practice when listening to the Standard Frequency transmissions to tune the receiver to zero beat with the incoming signals and then tune the frequency meter to be calibrated to zero beat with the receiver and the S.F.S. at the same time. While this practice is OK and very accurate, I have a much more convenient method.

If the frequency meter is of the heterodyne type, tune the receiver to the incoming signal in the usual manner, then back just off the point of oscillation and no beat note will be heard. Now tune the meter to beat with the incoming signal and the audio beat note will be heard in the "cans." Tune to zero beat, and you have the meter in step with the transmitting station and don't have to worry about the receiver. After tuning in the signal with the frequency meter it will be found that the tuning on the receiver is rather broad and the beat note of the same audio pitch regardless of receiver adjustment.

Sometimes it will be an advantage to use the frequency meter in this way to bring in a weak signal when working skeds, and BOY! that's
MERRY CHRISTMAS FOR THE STATION WHEN YOU INSTALL THIS SENSATIONAL RECEIVER!

The most practical Amateur band Receiver yet developed — designed for Amateur work by the oldest reliable manufacturer of Short Wave equipment. Just see these outstanding features:

1 — Employs new super sensitive 2-volt non-microphonic battery operated tubes
2 — Spreads each amateur band over the full range of the dial
3 — Equally efficient for DX, CW or phone reception
4 — Thoroughly tried and tested circuit guaranteeing consistent results
5 — Screen grid RF — detector — power audio
6 — Readily calibrated for each band
7 — Easily assembled and wired

A complete kit comprising all necessary parts to build this record-breaking Receiver — includes drilled and engraved panel, metal cabinet and three special Amateur band plug-in coils allowing each band to be spread over the entire tuning dial.

Price $30.00

Don't slip up on the finest Christmas treat you could ever have hoped for!

Write for our large loose leaf handbook full of information, kept up to date by regular bulletins. Price only 50c.

Our booklet 50 describes this Modern Short Wave Receiver together with a "bang up" Transmitter. Write for it, It's FREE!

RADIO ENGINEERING LABORATORIES, INC.
100 WILBUR AVENUE    LONG ISLAND CITY, N. Y.
Export Department, 116 Broad Street, New York City
This Issue Completes the 1930 Series of QST

You’ll want to keep these copies as a unit

A few years from now QST copies of today no doubt will be scarce. Every reader of QST appreciates its reference value. We are daily reminded of this fact by the many requests we get for back copies, many of which we cannot supply. If you have the 1920 series of QST—and probably you have not—you are one of the few. Even 1922 and 1923 copies are getting scarce. And copies before the war! Well, let’s change the subject.

Next year you will be looking for a certain 1930 issue of QST. You had better resolve right now to keep your copies in a QST Binder

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

One-fifty each postpaid

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

QST
1711 Park St., Hartford, Conn.

where the scheme shines: Tune approximately with the receiver out of oscillation and do the rest with the frequency meter. If the incoming sig is steady you will get a beautiful beat note and practically eliminate background noise due to local QRN from loose wiring systems and vacuum cleaner motors.

In this way the frequency meter serves not only as a standard of measurement but as a separate heterodyne oscillator.

— R. O. Williams, W8AIC

I.A.R.U. News
(Continued from page 50)

in view of the fact that several new stations have been authorized to operate in the band between 200 and 250 meters.

Moreover, complaints of interference with B.C.L. sets from amateur operation will in future be investigated by the Dept. with the assistance of an officer of the W.I.A. This latter concession has been made possible by the fact that the Institute has definitely proved that it is able to effectively control the operations of its members by virtue of their loyalty to the movement.

The 1715- to 2000-ke. band is used mainly for experimental broadcast experiments, and there are more stations operating in Victoria than in any of the other divisions, for some reason or other. In this state there are about 20 stations operating, and some sort of wavelength allocation has become necessary. Stations are allotted wavelengths from the top of the band down, with 20-ke. separation between allocations. The scheme works out very well, but has occasionally been upset by a stray non-member station coming in and heterodyning. No further trouble is ex-

AUIAO, THE STATION OF V. SOLOMIN, SENAJA 67, BISK, SIBERIA

pected from this source as the Dept. has in the public interest sanctioned our scheme and notified these “outside” stations that they are to observe our allocations. The Fed. Executive therefore has just cause to be proud of the result of the negotiations, and the faith which the Radio Dept.
(Continued on page 66)
A Test Panel for Production Troubles

THE Jewell Pattern 579 Service Test Panel is the last word in high speed testing equipment. Seven meters operated by remote control from a movable control panel, with color coded buttons that save time and eliminate errors, solve your unusual production test problems.

Overall dimensions of the panel are 30" x 12 1/4" x 4" with the back of the panel totally enclosed to protect instruments and connections. The remote control measures 8 1/8" x 8 5/8" x 4".

Your plant needs this equipment. Send for data today.

JEWELL ELECTRICAL INSTRUMENT CO.
1642-C Walnut Street, Chicago

Pattern 579 Service Test Panel with remote control is one of the recent Jewell achievements. Seven large 5-inch meters with clean-cut, legible scales and knife edge type pointers, remote control with push button switches of the selective type, color coding of instruments and push buttons all combine to make the Pattern 579 the most convenient, rapid, and accurate equipment for laboratory testing of radio receivers.

Jewell
579 Service Test Panel
Say You Saw It in QST — It Identifies You and Helps QST
has been pleased to place in our ability to control ourselves.

Federal Convention will take place in Melbourne in October, and delegates from every state will be assembled in conference for the best part of a week beginning October 26th. Incidentally, foreign amateurs who happen to visit Australia cannot press are assured of a welcome if they will communicate with the Headquarters of any Division in the capital cities. The necessary address can be obtained on application to the Radio Inspector at the central post office for the city. Poor conditions continue for DX work, but there are very definite signs that the approaching spring season is ushering in better ones. It is a pity that there are not more DX contacts attempted on the 28-mc. band as conditions above 10-mc. are definitely better than below at present.

The 28-mc. band is being systematically explored, and in view of the poor conditions on the other bands, more and more men are being attracted there. VK3CZ had a very interesting QSL from HAF1LG, who reported his 27-mc. signals in Austria. He had discovered immediately after the date of the report that he was outside the band, so that the exact indication is excellent proof of the accuracy of the reception.

The Victorian Division is holding an amateur exhibition in September which will be given over to a display of amateur work and equipment. It is planned to have I.A.R.U. Headquarters address us through the cooperation of the commercial 'phone stations and we are hoping that the stunt will come off successfully. I think we will just about gain the record for a long distance "attendance" of the H.Q. gang at a local convention, won't we? (And, as was chronicled in this department last month, the affair was carried out very successfully, although 'phone was not used as proposed. Instead, Pres. Maxim pressed a key and opened the exhibition by means of this signal. — C. B. D.)

Ross Hull has gone back to the United States, and while we feel the loss of such an excellent radio man, we are pleased to think that an Australian should receive the honor of a more attractive and lucrative appointment in America.

BRITISH NOTES

By J. Clarencots, Hon. Sec., R.S.G.B.

The Fifth Annual Convention held in London on September 26th and 27th proved an unqualified success. Some 150 members from the British Isles were present at the various meetings, which were presided over by Mr. Gerald Mareuse. The Convention opened at 6 p.m. on September 26th when the President made his opening speech of welcome. This was followed by the announcement of the election of new District Representatives, Messrs. G. W. Thomas, GSYK, and J. W. Mathews, G6LL. Then read a paper entitled "The Progress of 28-mc. Transmission and Reception." This paper is being published in the October issue of the T. & R. Bulletin, and can be forwarded to all interested non-members on payment of one shilling.
Photo-Electric Radiotron UX-867

RATING AND DATA
Anode Supply Voltage (Maximum) • 200. Volts
Anode Current (Maximum) • 20 Microamperes
Window Diameter • 1.25 inches

Approx. Sensitivity
Dynamic • 25. Microamperes/lumen
Static • 30. Microamperes/lumen

Maximum Overall Dimensions
Length • 6 5/16 in.
Diameter • 2 9/16 in.
Socket • UX or Navy Type

For Experimental purposes only.

Photo-Electric Radiotron UX-867 is a highly sensitive, general purpose photo-cell of the central anode type. An output of from 1 to 5 volts can be obtained with excellent fidelity.

A limited quantity of UX-867 Radiotrons is available for sale to amateurs possessing station licenses.

NET PRICE $17.50

Rectifier Radiotrons UV-217-A and UV-217-C

For the benefit of amateurs who wish to increase their Rectifier power without incurring the expense of purchasing new filament heating transformers, we are offering Rectifier Radiotrons UV-217-A and UV-217-C at a new low price. These rectifiers have standard “50 watt” filaments requiring 3.25 amperes at 10 volts.

UV-217-A, Rating
Filament Voltage • 10 Volts
Current • 3.25 Amperes
Maximum A.C. Supply Voltage (RMS) • 1500 Volts
Maximum D.C. Load Current • 200 Milliamperes
Length • 7 7/8 in.
Diameter • 2 5/16 in.
Socket Type • Standard 50 watt (RCA No. UT-541)
Net Price • $20.00

UV-217-C, Rating
Filament Voltage • 10 Volts
Current • 3.25 Amperes
Maximum A.C. Supply Voltage (RMS) • 3000 Volts
Maximum D.C. Load Current • 150 Milliamperes
Length • 8 1/2 in.
Diameter • 2 5/16 in.
Socket Type • UT-541 and Clip
Net Price • $20.00

Instruction books giving complete technical information concerning the above, and other Transmitting Radiotrons will be sent gladly upon receipt of a request accompanied by your station call letters.

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RCA VICTOR COMPANY, INC.
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Say You Saw It in QST — It Identifies You and Helps QST
Filament Heating Transformers, Plate Transformers and Radio Filter and Modulation Chokes, designed to meet amateur requirements, are of the same high quality that has made AmerTran products outstanding in a highly competitive field.

Bulletin 1066 gives complete descriptions and diagrams of new equipment. Every amateur should have this informative Bulletin as a guide in ordering new equipment.

At the conclusion of the meeting, two charabanc parties proceeded to visit the stations owned by Messrs. Mathews and Claricoats. The Saturday programme commenced with a Delegates Meeting presided over by Mr. H. Bevan Swift (Acting Vice-President). Many important decisions were reached, and recommendations made to the full meeting later in the day.

The usual souvenir photograph was taken just prior to the business meeting.

Mr. Marcus' first duty at this meeting was to present the Society's trophies, each recipient being greeted with acclamation.

The main business meeting dealt with many matters of local R.S.G.B. and B.E.R.U. interest, chief perhaps (as far as our colonial membership is concerned) was the decision to provide a new coat badge incorporating the letters B.E.R.U. One other very important decision was made which will, we believe, prove of immense interest throughout the world. This is the inauguration of an “Empire Radio Week” when every endeavour will be made to work Empire stations. This week will extend from Sunday, February 22nd, to Saturday, February 28th. Full details will be published shortly; meanwhile, suggestions from Colonial groups will be appreciated.

Convention concluded officially with the annual dinner held at Pinoli's Restaurant, Wardour Street, London. At this event a very great surprise was given to the members by the arrival, direct from Jersey by seaplane, of Miss Barbara Dunn, G6YL. This was the first occasion the O.M.'s of the R.S.G.B. had been given an opportunity of meeting our first and only active V.L member at one of our National gatherings. During the evening she was presented with the President with the cup she won in the recent 1.7-mc. tests. A further surprise was provided by the Honorary Secretary. Thanks to generous offers made by British radio manufacturers, he was able to offer over 25 valuable prizes to the persons present. The prizes were “drawn for” by the members and presented by Miss Dunn. Twenty-two firms made contributions. The presence of Mr. Drudge-Coates (ex 6Y-DCR), Mr. Shrimpton (ZL4AO) and Mr. Le Cheminent (V87AB) added great interest to the gathering, all three gentlemen giving or responding to the toasts of the evening. Mr. Arthur Watts proposed the toast of the Society Overseas, whilst Mr. H. B. Old welcomed the guests. Mr. Gibbs (representing the Daily Mail) responded.

The Society at Home was proposed by Mr. Drudge-Coates and the Honorary Secretary replied.

During the toast speech to the President, given by Mr. Bevan Swift, he presented to Mr. Marcus a large batch of QSL cards upon which each donor had written “Thanks, OM.” as a mark of appreciation for the work he had done on behalf of amateur radio. The final toast of the evening was proposed by Mr. Bevan Swift when he called for all present to show their appreciation of the work carried out by the Honorary Secretary.
He Thought He Would Take the Chance—

Bill, the second op, was just putting the finishing touches on the keying circuit and Jack, the first op, had placed the last power wire in position. "Well, I guess she's about ready to 'peek' now," Bill said. "Yes, looks as if our labors of this past month are beginning to bear fruit. Isn't she a knockout, though?" "Sure enough, but look what it cost you," Jack said as he threw the power switch. "Things begin to happen when the power hits your line. A wisp of smoke seemed to find its way from the middle of the transmitter and Jack literally flew at the power switch and with a wrench that seemed to possess every bit of his anger, sorrow and pathos, disconnected the power from the transmitters. But it was too late. "Whew," from Bill, "what happened now?" The words froze on his lips as he noticed the expression on Jack's face. Too often had he heard the sharp staccato cracks of the high voltage breaking through the insulation of his filter condensers. Jack felt downcast. "Happened? The condensers blew out and took the rectifying tubes along with them. There goes a month's work and money."

"But how could the condensers blow when they are rated at 2000 volts and the transformer only gives 1500?" Jack looked at him shamefully, "I know that, but I thought I'd take a chance on these condensers—they certainly looked good."

When you come to think of it, did Jack really have to take a chance in buying radio equipment? He had planned his "superb" transmitter time and again, went over every little detail, end on end. He had spent money on apparatus and bought equipment of a questionable character from a company of questionable name. That is where he made his mistake. Just imagine how much better Jack would have felt if he knew that he was dealing with a company that had been entering to the amateurs for 11 years, practically since the inception of the hobby, and that every piece of apparatus he purchased was unconditionally guaranteed by the seller. The American Sales Company (since 1919) has been supplying the wants of the amateur and has reached the point of being the largest amateur supply house in the country, only through its untiring efforts in dealing squarely with the amateur. Do you have to suffer Jack's fate?

**BARGAINS IN TRANSMITTING EQUIPMENT**

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<tr>
<th>TRANSFORMERS</th>
<th>CONDENSORS</th>
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<tr>
<td><strong>AMERICAN</strong> 2.5 volt transformers — two windings at 11 and 3 amperes. For mercury vapor tubes.</td>
<td><strong>DUBILIER</strong> Filter Condenser, 1.75 mfd., 1000 working voltage D.C.</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> 4000 volt center-tapped transformers — tapped at 2000 v. filament windings; 2.5 volts at 10 amperes, 7.5 volts at 1.78 amp.</td>
<td>$1.15</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> 4000 volt center-tapped transformers — tapped at 3000 v. filament windings; 2.5 volts at 10 amperes, 7.5 volts at 1.75 amp.</td>
<td>$3.75</td>
</tr>
<tr>
<td><strong>THORDARSON</strong> 175 watt — 1150 volts center tapped, two 7.5 and one 5 watt windings.</td>
<td><strong>DUBILIER</strong> Filter Condenser, 4 mfd., 600 working voltage D.C.</td>
</tr>
<tr>
<td><strong>THORDARSON</strong> 250 watt — 1200 volts center taped, two 7.5 and one 3 watt windings.</td>
<td>$2.50</td>
</tr>
<tr>
<td><strong>THORDARSON</strong> 100 watt — 1000 volts center taped, two 7.5 and one 2.5 volt windings.</td>
<td><strong>DUBILIER</strong> Filter Condenser, 2 mfd., 500 working voltage D.C.</td>
</tr>
<tr>
<td><strong>THORDARSON</strong> 100 watt — same as above but for use with 25 cycle A.C. current.</td>
<td>$2.75</td>
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<tr>
<th>CHOKES</th>
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<tr>
<td><strong>AMERICAN</strong> 30 henri, 400 milli-chokes</td>
<td><strong>DUBILIER</strong> Filter Condenser, 1.75 mfd., 1000 working voltage D.C.</td>
</tr>
<tr>
<td><strong>THORDARSON</strong> Filter Choke, 30 henri — 150 ma., 3000 volt insulation test.</td>
<td>$1.50</td>
</tr>
<tr>
<td><strong>THORDARSON</strong> Double Filter Choke, contains two 18 henri — 350 ma.</td>
<td><strong>DUBILIER</strong> Filter Condenser, 4 mfd., 600 working voltage D.C.</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> Power Choke, 20 henri — 250 ma., D.C. resistance: 110 ohms, $10.80</td>
<td>$1.15</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> Power Choke, contains two 30 henri — 100 ma.</td>
<td><strong>DUBILIER</strong> Filter Condenser, 2 mfd., 500 working voltage D.C.</td>
</tr>
<tr>
<td><strong>DUBILIER</strong> Filter Condenser, 2 mfd., 500 working voltage D.C.</td>
<td>$1.25</td>
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<tr>
<th>CONDENSORS</th>
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<tr>
<td><strong>FLECHTHIM HIGH TENSION</strong> Filter Condensers, with porcelain insulators, guaranteed.</td>
<td><strong>BRADLEYSTAT</strong> type E210, current capacity 10 amperes, for transmitters.</td>
</tr>
<tr>
<td>1500 volts — 1 mfd.</td>
<td>$0.95</td>
</tr>
<tr>
<td>2 mfd.</td>
<td>R.G.A. Power Rheostats, will carry up to 2.5 amperes.</td>
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<tr>
<td>3 mfd.</td>
<td>$3.00</td>
</tr>
<tr>
<td>1000 volts — 1 mfd.</td>
<td>R.G.A. Power Rheostats, (heavy duty) will carry 15 amperes for large tubes.</td>
</tr>
<tr>
<td>2 mfd.</td>
<td>$1.75</td>
</tr>
<tr>
<td>3 mfd.</td>
<td><strong>CENTRALAB</strong> Gain Controls for tube transmitters, 10000 ohms, $0.75</td>
</tr>
<tr>
<td>4 mfd.</td>
<td><strong>R.C.A.</strong> Double Control Choke.</td>
</tr>
<tr>
<td><strong>WESTINGHOUSE</strong> 1360 ohm transmitting grid leak, 60 watts. Tapped at 5000, 6000, and 1300 ohms.</td>
<td>$1.50</td>
</tr>
<tr>
<td><strong>BIBDUOY</strong> 1360 ohm transmitting grid leak, 60 watts. Tapped at 5000, 6000, and 1300 ohms.</td>
<td><strong>SCOTCH</strong> 250 watt transmitting sockets, 2 ends, $2.55</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> 50 watt transmitting sockets, 4 ends.</td>
<td><strong>STROMBERG-CARLSON</strong> Filter Condenser, 3.5 mfd., 600 working voltage D.C.</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> 250 watt transmitting sockets, 4 ends.</td>
<td>$1.50</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> 5000 volt center-tapped transformers.</td>
<td><strong>CENTRALAB</strong> Gain Control for tube transmitters, 10000 ohms, 2 mfd., 4 mfd. and 3 mfd. at 400 working voltage D.C.</td>
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<td>$3.00</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> 5000 volt center-tapped transformers.</td>
<td><strong>DUBILIER</strong> Plate Stopping Condenser, 2000 mfd., at 1000 volts.</td>
</tr>
<tr>
<td><strong>AMERICAN</strong> 5000 volt center-tapped transformers.</td>
<td>$3.85</td>
</tr>
</tbody>
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**SPECIALS**

| **DUBILIER** Filter Condenser, 4 mfd., 500 working voltage D.C. | **VIBROPLEX** new and improved, direct from factory in heavy gauge or heavy base, 200 ma. |
| **CENTRALAB** Gain Controls for tube transmitters, 10000 ohms, 2 mfd., 4 mfd. and 3 mfd. at 400 working voltage D.C. | $2.45 |
| **R.C.A.** Double Control Choke. | **CENTRALAB** Gain Controls for tube transmitters, 10000 ohms, 2 mfd., 4 mfd. and 3 mfd. at 400 working voltage D.C. |
| **DUBILIER** Filter Condenser, 4 mfd., 500 working voltage D.C. | $15.00 |

**AMERICAN SALES COMPANY, 21Q Warren St., NEW YORK, N. Y.**
Maximum output of any transmitter in short wave work is determined by the radio frequency output as indicated by the milliammeter in the antenna circuit. Naturally the reliability of this measurement is of utmost importance to every operator. The reliability of Weston instruments is without equal. Their design and quality of workmanship give them the dependability in service that overcomes the exceedingly slight difference in cost which would be offset by less reliable operation.

The Weston Model 425 was designed and developed particularly for short wave work. It is a Thermo-Couple type instrument, accuracy ±%, made as Ammeters, Milliammeters and Thermo-Galvanometers. The Ammeters, made in ranges of one to twenty amperes, may be used on D.C. or A.C. of any frequency. They have a safe overload capacity of 50%.

The Milliammeters, made in ranges of 125, 250, and 500 milliamperes, are for use on A.C. only. They are ideal for short wave transmission because they have a very low internal resistance, give true current value without any frequency error and do not disturb the constants in the transmitter.

Model 425 is designed for flush panel mounting. In size and appearance, it exactly matches the companion Model 301 D.C. and Model 470 A.C. Voltmeters, being 3½ inches in diameter.

For more complete information, write for Circular JJ.
FROM VOQH - Homeward Bound

OUT of the fastnesses of the Arctic, the staunch little schooner "Effie Morrissey" has again snuggled safely into her berth in home waters.

Her coming was not unheralded, because on September 26th her unfailing and efficient transmitter, out over many leagues of tossing ocean, sent this message:

From Pole to Pole, East and West, wherever Radio is known, the good, rugged Cardwell has rendered valiant service under trying conditions.

Your outfit may never be called upon to meet the test of salt water, salt air, extremes of heat and cold, shocks and unavoidable abuse; nevertheless, a transmitter or receiver, if worth building at all, deserves CARDWELLS for efficiency and long service. Send for literature.

The Allen D. Cardwell Mfg. Corp'n
81 Prospect Street, Brooklyn, N. Y.

CARDWELL . . . "THE STANDARD OF COMPARISON"

Say You Saw It in QST — It Identifies You and Helps QST
to November 2nd, and many amateurs are already testing their gear on this wave. Our present permit extends only until the end of November, but all Norwegian transmitters will welcome reports and QSO's in this band, particularly from the more nearby countries, to test the utility of this wavelength for schedules.

Amateur Radio at the Eastern States Exposition

(Continued from page 19)

forbear to mention the one day when the station was for a short time transformed into an experimental layout, merely in the hope of slightly increasing the already respectable wallap of the signals.

The filter — which, as you will note by turning to pages in November QST, consisted of a choke coil and electrolytic condenser in a brute force arrangement — was shorted out. After much re-}viving of the monitor, micrometric adjustment of the angles of antenna coupling coils, hairbreadth changes in the setting of tuning condensers, and careful plotting of the readings shown on W1LI's antenna millimeter (on which changes of a very few r.f. milliamperes could be read) the set was eventually put on the air at 6:00 p.m. W3PX was called by Blum, chief op, and worked. The note was reported crystal d.e. QSA 5, and W3PX could not be shaken from that description!

Now for heaven's sake, you fellows who are using similar sets, don't set forth immediately to lay a ten-penny nail or a rusty hairpin across the terminals of your filter on the strength of that report! If you do you'll get a.c. and an application of the Wouff Hong as you deserve — nothing more. It takes four cracker-jack ops and a magic potion to make d.e. out of even particularly well behaved r.a.e.

The station log gives us the following data; twenty-five stations were worked — some of them more than once — in seven districts. This was in five days, as the first and last days the station was not on the air. Inasmuch as traffic handling and not DX or an effort to fill the station log was the end in view, the results were eminently satisfactory. All reports were QSA 4 and 5, and operating was confined to daytimes. While the work wasn't spectacular, consideration of the conditions and the times gives one a lot of respect for the low-powered set.

A large number of messages was originated at the booth during the week; a considerable percentage of which passed through W1MK. RP's assistance in disposing of this traffic was invaluable. Many of the messages were of rubber stamp character, but some were of considerable interest. One of the Springfield papers carried a headline to the effect that flat pocketbooks were replenished through the station, a thought derived from messages requesting more cold cash from the home folks with which to meet the exigencies of existence.

The operation of W1ESE was a good example
The New A.C. Traffic-Tuner

Many new features, not previously found, have been developed by NATIONAL co.

Engineers for this remarkable all-purpose, high-frequency receiver — assuring a high degree of trouble-proof operation, a continuous tuning range, equal adaptability to phone or C. W., and absence of hum.

Equally Effective on Phone or C. W.

A MECHANICALLY and electrically stable true A. C. High-Frequency Traffic-Tuner and Receiver for amateur use. Will work with different sorts of antennas without readjustment except of antenna trimmer. Once trimmer is set, Thrill-Box tunes and logs with true single control. Extremely simple to operate. 1080 dial degrees available between 21.2 m.c. and 2.61 m.c. Easily adapted to still wider spreading of bands, if desired. Works down to 33 m.c. Very smooth sensitivity control, no grunting, no back-lash, or clicking on higher frequencies. No hand capacity. DOUBLE SCREEN GRID, with 224 grid-leak detection. Push-pull audio, with special phone-jack before the last stage.

See Description of Transformers, Condensers and Power-Supply at left

Also made in new Low-drain D. C. Model, using 230, 231 and 232 tubes.

Easily assembled with genuine NATIONAL Radio Parts.

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Hundreds of wiring diagrams, as well as important data, of commercial receivers since 1927, and some many years earlier, have been collected and placed at the disposal of radio service men. Additional service data for new receivers as they appear on the market will be supplied at trifling cost.

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WHAT IT'S ALL ABOUT

And that was triumph indeed. In fact, there were many such triumphs which were overshadowed by the principal objects of this cooperation. The new interest aroused in old-timers now out of the game was another. But the important ends we sought were equally successful. As an experiment in a new field it was productive of results and a fund of experience for future workers.

By this we do not mean to-day that the operation of a small amateur station in a booth at a show or exposition is a new experiment. But the second great purpose, that of instituting and training a class of selected boys in the principles and possibilities of amateur radio, is both new and, as we have proven, worthwhile.

There is a wonderful opportunity awaiting all of us in the advocating and assisting in work of this sort among boy's clubs and boys as individuals in our vicinities. This has a universal application and is not confined alone to Junior Achievement clubs, but if you have a J.A. club in your vicinity it gives many opportunities for leadership to those trained in or having hobby experience with any of its programs. Those of you who have inclination and ability for such work will gladly be given an opportunity to discuss any angles of it, or have any questions answered, by writing in to Headquarters.

It seems to us that the club plan is one particularly applicable to beginning amateurs. It results in an initial pooling of effort and expense, as well as the profit and pleasure which results. Eventually, of course, each budding club-member-amateur will have his own station on the air, but during the period while he is learning the principles of amateur radio his activities are controlled and guarded sufficiently so he will not be creating unnecessary interference, or becoming any of the other numerous sore spots beginners so readily become.

From the time he first learns the letter "A" of the code until a sufficiently long time has elapsed since the issuance of his license, he works with help and supervision in the quickest, most efficient way. He always has guidance and counsel when it is most needed, and his mistakes are thereby reduced to a minimum. This means more enjoyment for him in the successful application of his new hobby, and safeguards the interests of other amateurs who might be affected by any prolonged bungling on his part.

This pooling of effort is not only advantageous to the beginner; it represents real economy in the use of our allotted frequency allocations. And the result is new strength to amateur radio.

The system used in training this class of boys was a comparatively simple one, and can be organized by any one with very little effort. Time was allowed for six code lessons, so the alphabet and numerals were divided into five lessons, leaving the last open for abbreviations and extra

of the splendid efficacy of low-power under present conditions. That matter has been tested and proved to our full satisfaction!
The Vitrohm Plaque Resistor, non-inductive and non-capacitative, is ready. Standard resistance value 5000 ohms, handles the grid of a 50 watter and the price is only $2.00. Get the dope today.

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2. free!
3. ??????

If you haven’t received your supply of the snappy new Q.S.L. cards, write for them today. Your call letters will be imprinted in outline letters. There is no obligation for this service.

We have a very important matter to discuss with Radio Club Secretaries. Write at once giving the name of your organization and number of members. Club Members — if your secretary misses this, tell him to drop us a line.

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Perhaps you will be the one to discover a money-making new application for the Arcturus Photolytic Cell. Based on a new principle, this cell insures more efficient operation of any photo-electric device. Our new free book gives complete performance data and circuit diagrams; shows how to use this improved cell in various applications. Write for it today.

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For Amateurs, Commercial Stations and Dealers

THE STANDARD OF COMPARISON
POWERTYPE crystals are recognized as the best.
No off-frequency operation with POWERTYPE CRYSTALS
FULLY GUARANTEED BY A RELIABLE COMPANY

Ground by experts and calibrated from precision standards.
Crystals for amateurs around to approximate frequency and calibrated to better than 1/10 of 1%.

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550-1500 kilocycle band — calibrated at any temperature plus or minus 500 cycles desired frequency complete with plug-in dust proof mounting — $45.00. Constant temperature heater oven less crystals $15.00. We do any kind of special crystal grinding for any frequency.
Grinding instructions furnished with crystal blanks.
You may order direct from this ad C.O.D.

FREE Send name, no obligation, for full information on crystals, holders, blanks, heater ovens, etc.

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Specialists in frequency precision
practice. A half hour each day was devoted to drilling on the selected group of letters during each of the first four days, with constant review and the insertion of words and sentences to create and hold interest. On the last two days 45-minute sessions were held, to wind the lessons up properly.

After Mr. Hebert's speech on Monday, which dealt with amateur radio in general terms, the balance of the week was given over to the consideration of the following units (one each day) as has been mentioned before.

1. The background and tenets of existence of amateur radio, with a review of activities, history and character. Regulations, frequency bands, etc., were explained.

2. The receiver, dealing with practice, construction and elementary theory. For this demonstration the two-tube set shown in the foreground of two pictures was used.

3. The transmitter, with the same points brought out as above, including an explanation of the theory of oscillatory circuits, and the operating theory of rectifier-filter power supply systems. The single-control set and the W1ESE transmitter were used in this lesson for purposes of illustration.

4. Elementary radio theory, of the practical nature permitting understanding of the principles underlying design of capacity-inductance values, antenna lengths, etc.

5. Operating practice, using W1ESE as an object lesson.

It's all very easy. And yet, with a little application on the part of instructor and student, it is absolutely amazing the amount of practical amateur radio knowledge gathered by a young fellow who, when he starts, thinks UX-210 is a chemical formula. Try it with the non-radio boy's clubs in your locality, organizing a special radio class or subsidiary of your regular radio club. It's one of the most worthwhile things you can do and is also a lot of fun.

For help of any kind write in to Headquarters. We have a special booklet (How To Become a Radio Amateur) prepared to simplify and standardize such training, and they will be gladly supplied at 10¢ each or $1.00 a dozen. Organized beginner's amateur radio clubs represent the solution of one of our toughest problems. Let's get them going.

If no suitable brackets are available for mounting midget condensers in a readboard layout the ones used for holding window shades will serve very nicely. The necessary holes are already drilled. — W3CA.

W5WN suggests that the panel saw in the July "X" Section can be made to cut circles if the back of the hack-saw blade is cut off with a pair of tin snips. The blades are generally highly tempered only on the side that carries the teeth, the other side being left soft to prevent breakage.
Two Way Radio Link Never Interrupted—
Capt. Yancey's Radio Makes New Records—

Here's the Story behind These Headlines

The Yancey plane (ESCO equipped) in its non-stop flight to Bermuda maintained direct two way communication with New York. Darkness forced the plane down a little short of its goal. The plane floating on the sea remained in communication with New York.

Later, on its "Good Will" flight to South America the Yancey plane, on the ground at the Canal Zone, maintained two way communication with New York. Zeh Bouck, Radio Operator, said—"I believe this is without doubt a record for Airplane transmission, and it shows very clearly what we could have done had we been forced down in some of the jungle over which we have flown during the last few weeks."

And on July 1, this last record was broken — the Yancey plane, on the ground at Buenos Aires, communicated uninterruptedly for more than an hour with the New York Times Station, 5838 miles away.

The Yancey plane was equipped with an "ESCO" wind driven generator to supply radio power while flying, and a battery operated "ESCO" dynamotor for ground work.

"ESCO" has a very complete line of wind driven generators, and dynamotors for airplane service. Let "ESCO" Engineers help you with your power supply for communications.

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<tr>
<td>General Electric 24/750-volt 150-watt Dynamotors</td>
<td>$27.50</td>
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<tr>
<td>General Electric 24/1500-volt 550-watt Dynamotors</td>
<td>$72.50</td>
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<tr>
<td>550-volt 500-cycle generators with exciters</td>
<td>$7.50</td>
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<tr>
<td>Westinghouse 6-15 volt 500-watt</td>
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<td>Westinghouse 200-watt 900-cycle</td>
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<td>Westinghouse 27.5/350-volt 60 mfd.</td>
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<td>Twins for double voltage or current</td>
<td>$15.00</td>
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<td>Shirts for external drive $1.00 each additional</td>
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THE PERSONAL EMBLEM. A handsome creation in extra-heavy rolled gold and black enamel, 1½" high, supplied in lapel button or pin-back style. The personal emblem has come to be known as the sign of a good amateur. It identifies you — in the radio store, at the radio club, on the street, traveling — you can spot an amateur by it. Wear your emblem, OM, and take your proper place in the radio fraternity. Either style emblem, $1.00, postpaid.

THE AUTOMOBILE EMBLEM. 5 x 2½", heavily enameled in yellow and black on sheet metal, holes top and bottom, 50c each, postpaid.

THE EMBLEM CUT. A mounted printing electrolyte, the same size as the personal emblem, for use by Members on amateur printed matter, letterheads, cards, etc. $1.00 each, postpaid.

THE "JUMBO" EMBLEM. How about the shack wall or that 100-footer? Think of the attention this big yellow-and-black enamel metal emblem will get! 19 x 8½", same style as Automobile Emblem. $1.25 each, postpaid.

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Who’s Who
(Continued from page 25)

Francisco, and continuing successively with Standard Electric Co. of California, Central Gas & Electric Co., and the North Shore Railroad. In 1908 he became the electrical engineer of the Harriman Lines, in 1909 electrical engineer for the Southern Pacific Co. Since 1912 he has been Consulting Electrical Engineer for that company.

Mr. Babcock’s participation in general technical activities has been impressive. He is a Fellow and a past vice-president of the American Institute of Electrical Engineers, member and past president of the Engineers’ Club of San Francisco. He is a member of the American Association for the Advancement of Science and of the Astronomical Society of the Pacific. In 1924 he represented the United States as principal delegate to the Inter-American Electrical Communications Conference, held in Mexico City. He is an honorary member of La Sociedad Geográfica y Estadística (Mexico). He is a representative of affiliate membership in the Society of Automotive Engineers.

Always of distinctly nautical leanings, Mr. Babcock holds a commission as Lieutenant-Commander in the U.S. Naval Reserve and has had several lengthy cruises with the fleet in active duty. He is an expert amateur navigator, yachtman and fisherman, and a member of the San Francisco Yacht Club and the Berkeley Country Club.

In amateur radio he has been equally active. He pounds brass pretty steadily at W6ZD, particularly with Hawaii. Most of his radio efforts, though, necessarily go to his duties as Division Director. He is a vigorous director, keeping closely in touch with affairs through the large Pacific Division, maintaining an extensive correspondence, and frequently visiting the larger centers in person, particularly at the time of conventions and hamfests. Not The Old Man, he is yet one of the elders in the League, both in years and in counsel.

The Roanoke Division Convention

WITH real Southern hospitality the Richmond Short Wave Club, through its chairman, “Bob” Eubank, welcomed the delegates attending the first Virginia A.R.R.L. Convention at the Hotel Richmond, Richmond, Virginia on September 19th and 20th. The largest registration was the first day and every minute was taken up with something worthwhile.

The “dutch” lunch at noon on Friday enabled those present to get acquainted and kept the crowd together so that when the afternoon meeting was called to order the Winter Garden room was well filled with an enthusiastic crowd. Chairman Eubank introduced Director Gravelly W3BZ, one of the real old timers; one who has
QST Oscillating Crystals

"THE STANDARD OF COMPARISON"

AMATEUR BANDS:

Winter is coming, and no doubt you are going over your transmitter removing those weak links so as to get the most possible efficiency from your set.

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

- 1715 to 2000 Kc band •••••• $15.00 (unmounted)
- 3500 to 4000 Kc band •••••• $20.00 (unmounted)
- 7000 to 9000 Kc band •••••• $40.00 (unmounted)

BROADCAST BAND:

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

CONSTANT TEMPERATURE HEATER UNITS:

We can supply heater units guaranteed to keep the temperature of the crystals constant to better than a tenth of 1 degree centigrade for $900.00. Two matched crystals, ground to your assigned frequency in the 550-1500 Kc band with the heater unit complete $410.00. More detailed description of this unit sent upon request.

ATTENTION AIRCRAFT AND COMMERCIAL RADIO CORPORATIONS:

We invite your inquiries regards your crystal needs for Radio use. We will be glad to quote special prices for POWER crystals in quantity lots. We have been grinding power crystals for over seven years, being pioneers in this specialized field, we feel we can be of real service to you. We can grind power crystals to your specified frequency accurate to plus or minus 0.05 a. All crystals guaranteed and prompt deliveries can be made. A trial will convince you.

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represented his division so well for many years. Mr. Gravely spoke on the duties of the director and what it means to one to have the constructive cooperation of the members: he then introduced Mr. Chas. H. Stewart, Vice-President of the A.R.R.L., who has looked after the legislative end of the League so efficiently for a long time. Mr. Stewart said he was present to enjoy himself as a "ham" and intended to do so all through the convention and before the convention was over he was a member of the "young squirt" family by Doc. Woodruff, the "Sherlock Holmes" of the Board of Directors. The young squirt family now consists of Gravely, Stewart and Hebert.) Major W. G. Hawthorne, U. S. Marine Corps, Quantico, Va., and one of the active "hams" in the division under the call-letters of W3APT, gave a talk on the equipment used by the signal section of the Marines and showed some of the portable transmitters and receivers used in the field. The compactness and ruggedness of the outfits showed careful design and manufacturing. Thanks are due the Major for all his trouble. Fieldman Hebert from Headquarters had brought Ed. Handy's new Dynatron Frequency Meter and did his best to convince the group of the importance of each amateur station having an accurate measuring instrument. The importance of keeping within our frequency bands cannot be overlooked any more. Mr. M. M. Brisbane, Service Engineer, RCA-Victor, gave a lecture on condenser microphones as used in broadcasting stations. The afternoon ended with Lieut. Wilson, U.S.N.R., showing three reels of movies. Dinner found group after group of fellows who had become real friends together and the air buzzing with ham-talk.

The evening was devoted entirely to an illustrated lecture by L. S. Fox, Engineer, National Carbon Co., on tube construction, and made one appreciate the amount of research work conducted by his firm.

The traffic meeting on Saturday morning was in charge of SCM, J. F. Wohlford, W3CA, and general discussions on Communications Department affairs took place. Lieut. Wilson, U.S.N.R. brought out the benefits to be derived in enrolling in the Reserve, which remarks were supplemented later by Lieut. E. C. Rogers of the Navy. Capt. N. L. Baldwin, the Army-Amateur Liaison Officer from Washington, discussed the importance of the Army-Amateur net now being placed on an efficient basis and with a master control station (WLM and W3CXL) located in Washington. Our fellows should realize more and more the importance of these two services and extend full cooperation. Don Lusk, although an SCM for the Atlantic Division was present, with his OW, and that brings to mind there were several OW's and YL's present.

The convention was favored by two representatives from the Radio Division in the person of Mr. L. C. Herndon, Radio Supervisor and his assistant Mr. G. E. Sterling, of the third district. They were kept busy with examinations.

With some 25 automobiles in the line — looking just like a parade — a trip was made to the

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“How to Become a Radio Amateur," a helpful booklet for beginners, describing simple apparatus and telling the whole story. Ten cents postpaid, $1 per dozen copies.

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Ferranti specially designed precision audio and output transformers suitable for the exacting requirements of broadcast stations, laboratories, recording devices, amplifiers, telephone lines, special testing and other uses, where a flat curve is required over a wide frequency range, are now made in the U. S. A.

These transformers have curves flat within less than 1 db between 15 and 800 cycles. The above curve of 600 ohm line to line transformer is typical. Transformers of this class can be furnished for tube to line, line to speaker, line to line, line to tube, microphone to tube and other numerous requirements.

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Radio Inspector located here. New Orleans supplies operators for the various Gulf ports. Most logical location in the U. S. A. to come to for training.

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Our new and improved type "B" Unit with a sealed-in chemical dryer. Sold separately.

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Max. Inv. Peak Volts 7000
Fits UX socket and has plate cap and connection.

Price $20

NATIONAL RADIO TUBE CO.

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Who's Who

(Continued from page 28)

by c.w. Followed a half dozen very active years, during which Mr. Huber was president of the Tipton Radio Club and held a variety of A.R.R.L. positions: O.R.S., O.W.L.S., O.B.S., member X-Section, R.C.C., Asst. Division News Manager, and S.C.M. for Iowa.

These activities and qualifications caused him to be called to headquarters in the spring of 1928 to become Assistant to the Communications Manager. He put in a year and a half at Hartford but felt obliged in 1929 to return home to resume his studies at the University of Iowa, which had been interrupted by the sojourn at headquarters. Brass pounding was now divided between W9YA, the University station, and W9DOA, which had become crystal-controlled in 1927. In the fall of 1929 Mr. Huber was elected director of the Midwest Division, and has represented them this year. He was commissioned Ensign in the U. S. Naval Reserve and appointed executive officer for Section Eight (Iowa) of the naval communications reserve. Meanwhile he continued active in other work organizing the Iowa Amateur Radio Club at the university's seat, Iowa City, and having a good share in planning several of the conventions at Ames, annual Midwest Division affairs.

This fall he transferred his activities to Seattle in order to enroll in the School of Journalism at the University of Washington. His unfortunate distance from his division made it seem desirable to him to resign his post as director, as a consequence of which a special election is now in process to choose his successor in the Midwest. Meanwhile he maintains his interest in amateur matters and has become a member of the Seattle Radio Club.

air-port where an opportunity was given to examine the Department of Commerce radio beacon and weather station, followed with a visit to Broadcasting Station WRVA, where "Bob" Eubank is the chief operator. The final technical talk took place in the Red Room while the Winter Garden was being prepared for the banquet. Miss Elizabeth M. Zandonini, (our own W3CDQ) from the Radio Division Bureau of Standards, gave an illustrated lecture on the piezo-electric oscillators as used by the Bureau. We are thankful to Dr. Dellinger for permitting Miss Zandonini to bring slides along — for they always help a lecture. There were so many speakers that Doc. Woodruff, W8CMP, did not have an opportunity to speak on "chokes" until the banquet, but as he was the "Roostmaster" he found a chance to give a bully good talk. With a good orchestra and a side "skit" by two pickaninnies the entertainment feature was well carried out during the banquet. With the distribution of prizes as a finale the first Virginia convention came to a close with the gratitude of all present being expressed to the Radio Manufacturers for their donations and to the Richmond Short Wave Club and the convention committee for such a pleasant affair.

— A. A. H.
Install Tone Quality in unsatisfactory sets by replacing inferior, obsolete, or worn out units with THORDARSON REPLACEMENT TRANSFORMERS... It is what the set owner hears... the improvements in audio amplification... that makes pleased customers.

THORDARSON Replacement Transformers are constructed according to the true high standards set by all THORDARSON apparatus... and they are almost universal in application.

A small stock of THORDARSON Replacement Transformers enables you to recondition a wide variety of sets, with minimum investment in stock. For sale at all good Parts Dealers everywhere.

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Due to the unexpected demands for our new products, shipments were somewhat delayed. However, we have now increased our facilities and shipments of our type WM-1 wavemeter and type MM-1 Monitor can be made immediately. We thank all our customers for their patience.

Type WM-1 Wavemeter: Aluminum case, large micro-vernier dial, readings to 1/200 of full scale. Neon bulb resonance indicator, coils for 20, 40 and 80 meter bands. Fully calibrated, with graphs. $9.50

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Send us your dealer's or jobber's name and we will send you a copy of Bulletin 73-C. We manufacture special multiplying resistors for A.C. voltmeters. Full information will be sent on request.

Strays

It seems we were a bit too hasty in making that remark about the lack of a tube with a plug-in filament in Strays a month or so ago. Don Hawley, of Plant City, Fla., informs us that such a tube was described in one of the popular magazines not long ago. Anyhow this tube is a heater-type gadget, and we were thinking of d.c. tubes! — K. B. W.

Changes in Regulations

(Continued from page 80)

accordance with the Radio Act of 1927 as amended." The practical effect of this is to take out of the hands of the Supervisors of Radio the actual licensing of amateur stations and to centralize this work for the whole country at the offices of the Commission in Washington. General Saltzman, chairman of the Commission, explains in a letter printed in this month's "Correspondence" that the duty of issuing amateur licenses belongs to the Commission, under the law, and has been hitherto temporarily handled by the Radio Division. The Commission now possessing adequate facilities for doing the work, it now takes it over, as provided in the Radio Act.

The regulations of course continue to provide that normal amateur applications complying with the regulations shall be issued without more ado, and at this writing the issuing and renewal of station licenses is proceeding smoothly and promptly at Washington.

Application blanks must still be obtained from the Supervisor, and the filled-in form must still be filed with the Supervisor. It is not to be mailed direct to the Commission. (The Supervisors still issue operator's license.) In the past the greatest delay in issuing amateur licenses has been caused by the improper or incomplete execution of the application form. Supervisors have often had to return an amateur's application for correction or to secure missing data. With the forms now going to Washington, such delays will be greater. It is important, then, to make an adequate answer to each question.

Applications for renewal of station license must be filed with the Supervisor at least thirty days prior to expiration. It is up to the individual amateur to write for the renewal application blanks in time to comply with this requirement. Otherwise a prized call may be lost, and if renewal is not received by the expiration date of the old license, operation must cease until the new one arrives. Remember, too, that both station and operator licenses must be displayed conspicuously in the station.

— K. B. W.
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Financial Statement

By order of the Board of Directors the following statement of the income and disbursements of the American Radio Relay League for the third quarter of 1930 is published for the information of the membership.

K. B. WARNER, Secretary.

STATEMENT OF REVENUE AND EXPENSES FOR THE THREE MONTHS ENDED SEPTEMBER 30, 1930

REVENUE

Adverting sales, QST...... $16,883.30
Newdealer sales...... 30,097.03
Handbook sales...... 3,821.60
Membership dues...... 9,492.27
Beginners' booklet sales...... 180.84
Emblems...... 110.51
Interest earned...... 873.47
Cash discounts earned...... 295.74
Bad debts recovered...... 5.00 $22,547.12

Deduct:

Returns and allowances...... $3,891.26
Less portion charged to re­serve for newstand returns...... 250.51
$3,640.75

Cash discount on sales...... 258.11
Exchange and collection charges...... 11.40 $3,910.26

Net Revenue...... $18,634.86

EXPENSES

Publication expenses, QST...... $12,833.21
Publication expenses, Handbook...... 2,094.45
QST, misc. receipts and expenses...... 300.00
net balance...... 293.54
Salaries...... 17,214.43
Forwarding expenses...... 630.89
Telephone, telegraph and postage...... 1,200.51
Office supplies and general expenses...... 1,560.33
Rent, light and heat...... 931.06
Traveling expenses...... 1,630.71
Depreciation on furniture and equipment...... 450.46
Communications Department field expenses...... 72.99
Headquarters station expenses...... 392.41

Total Expenses...... $29,233.99

Net Loss from Operations...... $578.13

Calls Heard

(Continued from page 51)

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Price includes wood parts, hinges, louver and stand for finishing. All orders are cash or 25% advance on C.O.D. shipments. Height shown is not measured from top of 3/4 inch mounting board.

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Radio Catalog 1931

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is the real basis of comparison for a receiving set.**

### "X" Line Transformers

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX</td>
<td>Straight audio amplification.</td>
<td>$6.00</td>
</tr>
<tr>
<td>BX</td>
<td>Push-pull Input unit.</td>
<td>$6.50</td>
</tr>
<tr>
<td>CX-171</td>
<td>Push-pull Output Transformer, for 171 or 250 power tubes for cone speaker.</td>
<td>$6.50</td>
</tr>
<tr>
<td>DX</td>
<td>Same as CX except for 210 and 112 power tubes.</td>
<td>$6.50</td>
</tr>
<tr>
<td>HX</td>
<td>Push-pull Output for 171 or 250 Power Output tubes to match the impedance</td>
<td>$6.50</td>
</tr>
<tr>
<td>G-171</td>
<td>of moving coil of Dynamic loudspeakers.</td>
<td>$12.00</td>
</tr>
<tr>
<td>D-210</td>
<td>Same as G except for 210 and 112 power tubes</td>
<td>$12.00</td>
</tr>
<tr>
<td>H-171</td>
<td>Push-pull Output for 171 or 250 power tubes for Dynamic Speaker.</td>
<td>$12.00</td>
</tr>
<tr>
<td>G-210</td>
<td>Same as type H except for 210 and 112 tubes</td>
<td>$12.00</td>
</tr>
<tr>
<td>F</td>
<td>Plate Impedance for use as a choke to prevent oscillation and for impedance</td>
<td>$5.00</td>
</tr>
</tbody>
</table>

### "A" Line Transformers

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>List Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX</td>
<td>Similar to X Line but with special core metal to give greater amplification</td>
<td>$10.00</td>
</tr>
<tr>
<td>BX</td>
<td>Push-pull Input Transformer for all tubes.</td>
<td>$12.00</td>
</tr>
<tr>
<td>G-171</td>
<td>Push-pull Output, for 171 or 250 type power tubes with cone speaker.</td>
<td>$12.00</td>
</tr>
<tr>
<td>D-210</td>
<td>Same as G except for 210 and 112 power tubes</td>
<td>$12.00</td>
</tr>
<tr>
<td>H-171</td>
<td>Push-pull Output for 171 or 250 power tubes for Dynamic Speaker.</td>
<td>$12.00</td>
</tr>
<tr>
<td>G-210</td>
<td>Same as type H except for 210 and 112 tubes</td>
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<td>F</td>
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<td>$5.00</td>
</tr>
</tbody>
</table>

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