In this issue—
Why This
58 Mc. DX?
New
Emergency
Equipment
This question is frequently asked us by our customers. Any true answer must take into account the fact that most amateurs indulge in their hobby in cycles of three or four years duration, and, also, that the perennial amateur is in the habit of re-equipping his station at least every three years, either to increase power or to modernize his gear. Therefore, we think that an accurate picture of the cost of an amateur transmitter is its established resale value after three or four years of use, subtracted from the original purchase price.

We have obtained some interesting figures on the resale value of Collins transmitters by studying the QST “ham-ads” during the last six months. We found twelve “ham-ads” offering Collins transmitters for sale and four “ham-ads” advertising to buy Collins transmitters. The twelve Collins sets offered were valued at an average of 50% of the original purchase price after being in service an average of three and one-half years. The want-ads indicate a very definite preference for Collins transmitters. A ready market for used Collins equipment is shown by the fact that no set was offered for sale more than once.

The experience of many of our own customers, who have been in and out of amateur radio and of those who have sold their original sets and purchased higher powered Collins sets confirms the conclusions we may draw from the “ham-ads.” These conclusions are:

- A Collins transmitter is a tangible asset which, considering its unusually high resale value, costs surprisingly little to own.
- It is far cheaper in the long run to buy Collins than it is to buy a make which does not have an established resale value.
- It is sound business judgment to buy a Collins transmitter.
AN INVITATION TO ALL AMATEURS

THE MEMBERS of the Hallicrafters organization, and I am sure that we speak for all citizens of Chicago as well, are proud that we can welcome the American Radio Relay League to this city. Chicago is signally honored that it should be chosen as host for the first national convention of the ARRL in fourteen years, and it is our hope that it will be a memorable one.

THE HALLICRAFTERS wish to extend an especially cordial invitation, not only to visit our booth in the exhibit hall, but also to visit the Hallicrafters Laboratories as well, during your stay at the convention. The latch string is out, and there is a big "Welcome" sign being painted on the Door Mat.

73,

W. J. Halligan
PRESIDENT

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2611 S. INDIANA AVE. CHICAGO
Recognizing the need for an efficient, simply operated, marine radio-telephone unit that would sell at a moderate cost, the Hallicrafters designed the Model HT-3. Built only after a thorough study of the requirements for this service, the Model HT-3 answers every need for a unit of this type, — compact, — entirely self-contained, requiring only a 12 volt or 32 volt battery and an antenna, — simple to operate and highly efficient in operation. It consists of a 50-Watt-Output Phone Transmitter for operation on any 3 frequencies in the Marine Band (2100-2900 KC) and a 6-Tube, 2-Band receiver covering 2100 to 2900 KC on one band and the standard broadcast band on the others.

The receiver output is normally connected to the speaker but is switched to the earpiece when the handset is lifted from the hook. A button in the handset starts the transmitter (push-to-talk) so that conversation can be carried on with the same ease as on an ordinary telephone.

In this efficient Marine Communications Unit, the same painstaking, careful engineering is evidenced, — it is just another example of Hallicrafters Policy to build communications equipment to fill a definite need.

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**Transmitter**
- 50 Watts Carrier Output
- Any three frequencies in Marine Band (2100-2900 KC)
- Three-position Band Switch
- Low-Drift Crystal-Controlled Oscillator
- Tubes: 1-6F6 Crystal-Oscillator, 2-RK39 Class C Amplifier, 4-6L6G Modulator
- Power Supply — 12- or 32-Volt Battery, Transmitter Plate power furnished by built-in 450-Volt Dynamotor.

**Receiver**
- 6 Tubes
- 2 Bands: 2100-2900 KC, Standard Broadcast
- 3 Watts Output
- Built-in Speaker, Telephone Handset
- Volume Control, Band Switch
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All appointments in the League's field organization are made by the proper S.C.M., elected by members in each Section. Mail your S.C.M. (on the 16th of each month) a postal covering your radio activities for the previous 30 days. Tell him how you plan to use these contacts in your own A.R.R.L. member or get your OSF at the next meeting; he wants a report from every active ham. If interested and qualified for O.R.S., O.P.S., or other appointments he can tell you about them, too.

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*Officials appointed to act until the membership of the Section choose permanent S.C.M.'s by nomination and election.*
PLATE TRANSFORMER SPECS.

1. PRIMARY VOLTAGE AND FREQUENCY—
   (a) Does voltage fluctuate widely (more than ± 10%)?
   (b) Do the wiring in your building allow enough, to carry
   the load? (If not, the voltage will drop when the
   load comes on and poor regulation will result.)

2. SECONDARY VOLTAGE (R.M.S.)—
   (A) For a full wave choke input rectifier system, this is
   1.1 X (D.C. output + choke drop + tube drop and resistors).

3. D.C. OUTPUT VOLTAGE—
   (A) Type of rectifier system used: I. Full wave choke input;
   II. Full wave condenser input; III. Type of rectifier tubes
   (B) Type and resistance of choke used
   (C) Capacity of condenser used

4. D.C. LOAD (in amperes or milliamperes)—
   (A) Type of load: I. Continuous; II. Variable—give minimum
   and maximum values, III. Continuous, (where re-
   mark may be considered continuous); IV. Intermittent—
  Brief = given length of time load is on and length
   of time load is off.

Kandid Ken-O-Talk, No. 10

• PLATE TRANSFORMER SPECIFICATIONS •

PROBABLY the most common cause of unsatisfactory operation in all types of electrical
equipment may be traced to faulty or misunderstood specifications. If any trace of doubt
exists, the manufacturer should always be consulted to determine the exact meaning of his speci-
fications.

In the above "Page from an Engineer's Notebook" are listed the detailed specifications
which are required by an engineer before he can design a plate transformer. If any one of these
specifications is missing it means a delay while the information is obtained. If it is impractical
to wait for complete specifications, the unit must be built so it will operate satisfactorily under the
worst conditions which would normally be expected. This of course means a larger and more
expensive transformer than necessary.

The plate supply for class B stages sometimes has poor regulation due to the fact that the pri-
mary is supplied by a line which is incapable of supplying the power. As the load comes on, the
line voltage drops and the resulting poor regulation introduces distortion in the class B stage. It
is usually possible to find out the maximum safe load for a line from the power company.

If plate transformers are ordered by the D.C. voltage output required, it must be remembered
that the type of rectifier tubes, the resistance of chokes, and whether condenser or choke input
must be known in order to determine the secondary voltage. Even if secondary voltage is speci-
fied, it is important to know whether choke or condenser input will be used, for as much as 40%
difference in secondary current may be caused, even with the same D.C. output, by a change
from condenser to choke input.

In specifying the load current, account should always be taken of the bleeder resistor. This
seemingly unimportant factor may mean the difference between correct operating conditions
and a 15% overload.

If the load is of the swinging or variable type the maximum signal and zero signal drain should
be specified. This information is necessary to determine the average value of load, as well as to
get an indication of what the regulation should be.

Transformers to supply intermittent load, may be made smaller and less expensive than those
for continuous duty. If the duty cycle (say 15 minutes on — 10 minutes off) is known, the unit
may be designed to take advantage of this fact. A transformer to take care of this type of load is
by no means an inferior type. It is one in which a complete set of facts have been made available
so that an economical design is possible.

A. Page From an Engineer's Notebook.

F. P. Trenyon
The American Radio Relay League

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WELL, folksies, we’re going to have another national convention, as every ham in Christendom now knows and as has been extensively mentioned in our pages in recent months. It will be the first one in many a long year and the Chicago gang has been working industriously for months to make it a long-remembered one. Some of the details are to be found in this issue. The Chicago fellows have the habit of throwing pretty grand conventions, and we think every body can look forward to a swell time at this one. As can be expected from the word “national,” the scope of this convention should be greater than any we have had in over a decade and every effort is being made to arrange a program that will have nation-wide appeal, whatever the individual amateur’s pet interest in radio may be.

Perhaps the grandest feature of a national convention is the renewing of old friendships and the making of new ones with fellows we meet for the first time face to face, despite years of radio contacts. We still encounter many hams whom we have met only once before—at one of the national conventions. Chicago on September 3d, 4th and 5th will be the center of American amateur radio, a never-to-be-forgotten period in our ham lives. Any ham who misses it when he doesn’t have to is simply begging for future heartaches. So pack up the O.W. and all the little harmonics, O.M., and shove along to Chi. BCNU tr!

K.B.W.

ONCE, way back when, there was a fellow who said that amateur radio had lost all its fascination—that everything had been done and that all hams could do now was sit and coast. Of course, the bird was dead wrong, but in spite of that he was able to get quite a few followers. These are the guys who mumble about having worked the world and as how nobody has anything to do any more. What the ham game needs, of course, and what it seems invariably to get, is some “miracle” to ram home the fact that ham radio is still a limitless paradise for the worker blessed with some imagination. The most recent and most stunning of these “miracles” is this latest five-meter business. Here we sat for years pretty thoroughly convinced that five-meter waves were not privileged to arch their way through the ionosphere and bound down to delight the ears of the DX man. To be sure, we have witnessed the anticipated freak conditions, when some wandering five-meter signal managed to escape for a run of a thousand miles or so. But we were only too prepared to scoff faintly and say, “Another of those freaks—don’t mean nuthin’.” And now look at us—a group of amateurs (with engineers and scientists on the side) utterly flabbergasted at the way in which 56-Mc. signals have been smearing most of the country most of the days for the last three months. Thrills—why, there were never any like ’em. Excitement—you should just crank up that five-meter receiver on one of these “hot” mornings or evenings! But more than all that, this five-meter orgy is destined to result in a major contribution to the field of science. One only needs to glance at Jack Pierce’s preliminary survey, published elsewhere in this issue, to realize that, while much of the picture is still shrouded in mystery, a really comprehensive explanation and a new understanding of certain irregularities of the ionosphere are on the way. They will be contributions of first importance and they will be the direct outcome of that pioneering spirit and dauntless enthusiasm which most amateurs seem to have. We can chalk up one more of those all-important phenomena which almost certainly would have gone unobserved had it not been for the hams.

R.A.H.

September, 1938
Norfolk Amateurs Prepare for Emergencies

Standardized Transmitters with Interchangeable Power Supplies for Flexibility in Portable-Emergency Work

By Fenton Priest, W3EMM,* and Laurie Turner, W3BEK**

Evidence that amateurs are preparing, not only individually, but in groups for communications service during emergencies is supplemented by this story about the equipment which has been built by Norfolk, Va., amateurs. Five transmitters, all using the same circuit and parts, have been built; several more are under construction. The sets work on four bands, both phone and c.w., with inputs between 15 and 30 watts. Some good receiver suggestions are included, too.—EDITOR.

It was decided at a meeting of the amateurs of Norfolk, Virginia, that what the city and vicinity needed most in the line of emergency communication was a local net made up of portable battery-operated transmitters and receivers which could be relied upon to maintain communication with Red Cross Headquarters in the city, other sections of the town, and the outlying beaches. The most distant point to be covered would be Virginia Beach, approximately 20 miles from downtown Norfolk. The city covers quite an area for its population and is peculiarly situated in that it is almost completely surrounded by water.

With this idea in mind, we decided upon a transmitter that would work on a 6-volt storage battery or on the 110-volt power line. The transmitter works on 160, 80, 40 or 20 meters, 'phone or c.w., uses a 6F6 oscillator and an 807 final in the r.f.; with 6J7, 6C5, and 6L6 tubes in the audio working from a crystal mike. The audio and r.f. units work very nicely with a plate voltage of 150 to 400 volts, the power input to the final being 5 to 30 watts on 'phone and about 40 watts maximum on c.w., depending upon the plate voltage used. The sets are designed to work on a plate supply delivering 300 to 350 volts and optimum results are obtained with this voltage, both as to modulation and efficiency.

The five units already completed have two power supplies each. One, for a.c. operation, delivers 380 volts to the transmitter and the other, for 6-volt operation, uses generators that deliver 300 volts. On a.c. the maximum power input to the final is 25 to 30 watts on 'phone and 30 to 40 watts on c.w. On the 6-volt supply the input is between 15 and 20 watts on 'phone and about 25 watts on c.w. Three of the transmitters already built are exactly alike in every detail; the other two differ only in the size and shape of the cabinet. Some of the transmitters to be built (and being built) are identical units and the others will vary only in physical design and layout. The coils, tubes and parts are all interchangeable. The power plug connections likewise are all identical so any transmitter can be used on any power unit, whether a.c. or 6-volt. The power units vary somewhat as to the voltage delivered and the type of transformers, generators and general construction, but all have the same socket connections so any transmitter can be worked on them. These units are not "pack transmitters" in any sense of the word, but are designed to be portable, in that they can be very easily put into a car, or carried anywhere and put into operation with a minimum amount of work, and can operate independently of outside power. All the units are as compact and as light as possible and still are good dependable outfits.

Each portable station consists of a transmitter unit, a power unit, a receiver with "B" batteries, a storage battery and an antenna. When it becomes necessary to use the equipment in the field at least two operators, and three if possible, will go with each station. With two or three hams along, handling of equipment is easy and 24-hour operation, with shifts, can be carried on. If it is

* 508 Hanover Ave., Norfolk, Va.
** 115 W. 33rd St., Norfolk, Va.

8 QST for
necessary to keep one of these units going outside of the city on its own power for any great length of time, it will be easy enough to commandeer batteries from automobiles in the vicinity.

TRANSMITTER DETAILS

Panel and inside views of one of the three identical transmitters are shown in the photographs. The complete transmitter, including r.f. and audio units, is built in a Par-Metal cabinet (No. PC-1276) 12 by 7¾ by 6⅜ inches. The two chassis are also Par-Metal (No. 18760), 6½ by 6⅜ by 1½ inches.

The circuit diagram is given in Fig. 1. A grid-plate type crystal oscillator circuit is used, this circuit having the advantage that no tank circuit is necessary. Its output drives the 807, which operates either as straight amplifier or doubler. To cover the four bands from 14 to 1.75 Mc., it is necessary to have only two crystals and two coils. One coil is cut to cover 1.75 and 3.5, the other 7 and 14 Mc. With a 1.75-Mc. crystal, 3.5 Mc. can be used by doubling in the final. With a 7-Mc. crystal, 14 Mc. can be covered by doubling. Of

---

[Diagram of circuit diagram of the Norfolk Emergency Transmitter]

FIG. 1—CIRCUIT DIAGRAM OF THE NORFOLK EMERGENCY TRANSMITTER

- C1—0.005-µfd. mica, 500-volt.
- C2—150-µfd. mica, 500-volt.
- C3—100-µfd. mica, 500-volt.
- C4—0.002-µfd. mica, 1000-volt.
- C5—10-µfd. electrolytic, 25-volt.
- C6—0.1-µfd. paper.
- C7—0.02-µfd. paper.
- C9—8-µfd. electrolytic, 450-volt.
- C10—4-µfd. electrolytic, 450-volt.
- C11—200-µfd. variable (Hammarlund MC-200-M).
- C12—320-µfd. variable (Hammarlund MC-325-M).
- C13—260-µfd. variable (Hammarlund MC-250-M).
- R1—50,000 ohms, 1-watt.
- R2—50,000 ohms, 1-watt.
- R3—50,000 ohms, 1-watt.
- R4—80,000 ohms, 1-watt.
- R5—100,000 ohms, 1-watt.
- R6—15,000 ohms, 1-watt.
- R7—250 ohms, 10-watt.
- R8—6000 ohms, 10-watt.
- R9—400 ohms, 10-watt.
- R10—15,000 ohms, 1-watt.
- R11—15,000 ohms, 1-watt.
- R12—10,000 ohms, 1-watt.
- R13—100,000 ohms, 1-watt.
- R14—50,000 ohms, 1-watt.
- R15—100,000 ohms, 1-watt.
- L1—1.75 and 3.5 Mc., 42 turns No. 18 d.c.c. tapped 7th turn from plate end, close-wound on 1¾-inch diameter plug-in form.
- L2—14 Mc., 42 turns No. 18 d.c.c. tapped 7th turn from plate end, close-wound on 1¾-inch diameter plug-in form.
- L3—250-µfd. electrolytic, 250-volt.
- L4—8-µfd. electrolytic, 450-volt.
- L5—250-µfd. electrolytic, 450-volt.
- L6—100,000 ohms, 1-watt.
- L7—50,000 ohms, 1-watt.
- L8—10,000 ohms, 1-watt.
- L9—6-point tap switch (Centralab F-K121).
- L10—6-point tap switch (Centralab F-K121).
- L11—6-point tap switch (Centralab F-K121).
- L13—Output transformer (see text) (Thor- derson T-13841).
- L14—1.75 and 3.5 Mc., 42 turns No. 18 d.c.c., tapped 7th turn from plate end, close-wound on 1¾-inch diameter plug-in form.
- L15—14 Mc., 42 turns No. 18 d.c.c. tapping every 9 turns for four taps, 10 turns last tap.

September, 1938 9
course, fundamental operation is best, and for emergency work one of the three lower-frequency bands—7, 3.5 or 1.75 Mc.—would be used.

The two 100-ohm resistors in the 807 control grid and screen grid were necessary to kill a tendency toward self-oscillation when the crystal was removed. With these resistors the final shows no trace of self-oscillation even when the tube draws 80 ma. plate current with no excitation. The resistors have no apparent effect on the efficiency of the amplifier. The grid current to the 807 is 3 to 5 ma., depending upon the activity of the crystal in use.

The antenna is coupled to the plate tank of the 807 through a pi-section coupler. The tap switch has a 6-point stator and half grounding rotor. As the diagram shows, when the switch arm is on the first tap, the antenna and coupler are completely disconnected from the final. This makes it possible to bring the final tank circuit to resonance, then cut in the network and antenna with the switch, adjusting for proper load and resonance with the taps and the network condensers as with any other Collins coupler.

All of the by-pass and coupling condensers in the r.f. unit, with the exception of the 807 plate blocking condenser which has a 1000-volt rating, are postage stamp mica type. The tuning condensers are Hammarlund midget condensers, Type MC. Several values of resistors and condensers were tried in the audio and r.f. circuits and those that gave the proper bias, excitation, voltages and gain for the different stages are shown in the diagram. They are correct for optimum performance of the audio end, the crystal oscillator and the 807 final. Although the cabinets are not very large, there is plenty of room when small parts are used, and the assembling and wiring is easy where it would be difficult and crowded with big parts.

The modulation transformer is a standard receiver-type universal output transformer rated at 20 watts audio, and will carry 60 ma. d.c. each side. It is designed to work from a push-pull output stage to any voice coil. The plate load impedance of the 6L6 modulator tube working Class-A is approximately the same as the r.f. load impedance at 25 watts input. With a 1:1 ratio transformer the mismatch is only a few percent. The primary of the transformer, connected as an auto-transformer, fills the bill and is large enough to handle the power very nicely. The voice coil windings are not used and are left floating. The electrolytic condensers in the audio end are the new midget type.

The final is properly loaded with 350 volts on the plate when the current is about 70 to 75 ma., for 'phone operation. With 300 volts the plate current should be from 50 to 60 ma. These little sets when finished were checked with an oscillograph and found to have almost perfect wave-form, and looked surprisingly good at 100 per cent modulation with 25 watts input to the 807 from the a.c. supply and 18 watts from the 6-volt supply. The 1/4-watt neon bulb is used for a visual modulation indicator, giving a rough check on the peaks. After using the set for a while and watching the bulb "bounce," it is possible to get a fair idea of just how much audio to use. The brilliance of the glow will vary under different antenna load conditions and plate voltages, and has nothing at all to do with the tuning adjustments. The set there-

(Continued on page 128)
How many will disagree with the statement that "our modern receivers are still far from perfect?" Despite the many large advances made in the design and construction of expensive sets, some additional features, or some improvements in performance, however slight, often remain to be desired.

One of the improvements needed by some commercially manufactured and homebuilt receivers is an r.f. stage which will increase signal-to-noise ratio and reduce at the receiver the blocking effect of strong local stations. In addition, there are times when even a superheterodyne receiver with as many as two conventional r.f. amplifier stages lacks sufficient r.f. gain for very weak signals. Furthermore, sets with only one tuned r.f. amplifier with 465-kc. intermediate-frequency stages and sets incorporating higher-frequency i.f. stages with no tuned r.f. stage can well use the increased signal-to-image ratio which an additional r.f. amplifier stage will provide.

The simple one-tube regenerative r.f. amplifier shown in the accompanying illustrations is a step in the right direction for many amateur receivers. Built at an amazingly low cost and at the expense of very little time and effort, it undoubtedly provides the maximum of operating enjoyment for the cost involved. Although only few words and little space are required to describe completely this gadget, its value to many readers would justify the use of several pages, for it accomplishes, simply and thoroughly, the several desired results suggested in the paragraph above.

In the interest of simplicity and economy, a single stage with untuned output circuit is used. By incorporating the circuit most commonly used for regenerative detectors, substituting cathode-resistor bias for grid-leak bias, a commercially made tuning unit designed for a coil-switched regenerative receiver is made into a very effective preselector. Ganging worries often associated with two or more tuned circuits in such a device, and the expense represented by use of such features, are eliminated. Since many of the modern receivers require only rotation of a knob or an equivalent simple operation for moving the receiver from one band to another, it is very desirable that the preselector stage added be one which will not greatly increase the time required for band-change, and hence, switched coils are used in this set. In order to adjust the circuit so that the desired amateur band is properly located on the tuning dial when the

Circuit

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was tuned, and the regeneration was run up to the maximum usable value without oscillation. At this point, it was found that the amateur station could barely be heard with all the gain available in the receiver, and that most 20-meter amateur stations which could easily be heard before the connection of the preselector had become inaudible. On the other hand, with the gain controls of the receiver set to the original reference settings (the points at which they were adjusted before the preselector was connected), it was noted that stations in the vicinity of the frequency to which the preselector was tuned could be received with more than comfortable volume. Upon disconnecting the preselector and tuning the receiver to the higher frequency (the former image frequency) it was found that additional gain was necessary to bring the volume level to that which the combination of preselector and image-tuned receiver had produced.

By setting the receiver for reception on a frequency 912 kc. lower than that of a station in the 20-meter amateur band, and tuning the preselector to the frequency of the 20-meter amateur station, again using the reference setting of the gain controls, it was found that the amateur stations were received with more volume than when properly tuned in with the antenna connected directly to the receiver.

This simply means that the single regenerative preselector stage with untuned output circuit gave a better image ratio than the properly tuned and coupled r.f. amplifier and detector in the receiver.

**CONSTRUCTION**

The panel and chassis for the preselector are made of 1/16-inch aluminum sheet. Dimensions, and details for bending and drilling, are given in Fig. 2. One hexagon nut is removed from the variable condenser, and one from the band switch, before mounting the tuning assembly. This unit is then fastened to the panel exactly in the manner used to mount a switch and a condenser separately. The grid leak and grid condenser are then removed from the coil-condenser assembly, and are replaced by a grid lead approximately 2½ inches long. The single wire connection to the tuning condenser is left intact, and the other connection is of course completed through the metal frame, as supplied. Two lug terminals are provided at the rear of the band switch: The one nearer the tuning condenser is the cathode-tap switch terminal, and must be connected to the cathode blocking condenser, C4, while the terminal farther from the tuning condenser is wired through the antennas condenser,
C1, to the grid connection of the coil switch. This terminal is used for the antenna connection post on the preselector. Thus, aside from the use of one of the two terminal lugs at the rear for an antenna connection, only two wires are connected to the preselector. Thus, aside from the use of one grid leak and grid condenser—is made in the tuner.

Two lug strips are screwed to the aluminum chassis; one strip with a single lug is used to support the end of C6 opposite the plate terminal of the tube, and at the same time to provide a terminal for connection of the wire to antenna post on the receiver; and a strip with four insulated lugs is used to receive the connection of R2 and RFC (supporting the ends of these two parts) and the lead in the cable, connections between two of the cable wires and the heater terminals of the tube socket, and the connection between the cathode-tap switch terminal and blocking condenser C4. The last-mentioned lug serves to keep the r.f. circuit rigid.

The regeneration control resistor, R3, is mounted directly below the coil switch, and the terminals serve to complete the rigid wiring used throughout the preselector.

The diagram of Fig. 1 shows the connections of a 58 tube in the amplifier. The connections for the 6D6 are identical to those shown, while for an 1851 (or a 6K7, which type has also been used in the set) the shell pin of the tube socket should be grounded.

### POWER SUPPLY

The power connections for the preselector are most conveniently taken from the receiver through a four-conductor cable. Of course, if the receiver uses 6.3-volt tubes, either the 1851 or the 6D6 tube should be used in the preselector; whereas a 58 should be used if the receiver is equipped with 2.5-volt tubes.

### OPERATION

The preselector should be placed as near the receiver as possible, not only for operating convenience, but also to provide for short connections between preselector output and receiver antenna input terminals; and the power cable should be connected internally to the set. With the antenna connected to the receiver, some amateur station in the 20- or 40-meter band should be tuned in. The antenna connection should then be moved from the receiver input to the antenna condenser on the preselector, and the output of the preselector should be connected to the receiver. Then, with the switch of the preselector set for the band on which the receiver is tuned and the tuning condenser dial set for approximately half-capacity of the condenser, the trimmer on the coil in use should be adjusted for maximum signal strength by means of a screwdriver. If the regeneration-control resistor is moved from minimum to maximum screen-voltage position during this adjustment process, it should be found that the preselector can be made to oscillate strongly, producing a loud howl in the receiver. The correct adjustment for this control is that which is reached just before the point of oscillation when turning the control from minimum toward maximum. At this adjustment, the tuning of the preselector is quite sharp, and with frequent movements of the regeneration control while the trimmer condenser is being adjusted, the trimmer may be set right “on the nose.” Then, upon turning across the band to which the receiver and preselector are set, it can be determined whether this setting of the trimmer allows complete coverage of the band—if it does not, a slight readjustment of the trimmer condenser will remedy the trouble.

This procedure is repeated on the other amateur bands, and need be made only once for a...
A Five-Band Switching Exciter
With 807 Output

Single Frequency Control With Crystal; Alternative E. C. Oscillator

By T. P. Kinn,* WICC

The theme of operating convenience continues popular. Here is an exciter capable of covering five bands at
the turn of a switch, and any frequency inside a band at the turn of a knob. A new "untuned" coil system in the
low-power stages does the trick. And again the combination of crystal and electron-coupled oscillator.—EDITOR.

Most of us are forever engaged in planning or actually building a new transmitter. Possibly we are just making
changes in line with a new article we have read. But why this continual planning and rebuilding? It takes away many hours of happy operating
and makes a continuous drain on the pocketbook. The answer, I believe, lies in the fact that up to
now none of us has come even close to the ideal for which we all are apparently striving. Some of
us are rebuilding to get more power, but the majority are rebuilding, I feel sure, in the hope of
realizing that ultra-ultra rig with which, by
means of one control, we could put our signal
anywhere in any one of the ham bands.

Recently, we have seen some very fine designs featuring simplicity of frequency change, proving
that we are progressing towards this ideal. Here
at WICC the same problem was being considered
very seriously last fall, and the outcome is the
exciter unit to be described. Before we start,
however, let's lead up to the design by attacking
the problem from the beginning. When first
thinking of the new rig, the following general re-
quirements were set down:

1. It should operate in as many bands as possible.
2. It should select the band desired with a min-
imum of effort.
3. It should be possible to select any desired
frequency within any band with a minimum
of effort.
4. The control of band and frequency selection
should be from the operating point.
5. The signal should at all times be of a charac-
ter which would produce maximum operat-
ing efficiency.
6. The power should be the
maximum allowed by law.

The reasons for all of these
requirements are quite obvi-
ous, and they probably repre-
sent in general the basic desires of any amateur contemplating a new modern ama-
teur transmitter. Considering
the 4th and 6th requirements
first, it was necessary from a
practical standpoint to make
somewhat of a compromise
right at the start. Although
not impossible it was felt it
would introduce too many
complications to attempt to
put a 1-kw. outfit on the oper-
ating table within easy reach
of the operating position. Two
units therefore decided on; one
an exciter which would sit on
the operating table, and the
other an amplifier which
would sit next to the operating
table within easy reach of the

THE TOP OF THE CHASSIS SOMEWHAT RESEMBLES A SUPERHET
RECEIVER

Terminal strips along the back are for metering when making adjustments. Voltage-regulator tubes are used on the oscillator power supply.

QST for
operator. It is the exciter unit that will be described herein, so let’s go on with the details.

From the start it was decided that the exciter must cover the five main bands, namely; 160, 80, 40, 20 and 10 meters. If 3-meter operation was desired, a separate amplifier including an additional doubler stage would be the most practical solution. An attempt to include 5 meters in the exciter would, it was felt, introduce complications and possible sacrifice of flexibility on the lower frequency bands.

CIRCUITS

Referring to Fig. 1, the diagram of the exciter, it can be seen that the unit includes two separate oscillators—one crystal-controlled and the other self-controlled—two frequency multiplying stages and an output stage. Two power supplies are used, one for the two oscillators and the other for the frequency multipliers and the output stage. The crystal oscillator uses a Type 76 tube in a straightforward semi-tuned oscillator circuit. The plate circuit of this oscillator is designed for operation with either 1.75- or 3.5-megacycle crystals. The crystal selector switch S1 has two sections, one to select the crystals and the other to select the corresponding plate-circuit inductance. The self-controlled oscillator is a conventional electron-coupled oscillator except for the fact that the plate circuit is again of the semi-tuned type. The grid-cathode circuit of this oscillator operates on either 1.75- or 3.5-megacycle crystals. The crystal selector switch S1 has two sections, one to select the crystals and the other to select the corresponding plate-circuit inductance.

Crystal oscillator and intermediate stages are fixed tune, so that the unit is essentially single-control within a band. An unusual feature is a built-in keying monitor.

Coupling to the first doubler is adjusted by means of the small variable condenser C14. Type 6F6 tubes are used in the two multiplier stages, as it was found that these tubes provided more than enough excitation on the grid of the final and were far superior from the standpoint of self-oscillation because of their good internal shielding. Type 6L6 tubes will function, but provide no more excitation to the final and have much greater tendency toward self-oscillation. Small 25-ohm resistors, R8 and R9, were found necessary in the plate lead to each 6F6 to eliminate high frequency parasitics. These resistors do not affect operation at the normal frequencies, but eliminate all tendency to oscillation at high frequencies. The plate tank circuits of the two frequency multiplying stages also are of the semi-tuned variety. The diagram, Fig. 1, shows two variable condensers, C14 and C22, connected across these two plate circuits and may appear misleading. C14 is a very small trimmer of 3½ to 1½ µfd. and C22 is a similar condenser of 2 to 5 µfd. These two condensers are used to bring the plate circuits more nearly in resonance at 14 Mc. For the sake of possible reproduction by others the coils were designed to require this slight amount of trimming by means of C15 and C38. They are adjusted once, when the unit is first made, for best operation on 14 Mc. and then left alone. The use of semi-tuned plate circuits in the oscillator and frequency multiplying stages gives extremely broad tuning and allows wide frequency coverage without adjustment of any kind. It is through the use of this type of plate circuit that the third requirement listed above is practically fulfilled.

The final tube in the exciter is a Type 807 tube operating into a conventional tuned plate tank circuit. To provide output on the five bands, five separate tank coils are used in the output stage. Selection of any one of the five bands is accomplished by the band-switch S3. This switch is composed of four individual sections so located with respect to the plate circuits of the frequency multipliers and output stage as to provide the minimum length of leads. Section A and Section B select the proper plate inductance for the first and second multiplying stages respectively.
These two sections are of the continuous shorting type, as it was found necessary to short all unused sections of the doubler plate coils to prevent the unused portions from becoming resonant at the higher frequencies. Section C selects the proper plate coil for the final. Section D transfers the output circuit to the proper coupling tap on the corresponding tank coil. Basically, the output circuit is designed for link coupling to whatever type of amplifier is to follow the exciter. However, the tank coils each have four taps which allow rough adjustment of coupling for loads up to 500 ohms and make possible operation of the exciter directly into an antenna system.
The oscillator power supply is conventional except for the fact that the output is regulated by two Type 874 tubes. These two tubes provide a regulated source of d.c. at 180 volts which is used for plate supply to the crystal oscillator and the screen of the self-controlled oscillator. The full output of this rectifier, approximately 250 volts, is applied to the plate of the self-controlled oscillator. A Type 6X5G rectifier tube is used for economy's sake only. Since the r.f. tubes are all of the heater type it was necessary to have a standby position in which power was left on the heaters all the time. It was decided that it would be desirable to leave the self-controlled oscillator also running all the time to reduce drift during periods of no transmission. After much thumbing of catalogs it was found that no standard transformer was available with separate windings for the heater circuits of the r.f. tubes, the oscillator rectifier tube and the main rectifier tube. The transformer finally selected had two heater windings, one for 6.3-volt tubes and the other for a 5-volt rectifier tube, which made it necessary to find a rectifier tube, for the low-power rectifier, which had a separate cathode. The Type 6X5G fills this bill perfectly and allows operation of all heaters, including the oscillator rectifier tube, from one winding, the result being that in the standby position the oscillator power supply and heater power for the r.f. and rectifier tubes is left on.

The main power supply uses a Type 83 rectifier in the usual full-wave circuit. The fact that the filament of this tube is on at all times allows quick application of plate potential. The output of the rectifier is 500 volts under normal load. The plate transformer used has a tapped primary permitting an output voltage of around 700 volts if desired, but to insure operation of both the rectifier and output tubes within the manufacturers' ratings the lower-voltage tap is used.

The switch S4, which is used to control power, is a 4-section, 3-position switch with the extra two sections wired to terminals to allow control of the amplifier filament and plate power by means of relays, thereby keeping full control at the operating table.

**KEYING**

The problem of keying was solved by utilizing the voltage drop across part of the main-rectifier bleeder resistor for blocking bias when the key is open. All stages except the self-controlled oscillator are keyed by this blocking bias. No keying relay is necessary with this type of keying, but combinations of inductance, capacity and resistance are necessary to eliminate sparking at the key. The circuit or exact values are not shown on the diagram, as each individual installation will require a different solution due to length of keying leads and local pickup conditions. The Handbook covers all satisfactory types of spark elimination circuits so no difficulty should be had from that source by any one using this type of keying circuit. Any network or filter will also be more effective if located right at the key where the spark originates. One very easy adjustment, however,
that careful adjustment of the output coupling from the oscillator to the next stage plus selection of grid leaks for individual tubes was made. If these precautions were not taken, varying degrees of lift were encountered on the beginning of each keyed character. For this reason, keying of the self-controlled oscillator was discarded on the assumption that break-in operation on your own frequency very seldom is required, and that usually when it is required the operation is on a crystal frequency for schedule or network. Practically speaking, successful BK operation with a station on your own frequency can be secured on 7 Mc. or higher when using the self-controlled oscillator due to the fact that the harmonic output of the oscillator itself is low and any signal of reasonable strength will override it. The shielding used in the oscillator circuit also reduces the interference to a low value.

**MONITOR CIRCUIT**

Although not appearing in the original requirements, it was felt that monitoring of c.w. transmitters was desirable. The following is a typical example of a monitor circuit which has been found useful.

**TABLE I**

<table>
<thead>
<tr>
<th>Table 1</th>
<th>TYPICAL OPERATING DATA</th>
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<tbody>
<tr>
<td><strong>Oscillator</strong></td>
<td><strong>1st Doubler</strong></td>
</tr>
<tr>
<td>Plate</td>
<td>Freq.</td>
</tr>
<tr>
<td>Crystal Control</td>
<td>1.75</td>
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<tr>
<td></td>
<td>1.75</td>
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<tr>
<td>Self-Controlled</td>
<td>3.5</td>
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<td></td>
<td>3.5</td>
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<td>3.5</td>
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</tbody>
</table>

Plate voltage of crystal stage | 180
Screen voltage of s.c. oscillator | 180
Plate voltage of a.c. oscillator | 275
Plate voltage of doubler | 350
Screen voltage of 1st doubler | 150 av.
Screen voltage of 2nd doubler | 250 av.
Plate voltage of final | 500
Screen voltage of final | 200-250

(Continued on page 114)
Election  To all members of the American Notice Radio Relay League residing in the Central, Hudson, New England, Northwestern, Roanoke, Rocky Mountain, Southwestern and West Gulf Divisions.

You are hereby notified that, in accordance with the constitution, an election is about to be held in each of the above-mentioned divisions to elect both a member of the A.R.R.L. Board of Directors and an alternate thereto, for the 1939-1940 term. Your attention is invited to Sec. 1 of Article IV of the constitution, providing for the government of the A.R.R.L. by a Board of Directors; Sec. 2 of Article IV, and By-Law 12, defining their eligibility; By-Laws 13 to 23, providing for the nomination and election of division directors, and By-Law 14 providing for the simultaneous election of alternate division directors. Copy of the Constitution & By-Laws will be mailed any member upon request.

Voting will take place between November 1 and December 20, 1938, on ballots that will be mailed from the headquarters office in the first week of November. The ballots for each election will list, in one column, the names of all eligible candidates nominated for the office of director by A.R.R.L. members residing in that region; and, in another column, all those similarly named for the office of alternate. Each member will indicate his choice for each office.

Nomination is by petition. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members residing in any one of the above-named divisions may join in nominating any eligible member of the League residing in that division as a candidate for director therefrom, or as a candidate for alternate director therefrom. No person may simultaneously be a candidate for the offices of both director and alternate. A separate petition must be filed for the nomination of each candidate, whether for director or for alternate director. The following form for nomination is suggested:

(Place and date)

Executive Committee

The American Radio Relay League

West Hartford, Conn.

We, the undersigned members of the A.R.R.L. residing in the Division, hereby nominate , as a candidate for director (or for alternate director, as the case may be) from this division for the 1939-1940 term.

(Signatures and addresses)

The signers must be League members in good standing. The nominee must have been a member of the League and a licensed radio amateur operator for a continuous term of at least four years immediately preceding the receipt by the Secretary of his petition of nomination. He must be without commercial radio connections: he may not be commercially engaged in the manufacture, selling or renting of radio apparatus normally capable of being used in radio communication or experimentation, nor commercially engaged in the publication of radio literature intended, in whole or in part, for consumption by licensed radio amateurs. Further details concerning eligibility are given in By-Law 12. His complete name and address should be stated. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon E.S.T. of the 20th day of October, 1938. There is no limit to the number of petitions that may be filed, but no member shall append his signature to more than one petition for the office of director and one petition for the office of alternate director. To be valid, a petition must have the signatures of at least ten members in good standing; that is to say, ten or more members must join in executing a single document; a candidate is not nominated by one petition bearing six signatures and another bearing four signatures. Petitioners are urged to have an ample number of signatures, since nominators are frequently found not to be members in good standing.

These elections constitute an important part of the machinery of self-government in A.R.R.L. They provide the constitutional opportunity for members to put the direction of their association in the hands of representatives of their own choice. Members are urged to take the initiative and file nominating petitions immediately.

For the Board of Directors:

K. B. WARNER,
Secretary

August 1, 1938.

Revised Regulations

Last month we reported that the F.C.C. was beginning work on revising the amateur regulations as part of a general revision of all regulations. This work has suddenly accelerated, and at this writing a complete redraft of our regulations is progressing step by step through the higher chambers of the F.C.C., with a view to being announced soon and to become effective in the early autumn, probably in middle October. The League was accorded an opportunity to participate in all of the preliminary discussions. The regs were given a pretty thorough overhaul and many changes are contemplated, some of them important, most of them trivial. Just as soon as the new text is released, *QST* of course will carry it, with detailed explanations. It is expected that the new regs will assign our new u.h.f. bands and will incorporate rules for participation in communication emergencies. There is almost certain to be a general tightening up of technical requirements, some simplification of licensing procedure, and an elimination of some outworn practices. The dope will be of vital interest to every amateur—watch for it in *QST*.

Cairo and Rome

It is probably not news that we have been misquoted, but we think we ought to say so. In another radio journal we read the flat statement, in three different places, that an A.R.R.L. official has stated that we shall lose our 40-meter and 20-meter bands at Rome. Just like that; no qualification.

The reports are inaccurate. We do believe that we must expect that, at the Rome Conference, a strong attempt will be made by European administrations to liquidate amateur radio in these two bands. Considering the extent to which Europe tends to go its own way in international radio matters regardless of technical facts, and considering its heavy plurality of votes, we think it rather more likely than not that the European amateur will suffer heavily with respect to these two bands, at Rome. The European amateur, not the American amateur. We do not expect that the United States amateur will lose the right to these frequencies. We have no reason to doubt that, if it comes to cases, the United States administration—and, for that matter, all the American administrations—would sign such a treaty only with a reservation retaining these bands for amateurs. But stop and think what it would mean to us if we retained the bands but the European nations filled them up with non-amateur stations of high power! The usefulness of the bands would be seriously impaired, perhaps almost totally destroyed, and DX would be a scarce article. So it is our opinion that the Rome Conference constitutes a pretty serious threat against the future usefulness of these bands. But not because we would lose them in the United States; our worry is Europe, where the influence of American amateur radio and of the United States government does not extend.

Articles in the other radio magazine referred to suggested that, because of this situation, amateurs ought to appeal direct to the U. S. Senate and ask the lawmakers to protect us before the Rome Conference convenes. While it is conceivable that the Senate might, in some undisclosed fashion, indicate in advance to what it would or would not give its consent for ratification, this would be extremely unlikely; and the suggestion was based on the mistaken assumption that the Congress can instruct a delegation. Not so; these international agreements are negotiated by the executive branch of the government, whose creature the delegation is, and the Senate's function is to consent to ratification or to deny consent. Because the American amateur is a very valuable institution, we believe that we can count on the continued sympathetic support of our government. We don't have to worry about that part of it now, and least of all with Congress, which has no authority in the negotiation of such matters. The A.R.R.L. may be counted upon to continue, as always, its best efforts on behalf of its members.
Further Reports on 56-Mc. DX

WEYM and W6DNS Click Off History-Making Transcon

We had the idea when we rounded out last month's tale of the crazy way five meters had been acting, that the end of it was surely near. That was on June 29th. Since then things have been slowing up somewhat but the July period was still check full of achievement. Choicest morsel by far, of course, was the first 56-Mc. transcon between Nathaniel Bishop, WIEYM, and H. W. Hasenbeck, W6DNS. WIEYM heard W6DNS at S7 working a W7. As soon as he had signed, EYM called and grabbed him—the QSO lasting from 9:10 to 9:16 P.M. E.D.S.T. on July 22nd. Signals got up to S9 at the eastern terminal and lasted until 9:40. As suggested in Jack Pierce's story elsewhere in this issue, the contact undoubtedly resulted from a very unusual E-layer setup which allowed the necessary double hop. But it must be said that the contact is the direct result of skillful work on the part of two widely-experienced and super-enthusiastic u.h.f. workers. Bishop used a pair of crystal-controlled 6L6's feeding a vertical Johnson Q arrangement together with an acorn converter and a Super-Pro as the i.f. part. Hasenbeck used a pair of HK54's driven from a concentric-line-controlled HK54 and feeding three co-linear half-wave elements with tenth-wave directors. His receiver is a National 1-10.

It is too bad that space prohibits a full tale of all the work that went on during July, but we will list all contacts reported—arranging them by days to clarify the general picture. All reports of stations worked and heard are now being given the closest possible study at Headquarters and at Harvard's Cruft Laboratory in the attempt to get to the bottom of the whole business. More of that anon. Here, then, is the listing of get:

**July 1st**—W5CIR worked W3CMZ.
**July 2nd**—Q5MQ worked 11IRA; W8CIR worked W5ML.
**July 3rd**—W8CIR worked W5CSU W8QDU.
**July 6th**—W5EHM worked W8KAY RYK NED W3DBC.
**July 7th**—W1KJT worked W9ARN; W8CIR worked W5AJC EHSM OSU.
**July 8th**—W2HYJ worked W9ZCN; W5AJG worked W8CIR CLS DAL NED KAY OPO.

**HERE, LADIES AND GENTLEMEN, IS THE WESTERN END OF THE FIRST FIVE-METER TRANSCON**

Harold W. Hasenbeck, W6DNS, is at the downstairs receiving and control position. The transmitter (shown in another photograph) is in a dog-box on the roof.

**AND THIS, FOLKS, IS THE EASTERN END OF THE TRANSCON**

Nathaniel Bishop, WIEYM, relaxes in front of his unusually clean-cut layout. The transmitter is a 6L6 Tritet oscillator on 14 Mc., a 6L6 doubler and a pair of the same tubes in the final. An acorn converter feeds the Super-Pro for reception.

W9NY ZHB SQE; W5EHM worked W3HJO SCLS CIR CJL OPO RZB ESN NED PWE OIA DAL QAK W9U5I VFO CQV ARN NY OPW FFG W1O; W8QDU worked W1S; W8CIR worked W5EIM W9U1Z W9USI; W9U1Z worked W3BZJ; W9ARN worked W1KFM KTJK LIJ HXT IXP SI W2FQM ETN MO JCY FGB W8OH E2M W5EHM, W9NY worked W1J W3HFM CJL GJQ SGW W5AJC EHSM W9CIM.

**July 9th**—W1J worked W9ARN NY; W5EHM worked W8CIR; W9U1Z worked W8CIR VE9HG; W9USI worked W3HJO RL DBC GHY HPD HKM GLV W8CIR OPO KAY CLS NED NKJ RAQ RML QAK OBL OPW PEJ BSM AWB W6PK worked W9URZ ARN.

**July 10th**—W1J worked W9UDO WJUE worked W5ANA VE9HG; W1ZR worked W8ANA W8QDU worked W1UJ ETS W8QO; W8SQE worked W1KXK HLW HXG AQM JNX JZY LFT KCY ISS KBQ XPX XNN JUI.

**September, 1938**
THE TRANSMITTER AT W6DNS IN ITS BOX ON THE ROOF

The concentric grid line is 6 inches in diameter and has the HK54 oscillator tube sitting near its left end. The two HK54 amplifiers are mounted on top of the grid line toward the right.

W1KEE worked W5SHGG W9LNV VSB SQE ARN; W1JUE worked W8AOQ QFV W9CLH; W4EDD worked W1KNN W2HWX G2C W5DLDD NOR J1Q; W5EIM worked W8NEQ BDG; W8OFC worked W9ANA; W8JLQ worked W1KOE ELP W4EDD W9USI; W8QFV worked W1JNX DFY KCF KNX W5CSU; W9ARN worked W1KEE HXE APJ W2KLZ W8JW W9CLH; W9USH worked W2MO W3HJO GMZ BR HG W8JLQ NED LHV AOC FYV NBV; W9SQE worked W1FKV KUE KIP KIL KTF JNX DRL HDF APJ KEE BWJ W2ICY GAH FQM MO KLZ IUM; W9QCY worked W9BNT; W9ARN worked W1HXE APJ KEE W2KLZ W8JHW W9CLH.

July 12th—W5EIM worked W8RQG LZN RKE CIR W9HPP FFG ZGD; W9USH worked W3HJO RI. W8PGV NED AOC RAZ ODL.; W8SQE worked W1DEI DPW O8 EKT W2LAD; W8CIR worked W5EHM W9USI.

July 13th—W5EIM worked W6IDF OIN MLA MKS.

July 14th—W5EIM worked W9USI W8WN.

July 15th—W4EDD worked W1ADD W2HDG MO FBA HWX W3AIR W8VO LJP W9CLH; W5EIM worked W3GMZ GLVHKM W4EDD W8CIR NED EUK OPX BMU NZW FVY CIS OJN LKD BDG KG NAT QDU AOC LJP O8S IEF PTG FMI FTG CIR W9ZE0 UJD NYY SQF BFW FP; W8JLQ worked W525S EEX F1; W8QDU worked W5ML ZS CSU-EEX EHM F1 ML W8VO W4FLH; WSCIR worked W5EEX ML AKI CSU F1 EHM W4EDD W8NOR.

July 16th—W4EDD worked W5EIM CSU; W8CIR worked W5ML EHM W8RV.

July 17th—W1KJT worked W9RBK; W5AJG worked W8KG; W5EIM worked W8SMZW BDG LIU W9USI; W9USH worked W5EHM F1; W8CIR worked W5EIM CSU W9ZJB AI2 US1 ZD.

July 18th—W5EIM worked W8NED QFV BDG LKD NPE GCI NSS CIR; VE3DC worked W4AUU; W9ARN worked W3FOP.

THE RIG AT W8CIR

Edward Doherr has worked eight districts and twenty-four states on 15 meters. He grabbed a couple of sixes on the night that W1EYM and W6DNS contacted. His trans•mitter had a pair of crystal-controlled 35T's in the final, while the receivers include an acorn converter and a resistance-coupled super. The antennas include a dipole, 80 feet high, and a seven-element Yagi, 20 feet high.

July 19th—W1LJ worked W8EUK NED SFV NPE W9AHZ ARN ANA OLY; W1EHT worked W8LJQ LJP W9NY; W11XF worked W8RAZ IZJ NPE SAW; W5AJG worked W8CIR LJP LZN W9WAL YWQ ZSS VJO SQE ANA ZHB; W5EIM worked W1CSR W3BCC GMZ W8NIX JLQ MSK CMK LJP QDU NED QFV QAW CIR MST FP1 W8SQE LVK ZHB ANA ZGD NY; W8LJQ worked W1EHW W2KOZ BCC BYV KPX W3AQE Q8X; W8QFV worked W2MO W8JDC KJU KXZ.

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The 56-Mc. transmitter is crystal-controlled and ends up with a pair of 35T's. The receiver is an Ultra-Skyrider with a two-stage acorn preselector up front.
Interpreting 1938's 56-Megacycle DX
Ionosphere Conditions Deduced from Long-Distance Amateur Work on Five Meters
By J. A. Pierce,* WIJFO

This is "must" reading for any progressive amateur. It is a brilliant example of the way in which a basic contribution can result from ham work accompanied by careful observation and fulsome reporting. Mr. Pierce's prime interest is the layer height measurement program being conducted at Harvard University; this study of u.h.f. behavior is a logical offshoot from it. The study, of course, is to be continued and the League is collaborating in the preparation and reduction of ham reports. The only fly in the ointment is that while the hundreds of available reports paint a fairly complete picture, they are not sufficiently complete for a scientific study of this kind. Pierce joins us in a plea for reports of every single DX contact that occurred this year. Of particular consequence are details of contacts over distances greater than 1200 miles. Badly needed also is more dope on work between the West and Middle West. But all reports are important. We urge you to look up the log and send us an abstract.—EDITOR.

The reports which are being submitted to A.R.R.L. on 56-Mc. DX this summer are furnishing valuable scientific data, because the conditions which make 56-Mc. contacts possible are unusual and cannot be predicted with the same success we have when dealing with the lower frequencies. The story goes roughly like this: Most of the ionization in the upper atmosphere is caused by the action of ultra-violet light from the sun, although there are other sources whose relative importance is uncertain. The only ionized layer of interest to us in this study is the E, or Kennelly-Heaviside layer, which is about 70 miles above the surface of the earth. Ordinarily the amount of ionization in this layer increases during the morning and decreases in the afternoon; that is, it follows the height of the sun above the horizon. This is true throughout the year as well, there being more ionization in summer than in winter.

This ionization exists because ultra-violet light knocks electrons out of the atoms in the upper air. The amount of it is well known, and ordinarily never exceeds 200,000 free electrons per cubic centimeter. At times, however, the E-layer ionization shoots up to tremendous levels, in some cases as much as 5,000,000 electrons per cubic centimeter. This differs from the normal ultra-violet ionization in several ways. It may last only a few minutes, or for several hours; it may be strong or weak; and it may occur in very small patches or extend over hundreds or even thousands of miles. This last characteristic makes it hard for the two or three ionosphere observatories in this country to study the phenomenon because it often occurs in places where measurements are not being made.

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* Research Laboratory of Physics, Harvard University, Cambridge, Mass.

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FIG. 1—GRAPH OF NUMBER OF STATIONS HEARD AGAINST DISTANCE
All this is getting a bit technical, so let's turn to a sample study and see what we can learn from it. The A.R.R.L. has let me mull over the early reports on the work of June 5th. There didn't seem to be much chance of getting anywhere by studying the times of the various QSO's (we need a lot more data before going into that) so I started in with a call book and a map. After listing all the contacts with the distance each one covered, I grouped them according to distances. That is, I found how many contacts covered more than 675 miles but less than 725, and so on. By plotting these groups I made up Fig. 1. This shows that on June 5 you were more likely to hear a station about 650 miles away than any other distant station. But it shows more than that. If you have enough data to get a smooth curve in a case like this, you expect to find just one maximum in it. That is, up to 300 miles or so you don't hear any stations because of skip. Then you hear them better and better, but after a while the distance gets so great that the number drops to zero again. There are two things in Fig. 1 that don't fit with this idea. One is the upturn at 200 miles and the other is the bulge at 1100. Since you can't cover 200 miles at 56 Mc. without atmospheric bending, we can conclude at once that there was a lot of refraction that day caused by atmospheric stratification. This probably helped in working DX because it bent the signals down into cities and made pretty poor locations into good ones.

The bulge at 1100 miles is a bit more tricky. It turned out that if I plotted only the reports from east of the Mississippi I got a smooth curve C, and the same thing happened for the small number of reports from the region west of the river. The western curve (B) stuck way out on the distance axis and accounted for the bulge in the main curve A. This shows that the western stations had a long skip, which means less ionization where the signals were reflected. There were plenty of stations on the air in Ohio, for instance, but the boys in Kansas couldn't work them and had to go clear to the east coast to be heard. At this point I was able to say that there was less ionization over Indiana that day than there was over Pennsylvania.

The next step was to carry things farther along the same line. By marking on the map all the locations worked from Massachusetts I could see

(Continued on page 72)

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Believe it or not, 2396 VE and W stations took part in the contest by exchanging message preambles; 282 logs were received, a 30 per cent increase over last year’s contest. As I sat here night after night and day after day putting down the information contained in each log, I tried to visualize the net that was woven by the contacts of all these stations. From Alaska to Cuba and Porto Rico, from Halifax to San Diego on the continent, out over the Pacific to Hawaii and on to the Philippines, each contact bearing its little message of friendship and goodwill. I was thrilled by it all. YL and XYL operators had no small part in the contest. VE2HI in Montreal, Quebec; VE3HE in Stratford, Ontario; and VE5NG in Vancouver, B. C., are three we know were active; there may have been more.

An explanation of the long contest period: In setting the date, the Easter week-end was the only one which was clear of some kind of contest or activity, and in having the contest spread over five days, the idea was to give as many as possible a chance to participate and avoid making it a contest of endurance.

W9FOQ leads South Dakota again this year, making it four times in a row. W6MVK has made it three times for San Joaquin Valley. The following stations lead their sections again this year: VE5QP, British Columbia; W3FQZ, Md.-Del.-D. C.; W3FAX, Southern New Jersey; W9MUX, Illinois; W5KC, Louisiana; W2IOP, N. Y. C. and L. I.; W9YAH, Kansas; WITS, Connecticut; W4RJ, Eastern Massachusetts; K6CGK, Hawaii; W0IT, East Bay; W6NEN, San Francisco; W9YAD, Colorado; W4D1Q, Eastern Florida; W5DQD, Northern Texas; W5F2D, Southern Texas. Congratulations to you all.

The Canadian prize winners:

**FIRST PRIZE—Cup—Won by VE2EE, Montreal, Quebec.**

(Donated by The Canadian General Electric Co., Ltd., Toronto.)

**SECOND PRIZE—RCA800—Won by VE2EP, St. Lambert, Quebec.**

(Donated by Canadian Westinghouse Co., Ltd., Toronto.)

**THIRD PRIZE—RCA800—Won by VE5VO, Vancouver, B. C.**

(Continued on page 88)
A Deluxe Rotary Antenna Structure
A Supporting Assembly for Stacked Multi-Element Directional Antennas
By Byron Trowbridge, W9TMP*

Most stories about rotary antenna systems put the chief emphasis on electrical features, but here is one dealing with the—to the average ham—knottier problems of designing, building and erecting the rotating structure itself. Big enough to support a fairly elaborate 20-meter beam, it can also be used to hold a multi-element 10-meter array. No guy wires, negligible ground space, but ample strength to withstand strong winds without damage.

THE problem of obtaining more consistent results in amateur work can be solved in two ways: by increasing the power to the maximum limit or—the far better method—by putting all the power one can in the desired direction, and at the optimum radiation angle. To achieve the latter, one must use either a number of antennas or rotate one which gives the greatest gain obtainable in the space available. The so-called footing space required by many directive arrays also is frequently a damper to the ham living in town.

The antenna structure described here is self-supporting, requiring no external guys, and occupies a ground space only six feet square. The ten-meter antenna which it supports consists of a

FIG. 1—GENERAL PLAN OF THE TOWER, MAST AND CROSSARMS

two-section flat-top 46 feet above ground with a second flat-top 3/4-wavelength below fed in phase. The whole structure has a total height of 47 feet and a spread of 32 feet. It is rotated manually from the operating room. The choice of a particular type of antenna, however, usually is influenced by the builder's preferences, so the description will be confined to the more important mechanical features of the rotating structure itself. The dimensions are such as to accommodate 20- as well as 10-meter directive arrays.

THE TOWER

A general drawing of the tower and rotating structure is given in Fig. 1. The tower consists of the cross-braced part above ground plus four

FIG. 2—METHOD OF LEVELLING THE FOUR SUNKEN FOUNDATIONS

anchor posts, one on each of the four legs, sunk into the ground. The anchor posts, of burr oak, can be obtained from a sawmill and will last indefinitely. Each is 5" by 5" by 8', with the bottoms slightly beveled to set squarely on the concrete foundations. A pair of 2" by 4" by 18" crossarms is put on each one, set about six inches from the bottom, mortised into the post one inch and spiked. These pieces are sawed from the top where the legs of the tower proper are mortised in. There is a two-foot lap between tower and post, with four 1/2" by 6" bolts per leg.

The holes for the anchor posts are dug 2 1/2 feet square, six feet deep, and centered at the corners of a six-foot square. A foundation is formed by pouring concrete to a depth of about six inches in each hole. To ensure that the tower is level, a ten-inch stake is first driven in each hole, then a center-post set up as shown in Fig. 2, and by using a level on a straight board from the center post to a board held on top of the stake in the hole, each stake is driven in until its top is level with the tops of the others. The concrete is then

*124 West Grove St., Kendallville, Ind.
poured in and levelled to the tops of the small stakes.

The legs of the tower each consist of two 2" by 4" by 18' pieces spiked edgewise to form an “L” section. Two legs are laid out as level as possible and then boards X and Y, Fig. 1, are tacked on. A bevel square is used to get equal angles on the two opposite sides. Then the cross braces are marked out, laid in position and after being sawed are planed to give a tight fit at the ends. The horizontal braces are 2" by 6" and the diagonal braces 1" by 6". Eight-penny coated nails are used on the 1 by 6’s and 16-penny spikes on the 2 by 4’s. The cross-pieces should be securely nailed at the center. When spiking near the ends of the 2 by 4’s it is wise to drill holes for the spikes if the wood shows any tendency to split. A 3/8" drill is about right for 16-penny spikes.

The anchor posts are then bolted fast with the sections laid ready to go into the holes, and one side is walked up with the base sliding down planks. Then the other side is walked up and the two opposite sides are squared by temporarily tacking a couple of boards across between them and using a square or measuring diagonally between corners. Next the lower bracing can be put on, but leave the handiest side open in the two top sections so the mast can be swung in through the opening. The 2" X 6" sections are bolted to the legs with 3/8" X 4½” bolts. The holes are filled by packing the dirt back in, using a hose to keep it damp and tamping it down with a piece of 2" X 4". A tower similar to the one described, used to support a windmill, stood thirty-five years and was in good condition when torn down.

The Mast

The type of mast to be described can be used to hold about any kind of rotary beam simply by strengthening the lower half, if necessary. The main consideration is to get as much strength as possible with the least wind resistance. A quick solution is to get a light cedar pole from a telephone or light company; some of these poles are extremely light and strong and if one can be obtained thirty or forty feet in length it will save building one. We had to build our own mast.

Fundamentally the mast is constructed of 2 by 2’s, as shown in Fig. 3, four being used spaced 3/8" apart. A 40-foot mast will require eight sections of 2" X 2" X 20’ long or their equivalent. The joints should be staggered as in Fig. 3. To make the mast, lay a 20-foot piece and a 10-foot piece level, place a 3/8" board between the two near the end and tighten them together with a clamp, then spike (16-penny) a five-inch piece of 1" X 4" across the two. The 1 X 4’s are really only 3/8" thick and are used throughout the mast. Place another 3/8" piece between them about two feet from the first and spike another five-inch piece of 1" X 4" there. The square section will be about 4½" so the extra length can be sawed off after they are nailed. Where the butt ends of the 2 X 2’s come together they should be mortised and lapped three inches and a 1½" metal plate, 1½" X 6", bolted across the joint with 3/8" bolts, after nailing. The core of the mast will thus be four 2 X 2’s spaced 3/8" with so-called 1½" X 4" nailed crosswise both ways every two feet, and will be about 30’ 6” long. The justification for spacing the 2 X 2’s is that the mast will be much stiffer than if they were laid solid against each other. For the top section the cross pieces on one side are made 10 inches long to provide steps to the top.

Ship-lap is used to put another 3/8" layer
around the lower 25 feet, making this section about 5 5/8" square. The protruding ends are ripped off. Twenty-foot sections of ship-lap were used and no joints were left above the tower. We then added a 15-foot section of 3 5/8" ship-lap, starting 1 3/4 feet from the bottom. The bottom section was left 5 5/8" square to fit a coupling for the lower bearing. The last section of ship-lap will extend about 3' above the tower, making this part of the mast 7 5/8" square.

THE LOWER BEARING

The lower bearing for the mast is a regular ball bearing (1 1/4" balls) from a truck. It has an outside diameter of 8" and the inner hole is 8" in diameter. The coupling, Fig. 4, should be made after a bearing has been obtained because possibly a thrust bearing or a larger or smaller one will be available. The only dimensions that would need to be changed are those of the inner hole and connecting pipe if a different size of bearing is used. A piece of 3" diameter by 3 1/2" long pipe with 3/2" walls, with a 3/2" piece of iron pipe with 1 1/4" walls inside, is welded on to the flat bottom of the coupling for our particular bearing to make a good tight fit. The arc welding should be good and strong, since in a strong wind there is a calculated possible ton of side thrust on the antenna structure we have. To keep the outer end of the bearing from settling into the wood below and binding, a 12" square of 3/4" iron plate with a 5" round hole was put directly under it, and the two-inch plank holds the bearing securely sidewise. Two planks 2" X 10" X 5 1/2' long rest on Section 2 of the tower with a 2" X 6" plank on edge across under them; two pieces of 2" X 10" X 20" with an 8" diameter hole are bolted on the above, with eight 3/4" X 6" bolts, to hold the bearing.

THE TOP BEARING

The top bearing is made from two brake drums (Fig. 5) which have about 1/4" clearance between them, the one fitting snugly into the other but rotating easily in it. All the weight is carried on the bottom bearing and the top bearing is only to hold the mast vertical. The rim diameter of the larger drum we have is 12". To get these drums to go to a junk yard and pick out a pair so that one will rotate inside the other, the smaller having an inside diameter of at least 10 inches for the 7 3/4" mast described here. Cut with a cold chisel a 7 3/4" square hole in the smaller one and then form four wooden blocks 6" long to fit snugly around the mast and down inside the smaller drum, to hold it fast to the mast. The larger drum, which fits outside the other, has a 10" diameter round hole chiseled in it and fits inside a collar of two-inch plank. Do not fasten these drums until after the mast has been placed in position in the tower; they can be held in approximate position by a couple of small boards nailed under them. About 1/4" clearance should be left between the tops of the rims to allow for any settling, which will probably be about 1/8". The outer drum is fastened to the planking by sawing, with a hacksaw, 1/4" X 1/4" slots on four sides of the rim and nailing. A hexagon band of 1/8" X 1/4" X 1 1/4" iron strips is bolted around the bearing with 3/8" X 4 1/2" bolts. Holes are drilled 1" from the ends of the strips for the bolts. Two by 10-inch planks are used for the top also; two pieces of 2" X 10" X 4 1/2' long and two pieces 2" X 10" X 20" long.

OTHER DETAILS

The mast is trussed with No. 9 wire, and a pair of spreaders is used to secure a 3-foot spread at the middle. The top fastening is made by bending two pairs of brackets from 1/4" X 1 1/4" strap iron with inside dimensions the size of the mast, in this case 4 3/4". A 3/8" X 6" bolt is used to hold the hooks for the guys, and also to hold the brackets tightly around the mast. The mast should be filled in with wood where these brackets are put on. The hooks are made of 3/4" rod (at a blacksmith shop); eight are required for both top and bottom connections. The top

![Diagram of mast structure](image-url)
brackets hold the mast very securely and no twist can spread the mast as it would break first.
Since the bottom is already held securely by the brake drum, the bolts and hooks alone are used there—\( \frac{3}{8}'' \times 9'' \) bolts are used. The spreaders at the middle are made of \( 1'' \times 4'' \) with a base spread of 8 inches. The \( 1 \times 4 \)'s are each 16'' long and a piece of \( 2'' \times 2'' \) oak, 4'' long, is set in the outer end of each, and a \( \frac{1}{4}'' \) groove sawed to pass the wire.

To make the center guys, about 300' of No. 9 galvanized wire is used; heavy duty compression-type strain insulators are inserted every two feet. The smaller varieties of insulators were tried but would crush and powder up, since these guys have to be quite tight to secure any bracing action. They are tightened with \( \frac{3}{8}'' \) turnbuckles installed at the lower end. Larger spacing of the insulators can be used, but two-foot spacing will minimize any effects the guys might have on the antenna pattern. The turnbuckles have a take-up of four and one-half inches, so make the guys as short as possible and then snap them over the spreader in the middle.

**THE BRAKE**

The brake provides positive locking of the mast in any position and eliminates the whip which usually occurs when only pull ropes are used. It also allows complete calibration of the steering wheel in the house. It is put on after the mast is permanently in position. A round drum \( 12\frac{3}{4}'' \) in diameter is built out on the mast at section three of the tower by planing blocks of wood to form a good circle. Alternatively, a brake drum could be used as in the top bearing. A band of sheet iron \( \frac{3}{4}'' \times 4'' \times 42'' \) is next nailed on the drum with eight-penny coated nails, counter sunk with a dull center punch before nailing.

Four \( 2'' \times 4'' \times 5' \) pieces are used to hold the brake assembly. Two are made as follows; \( 10'' \times 4'' \times \frac{3}{4}'' \) metal plates are bolted to the middle of the five-foot sections and a \( \frac{3}{8}'' \) hole is drilled through, centered 1'' from side C and 5'' from each end. The other pair is similar except that the \( \frac{3}{8}'' \) hole is centered exactly in the middle.

The outer brake band is made in two sections with a hinge joint, with the open ends terminating in short lever arms. Two sections \( \frac{3}{4}'' \times 4'' \times 25'' \) are used, cut as shown in Fig. 6. Bend the ends around a \( 4\frac{3}{8}'' \) piece of \( \frac{3}{4}'' \) pipe, which is left in, and bolt with \( \frac{3}{4}'' \times \frac{1}{2}'' \) bolts. The holes are drilled after the bend has been made. Four 17'' pieces of 2'' wide brake lining were used to line the outer band, with rivets every 4 inches.

(Continued on page 100)
THE matter of grid-bias supply is not a serious or complicated one with low-powered transmitters, but it does present some real difficulties when one starts construction of a multi-stage high-powered rig. The writer was interested in building a separate power supply with the necessary voltage and voltage regulation to bias the several stages of a one-kilowatt transmitter. Information as to the correct bias power supply voltage, bleeder load and resistance values to give the necessary cut-off and operating bias voltages for each stage, with the required voltage regulation and the explanation for these requirements, were not obtainable in a form which satisfied our interest in the subject. So a power supply was built up and several tests, under actual operating conditions, were made in an effort to understand fully its behavior. The results of these tests are described briefly in the hope that they will serve to aid others in a better understanding of this subject.

The first series of tests gave results that were puzzling, and efforts to calculate what the tests should show quickly proved that something was haywire. It became apparent that several things were to blame, including errors attributable to the unknown voltage regulation of the bias supply, to the possible 10% plus or minus variation in resistors, to the possible variation in meters, to

grid current leakage through the bias supply, and to the additional current through the voltmeters shunted across the circuit.

While preparing to make a curve of the voltage and current of the bias supply, it occurred to us that with measured resistances and currents, the voltage for any set of conditions easily could be calculated by Ohm's law, so no curve was made.

The several resistors used in these tests were measured by using the series-connected battery, milliammeter and resistor method. None of the resistors showed departures of less than 5% from the value printed on the label, one being more than 20% off. The milliammeters were connected in series and found to vary as much as 3% at some current values. Obviously, to obtain consistent results, only one meter should be used, plugging it in to read the current in each part of the circuit.

Leakage of grid current through the supply was found to be negligible unless very high voltages were developed. In one test with a very high resistance and high grid current, neatly 1500 volts was developed and caused about 5 ma. leakage through the supply. Meters placed in the supply circuit indicated that all, or nearly all, of this was leaking through the 4-µfd. filter condenser in the output of the supply. We believe that the rectifier tube prevents any grid-current leakage through the supply transformer.

To avoid upsetting circuit conditions, it was decided not to use the voltmeters except as a

FIG. 1—TYPICAL CONDITIONS IN A BIAS SUPPLY USING A LOW-RESISTANCE BLEEDER, AND WHERE THE VOLTAGE DEVELOPED AS A RESULT OF GRID-CURRENT FLOW DOES NOT EXCEED THE SUPPLY VOLTAGE

FIG. 2—THE SAME SUPPLY AND AMPLIFIER AS IN FIG. 1, BUT WITH A BLEEDER OF HIGHER RESISTANCE

grid current leakage through the bias supply, and to the additional current through the voltmeters shunted across the circuit.

While preparing to make a curve of the voltage and current of the bias supply, it occurred to us that with measured resistances and currents, the voltage for any set of conditions easily could be calculated by Ohm’s law, so no curve was made.

The several resistors used in these tests were measured by using the series-connected battery, milliammeter and resistor method. None of the resistors showed departures of less than 5% from the value printed on the label, one being more than 20% off. The milliammeters were connected in series and found to vary as much as 3% at some current values. Obviously, to obtain consistent results, only one meter should be used, plugging it in to read the current in each part of the circuit.

Leakage of grid current through the supply was found to be negligible unless very high voltages were developed. In one test with a very high resistance and high grid current, neatly 1500 volts was developed and caused about 5 ma. leakage through the supply. Meters placed in the supply circuit indicated that all, or nearly all, of this was leaking through the 4-µfd. filter condenser in the output of the supply. We believe that the rectifier tube prevents any grid-current leakage through the supply transformer.

To avoid upsetting circuit conditions, it was decided not to use the voltmeters except as a

FIG. 1—TYPICAL CONDITIONS IN A BIAS SUPPLY USING A LOW-RESISTANCE BLEEDER, AND WHERE THE VOLTAGE DEVELOPED AS A RESULT OF GRID-CURRENT FLOW DOES NOT EXCEED THE SUPPLY VOLTAGE

FIG. 2—THE SAME SUPPLY AND AMPLIFIER AS IN FIG. 1, BUT WITH A BLEEDER OF HIGHER RESISTANCE
check on the calculated voltages. In practice the meters usually read slightly different voltages than those found by calculation, but were always close enough to prove the point.

**SUPPLY BEHAVIOR**

With all these variables confronting us it was seen that it would require laboratory equipment to pin the results down exactly. However, for our purpose a small error is not important; what we really want is to understand the thing so that we can get the best possible results with the least effort.

Speaking broadly, the supply generates a substantially fixed voltage while its current may be anything from zero to full load. The grid is exactly the opposite, generating a substantially fixed current while developing a voltage across an external resistor anywhere from zero to a high value. When we connect the supply and the grid circuits across a common load resistance (bleeder-grid leak) any voltage developed by the flow of grid current is in parallel with the supply voltage. Since parallel voltages do not add, then if the grid current develops less voltage than the supply, the voltage across the resistor will be the supply voltage only. If the grid current develops more voltage than the supply, the voltage across the resistor will be only that resulting from grid-current flow.

So long as the bias voltage is substantially fixed by the supply—that is, up to the point of the grid current developing more voltage—the current that can flow also is substantially fixed because, since grid current must flow and supply current need not flow, a rise in grid current causes a drop in supply current or a drop in grid current causes a rise in supply current. The currents behave in see-saw fashion—as one goes up the other comes down.

If the supply voltage regulation is perfect, the rise in grid current will be equal to the fall in supply current, and vice versa, because with a fixed voltage, the total current must be fixed also. However, no supply will have perfect voltage regulation, and when the rise in grid current causes a drop in supply current, the load on the supply is reduced, in turn causing the supply voltage to rise. This rise in voltage increases the voltage across the bleeder-grid leak, thereby increasing the total current flow, with the result that the drop in supply current will not equal the rise in grid current.

From this we learn that any change in bias voltage for any condition where the grid current develops less voltage than the supply is entirely to the voltage regulation of the supply. If the grid current develops more voltage than the supply, the supply current will drop to zero with its voltage as high as it can go at no load and the supply could be removed without changing the bias voltage or the current through the grid leak neglecting possible small leakage.

**EXAMPLES**

The series of diagrams illustrates several practical sets of operating conditions. The circles represent milliammeters and voltmeters with the meter readings written inside. The top reading is the current or voltage at zero grid current; the bottom reading is with grid current.
flowing, and shows the change in current or voltage due to the flow of grid current.

With grid current at zero, Fig. 1, the supply delivers 220 volts and 88 ma. to a 2500-ohm load. When 45 ma. grid current flows the supply current drops to 53 ma. and the reduced load on the supply caused its voltage to rise to 245 volts. This

25-volt rise adds 25/2500 = 0.01 amp. or 10 ma., so that the total current is increased to 98 ma., of which 45 ma. is grid current and 53 ma. is supply current.\(^1\) The grid voltage regulation is \(25 \times 100/220 = 11.4\%\), which is not bad.\(^2\)

In Fig. 2 the resistance is increased to 5000 ohms. With the higher load resistance the load on the supply will be lower and its voltage higher, so at zero grid current the supply delivers 250 volts and 50 ma. When 45 ma. grid current flows, the supply current drops to 15 ma. and the reduced load on the supply caused its voltage to rise to 300 volts. This 50-volt rise adds 50/5000 = 0.010 amp. or 10 ma. so that the total current is increased to 60 ma., of which 45 ma. is grid current and 15 ma. is supply current. The grid voltage regulation is \(50 \times 100/220 = 20\%\), which is not as good as in Fig. 1.

In Fig. 3 the resistance has been increased to 20,000 ohms. At zero grid current the supply delivers 300 volts and 15 ma. When 45 ma. grid current flows, the supply load is reduced to zero and its voltage increases to a value approximately 1.41 times the r.m.s. voltage of the supply transformer, which is of no importance because the grid current develops 900 volts. However this 900 volts might easily blow the supply filter condensers. The current is all grid current and all the voltage is developed by grid current, so the supply could be removed for all the good it is doing other than furnishing 300 volts at zero grid current. The grid voltage regulation is \(600 \times 100/300 = 200\%\), which is terrible.

If the required bias voltage is greater than the supply voltage, the method of Fig. 4 should be used. The additional voltage is developed across a series resistor and is not added across the supply to endanger the filter condensers. The behavior of this circuit will be seen to be like that of Fig. 2 except that the 112.5-volt drop across \(R_2\) adds to the grid voltage.

The circuit of Fig. 5 shows typical conditions where the required bias voltage is less than the supply voltage. The bias voltage regulation is 40\%, which is probably satisfactory for many types of operation.

**SEVERAL TUBES ON ONE SUPPLY**

A case where more than one grid is biased from the same supply is shown in Fig. 6. Note the way in which the currents add: The supply and No. 1 grid current add through \(R_1\), this current in turn adds to No. 2 grid current through \(R_2\), and this current in turn adds to No. 3 grid current through \(R_3\). The voltages developed across \(R_1\), \(R_2\) and \(R_3\) are in series and add up to a sum that is in parallel with the supply voltage. The voltage on No. 3 grid is the voltage developed across \(R_3\) only. The voltage on No. 2 grid is the voltage developed across \(R_2\) plus the voltage across \(R_3\). The voltage on No. 1 grid is the voltage developed across \(R_1\) plus the voltages on \(R_2\) and \(R_3\).

**CONCLUSIONS**

Now that we have an idea of bias-supply behavior, we need a simple rule to follow that will permit us to build a supply to fit our needs, whatever they may be. The final amplifier probably requires the best bias voltage regulation and usually takes the highest bias voltage. Therefore, the transformer selected for the supply should, when  

\(^1\) There is an instantaneous effect not considered here, in that the change in net bias voltage probably also would affect the amount of grid current flowing, so that an initial 45 ma. would drop slightly as the power-supply voltage rose. The final result, however, will not be affected so long as the grid current is maintained at a constant figure.—Editor.

\(^2\) Regulation usually is expressed in terms of the load voltage, but use of the no-grid-current voltage as a base is more indicative in this case.—Editor.

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\(^3\) This rise in voltage occurs regardless of whether a choke—or condenser-input filter is used in the supply. The choke-input filter will give better regulation so long as the portion of the current furnished by the supply is greater than the critical value (see power supply chapter in the *Handbook*) but below that point the voltage will rise rapidly toward the peak output voltage of the rectifier.—Editor.
THE following article prepared by the Fifth Corps Area is the fifth of a series appearing on this page. The Fifth Corps Area comprises most of the states of the Ohio River Valley: Ohio, Kentucky, Indiana, and West Virginia.

Writing about the Army-Amateur Radio System in the middle of July is not the easiest task in the world, for our season begins in September and ends the following May, which period embraces all of the emergencies in which the A.A.R.S. has been called upon to furnish communication facilities. We cannot, however, adopt the philosophy of the Arkansas Traveler whose roof never leaked when it didn't rain. It is the purpose of the A.A.R.S. to develop and maintain a network of active radio stations during the normal operating season and under ordinary circumstances in preparation for the time when an effective radio link is the only available means of communication.

Naturally, when no actual emergency exists, there are other ways of keeping our nets active. During the past season, Kentucky has made use of its stations along the Ohio River to furnish dam reports to several offices of the U. S. Engineers at vantage points, these reports originating from their office in Paducah. With seven dams concerned in these reports, it is easy to see the importance of such information in emergency flood work.

Ohio has been making a determined effort to become useful to the American Red Cross so that they may be well acquainted with the services of the A.A.R.S. before future emergencies crop up. On January 31st and again on February 28th of this year, a demonstration was staged for the purpose of contacting various chapters throughout the state for the exchange of Red Cross traffic. In both instances, almost the entire Ohio membership participated, and on the latter date the entire Corps area cooperated to make the demonstration a considerable success. Now that we have managed to "break the ice," it is hoped that the coming season will see further activity along this line.

Throughout the country, past experience has been mostly with floods, tornadoes, and hurricanes, although other emergencies can and often do arise. What has been done is history, and can be read in back issues of QST. The question now confronts us: How are we prepared for the future?

Each section of the country has its weak spots—places that are most likely to offer up emergency situations at more or less regular intervals. While it is the policy of the A.A.R.S. to be prepared for anything that might happen, regardless of where it might be, these weak spots are the ones that call for the most attention and preparation. In the Fifth Corps Area it is the Ohio River Valley. During the floods of 1936 and 1937 many stations along the river were able to step in and render yeoman's service to the stricken areas.

Now there is no mystical formula by which an amateur is transformed into a member of the A.A.R.S. The only requirements are a bona fide interest, a willingness to cooperate with the other members and to be regular, reliable and prompt. It is not necessary that he be a speed merchant, for many of our most reliable members operate at moderate speeds. Nor is high power required, for the A.A.R.S. is a cooperative system, and if a weak signal cannot be picked up successfully at one point, it is sure to come through at another, giving an outlet for any traffic that may be.

As in other Corps Areas, the Fifth Corps Area has been operating in spot frequency net fashion, with one channel for each state as follows:

- Kansas: 3656
- Indiana: 3810
- Kentucky: 3780
- Ohio: 3700
- West Virginia: 3700

Not only does this method utilize a minimum of amateur channels at any one time, but allows an opportunity for easy and positive break-in, since all stations in one particular state net are listening on just one frequency, and can follow the entire procedure almost without touching their dials.

At present writing, we find ourselves greatly in need of more members along the Ohio River—in all four states of the Corps Area. It is extremely difficult to make any decent preparations for emergencies when no stations are available where they are most needed. We would like to recommend that any licensed amateur in the Ohio River Valley interested in contacting the A.A.R.S. and placing himself in a position to be of service to his community in time of need, write to the Corps Area Signal Office, Fifth Corps Area, Fort Hayes, Columbus, Ohio. We can use stations anywhere in the states of Ohio, Kentucky, Indiana, and West Virginia, and we shall be glad to furnish additional information to any who are interested.

The following cryptogram is presented for those interested in these problems. Solutions received by the Liaison Officer, A.A.R.S., 3441 Munitions Building, Washington, D. C. will be acknowledged by mail.

AAPON ORELG TELE UTCAY MIITEI JUBIH NUTBA SPTLI NICTV QAFTK TVSI OPASS EANAAN NENST ORBIO NIARN

September, 1938
An Auxiliary Transmitter for 1.7- and 3.5-Mc. Work

A 50-Watt Self-Contained Unit With Ganged Tuning for Quick Frequency Change

By Don H. Mix,* WITS

The transmitter described was designed primarily with the requirements for state or section traffic net operation in mind. While rapid band-changing is not a requirement, it should be possible to tune to any frequency within the band of operation with a minimum of effort and time. Provision should be made for break-in operation, of course, and it would be desirable to build it as a completely independent unit to eliminate any possibility of failure because of its dependence upon station units which may be used for other purposes. An input power of 50 watts should be sufficient for reliable work.

The main dial controls the frequency and the small control to the right adjusts antenna tuning. No other tuning adjustments required.

The first requirement was fulfilled by the use of an electron-coupled oscillator and ganged tuning controls. Only two tuning adjustments are necessary for even wide changes in frequency. The main dial sets the frequency and the only other adjustment is the tuning of the antenna system. The 89 and 807 were selected as the most practical tubes for the purpose, considering cost and simplicity of circuit design for the power desired.

Circuit Details

Referring to the circuit diagram of Fig. 1 it will be noted that the oscillator circuit is quite conventional except that a separate winding is provided for the cathode tickler. In addition to the many other variables which affect the stability and output of the electron-coupled oscillator, an investigation showed that the amount of feedback must also be taken into consideration. In fact, this adjustment now seems to be one of the most important in eliminating chirp with keying. It also has a very considerable effect upon the power output of the oscillator as indicated by grid current to the following stage. The separate tickler winding makes these adjustments much easier and also permits cathode keying of the oscillator for break-in operation even though the coil and condensers of the tuned circuit may be grounded.

The grid-screen circuit of the oscillator operates at a frequency of 875 to 1025 kc. This range was selected principally to permit direct checking of frequency against a broadcast receiver tuned to stations of known frequency, and secondarily because it is usually easier to obtain good frequency stability at the lower frequencies. This means, however, that the circuit must be well shielded to prevent interference with broadcast reception in the immediate vicinity of the transmitter. The plate circuit tunes over the range of 1750 to 2050 kc. (the band limits which are to be authorized in the near future). The output tank circuit covers either the same range or that of 3500 to 4000 kc. by means of a pair of plug-in coils. Very little efficiency is sacrificed in doubling frequency for the latter band. The tracking system is the same as that used in the transmitter described in QST for June.1 C4, C5 and C6 are the circuit padding condensers while C1, C2 and C3 are the ganged tuning condensers. A switch is provided to open the cathode of the 807 while the frequency of the oscillator is being set. Parallel feed in the plate circuits of both oscillator and amplifier removes d.c. voltage from the tank circuits and eliminates the necessity for insulating the tuning condensers from ground; thus they may be mounted directly upon the chassis.

1 Mix. "Ganged Tuning for the Multi-Stage Transmitter," QST, June 1938.

* Technical Department, QST.
In order to make the unit complete, an antenna tuner and a power supply are built in. Successful tracking of the final amplifier tank circuit with the antenna coupler depends upon rather careful adjustment of antenna coupling. It was deemed advisable, therefore, to use separate plug-in coils in the antenna circuit so that permanent optimum coupling would be provided for each band.

Since the space available did not permit separate power supplies for oscillator and amplifier, the problem of well-regulated plate voltage for the oscillator was solved by the use of a pair of the new VR150 gaseous voltage regulator tubes in series. Regulation is held to within a few per cent of 300 volts.

**THE TOP VIEW SHOWING SHIELDING**

Antenna tuner is to the right. The antenna tuning condenser is mounted on small stand-off insulators.

Reflections of this principle, the line of shield-cans to the left contains the oscillator grid and plate coils and the 89 oscillator tube. The coils are wound on 1½-inch diameter Hammarlund forms. Since these coils are not changed, the prongs were removed and the forms fastened permanently to the base with machine screws. Leads from the coils pass through clearance holes drilled in the chassis before mounting the forms. Coil adjustments could be made more conveniently, however, if the forms were mounted in sockets of the sub-mounting type.

The coil shields are the National Type J30. The oscillator grid condenser and leak are mounted inside the oscillator grid-circuit coil form.

The National Type B dial controls the tuning gang. The oscillator tuning condensers are in front with the amplifier tuning condenser to the rear. The mounting insulators, which may be seen under the oscillator grid tuning condenser in the photographs, are unnecessary with the revised circuit shown. The tube in front of the 807 is the 83 rectifier. The amplifier coil is immediately behind the 807 and its socket is mounted on a short stand-off insulator. The two small knobs at the left-rear of the chassis are the controls for the oscillator and 807 plate-circuit padding condensers, which are mounted beneath the chassis. The two small tubes to the right of the 807 are the voltage regulators. The antenna coupling coil and tuning condenser are to the right.

Careful shielding and placement of circuit components are important to avoid instability in the amplifier circuit. All grid-circuit components, with the exception of the tuning condenser in the plate tank circuit of the oscillator, are mounted beneath the chassis, while the units comprising the plate circuit, aside from the padding condenser, are mounted on top. The tube is supplied with the usual low cylindrical shield coming up level with the lower edge of the plate. Because of the height of the tube, the socket for the 807 must be set about an inch below the surface of the chassis. This can be done easily with spacers.

A 2-inch milliammeter with a scale of 0 to 150 ma. is mounted on the panel. The top toggle switch controls the filaments, the central switch is in the primary circuit of the high-voltage transformer and the lower one opens the amplifier cathode circuit. The antenna tuning control is in the upper right-hand corner and the jack for the key in the lower right-hand corner.

Turning to the bottom-view photograph, the power-supply equipment may be seen occupying the right-hand side. Some thought should be given to the arrangement of power-supply components so that space will be provided for mounting screws for the antenna tuning condenser and also for the toggle switches and key jack. The oscillator and amplifier plate-circuit padding condensers are near the lower left-hand edge. The fixed mica padding condenser for the oscillator grid circuit is near the upper left-hand corner. One of the new low-drift mica condensers is recommended if frequency drift due to heating is to be held to a minimum.

**WIRING**

It will be noted that very little wiring shows above the chassis. Components have been arranged so that most of the wiring may be hidden beneath the chassis. Power wiring may be bunched in cable form where it happens to be convenient, but the r.f. wiring should be spaced well out from...
TUNING

Preliminary tuning and adjusting should not be a difficult job. The screen voltages for the 89 and 807 should be first set to appropriate values—100 for the 89 and 250 to 300 for the 807. Both tubes should be in place with filaments lighted but no plate voltage on the 807. The oscillator should then be tuned to the high-frequency end of the band. If frequency is checked against a broadcast receiver, the receiver should be tuned to some station in the vicinity of 1025 kc. for the 1.7-Mc. band or 1000 kc. for the 3.5-Mc. band. It may be necessary to open the cover of the transmitter cabinet or even run the receiver antenna lead-in near the transmitter to provide sufficient signal strength. With the frequency of the grid circuit set, the plate circuit may be tuned to resonance, indicated by a milliammeter connected temporarily in the circuit, by means of the padding condenser $C_6$. When resonance has been found, the

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**FIG. 1—CIRCUIT DIAGRAM OF THE AUXILIARY TRANSMITTER**

C1—140-µfd. midget variable (Hammarlund MC140S), oscillator grid tuner.
C2—50-µfd. midget variable (Hammarlund MC50S), oscillator plate tuner.
C3—Same as C5, amplifier plate tuner.
C4—350-µfd. fixed mica (250 and 100 in parallel), oscillator grid padder.
C5—Same as C3, amplifier plate padder.
C6—250-µfd. mica midget fixed, oscillator grid condenser.
C6—Same as C5, amplifier grid condenser.
C7—5000-µfd. mica (600 volts), oscillator plate-voltage blocking condenser.
C8—5000-µfd. mica (1000 volts), amplifier plate-voltage blocking condenser.
C9—0.01-µfd. tubular paper (600 volts) by-pass condenser.
C10—260-µfd. variable (Cardwell MR260BS) antenna tuner.
C11—Double-8-µfd. electrolytic, sections in series (450 volts working).
C12—50,000 ohms, 1-watt, oscillator grid leak.
C13—400 ohms, 5-watt, amplifier cathode biasing resistor.
C14—25,000 ohms, 50-watt, voltage divider.
C15—25,000 ohms, 25-watt, voltage divider with slider.
C16—15,000 ohms, 50-watt, oscillator plate-voltage dropping resistor.
C17—1-µfd., 1000 volts, 1-watt parasitic suppressor.
T1—750 v. each side center, 200 ma. (Stancor P5099).
T2—Filament transformer, 6.3 v., 3.6 a., and 5 v., 3 a. (Stancor P5099).
T3—8-40 henrys, swinging filter choke, 175 ma. (Stancor C1400).
T4—20 henrys smoothing choke, 175 ma. (Stancor C1410).
T5—52 turns No. 28 d.c.c., 1½ inches diameter, close-wound.
T6—12 turns No. 24 d.c.c. wound over ground end of L1 in same direction as L1.
T7—60 turns No. 24 d.c.c., 1½ inches diameter, tapped 6 turns from plate end.
T8—1.7 Mc.—50 turns No. 22 d.c.c., 1½ inches diameter, tapped 6 turns from plate end.
T9—3.5 Mc.—28 turns No. 20 d.c.c., 1½ inches diameter, tapped 8 turns from plate end.
T10—See text.

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QST for
setting of the padding condenser should be marked on the chassis. The oscillator should then be tuned to the low-frequency end of the band and the padding condenser again adjusted for resonance. If the resonance setting has changed, the tap on the coil is not correctly placed. If the padding capacity must be increased to regain resonance, the tap should be moved slightly towards the plate end of the coil, while if the padding capacity must be decreased, the tap should be moved away from the plate end of the coil. No difficulty should be experienced in locating a point for the tap where the tuning of the plate circuit will remain at resonance over the entire tuning range. When the proper adjustment has been found, the setting of the padding condenser should be marked in case it may be disturbed later by accident. Once tuned, this circuit should not have to be adjusted again in operation.

The same process should be followed in adjusting the plate circuit of the amplifier for either band. Proper padding-condenser settings for both bands should be marked on the chassis. The only difficulty encountered in tuning up the amplifier was the presence of an ultra-high parasitic oscillation. If similar oscillations are encountered they may be suppressed by the insertion of a small non-inductive resistance in series with the plate lead of the 807 close to the tube. The resistance need not be more than 25 ohms, even 5 ohms being effective in this particular instance.

ANTENNA COUPLER

The dimensions of the antenna coil and the question of whether series or parallel tuning should be used will depend upon the antenna system with which the transmitter is to be used. It is advisable, therefore, to wind experimental coils until a satisfactory combination has been found. When the best dimensions have been found, the coil may be wound permanently and the terminals soldered to the pins of the coil form. In general, it may be said that a comparatively small number of turns in the antenna coil and series tuning will be required if the antenna system is serving a current loop and that a comparatively large number of turns and parallel tuning will be required if the antenna system is serving a voltage loop. Once the correct combination has been found which will tune the antenna to resonance, the link windings may be adjusted to provide proper amplifier loading. In adjusting the link windings, it will be found that the amplifier tuning will not track if the coupling is too tight. It should be possible, however, to run the plate current up close to the maximum rating without disturbing the tracking, providing the antenna circuit is kept tuned to resonance. With the antenna coupled it may be necessary to readjust the setting of 

C6

to maintain tracking, and in some instances it may be necessary to alter the position of the tap slightly. It will be noted in Fig. 2, which shows the connections for the antenna coil and socket, that either parallel or series tuning may be used simply by changing the connections (Continued on page 74)

Six-prong sockets and forms are required.
THIS is its second year. In other words, it's just learning to walk and talk. Radio-controlled model aircraft, that is—not the neighbor's youngest child. But any art has to pass through stages of infancy and growth, as does any youngster.

Of course, there was talk of radio-controlled aircraft before last summer. In fact there were those who claimed they had flown models under control—and even those who would sell detailed plans for a consideration. Without peering too closely into these phases, however, it is generally agreed by the various authorities in the field that practical radio control first arrived during the summer of 1937.

Practical, did we say? Well, yes. It usually worked on the ground, and sometimes it worked in the air. There were a variety of systems. At the 10th National Model Airplane Competition at Detroit in July of 1937, where the new radio-control event was a novelty that excited popular imagination, no two similar methods were used in any of the six ships entered. Chester Lanzo, the winner, used a single channel with a regenerative SO-meter receiver, a gear train and a toy train motor giving single-cycle rudder control. His ship, an elementary stick affair, was the only one that flew; two others cracked up on the take-off. The remainder did not attempt to fly. One system was based on the principle of tuned vibrating reeds to select audio-frequency pulses for control maneuvers. Another entrant used miniature wind-driven dynamos to generate the current for control solenoids.

Solenoids—they were the standbys of these early radio-control experiments. Logical, and to some extent practical, they formed the basis of most systems. But actually to drive a control surface with a small electromagnet required an astonishing amount of power—power painfully bought with weight and bulk.

Then, in the late summer of 1937, QST introduced a new tool—the escapement, with the control surfaces powered by means of rubber bands. A series of soaring planes fitted by Ross Hull with this type of control made over a hundred flights during the summer and fall of 1937, providing a wealth of data for experimental development. This information was reduced to practical applications during the early spring in anticipation of the annual soaring meet at Elmira.

There Ross and R. B. Bourne, W1ANA, his pilot and co-worker, planned to enter a high-performance r-c soarer in competition with the regularly-manned ships, but unfortunately technicalities in the rules prevented this! A number of experimental flights were made during the course of the meet, however, each under perfect radio control. The principal result of this experience was the discovery of various enlightening aeronautical characteristics of large, high-performance model soarers of the type used.

For the 1938 meet Ross Hull adapted an improved, if bulkier and heavier, method of control employing continuously-reversible, small d.c. motors. This system of control had the obvious advantages of permitting the precise degree of control desired for a given maneuver, and also of permitting instantaneous reversal of the control without going through a complete cycle. Such a control system necessarily introduced appreciably more weight than the rubber-band powered escapement arrangement, however, and the latter still ruled supreme in the field of ultra-lightweight devices. In fact, following its presentation in QST modellers generally came to recognize the worth of this idea and it formed the basis for much of the experimental building and testing carried on during the past winter.

Indeed, so fully did the principle register that it literally dominated the 1938 national radio-

WALTER GOOD AND HIS 8½-FT. SPAN, 7½-LB. RADIO-CONTROLLED GAS MODEL AT WAYNE COUNTY AIRPORT, DETROIT, DURING THE NATIONALS

At the left is Paul Kreilick, W8QQE, the radio operator. Although the picture doesn't show it, the self-assigned number of the plane is "7398."

*Assistant Secretary, A.R.R.L.
control competition, the 11th National model meet, again held in Detroit in July.

The competition itself was not, unfortunately, a success. This was due basically to weather conditions, for a strong wind that grew stronger every hour made successful flying very nearly impossible. The winning ship was the only one to attempt to fly, and it suffered a severe crack-up on the take-off.

What the story might have been had the weather been favorable is conjectural. So far as is known Walter Good of Kalamazoo—who won the event—was the only one who had a tried and proven ship, one that had been put through a routine of test hops. Such experience is a tremendous asset. On the other hand there were some good-looking control systems in evidence.

The outstanding characteristic of the meet was that, in contrast to the previous year, it seemed more representative of radio talent turned to modelling than of modellers trying to vanquish radio. This is as it should be, for successful radio control is an astonishingly elusive goal even to those versed in radio technique. On the other hand, weakness in the aeronautical department is equally unfortunate. A joining of forces, as was evidenced at the 1938 meet, is a healthy sign—one that leads to a prediction that next year will see some real progress in the field.

WINNING SHIP USES ESCAPEMENTS

Walter Good's winning ship used two-channel one-cycle control, with movable tabs on both rudder and elevator actuated by ingenious little escapements built into the fixed surfaces right at the tail. Although apparently an awkward place for extra weight, the mechanical reliability of so direct a linkage seemed advantageous. At least, Good made several test flights under control before the meet—even landing back on the run-way in one case. Since the unfortunate crack-up, the re-built ship has continued to perform reliably and a number of other flights have been made—including three at a public demonstration.

The flying technique is quite simple. The ship is adjusted on the ground for normal take-off and climb, and it then takes off as would any gas model. Once in the air it is maneuvered in slow turns and gradual dives and climbs by pulses which move the escapements through their positions. Landing is accomplished by the usual glide to earth after power cuts, the rudder being used for directional control.

Two radio channels are used. The receivers employ a trick circuit; Good says he himself does not fully understand its operation. The tube is a single Type 30, superregenerative on 56 Mc., in the familiar "Minute Man" circuit. By juggling plate voltage and circuit constants a critical condition is found which gives 2-ma. plate current change. Actually, the tube seems to act something like a QY-4.²

The sensitive relays are of the polarized type, using small permanent magnets. This type was chosen on the basis of Good's three years of experience with about a dozen different varieties as being the most stable mechanically, less subject to shocks and changes in flight altitude than other types.

The total weight of the radio equipment, using penlite cells for filament supply, etc., is under 2 pounds. The transmitter uses a pair of T-20's. The frequency changer is a small relay which ties in additional capacity, giving the two-channel control.

Another interesting entry at the 1938 meet was

that of Howard Flannigan of Detroit, in which Al Pochelon, W8JYH, was the capable radio collaborator. The control system utilized QY-4's and Sigma relays, with two channels—rudder and elevator. The most notable feature was the lightweight construction and the ingenious use of the escapement principle. Flannigan, a quiet, competent man past fifty, is a capable mechanical engineer, and his workmanship shows it.

Speaking of competence, it is a remarkable thing to note the variety of talent which is being attracted to this radio-control game. Mechanical engineers, aeronautic experts, radio folk—they all find ample room for fascination in its confines. As a hobby it offers not only the absorbing interest of complex technical problems and the appeal of an interesting constructional project, but to that it adds thrills in the form of spectacular results not to be found in most technical pursuits—and it most certainly is a thrill to see those models fly!

But enough digression. The pictures show the general plan of the Flannigan-Pochelon control. The receiver tubes are plugged into wafer sockets, but these are used in lieu of a chassis rather than for mounting. All other parts are wired to the socket terminals. The tubes are mounted in the ship by light metal sleeves which are tightened over the bases.

The relays are assembled integrally with the minute escapements and midget plunger-type electromagnets on a wooden frame which slides into the fuselage. Control wires run back to the movable surfaces.

The writer's ship, which was awarded second place at the Detroit meet on the basis of a demonstration on the ground, is an experimental high-wing monoplane of 14-foot span powered with a special 24-hp. Forster opposed-type motor. It was originally designed to carry 10 or 12 pounds of radio gear in experimental set-ups, but the 25-lb. weight rule at the Nationals necessitated considerable paring. As a result, the control was limited to two channels—rudder and elevator—actuated by reversible d.c. motors. To accomplish this four receivers using Raytheon QY-4's, two for each channel in order to accomplish the reversing action, were used.

A detailed constructional description of this system and its application is scheduled for next month's QST.

If there is a moral to this yarn—and it seems there should be—it is that it takes radio folk to build radio gear and airplane people to build air-planes. Speaking in generalities, the 1937 Detroit meet was apparently characterized by modellers with ample aeronautical but inadequate radio experience. At the 1938 meet, on the other hand, all the radio-control systems functioned at least reasonably well on the ground, but when it came to actual flying—well, there just hadn't been enough of it.

The best recommendation that we can make, therefore, is that hams and modellers work together on a cooperative basis. That way all the details of both aircraft and control will be coordinated—and each will have an expert's attention. We have established that it takes hams to devise adequate control systems, but the reverse is usually true as well. So if you're interested in the thing, get in touch with your local modeller's club—aircraft or yachting; the latter is a lot simpler from the radio standpoint—and get going on a partnership basis. You'll be in for some of the biggest fun of your life.

More on the 1851

SINCE publication of the squib on using the 1851 in amateur-band communications receivers some additional data on the characteristics of the tube have been furnished us through the courtesy of J. R. Nelson of the Raytheon Production Corp. It develops that the undesirable feature of low input resistance and consequent circuit loading is to a very considerable extent a function of the operating voltages applied to the tube elements. By increasing the grid bias beyond the normal rated value it is possible to bring the input resistance up to a figure which is even better than that of the 6K7 at its maximum ratings. The mutual conductance naturally is lower, but still is high enough so that there is an increase in gain over the 6K7. More important than gain, however, is the fact that operating the 1851 at lower plate current does not affect the noise appreciably, so that with the increased bias the tube still gives an improvement in signal-to-noise ratio. The fact that the circuit loading can be reduced by increasing the grid bias on the 1851 makes it relatively easy to substitute the tube for a 6K7, because the tapping-down process previously suggested no longer is necessary.

In an experimental check it was found that, in substituting the 1851 for a 6K7 in one receiver (Continued on page 78)

1 "The 1851 in Communications Receivers," p. 41, QST, June, 1938.
THE clock in the tower of the Engineering Building sounded faintly in the distance. The wind was coming up fast now, howling and cold, blowing smoke down the chimney at each frigid gust. The windows of the shack rattle eerie accompaniment to the moan of the wind 'round the eaves. It was black outside, the cold blackness of early morning, made more dark and sinister by the occasional erratic flashing of lightning on the eastern horizon.

It was three thirty. Most of the fellows had departed over an hour ago, and now only Collier Parkes and Professor Wortham remained, toasting their shins in front of the flickering logs, talking in that way that friends talk—when the spirit moves them, answering in monosyllables, chuckling now and then, smoking peacefully as they stared at the fire.

Parkes had come off duty at two o'clock. When he signed on at midnight, the static had been imperceptible, but soon it had picked up to sharp, pistol-shot crashes occurring with increasing rapidity, and necessitating double sending at ten words, and breaks for fills every few seconds. So at the end of two hours, with conditions growing worse, he closed the station. Downstairs, Freshman Bradfield was cleaning up the bias motor-generator sets, a job that fell his lot once a month. It was an all-night job, usually, but to-night there were only two of the machines to work on, and to-morrow was Sunday and he could sleep late.

At the moment he was sanding in a pair of new brushes on Generator No. 4, and happy, being not only a small chap who could "take it," but a man of good disposition, and prideful of a good job. He snapped the tension springs all around, gauging the thrust with the air of a man inspecting the exciter-brush rigging on a 50,000-Kva. turbo, and went around again just to make sure all was right. Bias, Freshman Bradfield knew, was a very important thing. He held the lamp close, and inspected critically the polish of the commutator. The carbon dust in his taffy-colored hair and the smudge in his left ear gave him the appearance of a man who worked with zeal at the job.

Professor Wortham removed his horn-rimmed glasses, looked through them, and reached for his handkerchief. "Looks like a storm coming up."

"Won't be long, I guess. Enough QRN up there to take care of two of them."

Parkes glanced at the clock over the fireplace, stood up, looked at it closer. "Time for coffee, Prof. How about it?"

"Why, yes! Certainly."

Parkes went over to the stairway leading to the basement. "Rustle up a scuttle of java, frosh."

"Yes, sir," answered Freshman Bradfield, promptly. Coffee was something that went well about this time of the morning.

"How're they looking?"

"Pretty good. We're trying out a softer grade on No. 4. I had to change only two of them, this time."

A fierce gust of wind beat against the shack, hammering at the windows.

"On the job, frosh."

"Yes, sir."

Parkes walked over to the window and looked out, cupping his hands beside his face. Lightning in the east. A fierce glare overspread the landscape for an instant. A long period, followed by a distant rumble of thunder.

Freshman Bradfield came up the stairs, wiping his hands on a piece of waste.

"Hold the deal, frosh. I'll get the coffee started. Go get a flashlight and dash over yonder on the hill and take a look at that rotary beam. See that the tarpaulin is lashed fast over the motor mechanism. If it gets wet, we'll have a time with it."

Once before, the fastenings had come loose in a heavy rain, soaking the rotating mechanism, requiring pulling the motor and baking it out. Almost as bad, the water upset the readings on the Wheatstone bridge, one arm of which was a rheostat geared to the drive, which allowed the position of the beam to be ascertained in the operating room by galvanometer deflection.

"Don't let the rain catch you. Make it swift."

"Yes, sir," answered Freshman Bradfield, disappearing on a run through the door of the store room. Reappearing in a moment with a flashlight and his overcoat, he hurried out of the shack, pulling on his overcoat as he ran.

Outside, it was pitch black. The wind hit him in gusts. Damp feeling, in front of rain. He jogged along in the darkness, following the dimly outlined path to the beam. He knew every foot of the way, whether the path had been there or not, having helped erect the beam. Some job it had been, too!

The two great old wooden towers, which could be seen miles away in fair weather, were wholly invisible. The path to the beam followed the line of the towers, the beam being only a couple of hundred feet beyond the farther one.

(Continued on page 90)

*3071 Southern Ave., Memphis, Tenn.
GRID-CONTROLLED mercury-vapor rectifiers are more or less familiar to the amateur fraternity, but probably few of us are acquainted with the fact that a similar oscillator in the transmitter—capable of supplying a few watts to a pair of electro-magnets readily will handle the keying.

A typical keying circuit is shown in Fig. 1. $M_1$ and $M_2$ represent the magnet coils, wound on U-shaped cores the ends of which are placed on either side of the tube. Externally the Permatron resembles any conventional mercury-vapor rectifier, but internally has two pole pieces running vertically downward from the elements. The ends of the magnet core should be placed as close as possible to these pole pieces, and as near their tops as is practicable. When current is sent through the magnets, the magnetic field exerts a control over current flow similar to that of the electrostatic field in the grid-controlled tubes. Depending upon the strength of the field, current flow will be prevented until the voltage on the rectifier rises to a critical value, when the vapor ionizes and conduction takes place. Once current is flowing, the control is lost until the plate voltage drops to zero during the course of the cycle. If the field is made strong enough, the tube will not control by magnetic means is possible. Although magnetically-controlled gas-filled tubes have been in use for some time in various applications, chiefly at low voltages, it is only recently that types suitable for plate-supply requirements have been developed. We are now able to report, however, that magnetically-controlled tubes, to be known as Permatrons, are being made available by the Raytheon Production Corporation.

Permatrons have a number of interesting features which make them adaptable to a wide variety of applications. The one of chief importance to amateurs, however, is the obvious use as a keyed rectifier. Since the magnetic control circuit is external to the tube and needs no direct connection to the rectifier circuit, special insulation between the key and the power supply is not necessary, as it is in the case of grid-controlled rectifiers. A source of direct current—which conveniently may be the low-voltage plate-supply for the
McNinch Praises Amateur Radio

F.C.C. Chairman, Principal Speaker at Atlantic Division Banquet, Lauds Our Accomplishments; President Woodruff Responds

At the convention of the Atlantic Division of the A.R.R.L. in Washington on June 25th, the guest of honor and principal speaker was the Honorable Frank R. McNinch, chairman of the Federal Communications Commission. Mr. McNinch's address, illustrative of the esteem in which amateur radio is held by the Commission, was broadcast over a nationwide network. We quote the greater part of Mr. McNinch's remarks:

Mr. Toastmaster, distinguished guests, members of the Atlantic Division of the American Radio Relay League, and those of you who are listening to this program which is being broadcast from coast to coast: I am gratified that I have the opportunity to speak to you. I take this opportunity to acknowledge the fact that I have had the privilege of serving you and the public. Many who hear this program may know that there are radio amateurs but know little or nothing concerning the work of the amateurs. But now that I have come into a very great appreciation of the amateur. I ask the indulgence of those present at this banquet to recount some facts that will be an old story to you as I describe what to me seem some of the most significant and outstanding achievements of radio amateurs and tell some of the things I have learned about them.

Before coming with the Commission, I had, of course, read of the fine public services rendered by amateurs at times of flood, earthquake, fire, and other local and national calamity. I had read that radio amateurs had furnished an important and sometimes the only link between civilization and exploring expeditions into the polar regions of the Arctic and Antarctic. Until recently, however, I had no conception of how vast the number of people who can lay claim to the title of radio amateur, I did not realize that amateur radio was probably the only hobby not even excepting stamp and coin collecting, which is officially recognized and actively fostered by the Government of the United States and by some of the more forward-looking governments in other countries of the world. Neither did I realize how universal in character is the group of women as well as men radio amateurs, who according to Clinton DeSoto's book "Two Hundred Meters and Down, The Story of Amateur Radio" range in age from "8 to 80; in education from those who halted in the grammar grades to the erudite holders of doctor's degrees; in social status from convicts in federal prisons to society's women of wealth and the son of an ex-President of the United States; in occupation, from coal miners and bellhops to major executives in giant corporations."

I have learned something of the history of the American Radio Relay League and of the high place which it holds not only in the United States but in the world. For it, like radio itself, is not bounded by geographical lines but rather as proof of the golden surface values but rather as proof of the underlying golden creation and development of this altruistic passion for the unselfish dedication of the time and talent of the more than 60,000 radio amateurs in the world to the public service. No other aspect of amateur radio has so captured my imagination. The many isolated public services rendered by radio amateurs, great as they were, should, I think, be regarded as a geologist does those outcroppings of surface ore which, valuable in themselves, are of greater value in showing the mother lode of precious metal beneath the surface. I like to view these particular acts, not for their surface value but rather as proof of the underlying golden desire and ability of amateur radio to serve humanity.

At the outbreak of the World War, the Army and Navy Communication Systems were of utmost importance. They needed radio operators, and they needed them badly. The radio amateur's fraternity supplied this need. More than 3000 amateurs contributed their skill and endurance to the American cause. They were already skilled and experienced and were available at a moment's notice. To train raw recruits would have required upward of a year to learn the telegraph code alone, and many more months to acquire the technical knowledge and skill based on experience that the amateurs possessed.

The amateur has lent assistance to these arms of the Government on many occasions. In 1924 amateurs maintained reliable communication with the United States dirigible "Shenandoah" as it made a tour of the country. In 1925, when the United States battle fleet made a cruise to Australia, the Navy wanted to test out short wave equipment. The American Radio Relay League furnished amateur operators for the job who proved the value of these short waves for Naval use.

So valuable were the amateurs considered, that in 1926 both the Army and the Navy came to the American Radio Relay League of definite cooperation. The result is that the Navy now has its Naval Communication Reserve and the Army its Army Amateur Radio System with several thousand members throughout the entire United States. These amateurs secure actual training and handle routine matters over the air, become skilled in military procedure, and thus add greatly to national security.

In providing a secondary reserve line of national and international communication the amateur fills a role scarcely less important from the standpoint of the national welfare of our country than his role as a supplement to our military and naval forces. There are some 47,000 amateur stations in the United States and an equal number of amateur operators, or, in passing, that it is a source of great satisfaction to me that more than seventy-eight per cent of all the amateurs in the world are to be found in the United States.

To me the outstanding achievement of radio amateurs does not lie in the scientific field though I have a high appreciation of the remarkable developments in the art which have been originated and in many cases perfected by radio amateurs. I know that radio as we know it today would not be an actuality and perhaps not even a dream for the future were it not for the many scientific contributions that have grown out of the experimentations, the creative imagination and the ingenuity of radio amateurs who have struck out boldly along paths untrodden by those who have engaged in orthodox scientific research. Nor do I think its greatest achievement is to be found in any or all of the many public services rendered by radio amateurs in times of public distress such as was caused by hurricanes in Florida, the Mississippi, New England, Texas, California, Kentucky and other States; the California dam break; many devastating forest fires; and the New Zealand and Nigerian and Californian earthquakes. These were indeed great public services, saving many, many lives, and millions of dollars' worth of property. But to me the glory of amateur radio lies in the creation and development of this altruistic passion for the unselfish dedication of the time and talent of the more than 60,000 radio amateurs in the world to the public service.

It is the very paradox that whatever is done is done without hope or desire for pecuniary gain. I have no doubt there are amateurs in other fields who devote them-
selves as whole-hearted and as single-minded to their hobby as do radio amateurs. I know of no other field, however, where the public at large receives such great benefits as a direct consequence of the work of amateurs. I know of no other field of amateur activity which operates under a code so high-minded in conception as the code of the radio amateur. I want to read two articles from that code not so much for the benefit of those of you who are present tonight, but for the information of those who are listening in:

Article 1. The Amateur is Gentlemanly. He never knowingly uses the air for his own amusement in such a way as to lessen the enjoyment of others. He takes, up the privilege given by the American Radio Relay League in his behalf to the public and the Government.

Article 6. The Amateur is Patriotic. His knowledge and his station are always ready for the service of his country and his community.

My time is too limited to discuss in more detail the history and achievements of radio amateurs. I want, however, before closing to appeal to the radio amateurs in this country to throw their organized and effective efforts into another important public service, and that is to support the Federal Communications Commission in the work that the Congress has delegated to it. I extend the same invitation to all of you who are listening in tonight. You amateurs know better than most the gravity and difficulty of many of the problems that face the Commission...

Dr. Eugene C. Woodruff, president of A.R.R.L., and I.A.R.U., responded to Mr. McNinch as follows:

An amateur is one who struggles—not necessarily "struggles" followed by marked successes, but nevertheless struggles—against odds. Unfortuately indeed is he who knows no odds against which to struggle. However, in such case, that is, in the case of the lack of the usual difficulties, financial and material, there arises the even greater and more satisfying struggle, first to create (or better, to recognize) the handicaps and then to overcome them. This is, of course, not a case of simply setting up a straw man and then using him as a boxing partner. Progress is inhibited more by the limitations of which we know not, than by the lack of the usual difficulties. The way should be considered as in the public interest, convenient, and necessity. We thank you.

The A.R.R.L. National Convention

The speakers' roster for the A.R.R.L. National Convention to be held in Chicago September 3rd, 4th and 5th is a veritable "Who's Who" of amateur radio. Each speaker is outstanding in his field, whether he has charge of a group meeting or a mass meeting, and has been selected because of his ability to present his subject interestingly and thoroughly. Accordingly, we find the League represented by our president, Dr. Woodruff, and our vice-president, Mr. Bailey, as well as by Warner, Handy, Hebert, Hull and Grammer. For the technical department, the names of John Reihart of RCA, Prof. Hartig of the University of Minnesota, Ted McElroy, world's champion radio telegrapher, Frank Lester, W2AMJ, John Kraus, W8JK, Fred Schnell, W9UIZ, Marshall Wilder of National Union Tube Co., and Fritz Franke of the Bendix Corp. are all well known to you. These men will discuss with you the various phases of radio and television.

The equipment display and registration will open at 9:00 A.M., Saturday, September 3rd, and that morning will be spent viewing the displays and meeting your friends.

The program proper will open at 1:00 P.M., Saturday afternoon, and will be taken up with demonstrations of television, new circuits, antenna design and exhibits of high-speed code copying. Saturday evening the big party will be held in the main Ball Room where you will be entertained by various contests and such features as "Amateur Hour," "Professor Quiz" and "Awarding of the Chisel," as well as free refreshments. This will be an informal party for both men and women, with fun for all. Prizes will be awarded to winners of various events. Stars of the (Continued on page 85)
Announcing—The Maxim Memorial
(W1AW) Dedication Relay

September 2, 1938 (6 p.m. local time to sunrise)

Dedication Memento to Be Sent to All Participating in Relaying Messages from Officials of Each Division and Section

You are invited to get in the Relay. Operate and report results.

Hiram Percy Maxim, whose inspiration and guidance as our First President was so largely instrumental in bringing amateur radio to its present eminence, would have been 69 years old on September 2nd. Your League’s Board of Directors have honored his memory in the building of a station at your Headquarters to bear his call and carry on exemplary operations in his tradition. It is altogether appropriate that the new station be dedicated by your President and Vice-President and other officials on the anniversary of his birthday.

It is an occasion of significance in A.R.R.L. history. At the brief ceremony of dedication in the afternoon H. P. M.’s daughter and son will be present, with A.R.R.L. officials and the local members of the League who will be invited. Attendance will be by invitation and it is possible the simple exercises will be broadcast, as the broadcasting chains have inquired as to details. If so, information on the time and stations will be given in O.B.S. transmissions as soon as known, so all members who can may listen. Following the dedication exercise, messages will be received from every Division and every A.R.R.L. Section, we hope, and every member is invited to help in relaying the official messages. Nearly one hundred such messages will be started, addressed to W1AW, and to be received by W1AW or any other cooperating Connecticut station which will operate to assist in fast dispatch of traffic in the Relay.

Since only local members of A.R.R.L. can conveniently attend, the W1AW Dedication Relay will be an exercise to permit officials and members who wish to do so to send their good wishes on the occasion, and honor the memory of H. P. M., who himself established outstanding relaying records in the early days of the growth of our hobby.

RELAY PLANS

To take part. Just get on the air (any band) on telegraph or 'phone and look for Hartford-bound messages. “CQ CONN” will be used by stations having actual messages in the Relay. Besides the messages which Sectional officials are sending, any Member may send his own message. Try to send your message and relay at least one other additional message towards its destination.

Relay. The idea is not to attempt to put your message direct all the way. This is a commemorative Relay with which the ’38-’39 active season is being opened. To make it a true Relay, in the full spirit of those days before the vacuum tube, try to make every message a relay through at least one intermediate station! Note the calls of all handling stations consecutively in the preambles to messages; as they are passed along, add your call.

Report. The relay starts at six (6.00) p.m., your local time, continuing until sunrise September 3rd. Start traffic early. Stick with the relay as long as possible. Do as much relaying as possible. If you go off the air before morning, clear your hook first. If stuck with traffic at sunrise deliver it by mail, with your report on what you did. Calls of all stations participating will be listed in QST.

In addition, each participating station reporting will receive a memento of the occasion of the dedication of W1AW!!!

CONNECTICUT STATIONS

W1AW will be operated continuously throughout the period of the Relay, sending a short announcement to amateurs of the nature of the occasion from time to time, changing at least hourly from band to band, or 'phone to c.w., to take traffic offered. The following frequencies will be used (c.w.): 1800.5, 3825, 7150, 14,254 kcs. (Phone): 1808, 3950, 14,234 kcs.

To get continuous coverage on each band, Connecticut amateurs specializing in work on particular bands will assist in receiving messages in the Relay. The “best bets” are likely to be some of the following, who gave an excellent account of themselves in the Maxim Memorial Relay (3.5-, 7-, 14-Mc. c.w.): W1HSX, W1IKE, W1APB, W1GME, W1KV, W1FE, W1T1, W1JMY, W1GVV, W1YJB, W1TD, W1CSC, W1JXP, W1GKM, W1JUD, W1BIH, W1FAJ, W1UE, W1TS, W1JBJ, W1LJI, W1BHM, W1GS, W1HPI, W1KAY, etc. (3.9- and 14-Mc.

(Continued on page 114)
HINTS and KINKS for the Experimenter

A Simple Gear Drive for Rotary Antennas

In designing the gear drive of the rotary beam of the accompanying photographs and drawings, two main thoughts were kept in mind: First, that the arrangement must be reasonably light in weight, and second, that it should be inexpensive of construction. The antenna is an SJK beam arrangement, and a "Mims Signal Squirter" frame is used for the center structure. The base plate and upright was ideal for a basis upon which to plan the rotating structure, as use of this system saved a great deal of work and fitted perfectly with the original WSJK antenna.

The gear and drive mechanism, obtained from a nearby junk yard, is taken from the rear section of a discarded Model T Ford car. The parts required are the ring and pinion gear, and a small portion of the drive shaft, the exact length of the latter depending on the constructive details of the rotating arrangement. In addition to the above major parts, the large washer which is a stop for the shaft bearing may well be used for this purpose in the antenna system. After the gears are taken from the housing, all screws are removed from the ring gear. This gear is then mounted by means of wood-screws on an oak block which is turned out on a lathe to fit the outside dimensions of the gear. A pipe flange is centrally located on the opposite side and screwed to the block. The end of a section of iron pipe is then threaded to fit the flange, and this pipe, inserted firmly into the flange, is used to rotate the antenna structure.

A hanger must be provided to hold the pinion gear shaft. For this purpose, a horizontal piece of 2-inch by 4-inch wood and bearing brackets made of 1-inch by ½-inch strap iron may be used as shown in Fig. 1. First, the pinion gear and sleeve...
are removed from the drive shaft. The top part of the bearing is made by beating a short piece of strap around the shaft, forming a semicircular depression in the middle to receive the top of the shaft. The straight ends are then cut off to length, leaving only a small flat area large enough to be drilled for the bolts. The corresponding depression in the hanger is formed in the same manner, and the latter is drilled to mate the top half of bearing.

These strap iron parts are heavily coated with enamel, for rust would otherwise soon bring about difficulty in the use of the system.

In order to rotate the pinion drive shaft from the operating position, two bicycle sprockets and a quantity of bicycle chain are used, together with sufficient galvanized clothesline wire to connect the two lengths of chain, as shown in Fig. 2. The length of the chain at each sprocket is slightly more than is required to rotate the antenna through 180 degrees. One sprocket is welded to the end of the gear drive shaft, and the other sprocket is welded to the steering shaft at the operating table. At W4CCH a steering wheel and shaft from a discarded automobile are used, with pipe flanges screwed on inside and outside of window sill used as bearings. These flanges, with threads reamed out, make a watertight fit with the Chevrolet steering shaft.

The galvanized wire used to connect the two sections of chain is flexible enough to make two right-angle turns between the steering mechanism and the drive shaft, and affords an economical connection which will withstand long exposure to the weather. Two double-wheel idling blocks are used to align the drive wires at the turns.

Although this application of discarded auto parts is used on a tower, it may be readily adapted to a rotatable beam on a single large pole by means of a light supporting platform at the top of the pole.

Ball bearings are mounted upright on the tower platform, and are of the large type mentioned by Mims in QST for December, 1935.

—J. M. Carstarphen, Jr., W4CCH

Handy Kink for Tuning 5-Meter Auto Antenna

A readily constructed and very convenient device for adjusting portable and mobile 5-meter tubular antennas is shown in Fig. 3. One hole is drilled near each end of a thin bakelite strip of a few inches length and approximately one inch width. One clip for each end of the strip is formed from brass or phosphor bronze, and a hole is drilled in the base of each clip to receive a mounting screw. A round-head machine screw just long enough to receive a nut in the completed assembly is then run through a soldering lug, a hole in the bakelite strip, and the base of a clip, and a nut is firmly tightened on the end of the screw to complete the construction at each end. The point contact of a flashlight bulb is then soldered to the free end of one of the soldering lugs, and a short piece of copper wire is used to connect the base-thread terminal of the bulb to the other lug. The connections to the lamp serve to hold it firmly in place on the gadget. When clipped on the 5-meter antenna near the center, the brilliance of the indicator will increase when the antenna current is increased by proper adjustment.

—Goyn Reinhardt, W3AC

Remote Control of a Protective Relay

Although an overload relay in the load circuit of a large plate power transformer is a good investment in a transmitter, use of such a device ordinarily complicates the use of remote control of the transmitter. The usual type of overload relay operating with field coil in series with the center tap of the plate transformer and contacts in series with the primary of the transformer makes use of a mechanical latch which holds the contacts open after an overload occurs. This is necessary because there would otherwise be an intermittent opening and closing of the contacts as long as the overload occurs.
condition existed. The use of a mechanical latch on the overload relay makes it necessary to go to this relay and operate the mechanical reset device each time an overload opens the contacts.

A solution for this difficulty is shown in Fig. 4. This circuit, making use of two home-made relays in the author's application, is quite suitable for use with commercially available relays of conventional types. The circuit incorporates a d.c. operated, single-contact-normally-closed relay. Except for the fact that no mechanical latch is used to hold the contact circuit open after an overload, this relay is similar in function and circuit connections to the usual overload relay. A second relay, also with contact normally closed, but with a.c.-operated field coil rather than d.c. coil, is used to serve electrically in the holding, or latch, function. The combination provides for a remote reset control and indicator for the protective circuit. If the d.c. relay is opened by an overload, the circuit is held open by the a.c. relay, and an indicator lamp at the remote operating position lights, informing the operator of the trouble. The operator may then press a reset button located immediately below the lamp, and if the overload was of a temporary nature such as that caused by a flashover in a tank condenser, the light ceases to burn, indicating that the circuit is restored to normal operating condition. If the cause of the overload still exists, on the other hand, the light flashes on and off intermittently until the button is released. This latter trouble, of course, necessitates a visit to the transmitter to determine the cause.

The circuit functions as follows: The contacts of both relays, closed, under normal operating conditions form a short circuit across the winding of the a.c. relay and also across the indicator lamp, and at the same time maintain the circuit closed through the primary of the high-voltage plate transformer. When an overload occurs, excessive current flows through the winding of the d.c. relay, opening the contact. This removes the normal 110-volt source from the primary of the plate transformer and at the same time removes the short circuit from the winding of the a.c. relay. This operation places the a.c. relay in series with the primary winding of the plate transformer, causing current to flow in the a.c. relay, opening the contacts of this second relay and maintaining open the circuit to the plate transformer from the 110-volt a.c. source, except for a small current (a few milliampere) through the transformer primary and the parallel combined load of the indicator lamp and the a.c. holding relay. The contact of the d.c. relay immediately returns to the normally closed condition, and the pilot lamp indicates that the a.c. relay is holding the protective condition in the circuit. This condition is sustained, due to the current through the a.c. relay holding the 110-volt source from the transformer primary, until the reset button at the operating position is pressed. When this latter operation is performed, the field circuit of the a.c. relay is opened, allowing the contact to return to the normal position, applying 110 volts a.c. to the primary of the plate transformer. If the circuit is restored to operation, indicated by the pilot bulb going out and remaining dark, the button is released and the circuit is then in the condition which existed before the overload. If the overload condition continues to exist after the reset button is pressed, the d.c. relay will again operate closing the primary circuit just long enough to make the field current open the contact, and will thus alternate between open and closed condition, causing the pilot lamp to flicker off and on. The flickering pilot lamp immediately warns the operator of trouble in the transmitter, and the reset button is released until investigated.

For the indicator, a 5- or 10-watt 110-volt night-lamp or a neon bulb may be used. Both relays must have contacts capable of breaking an overload current in the transformer primary. The d.c. field coil should be such as to operate on the smallest current for which it is designed to be used, and the parallel resistor may then be set for any value of overload current. The a.c. relay should have a field coil designed to operate on 90 to 100 volts, and should require only a small value of field current.

(Continued on page 88)
How Would You Do It?

Methods of Varying Transmitter Tank Coil Inductance for Tuning in Conjunction with a Fixed Tank Capacity

Within the past few months, new air condensers, sealed in vacuum, designed for r.f. tank circuit applications have been introduced. Their use makes possible the construction of high-voltage r.f. tank circuits of compact proportions. Since these condensers are necessarily of fixed values of capacity, some additional means must be provided for tuning the circuit to exact resonance. Most of the experimental transmitters which have been built thus far using the fixed condensers have been tuned by changing the inductance of the tank coil by means of a rotatable metal ring or disk mounted in haywire fashion in the field of the coil. While such an arrangement may be entirely adequate for experimental work, it is obvious that something more permanent and reliable is desirable if the idea is to be incorporated in the construction of a permanent transmitter for serious work, especially if it is to be operated on more than one frequency. It was with the hope that some method of varying the inductance in a reliable and predictable manner would be forthcoming that we presented Problem No. 19 in QST for July.

Regrettably, it must be said at the outset that while the ideas submitted undoubtedly accomplish the primary object of a variable inductance, all of them involve mechanical or electrical weaknesses. It is our opinion that the use of a small variable capacity is still the most satisfactory way of doing the job. The following ideas are presented with the idea that they may serve to spur the development of simpler and more satisfactory means of tuning by variable inductance for the purpose of economy in space requirements.

Four different methods are suggested. The first involves the variometer principle in which a portion of the coil is made rotatable so that its inductance will either buck or assist that of the fixed portion of the coil. The second method varies the inductance by changing the mutual inductance between sections of the coil into which

Problem No. 21

For some time Our Hero has been trying to devise a suitable method for connecting the different units of his transmitter. The time-honored system of bringing all connections to a single terminal strip, making the connections and then cabling the wires together is all right but it isn’t versatile enough. Our Hero does too much experimenting and rebuilding to expect to have the same unit in one place a long time and, further more, he doesn’t like the inconvenience of unscrewing eight or ten binding posts every time he removes or replaces a unit. What can you suggest as a simple and effective way to make connections between r.f. units and power supply that will be versatile, speedy and capable of standing the high voltage to the final amplifier?
in the third scheme a body of metal is introduced in varying degree into the field of the coil resulting in a reduction of the inductance by eddy currents induced in the body of metal, while the fourth makes use of closely-spaced short-circuiting taps on the coil.

The photograph of Fig. 1 shows an example of the first method in which a variometer arrangement is used. A rotatable coil of a few turns is coupled to the main coil either at the center for a split tank circuit as shown at Fig. 2B or at one end for a single-ended circuit as shown at D. The unit shown in the photograph was constructed by J. J. Frekot, W3CHH. Two unmounted "air-wound" coils with a diameter of approximately 2½ inches and whose combined inductance is suitable to tune the tank circuit to the middle of a band with the fixed capacity selected are made or purchased. A second coil approximately 2 inches in diameter with about 4 turns is also required. The two larger coils are mounted on a ¾" by 6" strip of celluloid or other insulating strip with Duco cement, leaving a space of about one-half inch between the coils. A ¾" hole should be drilled at the center of the strip to clear the shaft of a Bud No. 531 shaft-and-bearing assembly. Holes to clear a No. 10 screw should be drilled also at each end of the strip. These holes are for mounting the coil on 1½" cone insulators.

The smaller coil is then mounted on a small strip of celluloid ½" by ¾" which has been drilled and tapped at the center for a ½" flat-head machine screw. The head of the screw is soldered to the center point of the small coil and the strip threaded onto the screw and cemented in place.

The panel is made of a piece of tempered Masonite and is 6½" by 4". This is drilled at the center to take the shaft and bearing assembly. Holes are also drilled for the mounting insulators. When the unit has been assembled, a piece of ¼" copper braid covered with spaghetti is soldered to each end of the small coil and also to the adjacent inner end of each of the larger coils so that the three coils are in series with the small coil at the center of the series. The end of the shaft is drilled and tapped for the flat-head ½" screw.

In series-fed circuits the shaft will be at plate potential so that it will be necessary to use an insulating shaft coupling between the shaft of the unit and the control dial on the panel. If the unit is built for the 3.5-Mc. band, turns may be short-circuited at each end for 7- and 14-Mc. operation. With this arrangement, the coil could be tapped each side of center for a link line to the antenna coupler or a link coil wound outside the tank coil with provision for clearing the control shaft.

If the scheme is to be used with a single-ended circuit, the rotatable coil may be mounted at the ground end and turns short-circuited at the plate end.

The same scheme is suggested by GM6RG and Robert Roberts, Louisville, Ohio. Mr. Roberts offers the suggestion shown in Fig. 3 for mounting the rotatable coil so that it may be changed conveniently along with a system of plug-in coils. (Continued on page 78)
Conducted by Byron Goodman

New Members:

We welcome with cordial best wishes the two new members of the Union, the Eesti Radio Amatoriid Uhing (E.R.A.U.), Estonia, and the Radio Club de Cuba (R.C.C.), Cuba. The membership of the Union now totals 33 member-societies, the highest in its history.

Switzerland:

With a total of 100 licensed amateurs now in Switzerland, 25 stations participated in National Field Day on June 11th-12th. Highest scores were made by HB1X, HB1AW and HB1CN. HB1 is the prefix for portable stations—HB9 is, of course, the prefix used with the same call at the fixed station.

A great deal of 56-Mc. work is being done, especially in the mountains. Permission was obtained from the Post Office to establish 5-meter 'phone links between the "High-Alpine Research Institute" at the Jungfraujoch (altitude 12,000 feet) and various refugees of the Swiss Alpine Club. Members of the USKA did all of the design, construction, and installation work, and already the system has shown itself to be invaluable, particularly for rescue work. Also, the USKA is making measurements of the radio shadow of the Jungfraujoch 5-meter station in the Jungfrau glacier region, in collaboration with the federal topographic department.

QSL:

The C.A.V. (Czechoslovakia) advises that the Post Office there refuses to transport QSL's stamped as "printed matter," and they, therefore, have to pay double postage on every parcel of QSL's. This has become quite a burden upon the union treasury, and they will, therefore, in the future refuse to accept QSL-parcels with insufficient postage. They advise that such consignments at least be stamped as "commercial papers" in the future.

VK-ZL Contest:

Last year’s VK-ZL Contest saw considerable participation throughout the world, and we present some of the final high scores (by radio VK2ADE-W5VQ).

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<th>SENIOR SECTION</th>
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<tr>
<td>VE2ADE</td>
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<td>VK2HF</td>
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<td>VE3EX</td>
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<tr>
<td>W8ARL</td>
<td>6,680</td>
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<tr>
<td>Y63AU</td>
<td>5,350</td>
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This year’s contest is run as part of Australia’s 150th Anniversary Celebrations, and should be
bigger and better than ever. VK2TI, the Contest Manager, sends the following rules for the event:

The Contest is divided into three sections, viz., Senior Transmitting, Junior Transmitting, and Receiving. The Senior Section embraces a power limit of 150 watts input to the final stage. The Junior Section is limited to 25 watts input to the final stage and this limitation is an endeavor to cater for the interests of the QRP enthusiast.

Three trophies have been provided for each Transmitting Section. In addition, certificates will be awarded to the highest scoring station in each country. In making these awards each W, G, VE, ZL and VK prefix will rank as separate countries. In order to obtain a certificate it is necessary for the contestant's score to exceed 100 points.

A plea is made to all participants to send in a log irrespective of the number of contacts made. As an inducement a special verification card will be sent to all amateurs who send in a log.

Rules—Senior Transmitting Contest

1. The Wireless Institute of Australia, New South Wales Division, Contest Committee shall be the sole adjudicators and their rulings will be binding in cases of dispute.

2. The nature of the contest requires the world to contact VK and ZL. Six-cypher serials are to be exchanged. The first three characters to be the RST of the station received and the last three the number of the QSO. For example, VK2RA may be in contact with W6TI and would send 579055. That would mean that VK2RA was receiving W6TI at RST 579 and that W6TI was VK2RA's 5th QSO in contest.

3. The contest is to be held from 1200 GT Saturday, 1st October, 1938, to 1200 GT Sunday, 1st November, 1938, and repeated over the same time period during next week-end, namely 1200 GT Saturday, 8th October, to 1200 GT, Sunday, 9th October, 1938.

4. The contest is open to all licensed transmitting amateurs throughout the world. Unlicensed ship and expedition stations are not permitted to enter the contest.

5. Power input to the final stage is limited to 150 watts. Where the national regulations of any country do not permit the use of this power, participants must not exceed the power allowed them by the said national regulations.

6. Only one contact with a specific station on each of the bands will be permitted during the contest.

7. All amateur frequency bands may be used.

8. Only one operator is allowed to work any station. Where more than one operator has worked a station, individual logs must be forwarded under the call sign of each operator, and each operator will be considered a separate competitor.

9. SCORING. Twelve points will be scored for the first contact with a station outside VK-ZL. Twelve points will be scored for the first contact with a VK-ZL prefix zone. 11 for second contact, 10 for third contact and so on until the twelfth contact which will count 1 point. Thus the first twelve contacts with a particular prefix zone will score 78 points. Each additional contact after the twelfth will count 1 point. This will apply to each prefix zone worked. The points scored in the above manner will be added and the total multiplied by the total number of VK-ZL prefix zones worked on all bands. Prefix zones are VK2, 3, 4, 5, 6, 7, 8, 9, and ZL1, 2, 3, 4.

10. SCORING by competitors beyond VK-ZL. Twelve points will be scored for the first contact with a VK-ZL prefix zone. 11 for second contact, 10 for third contact and so on until the twelfth contact which will count 1 point. Thus the first twelve contacts with a particular prefix zone will score 78 points. Each additional contact after the twelfth will count 1 point. This will apply to each prefix zone worked. The points scored in the above manner will be added and the total multiplied by the total number of VK-ZL prefix zones worked on all bands. Prefix zones are VK2, 3, 4, 5, 6, 7, 8, 9, and ZL1, 2, 3, 4.

11. No prior entry is required, but each contestant is to submit a log at the conclusion of the contest showing date, time (GT), band, station worked, ciphers exchanged, points claimed for the QSO, together with a declaration that the rules of the contest have been followed and that the power limit has not been exceeded.

12. A large percentage of reports under TS will render the participant liable to disqualification.

13. Out-of-band operation will also be a ground for disqualification. In all cases the national regulations of each country must be observed by the various competitors.

14. Entries from ZL Stations must reach N.Z.A.R.T. not later than 26th November, 1938. All overseas logs must reach Contest Committee W.I.A. (N.S.W. Division) G.P.O. Box No. 1734 JJ Sydney, N.S.W., not later than 31st December. All VK logs must reach Contest Committee not later than 2nd December, 1938.

Rules—Junior Transmitting Contest

1. The contest will be held from 1200 GT Saturday, 22nd October, 1938, till 1200 GT Sunday, 23rd October, 1938, and repeated during the same time period during the following week-end.

2. Power input to the final stage will be limited to 25 watts.

3. All other rules as set out for the Senior Contest apply.

Awards

Three handsome trophies are available for competition in each of the Transmitting Sections and will be competed for as follows:

First. For that station outside VK-ZL that has the highest score in the world. This trophy will become the outright property of the winning station.

Second. For that station in Australia or New Zealand who obtains the highest score. The winner will retain this trophy for all time.

Third. For that district of Australia or New Zealand whose first six participants aggregate a greater score than any other district. This trophy will also be won outright and its property will be vested in that division of the Institute or branch of the N.Z.A.R.T. which has the highest aggregate.

In addition to these trophies, handsome certificates will be awarded to the highest scoring station in each country. All G, W, VE, ZL, and VK districts to be considered countries when these awards are being made. The only proviso to these awards is that a contestant must score at least 100 points.

Each participant who forwards a log will receive a verification card of Australia's 150th Anniversary Celebrations and Souvenir of the 1938 VK-ZL.

The Cover

WITH 56-Mc. signals acting up the way they have been and with 28 Mc. headed for a big season, it is only natural that the DX man should hanker for a special rig that can be flopped from ten to five in no time at all. W16SZ has worked up just such a transmitter and in the picture is attending to a few final details. The rig is scheduled for description in an early issue. That four-o'clock shadow is, we would have you know, really a shadow.
September marks the start of a new season in amateur operating! The coming year promises further progress in emergency organization, traffic efficiency and DX practices. S.C.M.s ought to see that every community of any importance has an able Emergency Coordinator for the amateur service. Every Coordinator should start plans in his community that will result in amateur meetings, discussions—and registration of every active licensed transmitting amateur, of whatever frequency band or interest, in the League's Emergency Corps. In so registering, preparedness for communications emergencies is definitely advanced, and A.R.R.L. is enabled to point to a large body of men as going far in justification of frequency assignments through readiness for public service.

The Maxim Memorial W1AW-Dedication Relay announced elsewhere in this issue starts at 6 P.M., September 2nd, the anniversary of H.P.M.'s birthday. Get your station on the air and take part in this. Look for the official messages. Send one yourself. Relay 'em. Report what you did. This activity lasts until sunrise next day, and marks the official opening of the '38-'39 radio season as well as the opening of the new W1AW. Don't miss the fun of getting in on a real old time message relay. You can help make every amateur band one carrying relay activity.

The A.R.R.L. National Convention at Chicago will be held September 3rd, 4th and 5th. A record-breaking crowd has made reservations, and you want to be one of the gang. See you there.

56 Mc. The hottest operating news of the past month (July) is recounted in the report on 56-Mc DX. The month marked one more milestone in the League's Emergency Corps, which sent a truck equipped with a mobile transmitter. When the station was set up the operator notified the Army station at Lambert Field in St. Louis, and an airplane was dispatched to Belleville. Radiotelegraph communication was maintained with the plane from the field until it was sighted near the picnic grounds. A switch was then made to radiotelephony and the plane was directed to the location of the mobile installation. They were soon flying overhead, talking to the amateurs on the ground through the receiver on the truck. The Belleville Police Department also sent over one of its radio cars and the hams were able to inspect the two-way equipment which had recently been installed. The usual games, eats and prizes were in evidence and the crowd left at a late hour after a very enjoyable day.

Briefs

Sunday, June 5th, was the occasion of the fifth annual pilgrimage of Georgia, Alabama and Tennessee hams to the barbeque and hamfest staged each year by the Northwest Georgia Radio Club at Rome, Ga. The affair this year was handled largely through the efforts of W4UC, W4VO, W4HAZ, W4ENQ, W4APK, W4DBW, W4BIO, W4DAY and others. Over 500 were present to enjoy the festivities, which, besides the old-fashioned Georgia barbeque and Brunswick stew, included the distribution of numerous and highly-sought prizes, most of which were purchased by the club from the proceeds of previous hamfests, and the usual short but interesting speeches, preceded over by Doc Sanford, W4DHH, master of ceremonies. Three members of the F.C.C. field staff and practically every prominent ham within a reasonable distance were present. This affair has grown steadily in size each year since its inception and next year, on the first Sunday in June, the Rome fellows are planning on having an attendance of 600!

How to Send Fractions

In transmitting combinations of number groups and fractions by radiotelegraphy the sign AU (-.-.) should precede the numerator of the fraction. For example, in sending 45-¼ this is transmitted "45 AU 1 DN 4." DN is, of course, the fraction bar-.-, and is well known. In counting words the sign AU does not count since it is merely an operating signal and is not recorded; 45-¼ counts as five words.

The Greater St. Louis Radio Amateur Club held its fourth annual picnic, July 10th, in Bellevue Park, Belleville, Ill. About 200 members, their YL's and YF's were present. One of the most interesting features was provided by the U. S. Army Aviation Service, which sent a truck equipped with a mobile transmitter. When the station was set up the operator notified the Army station at Lambert Field in St. Louis, and an airplane was dispatched to Belleville. Radiotelegraph communication was maintained with the plane from the time it left the field until it was sighted near the picnic grounds. A switch was then made to radiotelephony and the plane was directed to the location of the mobile installation. They were soon flying overhead, talking to the amateurs on the ground through the receiver on the truck. The Belleville Police Department also sent over one of its radio cars and the hams were able to inspect the two-way equipment which had recently been installed. The usual games, eats and prizes were in evidence and the crowd left at a late hour after a very enjoyable day.

Members of the Pittsfield Radio Club set up and operated a system for reporting events held during the Stanley Club Field Day at Pittsfield, Mass., June 25th. All operation was on 56 Mc. W1BKG, located at the boat club, transmitted on 60 Mc.; all other installations transmitted on 56.
Mo. WICLI was at the tennis court, W2IJK/1 aboard a motor boat, W1JLT at the boat dock and W1HAZ and WIFAU mobile at the golf course. Reports from all outlying points were put through a P.A. system at the boat club. A number of emergency events were successfully controlled throughout the afternoon.

"East is east and west is east"—and to W9GBJ "west is east"; at least that's what he thought when his 14-Mc. CQ one July evening was answered simultaneously by W2JB and W6JB, both on the same frequency!

The usefulness of amateur radio was again demonstrated when, on April 13th, a doctor was urgently needed to attend a maternity case in the isolated mining camp of Surf Inlet, B. C. The regular government station being unable to contact the coast station since it was after schedule time, VE5LA at the camp hooked up a small oscillator and made contact with W2IBT/6, Oakland, Calif. W2IBT took the message, which was addressed to the mission boat at Alert Bay, B. C., and forwarded it by Western Union. VE5ID, Vancouver, whom W2IBT later contacted, also put the message into the wireless station which maintains contact with Alert Bay. A doctor was finally sent from Prince Rupert and everything turned out satisfactorily. W6GAC also worked VE5IA and attempted to notify the government service of the emergency.

PRIZES FOR BEST ARTICLE

The article by Mr. P. C. Feng, XU6LN, wins the C.D. article contest prize this month. Each month we print the most interesting and valuable article received marked "for the C.D. contest." Contributions may be on any phase of amateur operating or communication activity (DX, 'phone, traffic, rag-chewing, clubs, fraternalism, etc.) which adds constructively to amateur organization work. Prize winners may select a 1938 bound Handbook, QST Binder and League Emblem, six logs, eight pads of QSL cards, DX Map and three pads or any combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

Short Calls Get DX!

By P. C. Feng, XU6LN*

With the directional Vee I recently constructed, signals from the east coast and central U. S. A. are decidedly much stronger than the W6's, which in the old times when a half-wave antenna was used completely controlled the whole atmosphere in the evenings here in Canton. On the first evening with this Vee antenna I contacted 16 stations from the east coast and central U. S. A. are delightfully on the air again. But there are so many! As I said before, I always pick up the shortest, but even the shortest took more than two minutes! They feared too much that I might QRL or QHL! But if so, could they expect to make a contact at all? Don't they know that I can hear them without having to tune the receiver? If so, why not follow the conventional rule: "Call three times and sign three?" In fact, this is more than necessary in a case like this. If the rule had been followed, probably the QSO's could have been made much more easily for the same length of QSO, more contacts each hour could have been made.

I am writing this to my DX-hunting friends, hoping it will be of some help to the DX-hunting technique. I know that many are like myself—always pick up the one with the shortest call. The longer the call, the longer you will have to wait. So let's apply the principle of QRM or QMH, etc., even when not in the period of a contest.

Briefs

W6DPT, Compton, Calif., transmits code practice on 1790 kc. each Monday and Thursday from 7:00 to 8:00 p.m.

XU3MA and XU8DI Perform Real Service

With the commercial cable from Chefoo to Shanghai cut, leaving Chefoo without communication with the outside world, amateur radio stepped in and bridged the gap during the whole month of January. Dr. Wm. Malcolm, a 77-year-old Han and port doctor at Chefoo, working with Mr. J. Macdonnell, XU8DI at Shanghai, handled all commercial code, as well as other traffic for eighty-two firms. Several hundred of messages were handled. Without the amateur radio circuit, business at Chefoo would have amounted to a severe handicap, if not at a standstill. Letters of appreciation and gratitude were received from the British Chamber of Commerce, Chefoo; The Commercial Pacific Cable Company, Shanghai; The Great Northern Telegraph Company, Ltd., Shanghai; Chefoo Foreign Chamber of Commerce; and The Eastern Extension Australasia & China Telegraph Co., Ltd.
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The Navy's Strange People

By G. M. Millican, RM2C

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**Briefs**

The following hams were students at the California Institute of Technology during the '37-'38 school year: W6DEL EGS EZD FJJ (ex-W2ESG) GMD GSL GXZ HAC HBG HDT HYD IEF JFJ JQW JUX JVJ KIY KPK LBB LNY LQY LSV LZB MAI MCL NBB NHK NJD NPK NWP NCH OES OZS RZ RWG RZX RZF TVR, W6KZP W7CCH VU7J ex-ZL3CR2-BL ex-W6CYA W5ENK. A studious bunch, radio amateurs!

Here's one that will make a lot of W.A.S. aspirants weep: W9WEN had cards from all states except Utah and Nevada... those were his bugaboos. One evening, June 21st to be exact, he was tuning through the 14 Mc. band when he was brought to attention by W6OZ calling "CQ hr NEV." He raised him (lucky guy), got a promise of a QSL and mentioned that it was "Utah only" now. W8OZ promptly explained that he was located "across town on the Utah side" was W6OEY and if W9WEN QSL and mentioned that it was "Utah only" now. W6OZ, 21st to be exact, he was tuning through the 14 Mc. band and announced that he was "Utah only" now. W8OZ, 21st to be exact, he was tuning through the 14 Mc. band and announced that he was "Utah only" now. W8OZ had dragged OEY out of bed, tuned up to 14 Mc. and made one ham very happy. A real exhibition of ham spirit!!

**WIAW Schedule**

Effective September 5th, the new WIAW, Maxim Memorial A.R.R.L. Headquarters Station, will observe the following regular Official Broadcast schedules:

<table>
<thead>
<tr>
<th>Frequencies</th>
<th>Starting Times (P.M.)</th>
<th>Spreads (w.p.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OW: 1800.5-3825-7150-14254-kcs, EST CST MST PST</td>
<td>8:30 7:30 6:30 5:30</td>
<td>15 25 15 20</td>
</tr>
<tr>
<td>2100 1900 1800 1700</td>
<td>15 15 20 15</td>
<td></td>
</tr>
</tbody>
</table>

'Phone: Each code transmission will be followed, in turn, by voice transmission on 1808-3950 and 14,234 kcs.

General Operation: Following completion of the early evening (8:30 EST) transmissions on each frequency as above indicated, WIAW will operate each night of regular operation until the time for transmission of the midnight QST (Official Broadcast). This schedule will be expanded and announcements made in future issues of QST of additional periods of general operation.

Here's Nevada!

For the benefit of operators needing a Nevada contact for W.A.S., Andrew J. Williamson, W6OTU, Boulder City, Nevada, announces the following operating schedule: 28-Mc. "phone... week days, 7:00-8:00 A.M., 12:30-1:00 P.M. and 5:00-6:00 P.M. EST... Sat. and Sun., 7:00 A.M.-6:00 P.M. PST. He also works 3.5 and 14-Mc. c.w. in the evenings, and will be pleased to arrange schedules to furnish Nevada contacts. Go git 'em!

A reliable Canal Zone traffic circuit is available through the daily schedule maintained by W1H6X, New Haven, Conn., and KS4F, Aalborg Field, C. Z. Traffic may be routed to W1H6X via A.A.R.L. circuits or A.R.R.L. Trunk Lines.

SUICH made a novel QSO on April 10th when several stations were linked up to enable the American Minister to report to say hello to his brother in Oakland, Fla. Stations involved were SUICH, W4BYY, W4DU and W4CLW. SUICH transmitted on 28-Mc. "phone to W4DU, who retransmitted on 3.9 Mc. to W4CLW, where the brother and party were sitting in. Reply transmissions from W4CLW went on 3.9 Mc. to W4BYY, who retransmitted on 28 Mc. to SUICH. At the end of the contact W4WS, Deland, Fla., working 3.9 Mc., broke in on W4CLW's frequency with some more friends of the Minister. The entire work was completely successful.

**Comms vs. Periods**

Regarding the possibility that a change in International Morse Code, whereby a period would be indicated by the present symbol for a comma, and a comma would be indicated by the present designation for the exclamation mark in 'boxcar' code has been generally contracted to M (space) M and used with A.U. would give a combination that would suffice for the very few times that this punctuation is used in commercial communications.

**THIS BEAUTIFUL CERTIFICATE IS OFFERED BY THE OAKLAND RADIO CLUB TO ANY OPERATOR WHO SUCCEEDS IN MAKING A TWO-WAY AMATEUR RADIO CONTACT WITH EVERY COUNTY IN THE STATE OF CALIFORNIA**

There are fifty-eight counties in all. The rules: Work all fifty-eight counties. The station worked does not have to be a permanent one, but can be a mobile unit. The mobile unit cannot get a certificate. The person applying for the award must be present at a regular meeting of the Oakland Radio Club for the presentation, if he is within reasonable distance of Oakland. He does not have to be a member of the club. QSL cards confirming all contacts must be presented. Any further information desired can be obtained from S. C. Houston, W6ZM, secretary, Oakland Radio Club, 2584 Bona Street, Oakland, or from W6KZ, 1158 63d Street, Oakland. Who will be the first to W.A.C.C.?
How's DX?

How:

DX has been pretty fair this past month, in spite of the weather gods' attempts to make operating a mite uncomfortable for DXers. We have no special stories in this respect, but first we'd like to take time out for a few general remarks about this column. Any small measure of success that it may enjoy is due entirely to the fact that youse guys are so genereous and helpful with your reports, and we're mighty proud of the splendid list of contributors. However, we would like to make one small request: when you send in dope, please make it as complete as possible. This simply means giving the pertinent dope as to frequency, tone (axial or not), and time. It isn't necessary of course on the less rare stuff, but anything that looks good should be reported that way so that the others will know where and when to look.

And anything of general interest that you notice, such as the best times for different continents, is always quite welcome. "The world is smaller than we think," we mutter to each other.

Another thing. This gosh-awful bootlegging of calls is getting to be a pain in the neck. There are too many mental midgets who think it's just too, too funny to sign a fat card and give a fake QTH on the band. It is bad enough to be faking DX, and still is, if you have that kind of a sense of humor, but we don't want any part of it. Therefore, we're almost of the opinion to offer a substantial reward for every call-bootlegger delivered to our doorstep, dead or alive, preferably dead. We want to see, just once, that goofy look in their eyes when, because they can't work anything very hot, they borrow a juicy DX call and have such peacy fun.

Where:

After reading that last paragraph you might get the impression that we're a little bitter on the subject of "phonies." You are right, and just to present one side of the case, the following calls, recently active, have shown up as phoney: VQ8AA, PX1A, VQ1AJ, EZ1R, LX1AO, LX1AG, LX1AS, a mess of TFS, CR6PG, VP7NI, XU80L, VP7NH, ZC0PO, SU1UEQ, PK3XX (on an2o, and E2LZ. These are practically certain—others will show up later... One that looks pretty good from here is ZD4AB (14,300 T9x), who comes through around 4-6 P.M. EST. He said to QSL to T. Hall, Post Office Engineering Department, Aceras, Gold Coast. ZD4AA (14,165) is supposed to be active but no W reports on him yet... VP8AF (14,435 T9), worked by W2BHW, W6DOB, and others, gives his QRA as % Radio VJC, Port Stanley, Falkland Islands, and we hope he's legit. On May 1st, W6QKQ worked a station signing AC4YN on 14,120 kc. (the right frequency) with no confirmation yet, and W6RKK has been hearing him on 14.105, TS, on Thursdays from 1250-1315 GMT. But we still don't know who'll get credit for the first QSO with him... FOSAC (14,410 T9) gives his QRA as Andre Vaino, R Leste, Tabiti, according to W6PFLY and W6EPT. Then there's this TM8AA/TM1AA (14,300, 14,110 T9), who is supposed to be at Port Victoria, Seychelles, according to FB8AB. Dunno why he doesn't use VQ8AA (14,435 T8) and KAIAS (7000).

Another thing, This gosh-awful bootlegging of calls is getting to be a pain in the neck. There are too many mental midgets who think it's just too, too funny to sign a fat card and give a fake QTH on the band. It is bad enough to be faking DX, and still is, if you have that kind of a sense of humor, but we don't want any part of it. Therefore, we're almost of the mind to offer a substantial reward for every call-bootlegger delivered to our doorstep, dead or alive, preferably dead. We want to see, just once, that goofy look in their eyes when, because they can't work anything very hot, they borrow a juicy DX call and have such peacy fun.

The summer station of Jaroslav Chmel, OK1BC, at Hradistho, Czechoslovakia During the summer, OK1BC operates at his country lodging, and it has proved itself an excellent location. His signal ponders through on weekends on either 7 or 14 Mc., and gets a good start to this country via a vec beam with director. A W6QK flat-top is used on 28 Mc. The rig uses a 35T final on all bands with separate exciters; the receiver is a rebuilt FB8A with a two-stage preselector. But the power output is unimportant—88 and 89 reports have been given by W6's when the input was down to 5 watts, and an 88 has been received from there when the input was only 10 watts.

Virgin Islands, UX3FL (7293), NY1AD (7110), MZX2F (7000 T9), P21RL (7000), J8CD (7100), J8CH (7190), J8CB (7000), UX8DI (7025),UX8LS (7015), UX8GW (7080), KAI1R (7090), KA1MM (7020), KAI1CH (7090), and KA11AS (7000).

W2HBF sends one of those swell lists of his, and moans because with 124 countries he still hasn't the necessary pasteboards for the CC. Oh, well, he can console himself with HZ8AB (14,385 T8), HPI1C (14,410 T9) (the looks phonny because HPI1A is the only legit we know of in Panama), KAIHR (14,300 T9), K6NVJ (7185 T9) at Jarvis, VP6I (14,110 T9), PK1MF (14,380 T9), PK1RI (14,280 T9) and VK9BW (14,415 T9).... Lindy at W2BHW says J8CB has been worked between noon and 2 P.M. EST, including J2KJ, J2JKJ, J2KG, J2JJ, and J2MI. Some of the heard stuff includes J8CG (14,305 T8), KAI1BC (14,145 T9), X8T8L (14,355 T9), PKRTM (14,205 T9), UX8NR (14,335 T8), and YU8AO (14,355 T9).... W8OJK suggests OQ5AQ (14,370 T8s), EL2A (14,375 T9), and V84EC (14,410 T9) in Papis... W2OYS has worked O5SR (14,420 or 14,230 T8) and K6OVN (14,300 or 14,140 T9) in Guam... W8DFH knock off X8BCM (14,315 or 14,270 T9), V86AA (14,070 T9), and W6FUG (14,435 T9) and thinks FG8AB (14,435 T9) and AH2BU are the same guy... W8JDB drops in with some nice ones which in-
include FT4AG (14,400), VSTRA (14,085), J3JJ (14,405), VQ8AE (14,065), HR7WC (14,440), and HK4LE (14,040).

V3PQO contributes YN1AA (28,080 T8), VK0VG (14,100 T9), TVJLX (14,400 T7), and CT2BQ (14,400 T7) . . . W1JJJ has HC1PZ (14,489), VQ8AI (14,350), ZBIIH (14,370 T9), and YV1AE (14,489). W3RSO, flattered because someone has been signing his call, reports VS7GJ (14,110), KAIKDL (14,025), HSI1BJ (14,070), PK3AA (14,360), and V1L2K (14,010) . . . W7GFP tells about JCR (14,260 ‘phone), U1AD (14,420 T7), KAF7F (14,150 ‘phone), and KAS0Y (14,100 ‘phone). W8YFV has only been after DX a short while but has already hit like IC2MR (14,020 T9x) (QSL via HC1FG), PJ3CO (14,380, and 14,410 T7), VQ8AS (14,300), KAIKR (14,285 T9x), and XUBGC (14,010 T8) . . . W2IPF hasn’t been waving any time, and his list includes VQ4KTF (14,075), VKQ5LB (14,420), XZ2DP (14,030), VQ3GW (14,260), CR7AU (14,260), V8HTS (14,320), and VQ4CRO (14,060). Larry lists the following on the Channel Islands: GS6K (14,220 T9x) (14,300) . . . Old V3AUP up there in Unionville is doing OK, and he passes along FY8AA (14,430 T9), FBBAB (14,350 T9), VP1AA (14,420 T4), CR7AD (14,300 T8), and FT8AC (14,280 T9) . . . V8KBP reports hearing AR8MK (14,350 T9), OZ4H (14,400 T9), WP4DI (14,300 T9), PA0BZ, OB1PZ (14,400 T9), and PJ1BV (14,440 T7).

What:

We have some antenna dope this month that looks good enough to pass along to the mob. First off, a splendid article by ST2CM in the July issue of the T & R Bulletin points out a likely-looking improvement in the oil single-wire feed system. You probably know that the best place to feel an antenna of this type, from multi band operation, is at a point 1/2 wavelength on the wire but you usually use No. 14 wire or so for the feeder, and get a mismatch. ST2CM found that with No. 14 in the flat-top and a feeder of No. 18 he got much better matching, as indicated by the absence of standing waves. An editorial note suggests that this still doesn’t overcome the change in resonant frequency of the flat-top when operated on harmonics, and suggests a more specie operation by using two wires in parallel for the flat-top, and normal sized feeder. We’d be glad to hear from anyone that tries either system.

The other item about antennas is that when W6CHT was through here the other day with W5UK he told us that the antenna to use is the so-called “lazy H.” You know, two half-waves above and two half-waves in phase. A lot of the W6’s use these feeding them through here the other day with W2UK he told us that the antenna that has a lot of W contacts, and then wait until he signs their state during the CQ. An amazing number of DX stations are a little slow, just OY4C, VP7NT, VR4AD, ES6SC. W8MZH contains himself with T1MZ (14,420 T9), PAOQF (14,410 T8), ON4WX (14,410 T9), H2CMR, K6MAE, K1FA, K1EE, K2SL, and W5KQK, the leader of the “Podunk Hollow” gang is busy burning out transformers, but the buffer accounts for YS1FM (7100), ZD2H, PZ1AB, FASBG, VQ8AS (14,300), and enough stuff to bring him up to 106 countries . . . . W9IKKS says that QRA6 is over on from Paris, but there must be an EPAC there presently. They’re awfully tough on hams over there, though. ON4AU needs only Nevada for his WAS . . . Win Pebbles, W8QGB, says to tell the foreign stations that they’re very welcome in the Ham Club if they can qualify (see July column) . . . . If you see W1ACV walking around with the buttons popped off his vest, it’s only justifiable pride at working WAC after only 25 years of banding . . . K4MEJ, well-known on 20 ‘phone, is moving to a new home and is trying to get the licensing and stuff, according to W6ITF . . . W5E2W is doing all right with his 50 watts, working things like P8AF, J3JJ, J9KK, K4EIR, K1ABC, ON4FZ, PK1BX, and PY2AC around here. Latest at W1WTF is moving to a new QTH where he’ll have rhombics and a splendid antenna. W6KWK reports hearing AR81MK (14,450 T9), OZ4H (14,270) and C8DO (14,300). Old VE3AU (14,260), W8HTS (14,320), and VQ4CRO (14,060), Larry lists the following on the Channel Islands: GS6K (14,220 T9x) (14,300) . . . Old V3AUP up there in Unionville is doing OK, and he passes along FY8AA (14,430 T9), FBBAB (14,350 T9), VP1AA (14,420 T4), CR7AD (14,300 T8), and FT8AC (14,280 T9) . . . V8KBP reports hearing AR8MK (14,350 T9), OZ4H (14,400 T9), WP4DI (14,300 T9), PA0BZ, OB1PZ (14,400 T9), and PJ1BV (14,440 T7).

Who:

Just to keep the records straight, we record here that W5KCO made WAC in 45 minutes by working HK3LM, G3IQ, V56UL, VK4JR, J6CC, and 2BJCX, between 1:55 and 2:40 A.M., CSE, which should be the record in W5 if not in the whole east . . . . A printer’s error a couple months back had IQ8R getting married—it should have been H3R. Sorry . . . . W9H1F says that the only active J6’s are CH, CD, CG, CH, and CJ. W3ZMA skews VQ4KTF, who uses a 10 final with 25 watts input. KTF says that VQ4CHS is leaving for G and won’t be on for a spell, and that VQ4KGM uses only 2 watts . . . K6BAZ is no longer at Howland, but K6DSP (14,390) is using a 10 rig and the antenna. Kenny has been transferred to American Samoa, but only d.e. mains down there, and it may be some time before he gets on. But Samoa . . . (Jeeves, stop licking your chops . . . . Some of the boys out at San Jose, Calif., have a 210 Club of their own, all using tubes like the 10 or equivalent, and powers around 100 watts. Prea right now is W5KQK with 75 countries, W8MZH secretary, and W6C0G is most of the active membership because the others are QRL work. W8KQG has been working W5YBZ, W5QG, K6COB; K6QCB; K4ERY (7320 T9x) in Virgin Islands, V81AL (14,300), V82AS, HR7WC, E6TE, G15YW, YL2CD, and W5E20A with 81 contacts, and 81G4SK, VP8DD, ZD2H, UX1CN, YS2AE, YS0RF, ...
Seid of W2MQ sailed August 15th with the "Qwatt Earp" Norwegian sailing ship bound for the Antarctic. LDUC (The Ellsworth '38-'39 Expedition) is located on 14,000 and 28,000 kcs. for work on amateurs. User a 1000-watt transmitter with a pair of HF300's and an NC1000A receiver. VE2IC, the chief aviation pilot, will also be behind the key at times, when working amateurs.

W9YHD, Maysville, Ky., suggests as an aid to hams trying to Work All States that we add the abbreviation for our particular state after our call, thus: W9YHD KY AR, or W9YHD in Ky. This should prove particularly helpful in states having a small ham population. It should also do away with the need of referring to the call book so much.

"With the VK/ZL contest coming up in October, I have a suggestion to offer (to move stations away from the band edges a chance). This suggestion could be used equally well in other contests. Briefly, let's assume VK5HG (14,350 kc.) calls QO; tuning from the high-frequency edge to the middle of the band he gets an answer just a few kilocycles inside. After signing with this station, why not, instead of going back to the edge, continue to tune through the band to middle, working stations in order of frequencies; for example, he may work W6CUH (14,385), then tuning towards the middle, work others on 14,250, 14,275, 14,260, etc.; when he reaches the middle he can start tuning back towards the high-frequency edge. Stations operating near the low-frequency edge could use the same procedure, tuning towards the middle, then back to the low edge."

F.C.C. Disciplinary Actions

The F.C.C. en banc on July 26th took the following action:

Ralph Manley, Anderson, Ind. Barred from examination for radio operator license for a period of 6 months from date, because he attempted to obtain an amateur radio station license by fraudulent means.

Ralph Manley, Anderson, Ind. Suspended amateur radio operator license with Class H privileges, for a period of 6 months, because he attempted to obtain an amateur radio station license and amateur radio operator license by fraudulent means.

All inquiries should be addressed to the General Chairman, Roy D. Jordan, W2KUD, R.F.D. No. 7, Schenectady, N. Y.

LUDC

September, 1938
BRASS POUNDERS' LEAGUE

(June 15th-July 15th)

<table>
<thead>
<tr>
<th>Call</th>
<th>Orig. Del.</th>
<th>Rel. Del.</th>
<th>Credit</th>
<th>Total</th>
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<td>W14P</td>
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<td>169</td>
<td>1451</td>
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<tr>
<td>W7EHC</td>
<td>38</td>
<td>102</td>
<td>662</td>
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<tr>
<td>W6DKR</td>
<td>264</td>
<td>175</td>
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<td>703</td>
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<tr>
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<td>217</td>
<td>802</td>
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<tr>
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<td>132</td>
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<td>144</td>
<td>623</td>
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<td>W5TVY</td>
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</tr>
<tr>
<td>W6H</td>
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</table>

More Than One-Operator Stations

<table>
<thead>
<tr>
<th>Call</th>
<th>Orig. Del.</th>
<th>Rel. Del.</th>
<th>Credit</th>
<th>Total</th>
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<tbody>
<tr>
<td>K1HR</td>
<td>553</td>
<td>271</td>
<td>170</td>
<td>1094</td>
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<tr>
<td>K5AU</td>
<td>285</td>
<td>58</td>
<td>262</td>
<td>44</td>
</tr>
</tbody>
</table>

These stations "make" the B.P.L. with total of 490 or over. One hundred deliveries (or Del. Credits also rate B.P.L. standing. The following one-operator stations make the B.P.L. on deliveries. Deliveries count!

| W6ZBB   | 149        | 149       | 149    | 449   |
| W6PPZ   | 140        | 140       | 140    | 440   |

A.A.R.S.

More Than One-Operator Stations

<table>
<thead>
<tr>
<th>Call</th>
<th>Orig. Del.</th>
<th>Rel. Del.</th>
<th>Credit</th>
<th>Total</th>
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<tbody>
<tr>
<td>W1M (W2CLX)</td>
<td>124</td>
<td>1096</td>
<td>1240</td>
<td>5230</td>
</tr>
</tbody>
</table>

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

Emergency Planning

The Radio Emergency Coordinating Committee of Long Beach, Calif., has been meeting now for about ten months. The meeting of June 3rd is typical of all regular meetings which are held the first Friday of each month at the Richmaid Cafe, Fourth and American Avenues, Long Beach. Two days before the meeting, a W.P.A. assignee to the Police Department is given the list of likely radio amateurs, broadcasters, airport operators, or anyone else who is an engineer at a transmitter. These people are phoned concerning the meeting. The process is repeated about two hours before the meeting time and in that way a fair turn-out exists. Larry Lynde, W6DEP is chairman of the committee.

At the June 3rd meeting Captain O. M. Murphy had a large wall map showing the emergency set-up of the city. The members decided that each point of importance should be numbered to make radio communication easier. The following plan was tentatively suggested: Nos. 0 to 100, radio transmitter locations; 101 to 700, police stations, traffic communications; 700, public utilities; 400, traffic blockades; 500, traffic divisions; 600, Red Cross; 700, Red Cross Communications, concentration camps; 800, housing; 900, food depot; 1000 mobile units. The numbering system could extend on indefinitely, and each number would indicate the type of depot, fire station, police station, concentration camp, or anything else pertaining to an emergency.

Lawrence McDowell, chief engineer of KFOX, explained the operation of his five portable transmitters and the fact that practically all of them are immediately available for an emergency inasmuch as only one or two would be used for one possible emergency. At the present time, there are four available amateur 56-Mc. mobile units on a moment's notice, and one all-wave transmitter (the one owned by W6DEP), and which did such good work during the last flood. The city has offered to furnish each of ten amateurs with a six-volt heavy duty motor generator, and an emergency frequency crystal.

Application has been made to the F.C.C. for a frequency somewhere in the vicinity of nine meters to tie in with the local three-way police broadcasting system, these systems to be used for emergency only and to be a part of the amateur's care. These will be in addition to the present mobile units.

O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 50): W1KIN, W6GDU, W6BE, W6ZM, V6IKS.

60 QST for
CORRESPONDENCE

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

The Archduke Explains

Schloss Sonnberg, Bei Hollabrunn, N. O.

Editor, QST:

I have just read the article published in June QST, page 25, under “Hamdom” about OE3AH. I thank you very much for all the interesting and correct information about my station and my work as a ham, but I feel grieved that much incorrect news which has, alas, been published in many newspapers for the purpose of anti-German propaganda, should also have been reproduced in your paper. I would therefore ask you to listen to OE3AH himself, who is writing this letter about the 1938 contest and the days afterwards.

A few days before the 1938 contest I had been at Merano in Italy with my wife, the Archduchess Ileana, Princess of Roumania, paying a visit to my mother-in-law, the Queen Marie. I returned alone to begin the contest and started to QSO U.S.A. and Canada. Day after day I only pressed the key and added scores to my log. On the night of Friday, the 11th, I was told by a telephone call of the great event, and therefore I immediately listened at the wireless to get the last news. I interrupted the contest, having worked already 79 hours, and I spent that night listening on the long waves. On Saturday, the 12th, I had to drive with my car to Vienna, about 40 miles from here, to fetch my wife who was arriving by train from Merano, where I had left her. The train arrived normally and after we returned home and after a night’s rest from the many sleepless nights of the contest, I began again to operate my station on Sunday morning, the 13th, on until the end of the contest, making still 101 QSO’s and so completing the 90 hours. I ask you, would this have been possible if there had been any intention of arresting me?

Soon afterwards foreign newspapers published untrue reports about my imprisonment and I was not able entirely to stop those invented stories. To convince even my relations that I was a free man was sometimes difficult, and therefore I drove with my car again to Italy with my wife, passing the frontier in less than three minutes, without having been stopped a single time during the journey. It was funny to hear during my drive on the motorcar’s receiver from a station about my arrest and so on.

The incorporation of the Austrian amateurs into the D.A.S.D. was accomplished in the friendliest manner and with great consideration towards us. I myself, as ex-president of the Oe.V.S.V., have been intrusted with the reorganization of the ex-Oe hams and have been named “Landes Verbandsfuhrer der Donaulande,” that is to say: “Leader of the association of the Danube district.”

I trust you will find room in your columns for this letter, which will I think correct the bad impression made by false reports.

--- Anton Habsburg, Archduke of Austria

Class A Endorsement

Not a Renewal

1042 No. Calvert St., Baltimore, Md.

Editor, QST:

It has been brought to my attention that most amateurs are of the opinion that when they take the Class A examination and their license is endorsed for Class A privileges this automatically extends the expiration date to three years from time of endorsement.

This misunderstanding has resulted in two of our members losing their tickets within the past month. Of course they have unwittingly been operating illegally for a period of time. They of course will be required to take the examination over to regain their license.

I believe this misunderstanding is caused by not fully reading Rule No. 410.

--- R. W. White, W3GXO

For Public Service Nets

Port Wing, Wis.

Editor, QST:

Have just read with interest the two letters approving amateur help in recording geological data. Frankly, this is a better response than I expected to Dr. Campbell’s suggestion.

But I can’t understand why they pick on geology! (Beg your pardon, Dr. Campbell) While I know next to nothing about geology, I don’t see where the quick communication amateur radio brags about could help gather seismographic information, except in a few isolated cases.

I suggest an investigation into other possible services that would be benefited by daily reports from all parts of the country. To name a few: U. S. Weather Bureau; small-town municipal police; Dept. of Conservation (particularly firefighting and insect pest reports); transportation facilities (investigate the L. & N.R.R. Net in

September, 1938
although it would mean a hardship on fellows who have to "greatest good for greatest number" policy
in the eyes of foreign diplomats.

Commercial Vs Amateur Practice

Editor, QST:

Editor, QST:

QSL Analysis

Let Freedom Rule

Editor, QST:

Editor, QST:

Re Exams for Renewals

Preston R. Schuler, WSBYF

QST:

QST:

626 N. Poplar St., Allentown, Pa.

Henry F. Sarnovics, W9VPQ

Financial Aid

(Continued on page 64)
As we have remarked before on this page, there are a number of good reasons why we do not like to put a power transformer inside of a communication receiver. To anyone who has made comparative tests, the increase in temperature drift due to the extra heating and the greater background noise from stray fields is self-evident. So a long line of National Communication Receivers have had their transformers outside, at the end of a cable. The only exceptions to this rule have been receivers of the NC-100 series. These are rather a special case, because their use for broadcast reception has thrown emphasis on the audio output stage, and tone quality dictated the use of a built-in power unit.

The NC-80 is also somewhat of a special case, because low voltage beam tubes first became available at about the time it was being designed. We had long realized that 110 volts was entirely satisfactory for the plates of RF and IF stages and that omission of the transformer would improve regulation. Also, it would obviously eliminate heat and background noise originating in the transformer. Consequently, when the 25L6G made it possible to provide a two watt output with 110 volts, we swung over to an AC-DC design.

There are two objections to the use of a good AC-DC power supply in a communication receiver. The first is that it costs more than the usual AC supply. To be sure, there is no transformer to buy, but transformers do not cost much anyway. On the other hand, various complications such as insulating both sides of the power line from the cabinet increase the cost of construction more than might be imagined. However, after careful tests we decided that the extra cost of a good AC-DC supply was entirely justified. For example, the stability resulting from the excellent regulation of the power supply is an important factor in the remarkable performance of the NC-80 in the 10-meter band, where it can hold its own with any receiver on the market regardless of price.

The other objection is more serious from our point of view, and is entirely a matter of prejudice. “Most gyp sets are AC-DC, therefore all AC-DC sets are gyps.” Most of our customers judge sets on performance, fortunately, but we continually run into men who know that AC-DC sets are no good because they owned one once. Whenever we have had an opportunity to demonstrate the NC-80 in comparison with an AC set of similar price, we have been able to prove our point. We can prove it has no tunable hum. We can prove the tone is good. We can prove it will pull signals in. But we cannot reach all our customers that way, which is the reason we are writing this page.

We think that in most cases the AC-DC supply is the logical choice for a communication receiver, and we are going to stick to it. If our customers want a transformer inside, they can get one of the NC-100’s. But we do wish you would be broadminded about it. At the next meeting of the Radio Club, borrow an 80 from your dealer and give it a comparative test alongside any receiver of similar price. And invite the dealer, too. Apparently some of our dealers also owned an AC-DC set once!

James Millen
Massachusetts was by far the best with 41 cards sent and 41 returned. To the other states fewer cards were involved although more than 10 cards came from six of these 100 percenters.

The following states gave me returns of 80 per cent or better: New Jersey, Missouri, New York, Ohio, Illinois, Kansas, Montana, Pennsylvania, Washington, California, Indiana and Maine. Because of five-meter work in New York, my own state, saw the most cards involved with 72 responses out of 78 sent out. I received, however, more than 60 cards from Pennsylvania and California and in excess of 40 from Ohio and Illinois.

The responses were 70 per cent or better from Idaho, Rhode Island, Maryland and Michigan. Tennessee and Utah had percentages between 60 and 70 and Texas, Louisiana, District of Columbia, Alabama and Connecticut were between 50 and 50 per cent.

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Incorporated in this book is the famous RAYTHEON TEMPERATURE COLOR CHART, which enables you to tell when a tube is properly operated, merely by comparing the color of the plates of the tubes with the chart—and reading the temperature. Complete tube theory and application with the latest circuits—full data on modulation systems, classification of tubes for different uses, tube characteristics are all treated in detail together with pages of the newest circuit developments on Ultra High Frequency operation. This is the first time the amateur has been able to get all this data together, so that his choice of tubes can be intelligently made.

The Raytheon “Handbook of Amateur Tube Uses” is now available at all Raytheon Jobbers at a price of 50c each. If your jobber cannot supply you, write direct to Raytheon Production Corporation, New York City, enclosing 50c for your Handbook. You’ll say it’s the best 50c investment you’ve ever made!
THORDARSON
100 WATT TRANSMITTER

QUALITY PARTS SUPPLIED by THESE MANUFACTURERS
Aerovox Corporation
American Phenolic Corp.
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Bud Radio, Inc.
Cornell-Dubilier Corp.
Coto-Coil Co., Inc.
Crowe-Name Plate & Mfg. Co.
National Company, Inc.
Ohmite Manufacturing Co.
Taylor Tubes, Inc.
Triplett Company

RADIO FREQUENCY UNIT
Mounts in standard cabinets or racks.

MODULATOR UNIT
Mounts in standard cabinets or racks.

AMATEUR SPEECH AMPLIFIER
Mounts in standard cabinets or racks. Metal screen cover for table use.

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

- 100 watts input on all bands.
- Power supply and R. F. section on one chassis.
- Single meter reads all plate currents as well as grid current of the final stage.
- Modulator and power supply on one chassis.
- Bands switched from front of panel.
- Modulator lineup 6J7, 6F5, 6F6, 2—6L6's.
- Band-switching feature optional, plug-in coils may be used.

Here is the answer to the demand of amateurs for a high-quality transmitter which they can build with assurance of top performance. Only nationally-known, highest quality, standard parts are used throughout. Chassis, panels and chassis brackets are supplied completely punched for easy assembly. The complete transmitter requires only 26¼" of panel space and may be mounted in any standard rack or cabinet.

AMATEUR SPEECH AMPLIFIER

Designed specifically for Ham requirements—Adapted to any phone transmitter—Optional over-modulation control—Sufficient driving power for any Class B Modulator—R. F. feedback and Hum eliminated—Standard rack and panel or with metal screen cover as table model.

See your distributor or write factory for descriptive bulletin SD-378A.

Available in foundation unit or kit form.

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500 W. HURON ST.
CHICAGO, ILL.
Today's most modern instruments... 18 styles to fit individual taste... at popular prices.

New methods and extremely accurate processes are embodied in Triplette instrument designs. An example is the long research in developing a super-magnet (the heart of the instrument) by means of which it has been possible to eliminate extra pole pieces. This achievement has brought from prominent laboratories, graphs that prove Triplette magnets give more uniform scale characteristics.

Most models available with front or rear illumination.
Taylor Tubes endorses THORDARSON
100 WATT TRANSMITTER
The SALES CHAMPION
TZ-40
has been chosen by THORDARSON as the tube which offers more value and finer performance.

Taylor Tubes is honored and happy at this selection by America's Oldest Transformer specialists. We are certain that the TZ-40 will live up to all legitimate claims made for it. We highly endorse this fine 100 Watt Transmitter. For better results use Thordarson T-14M49 Class B. Audio output transformers with the TZ-40.

COMPARE!!
TZ-40 RATINGS — CLASS B AUDIO

<table>
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<tr>
<td>Audio Output</td>
<td>175 watts</td>
</tr>
</tbody>
</table>

Price - $3.50
* Indicates Two Tubes

IT'S NEW!
Panel Band-Switching

THORDARSON "MULTI-BAND" TRANSMITTER
AVAILABLE ON THE M & H TIME PAYMENT PLAN
Designed to give the amateur what he wants. You will like the flexibility which panel band-switching gives your operation. Mounts in standard cabinets or racks.

AMATEUR SPEECH AMPLIFIER
Optional over-modulation control—Adapted to any phone transmitter—R. F. feed-back and hum eliminated —Standard rack and panel or table model.

M & H
SPORTING GOODS CO.
512 Market St., Philadelphia, Penna.
1709 Atlantic Ave., Atlantic City, N. J.

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

(Continued from page 13)

single antenna. However, a change of receiving antennas will probably necessitate slight readjustment of at least the antenna coupling condenser, and possibly of the various trimming condensers as well. For a given antenna, the antenna coupling condenser is set to give a good balance between sensitivity and freedom from blocking. The sensitivity is increased slightly by an increase of capacity of the antenna coupling condenser, whereas the sharpness of tuning is decreased by an increase of capacity of this control. Because only one antenna condenser is used, the final setting is determined by the general operation of the preselector on all bands, or on the bands on which its operation is considered most important.

Just as there was little to be said on the construction of this unit, there is also little to be said on troubles to be expected with it. Of the former, little need be done; while of the latter, there is little likelihood that any will be encountered. The preselector requires only a short while for construction, only a few minutes for adjustment, and, very likely, no time at all for correcting trouble. Any of the three tube types works well with the set. The 1851 gives slightly improved operation with 6.3-volt sets, and is to be preferred even at a somewhat higher cost.

It is interesting to note that when this preselector was planned, it was expected to prove a valuable addition to the receivers in the medium- and low-price class, but it was certainly not expected that the operation of the device would warrant continuous use of it in conjunction with one of the most expensive amateur receivers. Operation of the preselector has proved otherwise, however, and it is found to be quite a decided improvement with a set or the latter class.

Furthermore, those amateurs possessing regenerative receivers and desiring to take the step to t.r.f.-regenerative receivers will find this a simple way to achieve the latter without a complete rebuilding operation. While this means that the r.f. stage and detector lack the gang tuning feature usually associated with such receivers, the superiority of a regenerative r.f. amplifier over the usual non-regenerative stage must not be forgotten.

Thus, while the major advantages of this simple gadget include increased signal-image ratio and added sensitivity for large superheterodynes, an important reduction of image and increase of r.f. amplification for medium-size supers, and a tremendous advantage on all counts for the smallest superheterodynes, it also finds a place beside one-, two-, three-, and four-tube regenerative receivers with or without built-in t.r.f. stages; and it aids more than anything else could, with any of the sets listed above, in reducing the effect of exceptionally strong signals in the same band, distant perhaps from the frequency of the desired station, but too strong to allow satisfactory reception with the receiver alone.
PLATE and FILAMENT TRANSFORMERS

600 VOLTS—200 MILS

Another Scoop by Newark. Famous plate and filament transformer made for us only. Thousands used in Ham rigs.

600-0-600 at 200 M. A.; 2.5 v. at 10 amps; 5 v. at 3 amps; 7.5 v. at 3amps. Weight 10 lbs. Use this transformer for your Buffer and Final amp. stages. Just the thing for 46's, T-20's, 807's, etc.

NEW "FOREIGN ORDER" DEPARTMENT

Special Attention given to FOREIGN ORDERS in this new Export Department. Hams outside the U. S. be sure to WRITE TODAY for Big New Catalog and full details of Newark's New Foreign Order Dept.

THORDARSON MULTI-BAND TRANSMITTER

SEND $10 WITH ORDER

BLUS ORDER

then a small payment on delivery and the balance in 6, 9, or 12 months.

on NEWARK'S EASY-PAY PLAN

The city's share of the super-struction would be for.

THORDARSON's latest design with Panel Band Switching and Other Big Features!

- 100 watts input on all bands.
- Power supply and R.F. section on one chassis.
- Single meter reads all plate currents as well as grid current of the final stage.
- Modulator and power supply on one chassis.

All parts are ready for immediate delivery from complete stock on hand and will be shipped promptly in "Foundation Unit" form with complete instructions for easy assembly. Entire transmitter, requiring but 24½" of panel space, may be mounted in any standard cabinet or rack on the market. Only standard parts of nationally known manufacture and highest quality are used. Both R.F. and modulator units supplied complete with their own power supplies. Complete band-switching feature optional, regular plug-in coils may be used.

$139.50

THORDARSON Universal SPEECH AMPLIFIER

Total approximate price $27.45

less tubes and metal cover with regular type transformers and 500 ohm output. Prices on C. R. T. Transformers on request. Designed to eliminate transmitter building troubles for the Ham. The 2A3 Output stage provides ample driving power. Chassis adaptable to rack-and-panel mounting or to conventional chassis type with metal screen cover and bottom. Supplied less panel, but with panel drawing and full instructions included. Easy terms when included in an order of $60.00 or more.

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BY THORDARSON

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1. Lower interelectrode capacities.
2. Longer life — more rugged construction.
3. Space economy, — Dia. 1¼", overall dimensions ranging from 2¼” to 3 ¾”.

Bantam Tubes Cost No More Than “Metal” or “G” Series

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6AC5GT *6K5GT *6R7GT
*6A8GT 6K6GT 6X5GT
*6C5GT *6K7GT 25A6GT
*6F5GT *6K8GT 25A7GT
6H6GT *6P5GT 25L6GT
*6J5GT 6Q5GT 25Z6GT
*6J7GT *6Q7GT

Bantam Types are Interchangeable with “Metal” and “G” Series

*Shields furnished with necessary types as indicated.

Packed in “sealed cartons” for your protection. Ask your distributor or write us for technical data.

HYTRON CORPORATION

76 Lafayette Street
Salem, Massachusetts

Interpreting 1938’s 56-Megacycle DX

(Continued from page 84)

what the skip distance was in different directions. Knowing the skip distance and the height of reflection (more about this in a minute) I could calculate the amount of ionization which had to be at the midpoint of the path to reflect a five-meter wave. After marking these points I went on to study the locations heard in Kansas City, and so on. When I had been through all the reports I had a map with nearly a hundred points marked on it, and alongside each point a note of the ionization there. Then I drew contours much like those on a topographic map, except that in this case they show how far the high ionization extended. Of course there is a serious flaw in it, because we don’t know at what time of day the various levels were reached. We can say, though, that the map shows the highest levels reached at each point, which is a good step in the right direction.

Now a word about this question of height of reflection. We have known for some years what is called “abnormal E ionization” occurs mostly in May, June, and July. Since this is just the time when 56-Mc. DX occurs, it looks as though there were a connection. This year we have been noting that the abnormal E ionization, which we usually observe at low frequencies to be about 70 miles up, occurs on the same days and often at the same hours with 56-Mc. DX. This pretty well settles the matter, but there is still a nice point in connection with Fig. 1. If you figure out how far you can send a signal around the curve of the earth by reflecting it at a height of 70 miles, the answer turns out to be about 1400 miles, and this is just the place where our curve reaches zero. This means that the height of reflection really is about 70 miles, and that if we want to talk over 1400 miles the signal must make it in two or more jumps. Since this sort of ionization doesn’t often extend over as big a region as 1500 miles we can’t expect that transcontinental QSO’s will happen very often. The only confirmed report of one yet is between Fairfield, Conn., and San Diego in the early evening of July 24. At this time there must have been high ionization over Indiana and over Northern New Mexico, and the signals probably were reflected from the earth somewhere near Kansas City. If this is right, stations in Missouri and Kansas should have been able to work both the East and West coasts. We hope the gang will report any work of this sort which took place.

All this should give a rough idea of the way this sort of data can be worked up. What we want is to find out as much as possible about when and where 56-Mc. DX has occurred. It is a lot of work to study all the data, and it may take years before we can be sure of all the answers, but sooner or later we shall be able to foretell radio conditions and that, to most of us, will be the useful outcome of this sort of study. There will be other results, too, but, like the results of much scientific work, we can’t tell just how the answers will be useful until after we get them. It’s all a fascinating conundrum, and another chance for the amateur to contribute to the knowledge of radio.
with the B & W MODEL B TURRET
used in the NEW THORDARSON 100-WATT "MULTI-BAND" TRANSMITTER

The B & W MODEL B TURRET makes possible one of the most important features of the THORDARSON "MULTI-BAND" — fast, effortless, highly accurate band switching!

It was selected by Thordarson engineers as the only band switching unit on the market today that offers the high standard of scientific design, proved efficiency, rugged construction and easy, positive operation they insisted upon in designing the "Multi-Band."

The MODEL B TURRET enables you to change bands and "tune on the nose" with a flick of a switch . . . from the front of the panel! You can select any 3-band combination — simply plug in the desired coils! You can pre-tune coils for spot frequency operation! In short, you get the quickest, easiest and most practical band changing you've ever known!

See the new Thordarson "Multi-Band" Transmitter at your dealer's — note particularly the many advantages in the use of the B & W TURRET. At the same time, get acquainted with other B & W AIR INDUCTORS — there's a type and size for every inductance application!

BARKER & WILLIAMSON
ARDMORE, PENNA.

See the NEW THORDARSON "MULTI-BAND" TRANSMITTER
with PANEL BAND-SWITCHING

and the NEW UNIVERSAL SPEECH AMPLIFIER

Designed for Hams at the CALIFORNIA AMATEUR'S Favorite Supply House PACIFIC RADIO EXCHANGE, INC. 729-31 SOUTH MAIN ST. LOS ANGELES, CALIF.

BY THORDARSON

Say You Saw It in QST — It Identifies You and Helps QST
An Auxiliary Transmitter for 1.7- and 3.5-Mc. Work

(Continued from page 37)

to the coil form pins. Thus, if series tuning is required on one hand and parallel tuning on the other, the change may be made automatically when antenna coils are changed.

With the antenna coupled and the entire transmitter running, a last check should be made on the screen voltages to make certain that they are still appropriate. It would also be advisable to check grid current to the 807 to make sure that the tube is receiving sufficient excitation. A grid current reading of 3 to 5 ma. should be satisfactory.

NOTES ON E.C.O. ADJUSTMENT

It has been mentioned previously that the position of the cathode tap (or the size of the cathode winding) has been found to have appreciable effect upon frequency stability when keying and upon the power output of the oscillator. If the details given have been followed carefully, no trouble should be experienced with chirpy keying. The following suggestions may be helpful, however, in case something goes amiss and checking becomes necessary.

Starting with a cathode winding with approximately one-third the number of turns in the grid winding, turns in the cathode coil should be reduced one at a time, each time noting the grid current to the 807 and monitoring the signal for stability. As the number of turns is reduced, the grid current will probably increase and a maximum of 7 or 8 ma. may be obtained. Usually at this point chirps with keying are quite evident, however, so that it is necessary to reduce turns still further until the chirp disappears. It should be possible to maintain a grid current of 3 to 5 ma. with good keying characteristics.

OPERATION

Once everything is set, operation is of utmost simplicity. If the oscillator has not been calibrated, the frequency may be set to any desired point by monitoring with the station receiver. While setting frequency, the 807 cathode switch should be opened to prevent the signal from being radiated. As soon as the frequency has been set, the final amplifier may be turned on and the key closed momentarily while the antenna tuning is swung to resonance as indicated by maximum rise in plate current. To change bands only a change of plug-in coils in the amplifier plate and antenna circuits is necessary.

Since considerable heat is developed during the course of operation, it would be well to drill several large holes in the upper part of the cabinet. Otherwise, some initial drift in frequency may be experienced. Once the unit has become thoroughly warmed up, frequency should remain quite constant.
"MULTI-BAND" TRANSMITTER

naturally....
"MULTI-BAND" TRANSMITTER
BY THORDARSON

FIRST WITH THE LATEST... as usual... we present for your investigation the completely assembled and wired transmitter...
also the amplifying equipment... drop in and have a look-see

TERMINAL
Radio Corporation
80 CORTLANDT STREET, NEW YORK, N. Y.
Intended as it is for commercial application, the "P" type Cardwell is characteristic of all its larger and smaller companions in the Cardwell line, representing highest quality of material and workmanship. Such types are listed which may be of interest to high power amateur constructors as well as the commercial designers for whom they are intended.

General specifications on "P" type CARDWELLS:

End Plates—Stamped and folded 7/16" aluminum 7/8" square-satin finish.

Mounting—On any side—aluminum stand-off insulators provided for raising electrically and mechanically above chassis ground, if desired.

Rotor Contacts—Heavy disc type double finger wipers on each end of condenser.

Insulation—High frequency G.E. mycalex. No metal tie rods.

Rotor Plates—0.0625" thick, 6¾" diameter, buffed and polished aluminum. Extra large plates make possible dual condensers for high power amateurs of sufficiently high "Q" for optimum "Q", without abnormal frame length.

NEW "P" TYPE CARDWELL

High Power Dual Transmitting Capacitors

<table>
<thead>
<tr>
<th>Type</th>
<th>Max. Min.</th>
<th>Air</th>
<th>Back</th>
<th>List</th>
<th>Amateur</th>
<th>Price</th>
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<td>450'</td>
<td>7.50</td>
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<td>60</td>
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<tr>
<td>PKD-250-OD</td>
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<td>$200.00</td>
</tr>
</tbody>
</table>

Specials made to customer's requirements. Inquire.

How Would You Do It?

(Continued from page 50)

A very similar idea was submitted by W8OMM. It is shown in Fig. 4. A coil of a few turns wound in a direction opposite to that of the tank coil is inserted in series with the coil at the center or at one end and provision made for varying the coupling. The circuit is shown in Figs. 2B and 2D. As the coupling is increased, the total inductance decreases because of the bucking action of the reversed coil. If the small coil is wound in the same direction as the main coil, the variation in frequency will be reduced somewhat, but the Q of the coil should be better than with the reversed-turn arrangement. In this case, inductance increases with an increase in coupling. With circuit A, the link winding preferably should be split and coupled to the outside ends of the tank coil. Electrostatic shielding between tank coil and links is recommended to eliminate electrostatic coupling.

W8OKP suggests the arrangement shown in Fig. 5 in which half of the tank coil is mounted so that the coupling between it and the other half may be varied. The circuit is shown in Fig. 2C. W8OKP states that a tuning range of about 300 kc. at 3.5 Mc. may be obtained in this fashion.

The third method of changing inductance by the introduction of a block, ring or disk of metal is suggested by WSKYN and W1KFN. WSKYN uses a mechanical arrangement similar to that shown in Fig. 4. A ring of wire or heavy brass or copper is substituted for the coil. Its resistance should be as low as possible and the ends should be brazed together rather than soldered.

Figs. 6A and 6B show the method used by W1KFN. The block of brass, when brought into the field of the coil, will reduce its inductance, while the iron will increase it. If the brass block is sufficiently large, the change in inductance should be sufficient to make the iron block unnecessary. The iron block was used to eliminate the necessity for pruning the tank coil within close limits, although it reduces the efficiency of the coil. W1KFN uses large 1/2" brass nuts, which he obtained at a hardware store, for the brass blocks. This system has the advantage that standard-type coils may be used and no complications are involved in antenna coupling.

In the first arrangement shown at A, the metal blocks are mounted on a sliding rod controlled from the panel. The rod is marked with a scale of points so that settings may be duplicated. If plug-in coils are used, it is necessary to use a plug-in scheme at the rear support to permit removal of the coil. This objection is eliminated in the second arrangement shown at B. A similar idea was submitted by W2KZK.

The last idea is shown in Fig. 2A. The tank coil is provided with short-circuiting taps. This simple scheme might work out satisfactorily if operation at only two or three fixed frequencies is desired, but would undoubtedly be unsatisfactory for a continuous frequency range.
RADIOGRAM
ST. LOUIS, MO., 1100 PINE ST., SEPT. 1, 1938

TO ALL AMATEUR OPERATORS AND BROADCAST ENGINEERS:

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OUR AIM IS TO PLEASE THE MOST DISCRIMINATING BUYER AND TO GIVE PROMPT SERVICE. OUR TECHNICIANS W9FIS W9KEH ARE ALWAYS ON HAND TO ASSURE YOU OF THIS SERVICE PLUS HELPFUL ADVICE AND ULTIMATE SATISFACTION.

YOU ARE INTERESTED IN THE THORDARSON MULTI BAND TRANSMITTER AND YOU MAY REST ASSURED WE CARRY IN STOCK AT ALL TIMES EVERY SINGLE ITEM FOR THE COMPLETION OF THIS UNIT. NO SUBSTITUTIONS ARE NECESSARY.

WE ARE DISTRIBUTORS FOR THE FOLLOWING MANUFACTURERS WHOSE PRODUCTS ARE INCORPORATED IN THE THORDARSON MULTI BAND TRANSMITTER.

AMPHENOL
BARKER & WILLIAMSON
BLILEY
BUD

CENTRALAB
CORNELL DUBILIER
COTO COIL
CROWE

IRC
JOHNSON
MALLORY
NATIONAL
OHMITE

SIMPSON
TAYLOR
THORDARSON
TRIPLETT

THIS COMPLETE STOCK PLUS OUR ASSISTANCE IN EVERY CONCEIVABLE MANNER ARE THE REASONS YOU SHOULD PURCHASE YOUR PARTS FOR THE MULTI BAND TRANSMITTER FROM US.

(SIGNED) WALTER ASHE RADIO CO.
G. E. BIDWELL W9FIS
J. KEESE W9KEH

First Consideration: CORNELL-DUBILIER Capacitors WITH THORDARSON MULTI-BAND TRANSMITTER

RADIO amateurs know they can rely on C-D quality and dependability for best results in high voltage power supplies—it's no wonder most hams insist on Cornell-Dubilier!

We recommend DYKANOL capacitors for high powered transmitters. Cornell-Dubilier types TJ-U and TL-A Dykano1 filter capacitors will operate even at voltages 10% higher than rating!

C-D Dykano1 capacitors are FIREPROOF!

THERE ARE CORNELL-DUBILIER CAPACITORS FOR EVERY RADIO REQUIREMENT—PAPER, MICA, DYKANOL, WET & DRY ELECTROLYTICS

Write for catalog 161 for complete listing

CORNELL-DUBILIER ELECTRIC CORPORATION
1022 Hamilton Boulevard, South Plainfield, New Jersey
Cable Address "CORDE"
INTERESTED IN TELEVISION?

— Sylvania announces cathode-ray picture tube type 906

If you are one of today’s modern amateurs... this announcement will prove of value to you.

For Sylvania’s new television tube, type 906, is especially intended for use in compact equipment sets. Due to its size (approximately 12” x 3”) and the brilliance of its image... this cathode-ray tube is just what you want— particularly for that small-sized receiver you plan to build. And of course, type 906 is high in quality like every other Sylvania tube.

Send today for FREE technical information on this tube. Write Dept. Q-9, Hygrade Sylvania Corp., Emporium, Pa. Also makers of famous Hygrade Lamp Bulbs.

No information as to the relative losses involved by the various methods was submitted. It is probable that the difference is not marked, but it is quite obvious that the losses introduced by any of the systems described, with the possible exception of the tapped coil method, would run appreciably higher than with the usual variable air condenser and low-loss coil combination. It would appear that the schemes of Figs. 5 and 6 would cause some unbalance in a push-pull or neutralized amplifier circuit unless the split-stator neutralizing circuit is used.

Prize-winners are as follows:
First Prize: Thomas Marshall, W1KFN
Second Prize: Joseph J. Frekot, W3CHH

Rules under which the contest is conducted are as follows:
1. Solutions must be mailed to reach West Hartford before the 20th of the publication month of the issue in which the problem has appeared. (For instance, solutions of problem given in the April issue must arrive at QST before April 20th.) They must be addressed to the Problem Contest Editor, QST, West Hartford, Conn.
2. Manuscripts must not be longer than 1000 words, written in ink or typewritten, with double spacing, on one side of the sheet. Diagrams must be neat and legible.
3. All solutions submitted become the property of QST, available for publication in the magazine.
4. The editors of QST will serve as judges. Their decision will be final.

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

More on the 1851
(Continued from page 40)

having a single preselector stage, proper adjustment of grid bias resulted in a reduction in circuit loading to the point where the performance with respect to image response was about the same as with the 6K7. The gain of the stage, however, increased 40 per cent to 50 per cent, and the noise equivalent (signal input required to give the same audio power output as the noise alone) dropped about 20 per cent. These results were obtained with 250 volts on the plate, 150 on the screen, and 3.25 negative on the control grid, and represented optimum conditions obtained after trying a considerable number of combinations. To get these voltages, the screen was fed through a 40,000-ohm series resistor from the plate supply, and the cathode resistor was 1500 ohms. The gain and signal-noise ratio figures apply, of course, only in the particular instance taken.

The improvement in signal-to-noise ratio is likely to depend considerably on the particular receiver in which the comparison is made. On the basis of the tubes alone, the 1851 according to the
Now and then I get enthused about some new piece of equipment. The New Thordarson 100 Watt Multi-Band Transmitter and Universal Speech Amplifier are such items. If you are new in the game they are just the gear to start with and if you are an old timer you will realize the extra features that make them so well liked.

Think of the advantage of being able to use ALL amateur bands and of being able to use band switching on ANY THREE BANDS. I know from my experience that I pass up lots of QSOs and DX because it takes time and effort to change bands.

These new kits give you maximum performance and value and will not go out of date "next year." The RF unit and its power supply are complete in one unit and, if you should wish to increase power, will drive a 1 kw final stage. The speech amplifier and modulator unit will drive a 500 watt, class B audio stage. Both units can be used either in relay racks or in cabinets for table use.

Thordarson has done for you the hard work of designing the units and drilling all holes. The line-up is most sensible. All parts are arranged for greatest accessibility, ease of operation, and maximum efficiency. Excitation is more than sufficient, even on the highest frequencies.

Thordarson has made the kits available. Bob Henry makes it easy for you to own them. Consider these reasons why it is to your advantage to buy from Bob Henry, W9ARA:

You get personal attention. I will see that everything is handled as you wish and that you are 100% satisfied. From our experience in building the kits, we supply you with valuable information about using them. We have the kits as a packaged unit containing everything. Or we have the parts individually.

You can buy the kits assembled and wired ready for you to use.

You can buy them on Bob Henry’s economical, 6% time plan, on terms arranged to suit you personally and financed by myself, so you can buy with less cost and more convenience. No finance company is concerned in the matter.

It is not possible to give complete details here, so write to Bob Henry, Butler, Missouri for prices, terms, and all other information. Your inquiries are invited. You can reach me by letter, telegram, 'phone, or visit nearly 24 hours a day, 365 days a year.
Your Favorite Jobber has
The New
PRECISION 842-L
A.C.—D.C.—VOLT—OHM—DECIBEL
MILLIAMMETER—AMMETER
WITH 2500 VOLT A.C.—D.C. RANGE
AND 1000 M.A. AND 10 AMP. RANGES

SPECIFICATIONS
★ 5 A.C.-D.C. VOLTAGE RANGES from 0-2500 volts at 1000 ohms per volt: 0-10; 0-50; 0-250; 0-1000; 0-2500 volts.
★ 6 D.C. CURRENT RANGES: 0-1; 0-10; 0-50; 0-250 MA; 0-1; 0-10 AMPS.
★ 4 RESISTANCE RANGES: 0-400 ohms (20 ohms center) Shunt Method, 0-100,000 ohms (800 ohms center), 0-1 Megohm (8000 ohms center), 0-10 Megohms (80,000 ohms center). Note: Provisions for mounting ohmmeter power supply (4½ and 45 v. batteries) on inside of case. No external connections necessary.
★ 5 OUTPUT RANGES. 0-10; 0-50; 0-250; 0-1000; 0-2500 volts.
★ 5 DECIBEL RANGES from -10 to +63dB; 0dB; +14dB; +28dB; +40dB; +48dB.

Complete facilities for obtaining all measurement requirements for Service, Amateurs, Laboratory, Industrial use. Master Rotary Switch permits speedy selection of all ranges. Large PRECISION 4½ inch square type meter with easy reading scales and large numerals. The base sensitivity of the meter movement, 400 microamperes, permits overlapping resistance ranges up to and including 10 megohms, and A.C.-D.C. voltage ranges at a sensitivity of 1000 ohms per volt.

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Cables: "MORHANEX"

New Apparatus

New 1.4-Volt Receiving Tubes

Five tubes suitable for operation from a single-cell dry battery have been announced by the Sylvania Corporation. These glass tubes bear the following type numbers: 1A5G, 1A7G, 1C5G, 1H5G, and 1N5G.

These battery-type receiving tubes take only a very small current at the low filament voltage rating. The drain on the "B" battery by a receiver using these tubes is also low.

The 1A5G and 1C5G are power output pentodes; the 1A7G is a pentagrid converter; the 1H5G is a diode-triode for detector and audio service, and the 1N5G is a pentode suitable for an r.f. or i.f. amplifier.

Original Cast to Present R.O.W.H.

TIME will be turned back in its flight on the night of Sunday, September 4th, at the A.R.R.L. National Convention in Chicago when the original crew of Flint (Mich.) radio amateurs who staged the first R.O.W.H. initiation at the 1923 national convention will reenact the time-honored ceremony.

To recall the spirit of that first performance we can do no better than to quote from the November, 1923, QST account:

"The spirit of the ham as we have known him was exemplified to a remarkable degree through the initiation into the Royal Order of the Wouff Hong, held on the 'Night of Mystery.' Even the hard-boiled owl, breathing in the unmistakable sense of dignity, gazed with unblinking eye on the ritual that was here performed. The weird figures within the closely packed circle of spectators would indeed have done justice to a dramatic setting of the Middle Ages. The intangible fraternity—that something which had kept the amateurs together as a solid body—was being shown as in a play. The old-timers were quick to realize

figures furnished is about three times as good as the 6K7. This does not mean, however, that a 3-to-1 improvement can be realized just by replacing a 6K7 by an 851. The residual noise in the receiver consists chiefly of two components, one the tube noise and the other the noise resulting from thermal agitation in the first tuned circuit. In a well-designed receiver the thermal agitation noise will be predominant and will be unchanged regardless of the type of tube used so long as the circuit Q is unaffected. Tube improvements, therefore, only affect one source of noise, so that the net gain in signal-to-noise ratio never can equal the ratio of noise between two types; indeed, the better the receiver originally the smaller the improvement that can be made. Nevertheless even a small gain is worth-while for weak-signal reception.

—G. G.
We Have the New THORDARSON "MULTI-BAND" TRANSMITTER

Featuring PANEL BAND-SWITCHING and 

THE NEW UNIVERSAL SPEECH AMPLIFIER FOR HAMS

CAMERADIO

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Meet the high-quality specifications of the THORDARSON "MULTI-BAND" TRANSMITTER

A new line of tuning dials particularly designed for amateurs and experimenters will be ready soon. These units as well as new dial plates, knobs, tuning devices and other radio components are shown in Bulletin 220. Write for a copy now.

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Say You Saw It in QST --- It Identifies You and Helps QST
It's YOUR Job Today
to prepare for a better radio job tomorrow!

CREI Training Insures Your Future

Don't say you never had the opportunity to get ahead—because you were never encouraged to do so—because you were never trained properly. It's your job today to prepare yourself for a better radio job tomorrow.

E. H. RIETZKE, Pres. CREI

The A.R.R.L. Convention
(Continued from page 44)

Broadcasting chains will be on hand for your entertainment.

Sunday morning will be devoted to group meetings and you will be able to find several meetings where your "pet peeve" is being discussed. These meetings will cover DX, traffic, u.h.f., phone, emergency work, N.C.R., A.A.R.S., television and other subjects. Each meeting will have as its chairman the outstanding man in the field,
"MULTI-BAND" TRANSMITTER

WE CAN DELIVER —

The THORDARSON

PANEL BAND-SWITCHING

"MULTI-BAND" TRANSMITTER

FEATURES

1. 100 watts input on all bands.
2. Power supply and R.F. section on one chassis.
3. Single meter reads all plate currents as well as grid current of the final stage.
4. Modulator and power supply on one chassis.

FEATURES

1. Bands — switched from front of panel.
3. Modulator lineup — 6J7, 6F5, 6F6, 2-6L6’s.
4. Band-switching feature optional, regular plug-in coils may be used.

Available in foundation unit form with complete instructions for assembly and operation. R.F. and Modulator units are complete with their own power supplies. The illustration shows the R.F. and Modulator units in a standard cabinet.

UNIVERSAL SPEECH AMPLIFIER FOR HAMS

Foundation unit and complete parts. Designed to eliminate the trouble usually encountered by the amateur in the building of a phone transmitter. It can be used with a metal screen cover for table mounting.

All three units fit standard racks or cabinets

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Dual Diaphragm CRYSTAL MICROPHONE

An outstanding achievement in microphone construction for night club and public address installations. Maximum amplification without feedback. Cannot be acoustically overloaded. Made in two models. MU-2 constructed with two dual diaphragm crystal units using four diaphragms. MU-4 uses four dual diaphragm crystal units and eight diaphragms. Black and chrome. Complete with three-prong interchangeable locking connector and 25-ft. cable.

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ESTABLISHED 1892

who will be supported by a talk from other outstanding men. There will be ample time for discussion of problems at the conclusion of each meeting.

Sunday afternoon will be in charge of the League and at that time you will hear from our officers. Particularly interesting to all should be Mr. Warner's report regarding the Cairo Conference. There is to be an “open forum” meeting at which time various League problems will be discussed. It is expected that most of the directors will be here as well as all of the officers.

Sunday evening will be the big banquet with entertainment galore—and no long after-dinner speakers or boring prize drawings. At the solemn hour of midnight the Royal Order of Wouff Hong will gather to initiate into its folds those loyal amateurs who prize the hobby of amateur radio and its traditions. (More about this elsewhere in this issue.)

Monday morning’s program will offer an actual demonstration of the action of waves on transmission lines and antennas. There will also be demonstrations of airways equipment including some that Howard Hughes used on his round the world flight.

The ladies will be entertained with bridge-tens, luncheons, sight-seeing tours of Chicago, trips through Chicago’s shopping district, trips through the various broadcasting stations and, of course, the big Saturday night party and Sunday’s banquet.

There will be free trips to and through many of Chicago’s leading amateur radio equipment manufacturing plants, speed contests (both high speed press copy and coded groups), trips through broadcasting stations, etc.

The equipment display will be the finest strictly amateur display ever held. Only those companies who are honestly interested in serving the amateur will display. Your favorite apparatus will be shown, so come and see it—make it a point to spend lots of time viewing this display. The manufacturers have gone to a great deal of trouble to bring you this show, feeling that your coöperation deserves only the finest treatment on their part.

Prizes will be limited in number, but all will be worth-while. There will be several transmitters in addition to receivers, large tubes, complete power supply kits, oscilloscopes, etc. There will be no long and tiresome prize drawings. Each prize will have a value in excess of $25.

Trained ushers have been hired to manage the crowd and see that your reserved banquet ticket assures you the place to which you are entitled. There will be plenty of recess periods for rest and viewing the exhibits. Adequate time has been set aside after each talk for discussion. Speeches are all limited to 45 minutes. The Hotel has extended the use of its many facilities for your entertainment. Chicago’s beaches will all be open for swimming. Movies are close at hand. Many restaurants are within easy walking distance of the hotel. Everything has been arranged for your pleasure and your convenience.

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In the specifications for the latest THORDARSON 100-Watt Band-Switch Transmitter, you'll find AEROVOX specified for every condenser required. Thor­darson engineers have selected AEROVOX condensers for their master models, as indicated in the illustrations.

In condensers, quite as well as other components required for this mighty fine ham rig, Thordar­son designers sought trouble­proof performance. They have made full use of the wider scope of the AEROVOX line which provides the correct condenser for every radio need.

So in building your Thordarson job, use AEROVOX through­out if you want the standard of performance and economy estab­lished by Thordarson engineers.

Ask for DATA...

See your nearest AEROVOX jobber about the necessary con­densers. Ask for copy of latest catalog. Or write us direct.

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THE NEW

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Panel Band-Switching

"MULTI-BAND"

TRANSMITTER

ON DISPLAY

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Complete Kits for
Transmitter and
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Ship or bring your faulty receiver to us. We are fully equipped to correctly align and service your receiver in our own laboratory.
Micro-Volt per Meter Sensitivity Reports Furnished
Know Your Receiver Work Guaranteed
Out-of-town inquiries invited

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525 Woodward Avenue 22 years in radio Detroit, Michigan

Announcing... The Precision Labs.
Type PX-5 Holder
New Low Loss Construction:
Size: 1 1/4" sq. x 9/16"
Ideal for Amateur or Aircraft use as it is designed to operate in any position. Crystals within 1% of specified frequency mounted in PX-5 holders listed below.
80-160 Meter, X cut...$3.75 Low Drift...$4.75
Commercial Crystals 20 Kc. to 20 Mc
Prices on request. FCC Approved.

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Your League and the Chicago amateurs have worked long and hard to bring you this, the first National Convention to be held in fourteen years, and we now await your arrival in September. This is your chance to meet all the people with whom you have been talking and about whom you have heard or read, and to join with other fellow amateurs for a week-end of fun and information.

—G. L. E.

The Permatron
(Continued from page 48)

conduct during any part of the cycle. This is the condition existing during keying.

The m.m.f. required for cut-off depends on the plate voltage and the condensed-mercury temperature. For keying, a magnetizing force of about 190 ampere-turns (magnet coil turns times current through the coil in amperes) is sufficient to take care of extreme conditions. Since it is usually more satisfactory to obtain the necessary m.m.f. by using small current and a large number of turns, the recommended specifications call for 5000 turns of No. 34 or 36 wire on a half-inch square silicon-steel laminated core, approximately 1 1/2 inches long on each side of the "U." In Fig. 1, when the key is closed, the magnets are short-circuited. The resistor in series with the magnets limits the current with closed key; its value should be approximately 4000 ohms if a 350-volt d.c. supply is used. The current is of the order of 40 milliamperes, and does not change greatly with keying, hence the resistor and magnets might well serve as the bleeder for the supply.

Permatrons also are equipped with a control grid for the usual electrostatic control circuits. This element may be used for keying if desired, but with magnetic keying it is normally connected to the filament and has no effect on the operation of the tube. However, the grid does make it possible to incorporate both output-voltage control and keying in the same power supply. A circuit for this purpose is shown in Fig. 2. By controlling the time of firing—that is, the particular instant during the a.c. cycle at which the tube starts to conduct—it is possible to make the d.c. output voltage anything between zero and the maximum available when the full a.c. cycle is used. The firing time is conveniently changed by using a.c. on the grid and shifting its phase with respect to the plate voltage. In Fig. 2, this is accomplished by means of $R_4$ and $C_3$, the relative values of which determine the phase of the voltage applied to the grids; the phase difference is zero when $R_4$ is zero and practically 180 degrees when $R_4$ is large with respect to the reactance of $C_3$. With the grid-voltage supply transformer properly poled, the output voltage is maximum with $R_4$ equal to zero, and minimum when $R_4$ is at its maximum setting. The grid voltage required is about 100 r.m.s. Because of the nature of the control action the overall regulation of the supply is

1 These magnets are available from The Raytheon Manufacturing Company, type number U3372.
THERE'S nothing "out-of-the-way" about HARVEY'S... Easy to reach from anywhere...
Easy to find whatever you want in radio... Pleasan­ant and economical... just CONVENIENT to everywhere and EVERYONE, that's all...

THORDARSON
MULTI-BAND
100 WATT TRANSMITTER

100 watts input on all bands.
Power supply and R.F. section on one chassis.
Single meter reads all plate currents as well as grid current of the final stage.
Modulator and power supply one chassis.

This self-contained 100-watt "Multi-Band" transmitter is available in "Foundation Unit" form with complete instructions for assembly and operation. Chassis, panels and chassis brackets are supplied completely punched for easy assembly. The entire transmitter requiring but $20 of panel space may be mounted in any of the standard cabinets or racks available on the market. Only standard parts of nationally known manufacture and highest quality are used throughout. Both the R.F. and the modulator units are supplied complete with their own power supplies. Complete band-switching is accomplished from the front of panel. Approximate price complete including Cabinet, but less Tubes and Crystals.......... $139.50

THORDARSON
UNIVERSAL SPEECH AMPLIFIER

Total approximate price........ $27.45

less tubes and metal cover with regular type transformers and 500 Ohm output or Multi-Match driver output.
Designed to eliminate transmitter building troubles for the Ham. The 2A3 Output stage provides ample driving power. Chassis adaptable to rack-and-panel mounting or to conventional chassis type with metal screen cover and bottom. Supplied less panel, but with panel drawing and full instructions included.

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WITH ALL THE PARTS
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TRANSMITTER
AND THE AMATEUR
SPEECH AMPLIFIER

SUN RECOMMENDS the
"Multi-Band" transmitter
because of these features

- 100 watts input on all bands
- Power supply and R.F. section on one chassis.
- Single meter reads all plate currents as well as grid current of the final stage.
- Modulator and power supply on one chassis.
- Bands — switched from front of panel.
- Modulator lineup — 6J7, 6F5, 6F6, 2-6L6's.
- Band-switching feature optional, regular plug-in coils may be used.

HINTS AND KINKS

The relays used by the author are built on the cores of old audio transformers, and make use of part of the transformer winding in the field circuit. In some cases, the windings of the transformers may be used with no alteration, being inserted directly in the field circuit with a parallel or series resistor used to regulate the current or voltage required to operate the relay. The E and I laminations of the transformer are stacked separately to form field and armature, respectively, and for the a.c. relay, a brass ring of % inch by \( \frac{1}{2} \) inch stock is inserted in a saw slot to form a shorted turn in the end of each pole piece of the E laminations. The ring should encircle approximately two thirds of the area of the end of each pole piece. The contacting surfaces of the core and the armature are then carefully fitted together and hinged at one end of the E laminations.

Drilling holes in the end of the field laminations and in the corresponding end of the I laminations is simplified by use of wood boards clamping the laminations tightly. The drill is thus held in correct alignment when entering the laminations after penetrating the wood support, and in addition the likelihood of breaking drills is reduced by this simple expedient.

This complete protective system, requiring little expense and only a small amount of time for construction, quickly pays for itself in saving expensive equipment and providing operating safety, and gives the operator an accurate warning the instant trouble occurs.

— M. E. Lowrey, W9SRX

Bridge Crystal Oscillator Circuit

An unusual application of a balanced bridge circuit is shown in Fig. 5. A crystal (equivalent circuit of which is a series resonant circuit) is used as one element of a neutralized vacuum-tube circuit in which grid and plate are coupled through a bridge.

At all frequencies except that at which the crystal is resonant, the circuit is balanced, and oscillation is prevented. The balance of the circuit is obtained by adjusting the condenser \( C_2 \) so that the anode-to-grid capacity plus the capacity of \( C_2 \) equals the effective capacity of the crystal.
A NEW JOHNSON
“Q” BEAM ANTENNA

For 2 Band Operation!

- A Matched Impedance, Two Band Beam Antenna.
- 4 db gain on fundamental. Approximately 6 db on second harmonic.
- Easy to construct — easy to erect.
- No critical matching stubs to adjust — all calculations made at factory.
- For any two adjoining harmonically related bands from 80 to 2 1/2 meters inclusive.
- The efficiency of the world-famous Johnson “Q” and the gain of closely spaced elements.
- Compact — only 3/4 wave length at fundamental frequency.

A COMPACT, 2 Band, Matched Impedance Antenna, consisting of two half-wave Johnson “Q” Antennae, designed for fundamental frequency, spaced 1/2 wave and fed 180° out of phase with a 600 ohm line with resulting matched impedances between antenna and transmission line on both fundamental and second harmonic operation.

Present owners of standard Johnson “Q” Antennae can easily convert them to the New Johnson “Q” Beam Antenna with the addition of another “Q” for the same band.

With a new one-piece suspension insulator equipped with slots permitting spacing adjustments of the “Q” bars and taking off the “Q” bars and transmission line in any direction — new connecting plugs and new clamps for “Q” bar spacing insulators, possibilities of breakage are reduced to a minimum, and the entire antenna is greatly improved mechanically.

Johnson “Q” matching systems are ideal for other types of antennae such as reflector-director systems, two half-waves in phase, harmonic "longwire" radiators and "V" Beams. Tubing for 5, 10 and 20 meter “Q” antennae can be supplied in straight lengths if so desired, instead of coiled.

Watch for the announcement of the “‘Q’ in a Can”, a NEW Johnson antenna matching system for use with 40, 80 and 160 meter antennae where the conventional “Q” is mechanically inconvenient.

Ask your jobber or write for Antenna Handbook 1021 available soon, describing application of “Q” antennae.

E. F. JOHNSON CO.
WASECA, MINNESOTA

MANUFACTURERS OF RADIO TRANSMITTING EQUIPMENT
Say You Saw It in QST — It Identifies You and Helps QST
See the New
THORDARSON
MULTI-BAND
TRANSMITTER

This 100-watt transmitter offers
what the amateur wants—a high-
quality unit with panel band-
switching and many other features.

NEW AMATEUR SPEECH AMPLIFIER
Optional over-modulation control
—Adapted to any phone transmit-
ter—R. F. feed-back and Hum
eliminated—Standard rack and
panel or table model.

Ask for Bulletin SD-378A
We stock all lines of
nationally-known parts

H. JAPPE CO.
46 CORNHILL, BOSTON, MASS.

and-holder unit. This capacity balance must ac-
company accurate center-tapping of the coil, L.
When the tank circuit composed of L and C_1
(plus the additional capacity of the series com-
bination of crystal and the parallel combination
of C_2 and grid-plate capacity) is tuned to the re-
gion of the crystal frequency by means of C_1,
the balanced condition of the bridge is removed,
and oscillations are produced.

HA3J, with whom I have proved this, was
able to use this oscillator circuit with an output of
8 watts, using a crystal of only \( \frac{1}{2} \) square inch
surface area.
The capacity of the neutralizing condenser is
critical, particularly when the circuit approaches
resonance with the crystal, and by careful adjust-
ment of this condenser, perfect T9X is obtain-
able.

This circuit makes possible three important
advantages in a triode crystal oscillator: More
output at a given value of crystal current; high
stability of the crystal oscillator; and high
efficiency.

—G. Neu, Box 85, Szolnok, Hungary

Freshman Marlow
(Continued from page 41)

He passed under the west tower and noticed
the shrieking of the wind through its timbers—
one hundred and sixty feet tall. The halyard
snapped viciously against the members of the
giant structure, and a faint chorus of little creak-
ing sounds could be noticed, like little voices, if
one listened. What if it should fall? Freshman
Bradfield grinned as he ran. Not much danger.
The fellows who put those towers up in 1920
didn’t put them up to fall!

In the distance, the other tower’s faint silhou-
ette marked the pathway. Bradfield pulled his
overcoat collar up around his ears and ran on.
His breath began to grow short, and he fell into
a rapid walk. Too many cigarettes. Funny how
quickly a fellow got out of condition.
The howling of the wind through the struc-
ture ahead of him sounded cold, cold. It
was cold.

Suddenly he stopped short in his tracks.
There was somebody standing in the pathway
at the foot of the tower!

It had, somehow, all at once, occurred to him
that there was someone there in front of him.
Just that quickly. And as he looked closer, he
saw that there was.

He felt the short hair on his neck stand. Whip-
ting the flashlight around, he illuminated the
person standing there. A cold feeling of something
unexpected gripped Bradfield’s stomach.

It was a boy about his own age, a freshman,
wearin a sky-blue cap, staring unwaveringly at
him. He was wearing a grey sweater,
the regulation freshman’s sweater, with a wide blue outline
around the neck. Then he noticed that one sleeve
of the sweater was torn, a long ragged tear ex-
tending from the shoulder down to his elbow. The
frayed rent flapped back and forth in the wind.

Freshman Bradfield took a breath. This was
funny aplenty. What was a freshman doing there?
THE JUDGES HAVE AWARDED THE VERDICT of
NEW SALES CHAMPION to the T-40 TZ-40

From the ranks of 40,000 good men and true, the award of NEW SALES CHAMPION has gone to that pair of Wonder Tubes, the T-40 and TZ-40. From every district, Amateurs, Radio Engineers and Parts Jobbers are cheering these newer, better tubes. Radio parts and set manufacturers are adding their support to the pair of tubes which recreated thrill in Ham radio. Whether your need is R F or Audio these two tubes will live up to and exceed every claim we have ever made for them. The husky filament and sturdy oversize plate really stand up under overload. Notice the approval and use of these tubes by such LEADING Manufacturers as Bassett—Gross—Temco—Thordarson—Utah—Harvey. COMPARISON SELLS TAYLOR TUBES. Your favorite parts jobber will tell you why!

ATTEND THE A. R. R. L. CONVENTION AND AMATEUR RADIO EQUIPMENT SHOW Chicago will once more write radio history, when the A.R.R.L. NATIONAL CONVENTION AND THE AMATEUR RADIO EQUIPMENT SHOW is held Sept. 3-4-5 at the Sherman Hotel, Chicago. Ask at our booths for particulars on trips through the Taylor Tubes Plant. See how your favorite transmitting tubes are made.
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5 BANDS
COVERING 9.25 TO 565 METERS

FEATURES

* 14 Tubes * 5 Band Pre-Aligned Tuning Unit * Better than 1 M.V. Sensitivity on all Ham Bands * Large 9" Linear Scale Dial accurately calibrated * Flywheel Tuning on main and Band Spread Dials * "Align-Aire" (Air-Tuned) Coils * Built-in Noise Silencer Circuit * B.F.O. with Pitch Control * 3 Gang Precision Tuning Condenser — Ceramic-Insulated * Mono-Unit Crystal Filter Assembly with Phasing Control and Shorting Switch * Electrical Band Spread Condenser.

This 14-Tube Communications Super has the things every amateur wants — sensitivity better than 1 M.V. on the amateur bands — excellent selectivity and high signal-to-noise ratio — a built-in Noise-Silencer — and a dozen other splendid features that make it an outstanding receiver of amateur radio.

The Traffic Master comes to you in complete, easily-assembled form — everything except tubes — with completely assembled Tuning Unit ready for mounting. You can't go wrong with a Traffic Master!

SEE YOUR PARTS JOBBER

$81.90 LESS TUBES AND SPEAKER PANEL AND CABINET AVAILABLE

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MULTI-BAND TRANSMITTER

The sturdy dependability of Ohmite Resistance Units again is evidenced in the selection of Ohmite Vitreous-Enameded Fixed Resistors, "Dividohm" Adjustable Resistors, and "Brown Devils" for the R.F. and Modulator Units of the new Thordarson 100-Watt Multi-Band Transmitter, and for the Universe Speech Amplifier.

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Resistors * Rheostats * Band-Switches
R.F. Plate and Power Line Chokes

OHMITE MANUFACTURING CO.
4831 W. Flournoy Ave. * * Chicago, U. S. A.

BY THORDARSON

He retraced his steps a short distance, shining the light ahead. The illumination was feeble.

"This punk is going to get pneumonia out here if he —"

There was a blinding flash of lightning that illuminated the landscape with fierce intensity, followed by a clap of thunder that shook the ground, echoing and rolling away into the distance.

Freshman Bradfield stopped short, staring. His eyes were wide. He shone the light along the path and increased his pace abruptly, coming in a few seconds within view of the tower.

A cold perspiration broke out upon him. He stopped in his tracks, shining the light at the foot of the tower.

There was no one there.

A feeling of fright clutched him. In the glare of the lightning, it had seemed that the freshman had disappeared, but being blinded, he was not certain. Now there was no doubt of it.

Bradfield shone the feeble pencil of light all around, conscious of a feeling of terror of something that he could not understand. He simply could not have got out of sight this quickly. Unless—

He shone the light up the side of the tower and walked around it looking up as far as the light would carry; walked underneath and shone it along the interior. Nothing but timbers crossing and criss-crossing up and up, fading dimly skyward.

It was too much.

He sat down for an instant on one of the tower foundations, exhaustedly, noticing that his breath was coming in gasps. The heavens were lit by a reddish flash and ripped by an ear-splitting roar like seacoast guns firing in battery. A few heavy raindrops began to patter around. He did not notice the rain, just sat there staring. Wonderingly, it occurred to him that he had seen no one there at all. Then he shook his head. He wasn’t crazy. Plain as day, that freshman standing there, looking at him...

A sound like a sob came from Freshman Bradfield. Suddenly he jumped to his feet and began to run, fell headlong, got up and ran again, the rain beating against his face, hitting him in the mouth. The lighted windows of the shack seemed to recede as he ran, his breath coming hoarsely, his lungs aching. He ran on, unconscious of the water streaming from his face, the dim course of the path with its hollows ankle deep in water; plunging through them heedless of anything but the mad desire to run.

He slowed to a walk as he drew near the shack. His lungs were on fire.

“They’ll think I’m crazy,” he thought. “Crazy —”

He pushed open the door weakly and stumbled. Parkes looked at him and grinned.

“Didn’t get wet, did you, frosh?”

Bradfield flopped into a chair, his breath coming in gasps. He wiped his face with the wet sleeves of the overcoat. He tried to grin but couldn’t make it.

Say You Saw It in QST — It Identifies You and Helps QST
Tubes with SPEER Graphite Anodes can take it. A user who signs himself “A Ham Since 1903” writes:

Most important to the amateur radio station owner are economy and efficiency. If the tubes do not stand at least 300% overload, he does not consider them suitable to his purpose.

“A tube having Graphite Anodes gives him these requisites. Graphite Anodes will stand three to four hundred percent overload without puncturing or warping and for these reasons frequency stability is assured. Metal anodes made of such metals as Molybdenum, Nickel and Tantalum WILL bend and warp, consequently giving rise to considerable frequency drift and reduced power output.

“Gassing is greatly reduced by use of Graphite Anodes, which makes for longer tube life. Furthermore the warping of metal anodes, causing poor alignment of tube elements, changes the general characteristics of a tube, a cause of poor matching of circuit impedances, necessitating continual adjustment for correction.

The writer voices the experience of the rapidly growing hundreds of amateurs who buy and use tubes with SPEER Graphite Anodes. Try them and see for yourself.

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WRITE US FOR LIST AND ANODE BOOKLET NO. 80

SPEER CARBON CO., ST. MARYS, PA.

SPEER GRAPHITE ANODES

Say You Saw It in QST — It Identifies You and Helps QST
“Run all the way?”
Bradfield nodded.
“Everything OK?”
He nodded again.
“Get over here by the fire, boy!” said the
professor, moving his chair back. He smiled
as he looked at Freshman Bradfield’s wet face.
“Get those shoes off and put them up here!”
“In—a minute.”

The professor looked at the bowl of his pipe
thoughtfully and cleared his throat preparatory
to resuming his interrupted conversation.

“Yes, Collier,” he said slowly, “it’s a thing
that I hate to think about.” He shook his head
regretfully. “This Marlow was a dare-devil sort
of youngster and when they got the halyard
jammed in the pulley, he volunteered to climb the
tower. You know how it is when you’re pulling
up an antenna for the first time, watching it go
up and up toward the top and then the rope comes
off. They had all been working on it steadily
since about noon and it had got pretty dark, so
they drove some flares in the ground and kept on.
You know, these red flares, like they use on the
railroad sometimes. And then the halyard stuck.

“It was a night rather like this, cold and windy
and rain threatening every minute. Hard wind,
coming in gusts that would nearly blow you over.
Some of them wanted to wait until daylight but
you know how amateurs are; most of them wanted
to keep on, climb the tower or do something.
Well, this young fellow Marlow wanted to go up.
They tried to talk him out of it because he had a
bad hand. Cut it on a piece of plate glass. Back
in those days they used a United Wireless ‘Coffin,’
as they called it, and a four-tooth synchronous
gap with a disc this big around. Every time the
key was closed with the gap out of synchronism,
it would tear up three-quarter-inch thicknesses of
plate glass like they were pieces of window pane,
and this Freshman Marlow had cut his right hand
on one of them down under the oil. Bad cut, too.
Had it bandaged up. But he went, anyway.
About half-way up he got his sweater caught on
something and wrestled with it until he got im­
patient and tore the sleeve out of the sweater.
It took him about an hour to get to the top, but
he finally got there. We just could see him, ‘way
up there on top of the tower.”

The professor paused and pulled slowly on his
pipe.

“He put the halyard back in the pulley—”
Professor Wortham cleared his throat.
“Lord!” he murmured as to himself. “I wish
to heaven they had never let him go!” He
Twisted the heavy class ring on his finger. He con­
tinued, louder:

“He lost his balance, I suppose. The wind was
terrible up there, of course.”

Parkes was silent for a minute, gazing at the fire.
“Did he live long, Prof.?”

“No.”

The professor smoked in silence, watching the
sparks sail up the black throat of the chimney.

“Every time I look at that far tower over youn­
der,” he said, softly, “I think of that boy.”
Features:
Small size. Bakelite case is 1¾" in diameter x 9/16" deep.
Available in values from 2 to 10,000 ohms.
Insulated construction — no washers required in mounting.
Regular Radiohm switch covers can be attached.
Dissipates up to 4 watts without damage or change.
Universal shaft for all replacement work.
Close tolerance — ±5%.

Chief Applications
1. Instruments.
2. In radio receivers where very heavy bleeder current passes through unit in cathode and screen circuits.
3. Filament control.
4. Hum control.

In linear curve only.

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DEFINITE DEMAND

"Build us a wire wound resistor that's as good as your other products"... they asked us time and again. And so we "gave in," with the result that where circuit requirements call for "wire wound," service men have been using the new Centralab Wire Wound Radiohm with remarkable success.

Available at your jobber... in dimensions identical with the Standard Radiohm. Be sure to specify Centralab.

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Wire Wound
RADIOHM

CENTRALAB: Div. of Globe Union Inc., Milwaukee
I T IS with deep regret that we record the passing of these amateurs:

Leslie Elmer Anderson, W9MKS, Granville, Ill.
Douglas A. Buchanan, VK2ABT, Yerrinbool, N.S.W., Aust.
A. D. Campbell, ex-VE3YZ, Ridgetown, Ont.
Eugene P. Chase, Jr., W2KAK, Teaneck, N. J.
Charles Clemmer, W8QUI, Detroit, Mich.
Norman L. Dahl, VK2ND, Wahroonga, N.S.W., Aust.
Harold Gies, W7DTO, Walla Walla, Wash.
John D. Hertz, W7BRC, Walla Walla, Wash.
Raymond Howell, ex-W6CID, Modesto, Calif.
Harry A. Linee, W8LCL, Allegan, Mich.
Harold William Lots, W6NXK, ex-W2BST, Los Angeles, Calif.
Charles E. Lounsbery, W9ZPC, Denver, Colo.
Karl D. Sidebottom, W9SYL, Lamar, Colo.

Grid-Bias Power Packs

(Continued from page 32)

fully loaded, deliver the required bias voltage on the final grid. The current that the transformer should be rated to deliver, and the resistance to use for the common bleeder-grid leak, depends on the total expected grid current.

A study of power supply voltage regulation in this connection shows that the worst regulation occurs when the supply is lightly loaded. Therefore we should never allow a bias supply to drop below a certain load, say 50 ma. Now if we expect to have a total of 50 ma. grid current, we add these values and divide the result into the supply voltage to get the required resistance. The sum of the currents also is the required transformer current rating.

As an example, suppose the supply is rated to deliver 250 volts at the required load of 50+50 = 100 ma. Then 250/0.1 = 2500 ohms, the bleeder resistance. Do not hesitate to load the supply up to its full rating, because the load drops during the time the grid current is flowing. Use a 200-watt slider-tap resistor to make voltage adjustments easy.

An interesting thought arises in connection with the current drop in the bias supply. Why not make it duplex and supply the plate of an oscillator also, adjusting the resistance on the bias side until the drop in current exactly balances the rise in oscillator plate current? This should achieve perfect voltage regulation on the oscillator plate and on the grid of the tube being biased. The thought should be worth investigating.
What does it mean to you?

More perfect neutralization...less driving power...freedom from parasitic oscillations...more efficient circuits...higher frequency operation.

Eimac tubes are more easily neutralized and require less driving power than most high-capacity tubes because low capacities have been gained without loss of electrical characteristics. Every radio engineer knows that neutralizing is made necessary only because of the capacity existing between the electrodes of the tubes. This capacity must be offset by the introduction of an extra condenser which is adjusted to reduce the detrimental effect of these inter-electrode capacities.

Providing all other factors are equal, the tube having the lowest inter-electrode capacity will give superior all around performance in any application, being equally efficient for radio frequency or audio frequency. In reality the high capacity tube is a hang-over from the time when 200 meters was the lowest practical wavelength. High capacities are not necessary to obtain low impedence. This fact is proven conclusively by a comparison of the electrical characteristics of Eimac tubes with certain other tubes having extremely high capacity.

Because of their unusual design, Eimac tubes have the lowest inter-electrode capacity of any tube having equal ratings and capabilities, yet their electrical characteristics are on a par with tubes which have three to five times the grid and plate capacity. High electrical efficiency...low inter-electrode capacity...tantalum elements...extraordinarily efficient thoriated tungsten filaments...the exclusive Eimac exhaust technique...positive guarantee against tube failure caused by gas. These are but a few of the reasons why you should insist on Eimac tubes for your transmitter. See your dealer or write to the factory for information.

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THREE WINNERS  
CB-55  CB-150  CB-250  
Fine Radiophone transmitters selling at amazing low prices  

Gross CB-150  
Input — 150 watts  
Coils available for 30, 14, 7, 3.5, and 1.7 mc  
Class B modulation  
All the very latest type tubes used throughout  
Completely self-contained from mike jack to antenna tuning unit.  

Descriptive Bulletins on Request  

CB-55 POWER 95 WATTS  
CB-250 POWER 250 WATTS  

"THE STANDBY" (2 to 2000 Meters)  
3 TUBE A.C. AND D.C. RECEIVER  
The Standby was designed to supply a need for a receiver to cover all the amateur broadcast and commercial frequencies (2 to 2000 meters). It will fill the requirements for an all round "Standby" receiver. Super regeneration is used from 2 to 15 meters and straight regeneration on the higher wavelengths up to 2000 meters. Loud speaker reception is possible on most stations.  

Power supply incorporated. Individual antenna tuning for high and low wave ranges. 1-76 super regenerative detector, 1-6J7 regenerative detector, 1-12A7 audio amp. and rectifier.  

BULLETIN ON REQUEST  

Complete kit of parts less coils, tubes, cab. .................. $7.59  
3-3-10 meter coils (set of 3) .................. .96  
945 to 15 meter coil .................................. .39  
15-200 meter coils (set of 4) .................. 1.30  
200-310 meter coil .................. .39  
310-550 meter coil .................. .36  
550-1050 meter coil .................. .60  
1050-2000 meter coil .................. .60  
Metal cabinet .................. 1.50  
Kit of three tubes .................. 2.40  
Wired and tested in our lab., additional ................. 2.00  

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NEW YORK  
Cable Address: GROSSINC  

A.R.R.L. NATIONAL CONVENTION  
Hotel Sherman, Chicago  
September 3-4-5  

A Deluxe Rotary Antenna Structure  
(Continued from page 29)  
The heads of the rivets should be countersunk. The wood levers R and S are 2" X 4" X 20" long with a 9½" hole 3½" from the drum end. A three-inch lap of the brake band is extended on the lever, and two ¾" by 2½" bolts are used through each to hold it. Another pair of 2" X 4" X 10" arms is used to secure additional leverage. The smaller levers are notched to fit the tops of the long levers. The bottom is pulled together by the ropes, spreading the top levers and tightening the band. The leverage obtained is about 144 times, counting the gain in the windlass at the house.  

THE ROTATING SYSTEM  
The antenna used here gives a two-way beam, so the mast only has to rotate 180 degrees for 360-degree coverage. A piece of 1" X 4" X 40" with a 9½" hole drilled 1" from each end is used as a lever arm, braced with 1" X 4" pieces as shown in Fig. 7. The section D is to take up the rope and complete the pulley action; the side pieces are each 15" long and a block of oak 1" X 4" X 5" is shaped to catch the rope from the pulleys. With 360-degree rotation it would probably be better to use four sections as shown at D and provide a means to keep the rope from slipping off the arms, such as deeper groves with an extension on the lower side. Then one complete turn of rope fastened to the mast pulley at only one place would be necessary, and if the ropes are kept fairly tight good calibration of the steering wheel is possible. Three-eighths inch manila rope is entirely satisfactory and it can be waterproofed quite simply by boiling it in paraffin. We treated the 250' required here by boiling it in sections; each section for about five minutes is plenty.  
The steering ropes go through regular pulleys to an 18-inch home-made wooden pulley mounted on the window casing of the operating room. The steering wheel, inside the window, is from a '29 Ford, although any type will do. The steering shaft should be secured with the wheel so one can be sure the threads will fit. The shaft is sawed off to a length appropriate to go through the casing, and rides in 3½" X 1⅜" X 4" bearing plates. One complete turn of the rope around the wooden pulley should be sufficient, but if there is a tendency to slip another can be added or some powdered rosin poured on the drum and rope.  
The windlass for the brake rope is 3¼' rod, with a home-made handle on one end for turning. The rod also goes through the window casing, bearing plates similar to those used for the steering.
UNDER THE CHASSIS
in the new
THORDARSON
TRANSMITTER

• The convenience and compactness of National Transmitting Condensers are well illustrated by their use in the new Thordarson "Multi-Band" 100-watt Transmitter. Their light weight enables them to be mounted on small insulators. Their small size contributes to efficient layout. Tucked away under the RF chassis, they add to dependability and high performance and make a good transmitter better.

NATIONAL COMPANY, INC. MALDEN, MASS.
Pick a Winner . . .

In racing that's easier said than done, but with Radio Transmitting Equipment there are more stable factors by which to judge. The UHX-10 and 80-T have consistently led the field since their introduction. They perform equally well in the hands of the novice or the experienced operator. Their blue-ribbon qualities stand out when competition is the keenest. You take no long shot when you choose what owners call a sure bet. Take a straight tip—Buy Harvey Every Time. We will gladly send you a dope sheet (catalog) if you will write to

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Radio Laboratories, Inc.


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HOWARD GIVES YOU

A brand new Howard design covering .54 MC to 40 MC (7.5 to 555 meters) in 5 bands. For those advanced amateurs and professionals who want the very best up-to-the-minute design in this range, Model 440 we believe is the outstanding buy. Same high performance hairline selectivity circuit as used in the famous Howard Model 450-A. The fully illuminated edge-lighted dial is calibrated for band spread and Straight Line Frequency calibrations for main tuning circuits. The dial also has a finely calibrated band spread re-set or logging scale.


PRICE:
Model 440 . . . $66.50 NET
including tubes, but less speaker, less crystal

OTHER HOWARD MODELS


Model 450-A — 12 Tubes — 6 Bands — Frequency Coverage .54 to 65 MC . . . . Ceramic Coil forms . . . . Dual I.F. Channels . . . . Two S.L.F. Ceramic Insulated Tuning Condensers . . . . 47 inches of electric band spread . . . . crystal filter . . . . Calibrated 'R' Meter . . . . Accurately calibrated direct reading dial. Price . . . . with Tubes, less Speaker, less crystal. $87.50 Net

Longwave . . . . 25-cycle and special voltages available
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RADIO SHACK
46 BRATTLE STREET
BOSTON
"OD-10" is the third in a series of Hammarlund foundation units designed to make it easier for the Ham to build his own transmitter. This unit is used in building the crystal oscillator-doubler shown in the illustration. Like the other Hammarlund kits, this one includes all necessary brackets completely drilled and shaped. Just the thing for the beginner who is not experienced in designing transmitters. The completed unit is capable of up to 25 watts output and operation on two amateur bands with a single crystal. Starting with this surefire rig, the beginner can add units to it until he has a complete 300 watt all-band transmitter.

The "OD-10" oscillator-doubler unit is a companion to the "PA-300" and "BD-40". These three, when used together, constitute a highly efficient modern all-band transmitter with up to 300 watts output. The whole transmitter can be built on a single 19" x 15 3/4" standard relay panel and can be assembled and wired in a single evening. Ask your jobber to show you all three of these modern units.

Write Dept. Q-9 for folder describing these new "Foundation Units"

HAMMARLUND MANUFACTURING CO., INC.
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Canadian Office: 41 WEST AVE., NO., HAMILTON, ONT.
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THE TURNER COMPANY
CEDAR RAPIDS, IOWA
The A.R.R.L. NATIONAL CONVENTION AND AMATEUR RADIO EQUIPMENT SHOW

SHERMAN HOTEL, CHICAGO
SEPT. 3-4-5 1938
Greatest Ham Event of all Time

Say You Saw It in QST — It Identifies You and Helps QST
Station Activities
(Continued from page 60)

CENTRAL DIVISION

ILLINOIS—SCM, Leslie M. Dickson, W9RMN—KJY changed the gang for their cooperation the past two years. We wish to extend to him for an excellent job as S.C.M. Sgt. Benfer at 9EC has been transferred to Panama, says 75 to the gang and promises to keep a schedule from KSA. HPG has been appointed 6th C.A. Radio Aide in place of DOU who resigned. TZQ is new O.R.S. in Waukegan. BEN is proud possessor of a new national band-switching exciter and will be on with a kw. this fall. Looks like the score of the Egyptian Radio Club station, 9AIU, will be right up on top of the shed. This year has a 3.9-Mc. Hertz and a 14-Mc. "Q." Q0J, using 10 watts on 7 Mc., gets 88 on both coasts. A "Z" Net is now in operation on the high end of 7 Mc. ZEW invites anyone whose call starts with a Z to join. NIF is looking for pre-owned portable equipment. VE6E is busy with either traffic or schedules during the summer. Last call for the A.R.L.L. National Convention at Chicago, K5AA. HPG has been appointed 6th C.A. Radio Aide in position on the high end of 7 Mc. ZEW invites anyone whose call

...
daily, QAK finally got parts for the new power supply. To
get the most out of your tubes, says US1F, tape up the cracks
with adhesive. YWJ knocked off OAMQ and XE1H with
the new 660-TX-211 rack and panel job. 4FBP, ex-W9WSTU,
is home for summer vacation, S6X is going glassy with P-P.
21 that outperforms 214. WM9 is going glassy with 214 on
the U.S.S. Pasadena on the Great Lakes this year. CRY has
'03A final going. ZRA gets more sck to his final after
rebuilding. RDI finally got the buses out of the T40's, LYO
and T9G made a good run for 'em on 7 Mc. BKK's new 14-Mc.
vertical works FB on other bands, too, N1JC on 7 Mc. and LRA on 1.75-Mc. 'phone are new hams in Garretson. 2NM had to
desert 14 for 1.75-Mc. 'phone to satisfy the YX, which made the why YNW suggests a new
ham term— "YX"—is the correct one to call it. JBC got his 7
zepp. REE borrowed equipment and knocked off G5, VK4, and K6 on 14-Mc. 'phone, using 150 watts to an 808B. V0S is trying an e·c.
arator on 14 and 7 Mc. DKJ is re-
building the rig, and others going to work on their rigs. W1GZ-YCR is on 14 Mc. ZGT gets out nicely on 7
head Radio Amateurs are publishing a newsy little paper,
"The Discharge." Now that fall is coming and there will be
more activity, I will appreciate your monthly reports.

On 7 Mc. YKD spent two weeks at Camp Ripley with Na­
opera ting and living in a trailer house. QPG is the old reliable
season almost on us, we should have a lot of activities with
0200-mile vacation to the west coast, visiting YOB en route.
Decided to let band-switching go until his pocketbook re-
timing and running off races in the sottp box derby there;

QRV—YCR is on 14 Mc. ZGU built a new rack. IFW is building new rig. FUZ is
his rig on 28 11c. and got a "heard" card from
.


NORTHERN MINNESOTA—SCM, Edwin L. Wicklund, W9QW—TCR is on 14 Mc. ZGT gets out nicely on 7 Mc. ZGQ built a new house and is going to live in it. FWJ is operating from a trailer house. OPL is the old reliable on 7 Mc. YKD spent two weeks at Camp Ripley with Na­
tional Guard. RQA has been playing with 56-Mc. receiver.

Traffic: W9QW.

W9YOD 7.

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The quartz crystal is the "heart" of any transmitter. It does not pay to take chances—buy BLILEY and be certain. See your distributor today!
NORTHERN TEXAS—SCM, Lee Hughes, W5DAX—EOE is rebuilding. DNB is changing rig and getting better receiver. ECE is active on 1.9, 14 and 28 Mc. FZJ is sending O.S.S. on 7187 and 14.374 kc. FI1N is new call in Childress. FNP is active again on 7 Mc. BRR is very much with N.C.R. work. On trip to Amarillo, EZY met GTW, operator at English Field. Boys, it is time to get those traffic schedules, net and trunk line connections lined up. Let’s put this section on the traffic map.


OKLAHOMA—SCM, Carter L. Simpson, W5CZE—DTU maintained schedule with FLU, who had a portable rig at Y. M. C. A. Camp near Davis. ASQ is installing remote control for transmitter. DAK received certificate for having competed in the United States Navy Radio Course. With Mert and Duke on furlough, a new operator, Jeff, is holding down schedules at FSK. AIR was in car wreck. FRC returned from Port Arthur, Tex., and is located at Blanchard. FRB landed a job and moved to Transverse City, Mich. HBG and HBF are new hams in Buffalo and Poney City, resp.; the former is using battery powered equipment. PWZ, AXA and BRX are new officers of the Tulsa Radio Club. JSQ has been ill for past 6 weeks, but is now able to get around. HGB and HJG are new hams in Tulsa. DQV is working 14-Mc. DX. GMT and FRB have been rebuilding. CEB took portable to Cola, on vacation. GZU and GKP are interested in A. R. S. See you in Carlsbad, Aug. 25th-27th.

Traffic: W5QCE 150 DTU 110 ASQ 41 DAK 30 EZM 4 FSK 30 (WLJY 12).

SOUTHERN TEXAS—SCM, Dave H. Call, W5BEO—MN reports the A. R. S. putting a membership drive in the eastern section. PDR is building a 70-Mc. tower, and will have two transmitters, one on 7 Mc. and one on 3.5 Mc. FZD has W. A. C. certificate and needs only Nevada for W.A.S. EBW worked country No. 21, PK1B. EBE reports working plenty of DX, with 50 watts. AWS is on 7 Mc. portable. FNY is knocking ‘em cold on 14-Mc. ‘phone. GWL is trying for W.A.S. with 50 watts. HAQ works lots of DX. HAP is building for 14-Mc. c.w. with pair of 35T and 250 watts. HGO and HGG are new calls in Houston. JDX and HGT report that 56-Mc. signals were heard in Galveston, July 16th; several WS’s and W9’s were heard. BRE put up new beam antenna. The Galveston Amateur Radio Club held a Field Day and Hamfest, July 3rd and 4th, and everyone had a very good time on the beach.

Traffic: WSOW 1036 MN 242 EDR 103 DLZ 5 FZD 61.

ROCKY MOUNTAIN DIVISION

COLORADO—SCM, Glen Glasscock, W9FA—A. R. S. activity will commence about Sept. 12th. TDR is plenty busy on convention plans and preparations. TTD, head of this section, Paces, is a proud possessor of telephonic ticket. WWB, convention chairman, makes preparations and expects a real get-together for the division. ZDZ worked a few KS’s and finally hooked K5AG; ZDZ has been visited by 4AF, G4UR, 9PE, 9GE, 9AT, K7ZCD, K6E, GFR, and 9UE. EYJ spends his time constructing a new 110-a.c. or 6-volt d.c. portable emergency rig. C.C.R.A. gang had a swell Field Day, WJJ still hangs on 14-Mc. ‘phone work. BRZ has right arm in a cast, due to sprained elbow, but manages to keep the key going and do a few lectures, one in Laramie with his left hand. SJH has a Jr. opr. to train now—congrats and best luck, OMI. Ex-UXBRR and 9R9Z entertained the Montrose Rotary Club recently with demonstrations and talks about ham radio. EHC is working on a new rig. Ward, on the New Mexico border, is building a 70-Mc. tower, and expects to have two transmitters, one on 7 Mc. and one on 3.5 Mc. FZD has W. A. C. certificate and needs only Nevada for W. A. S. EBW worked country No. 21, PK1B. EBE reports working plenty of DX, with 50 watts. AWS is on 7 Mc. portable. FNY is knocking ’em cold on 14-Mc. ‘phone. GWL is trying for W. A. S. with 50 watts. HAQ works lots of DX. HAP is building for 14-Mc. c.w. with pair of 35T and 250 watts. HGO and HGG are new calls in Houston. JDX and HGT report that 56-Mc. signals were heard in Galveston, July 16th; several WS’s and W9’s were heard. BRE put up new beam antenna. The Galveston Amateur Radio Club held a Field Day and Hamfest, July 3rd and 4th, and everyone had a very good time on the beach.

Traffic: WSOW 1036 MN 242 EDR 103 DLZ 5 FZD 61.

WEST GULF DIVISION

Louisiana—SCM, Eugene H. Treadaway, W5DM—R.M.’s: 5BN, 5DWW, P.A.M.: 5BMM, E.C.: 5FPO. O.O.’s: SDXK, 5FXX, FXX is doing a swell job as O.O. KU will sail with U.S. N.C.R. to Vera Cruz, Mexico. DGB is getting some DX on his rig, worked 4DX this year. K4VJ has new antenna and small amplifier. LFC bought 9KH’s rig. NJH fixed the flywheel on his 1.8-Mc. ‘phone, good performance, and is having a grand time. OKY is papering the club-room wall with cards gathered during the Field Day contest. UEK holds schedules on 1.8 and 7 Mc.; he is building a generator and generator for emergency work. K7X has a new 6L6-T40 rig on 7 Mc. YLT is building another c.w. rig using 36-416-R339. YZS is on 7-Mc. operating portable in New Mexico. ZBS has his new 1.8-Mc. ‘phone rig tuned up and is working his DX antenna. Working all bands 1.8 to 28 Mc., ZKU is on 3.5 Mc., JVR will have W. A. C. if he can collect cards from the many DX stations he has worked this year. KKY, on a trip into Illinois, has his rig with him to work portable at stops on route. ZCM received a card stating he had been heard on 14 Mc.!!! AMS of WDF is back in Colo. Springs on his honeycomb; he is taking his rig back to K.C., and intends to get on the air there. FXQ, radio sqt. in National Guard at Colo. Springs, demonstrated the Guard’s new portable transmitters to the club. NO is licensed man in C.S.; he has sky Champion receiver and a small transmitter. KAD of Pueblo applied for O.R.S., ... also JWC of Colo. Springs. Any more? just drop a line to the S.C. M. S. and ZEP are digging a new DX hole. JY7 passes along some DX information via the “Ham Rambler,” which is the official publication of the San Isabel Amateur Radio Ass’n at Pueblo. Bud Walters is snuggling stuff like VK3AJ, W5JZD, VK3AL and YV6AL and YV5 on 28 Mc. KAD made his 100th DX contact on 28 Mc., and 15 minutes later was heard working VK3KR. UEL added a couple of new ones to his list when he worked Peru and British Honduras. ATW added 6 new counties, making a total of 64 worked; the new ones were PFSIM South Orkney Is., YL2CD Latvia, ISAB Italy,TestClassJ Liberia, J5C Chosen and ZK1AA Cook Islands. ZQK is another DX hound in Pueblo. Thanks to all those sending in reports this month. It is hoped that others will follow the lead and see that their gang is represented in the next report.

A card will do the trick, fellows, come on. The N. C. R. gang in Denver is fixing things up at the Old Customs House for the winter activity; tables are about wired and transmitter is the setting stage of construction. At the present time the N. C. R. activities, just drop a line to F. A., MKN, PWO or GLL, and information will be sent you. Last, but not least, is official announcement of the Rocky Mountain Division Convention to be held in Pueblo, Sept. 17th and 18th. Reservations made before Sept. 7th—$2.50 per person, after that date $3.00. Tickets may be purchased at any of the radio dealers’ stores in Colorado or by writing to WWWB, E. S. Buchanan, 1007 W. Evans, Pueblo, 23.

Traffic: W5ESA 78 TDR 46 (WLS 47) WWB 31 TDS 25 WWZ 24 WJJ 20 DZD 14 FEC 3.

UTAH-WYOMING—Acting SCM, E. E. Parshull, W7DMF—Please, gang, mail your reports direct to me, c/o Salt Creek Elegante Plant, Minersville, Utah. Readers, please forward to T. J. Rigby in Montana, and I can’t make up a report to give you any credit unless I hear from you. Let’s see if more of you can’t take a few minutes to report just once a month. Use a penny postcard, or ask for regular cards, and I will send them to you. 7GEE, Laramie, is putting up new vertical antenna; he just got Class A ticket. Courgars, OLB, 7G0H, Midwest, reports long skip on 28 Mc., coming on. 7G6F, Midwest, is on ‘phone regularly, and 7GUX, Midwest, had first outside QSO short time ago. 7C0G, Midwest, attended Casper Radio Club meeting. All Utah hams interested in the Division Convention at Pueblo, Sept. 17th and 18th, are requested to write 6PKB, Carl C. Adler, 2555 East 72nd South Street, Holladay, Utah, stating their power, frequencies, availability, and equipment. 8FIA, Shennanob, Pa., is anxious to work Utah for W.A.S. How about arranging this? 8X6GM? gang?

Traffic: W7VGB 8 AMU 12.

DELTA DIVISION

QST for
Further Reports on 56-Mc. DX

(Continued from page 8)

W1IZY KOE SI QKF JNX KCS HWL JFF JNC; W8QDU worked W1IFU DPP KXK OE DEI W3GCW W5EHM; W9USH worked W5CSU; W9NY worked W1IZY EHT CSR W2KIL W3DBC HI YX RL W5PHN W9AGU; W9SUE worked W1HXXE JQG CUU IIP OE KXK SI JUI KEE SS JUI KBQ DPP W2ICY W3AIR GSK DBK RL GMZ W5EHM; W9ARN worked W1KNM JI KTP JMT SI W2GAH JCY ETN BHD LAH KLV ISY FUZ HGB KDB W3DBC W8JEW.

July 20th—W5EHM worked W8CIR BDG HCG MST NED CMK NOB EUK QKI MSK W3GLV W9QEI FEN; W9USH worked W3GLV HJO FKF W8CIR NED IZJ RYM QNK W9UIE; W9NY worked W5CSU W9CLL; W9ARN worked W2FBA W3GLV W9CLL; W8ICR worked W1ISI HXE KXX BOC LAQ CRZ LDM ESQ IZJ FZU DFF JXK KPN OF EWM LTM W5EHM AJG CSW 8SRV GU.

July 23rd—W4EDD worked W9ZHV; W8QDU worked W5EHM; W8CIR worked W4EDD W5CSU EHM.

July 24th—W1EYM worked W6DNS; W5AJG worked W8VO BDG PWW QKI QDU NKJ L1Q NZ W9VHG CLH ZGD FP FEN YTI; W8JLQ worked W5EHM AJG W6DNS PEK RR IOJ AVR W9JLB; W8QIV worked W5EHM; W6DNS worked W1EYM W5CSU W7FDJ.

W1KJT HAS GRABBED A BIG SHARE OF THE DX

His transmitter runs a pair of 6L6's, crystal-controlled, in the final. The receiver is a four-tube superregenerator (with an r.f. stage) and the antenna is a Johnson Q, 55 feet above ground.

W8JLQ CIR AGU; W8CIR worked W5EHM CSU W6DNS PEK W9USI NJR V1Z; W8QDU worked W5EEH AJG EHM CSU; W9USH worked W3HGR GMZ AXR W4DUK W8CIR N8S AKY MST RWJ CQI IZG W9VHLX; W9ZGD worked W5AJG; W9ARN worked W3EMZ W8JH.

July 25th—W4EDD worked W1RY KNM W2JCY KLV KXX KHR W3EKM RL AXR GSK AIR DX HPD EZM HJO HPY CYE FPL DBC W8CIR IZG W92HB; W8JLQ worked W9USI; W8CIR worked W4EDD W9USI BP OLY; W9USH worked W3HJO EZM FBH HGW FKF GMZ GQ8 W9LHU NED MVL

IZG RUE CIR VO RPC PWE JLQ OJA QNK MST W9WLX NR; W9NY worked W1BRL W3AIR BZJ; W9LNV worked W2GAH; W9ARN worked W1SI W2KILZ.

ANOTHER OUTSTANDING STATION HAS BEEN W9USI

W9USI himself is here seen at the left, the assistant op. being W9USH. The receiver used is a two-tube superregenerator, while the transmitter is a push-pull short-line-controlled rig.

July 26th—W1KJT worked W9VHG; W8CIR worked W5EHM.

July 27th—W4EDD worked W3BYF PPD W9USI.

July 28th—W6DNS worked W7AQQ.

July 29th—W5AJG worked W8LJP VO.

MORE REPORTS WANTED

This all goes to show that 56-Mc. DX was reported for almost every day of the month—reported, we said. It seems entirely probable that the band was open in some parts of the country every day and it is evident that much more went on than has been reported. There would have been much more to be said if the most recent log from W5EHM had not ended on the 20th. We take our hat off to Patterson—his was a brilliant showing.

The trailing off of reports towards the end of the month suggests that conditions were on the wane, but this is not necessarily so. Some five-meter DX men have the idea that their DX work is routine stuff these days and that reports are of little consequence. Nothing could be further from the truth. Every report of 56-Mc. DX, even if it has been duplicated thousands of times before, is of particular importance at this time. We make a sincere plea for copies of all logs.

As we have already said, space forbids the publication of the "heard" reports. They are, however, being incorporated in the material under study and have already proved to be of tremendous value.

—R. A. H.

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September 3-4-5
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Crystals can be furnished with square holder as illustrated (fits G.R. type jacks) or with round holder to plug into tube socket. When ordering be sure to state the type holder desired. G.R. jacks to plug illustrated holder into — 15c pair.

Low frequency drift crystals (Type LTC) supplied within 0.1% of your specified frequency and calibrated to within 0.05% are priced as follows: 1750, 3500 and 7000 kc. bands — $3.50 each. Holder $1.00. (State type desired.)

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‘AT’ cut crystals for commercial use quoted on your request. When ordering our product you are assured of the finest available. Now in our ninth year of business.

PRECISION PIEZO SERVICE

427 Asia Street

Baton Rouge, La.

Announcing — The Maxim Memorial (WIAW) Dedication Relay

(Continued from page 46)

'phone): W1DWP, W1EAO, W1SZ. (1.7 Mc.): W11MV, W1HLE-HSU, W1KAB, W1DAV, W1AQF. (28 Mc.): W1GS, W1BAW. (56 Mc.): W1EYM, W1IJ, W1GYT.

We shall request officials in filing messages to make them of reasonable brevity to facilitate relaying. All stations are asked to follow standard A.R.R.L. message procedure, as given in the Handbook. Most of the messages will directly refer to the dedication of WIAW, the Maxim Memorial Station, on this occasion of H. P. M.'s birthday anniversary. The whole affair carries on the spirit and traditions of amateur radio and every present-day amateur should get a big thrill from taking some part. The “relay” idea was the basis of founding our Association. It still calls for the ultimate in universal cooperation and friendship between amateurs.

Every active amateur, and A.R.R.L. members especially, are invited to participate in this Relay and in that manner in the first official night of operations, dedicating Maxim Memorial Station, WIAW. An article in a future issue will give details on the several antennas and transmitters, and facilities of the new WIAW.

—F. E. H.

A.R.R.L. NATIONAL CONVENTION

Hotel Sherman, Chicago

September 3-4-5

A Five-Band Switching Exciter

With 807 Output

(Continued from page 18)

mission would be highly desirable to help maintain proper keying. The unit is, therefore, equipped with a Type 6A8 tube which functions similarly to a converter or mixer tube in a superhet receiver. A separate oscillating circuit is provided for this tube with the frequency controlled from the front panel. A small amount of energy is taken from the plate circuit of the crystal oscillator and mixed in the 6A8 tube to give 465 kc. output in its plate circuit. A coupling lead is then run from the plate of the 6A8 to a point near the grid of the first i.f. tube in the receiver and by adjustment of the control on the front panel continuous monitoring of keying is obtained at any frequency setting of the receiver.

The monitor is coupled to the crystal oscillator for a very excellent reason not apparent at first glance. The crystal oscillator is keyed and in addition runs all the time regardless of whether the crystal or the self-controlled oscillator is being
FRACTIONAL micro-volt sensitivity of "Super-Pro" means "consistent DX". With a 6 to 1 signal-to-noise ratio, sensitivity is better than 1 micro-volt. With such performance even the weakest signal can be received with a minimum of noise. Selectivity is another very important factor in weak signal reception. Here, "Super-Pro" offers variable selectivity (without crystal) from 3 to 16 kc. At 3 kc. a very large percentage of adjacent channel QRM is eliminated and the band width is still wide enough for perfect phone reception. Constant band spread, band switching, crystal filter, A.V.C., shielded input, are just a few of its outstanding features.

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NOW you can obtain G-E Pyranol Capacitors in this space-saving shape. They have all the superior qualities of the popular rectangular units—long life, small size, conservative rating, hermetically sealed. Ratings are 2, 3, and 4 mfd—600 volts; 1, 2, 3, and 4 mfd—1000 volts; 0.5, 1, and 2 mfd—1500 volts; 1 and 2 mfd—2000 volts. See your dealer or write for Bulletin GEA-3018. Radio Dept., General Electric, Schenectady, N. Y.

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New Pyranol filter capacitors for television sets are now available. Single-capacity cylindrical units in two sizes—.05 mfd, 4000 volts d.c.; and .03 mfd, 7000 volts d.c. Write for Bulletin GEA-3018.
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Available only to A.R.R.L. Members

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

Do You Wear the A.R.R.L. Pin?

THE EMBLEM, with both gold border and lettering, and with black enamel background, is available in either pin (with safety clasp) or screwback button type.

In addition, there are special colors for Communications Department appointees.

• Red enamelled background for the SCM.
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(Blue available in pin type only. Blue may be had in either pin or button style.)

THE EMBLEM CUT: A mounted printing electrotype, 5½" high, for use by members on amateur printed matter, letterheads, cards, etc.

ALL EMBLEMS PRICED THE SAME
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The stationery is standard 8½ x 11 bond paper which every member should be proud to use for his radio correspondence. Lithographed on 8½ x 11 heavy bond paper.

100 Sheets, 50c
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THE AMERICAN RADIO RELAY LEAGUE
WEST HARTFORD, CONNECTICUT

used for actual frequency control. If the self-controlled oscillator is being used the crystal selector switch can be set to a 'phone frequency crystal (one seldom used for c.w.) and the monitor set accordingly. Then, band changing or frequency change within any band will not affect the monitor setting and you can hop around to your heart's content without readjusting the monitor. (Ideal when the heat is on in a DX contest!)

CONSTRUCTION

The top view of the unit shows the general arrangement of parts. The power transformer, filter reactors, capacitors, rectifier tube and regulator tubes which make up the oscillator power supply occupy the right rear corner of the chassis. Directly in front of the regulator tubes is the space for the crystals. The photo shows this space to be rather bare, as the desired number and arrangement of crystals had not been decided upon at the time the picture was taken. However, this space will be taken up with between 12 and 15 crystals. The crystals will all be mounted in small, vertical type plug-in holders, manufactured by the Precision Crystal Laboratory. These holders occupy very little horizontal space and a large number can easily be mounted on a relatively small arc. The space allowed for crystals is large enough to take six standard tube sockets, which allows the use of six crystals in the usual horizontal plug-in holder if desired.

Directly behind the front panel on the right is the crystal oscillator tube and its associated plate coil. The self-controlled oscillator tube, its plate coil and tuning condenser are next in order. In the center of the front panel is the tuning condenser for the monitor oscillator. The monitor oscillator tube and coil are just to the left of the center, back of the front panel. Down the center of the chassis we have the two 6F6 frequency multiplier tubes and their associated plate coils, and ending up at the rear are the four lower frequency output tank coils. The fifth output coil (10 meters) is mounted under the chassis directly on the band-change switch. The 807 output tube can be seen next to the second multiplier plate coil and the output tuning condenser at the rear. The main power-supply transformer, rectifier tube, filter capacitors, and bleeder resistor occupy the left side of the chassis.

All the coils used in the unit are individually shielded, the shielding being similar to that used in modern receivers. This construction was made possible through the cooperation of the F. W. Sickles Company in the design of these coils. Each coil was carefully designed to function properly in its own shield can and is provided with easily accessible terminals which make wiring from coil taps to the band switch and other parts relatively simple.

The view of the under side of the chassis shows the arrangement of sub-chassis shielding and mounting of parts. Each stage is shielded from the others by the bent-up sections of aluminum. These sections not only provide shielding between stages but are made to constitute a separ-
DO YOU WANT TO KNOW—

How to Become a Radio Amateur?

The purpose of this booklet is to tell you, as simply and straightforwardly as possible, what amateur radio is, how one can become an amateur, how to build a simple receiver and transmitter, and how to get on the air.

This NEW EDITION of HOW TO BECOME A RADIO AMATEUR contains many more pages which means much more elaborate treatment of the subject. The receiver is a two-tube one and operates either on A.C. or from a battery supply. This receiver may be built for approximately $12.00. The transmitter described uses a 6L6 crystal oscillator with the power-supply and antenna-coupling unit on the same board, and will operate on any two bands with one crystal, and with proper crystals may be used on any band from 160 through 20 with an output of approximately 10 watts. This transmitter may be built for approximately $21.00. Information on the various antennas for the different bands is also given. A code-practice oscillator is also described and may be built for a cost of about $2.25.

Price 25c (NO STAMPS PLEASE)

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The pioneer is still the leader!

Type TL-A Dykanol
High Voltage
Filter Capacitors

Sends 2 to 70 words a minute. Entirely automatic. Speeds up reception. Good practice medium for beginners.

Gardiner-Levering Co.

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the way you'll be using it—by SOUND

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TELEPLEX CO. 79-76 CORTLANDT ST. NEW YORK, N. Y.

rate sub-assembly including the main band switch, by-pass condenser, chokes, grid leak mountings, etc. This sub-assembly construction made it much easier to mount and wire the various by-pass capacitors and switch sections.

The self-controlled oscillator grid coils are mounted directly to the 3-section switch $S_1$ which selects between crystal and self-controlled operation. The 2-section crystal-selecter switch is mounted directly below the crystal oscillator tube and plate coil. The main band-change switch has each of its sections located directly below its associated coil, making leads direct and short. The arrangement of tubes, coils and switch sections as well as shielding for the two multiplier and output stages is highly important to keep the unit free from self-oscillation. Too much care cannot be taken in keeping all leads short and in shielding the grid and plate circuits from each other. The two remaining switches shown on the front panel are the power control switches $S_3$ and $S_4$. At the time the photo was taken the 'phone switch $S_5$ had not been wired to its terminals at the rear of the chassis.

Sufficient terminals were provided to allow metering of all the plate and grid circuits. These metering terminals were located to be very handy during the adjustment period as they provided an easy means of checking what was going on in all parts of the unit.

OPERATION

To give a complete picture of the actual operation of the unit a typical set of data was taken and is shown in Table I. No actual output has been included in this table as it was felt that excitation to the output stage measured in the form of grid current was adequate proof of the output that could be expected. Actual output measurements are purely a guess unless made carefully with adequate equipment, while excitation to the output stage grid is something which can be measured accurately. Reference to the published typical operating data, Class C, on an 807 tube shows full output with 50 volts of bias. A 100,000-ohm grid resistor is used in the grid circuit of the 807 output tube and it was found that 0.5 to 0.6 milliamperes of grid current provided full output.

Examining Table I, it can be seen that regardless of which oscillator is used, extremely satisfactory operation and output are obtained on all bands including 14 megacycles. Only when using a 1.75-Mc. crystal is the excitation down to the low limit in the 14-Mc. band and even then entirely satisfactory operation is obtained. To reach 28 Mc. in the final it is necessary to double in that stage and therefore no data in the table changes from that shown for 14-Mc. operation. To produce satisfactory output where doubling to 28 Mc. in the final it was found necessary to have at least 1.5 ma. of grid current in the 807 tube and that more excitation gave still better efficiency. For 28-Mc. operation, the table shows that only 3.5-Mc. crystals or the 1.75-Mc. self-controlled oscillator should be used. Using either of these two oscillator frequencies, roughly 18 watts into a
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For some time our advertising in QST has carried a by-line reading "Number ....... in the Series entitled Radio Amateur's Library." Many requests have been received for copies of this list and now we present it in QST in its complete form — to give a comprehensive picture of our publishing services to the amateur.

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THE AMERICAN RADIO RELAY LEAGUE, INC.
West Hartford, Connecticut

Further study of the table shows the rather peculiar operation which is used when operating self-controlled. The output circuit of the oscillator is adjusted for peak operation at four times the oscillating circuit frequency, which means that when operating on 1.75 and 3.5 Mc, the grid of the first 6F6 tube has a predominance of excitation voltage at either two or four times the actual frequency it is amplifying. As can be seen from the amount of grid current obtained on the second 6F6 tube, however, there is still sufficient fundamental or second harmonic excitation available to allow the first 6F6 tube to do a nice job of amplification. In effect this demonstrates the wide-frequency pass characteristics of the semi-tuned plate circuits used, especially at the lower frequencies.

In actual operation the unit has been used to excite a final amplifier consisting of two 803 tubes in push-pull. Excellent operation has been obtained and the joy of being able to shift frequency at will with practically no effort has been a great thrill. More specifically, for the benefit of the DX man it has been found practical to shift from one end of the 14-Mc. band to the other with no tuning adjustments necessary except on the plate circuit of the 803 amplifier tubes, and even this adjustment was made after actual transmission was started. With the tank circuits of the 807 tube designed for relatively low-C operation and with this tube fully loaded, broad tuning results, and by permitting a slight rise in plate current in this tube the full 400 kc. is covered with ease. The grid circuit of the 803 final is also designed for low-C operation, and by slight over-coupling to this circuit no adjustment is necessary to cover the 14-Mc. band.

As to how well the unit fulfills the fifth requirement mentioned at the beginning, that of signal quality, general reports by competent observers indicate that the output is T9 and that no difference can be noted between crystal- or self-controlled. During the experimental stage a bad self-controlled note was traced to feed-back from the final 803 amplifier into the oscillator, by means of the supposedly cold inter-connecting power wiring. Proper filtering of these leads removed the trouble and so I am passing this bit of experience along in case others may have similar trouble.

For the first 5 to 8 minutes a drift in frequency will be observed when operating on the 7, 14 or 28-Mc. bands with the self-controlled oscillator. On 14 Mc. this drift amounts to approximately 6 or 7 kc. However, after the oscillator has warmed up, keying or long periods of no transmission will produce very little drift. Actual contacts on 14 Mc. lasting from 15 to 45 minutes have brought the report from the other end that no change in receiver tuning was necessary during the QSO.

In conclusion I might say that in order to check the design, a duplicate unit was constructed by W1BDW and it worked perfectly with only normal adjustments.
A directory of suppliers who carry in stock the products of these dependable manufacturers.
Norfolk Amateurs Prepare

(Continued from page 10)

fore should not be tuned using the neon bulb as resonance indicator.

Contacts have been made with haywire antennas at distances up to 100 miles on 1.8-Mc. 'phone. Newport News has been worked with 10 feet of antenna on one of the transmitters, a distance of about 15 miles. QSO's have been carried on around town on 1.8 and 4-Mc. 'phone with nothing but a 25-watt lamp linked to the final as a load, at distances of 1 to 3 miles. With a fairly good 80-meter antenna working against ground, contacts up to 300 miles have been had with 15 to 25 watts input on 4- and 1.8-Mc. 'phone.

The receiver situation is something that cannot be overlooked. One or two of the local hams are fortunate enough to have SW3's, FB7's or similar receivers adaptable for local portable work. For W3EEMM's portable set, an a.c.-d.c. Bosch superheterodyne chassis has been converted by the writers into a battery-operated communications receiver with excellent results. Another receiver is being "operated on" for W3BEK.

W3EEMM's receiver was one that was junked by a local radio dealer. The speaker was bad, the dial was broken and the filter condensers were shot. However, the r.f. section and the i.f. coils were in good shape and of fair construction and design. This particular receiver covers from 20 meters through the broadcast band. The band spread is not very good on 7 and 14 Mc. but is satisfactory on 3.5 and 1.75. With a few changes and the addition of a beat oscillator the set really worked well. The plate voltage originally was 105 volts from a 2SZ5 rectifier circuit. With 90 volts of "B" batteries the current drain is from 5 to about 12 ma. for the r.f. and detector tubes, the line-up consisting of a 6A8, 6K7 and 6Q7. The output tube is not used on the "B" battery supply. The beat oscillator tube is a 6K7. A small a.c. pack was built up to supply about 130 volts so that the set could be used on a.c. if available, in which case a switch cuts in the 6V6 output tube which drives a 3-inch speaker installed in the cabinet. Judging from the way this converted set works and the low cost of obtaining it and getting it to work as a ham receiver, this idea might be investigated in other localities as a possible source of supply of portable receivers. The receiver was bought for $3.00 and the cost of revamping it made the total cost about $8 or $9, including a new dial, metal carrying case and new speaker. The speaker is not necessary, but was put in so it could be used when the set was running from a.c. There are quite a few sets similar to this one that are of good construction and which are adaptable to such a conversion.

Several of these portable rigs have been carried out in the field and operated emergency style, and it looks as if the situation here is well in hand. If we don't have a hurricane or something to necessitate the operation of our portable net, we are going to whip up a storm or two just for the fun of it!
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(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in radio
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40 and 80 watts, $1.60. Fracture resisting, high activity type,
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Edison, Havana, Cuba; Frank Ansarine, 1560 Broadway, Room
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HIPOWER LOW DRIFT CRYSTALS:
within 10 kc. or Choice of stock
AH-10, 1700-3500 kc. bands $2.35
AH-10, 7000-7300 kc. bands 3.90
WRITE FOR NEW LITERATURE
Hipower "Low Drift" Broadcast and Commercial Crystals Are Approved by F.C.C.
Hipower Crystal Co., 2035 Charleston St., Chicago

VIBRATOR POWER SUPPLY

COMpletely FILTERED
D.C. OUTPUT

Unequalled for portable transmitters — giving high output of 30 to 40 watts after filtering. Inexpensive. Engineers for extra long life and heavy duty applications. Variable output range from 250 volts D.C. to 330 volts at 12 MA. Completely filtered for RF interference. Sent post card for FREE Illustrated and technical catalog. DC to AC Converters recommended by Hallicrafters and other leading manufacturers.

ELECTRONIC LABORATORIES, INC., Indianapolis, Indiana

A GOOD NAME

... means that users are satisfied. You too, will be satisfied with the perfect performance of dependable Ken-Rad Radio Tubes. Get better results and more enjoyment out of radio with Ken-Rad Tubes.

Ken-Rad Radio Tubes

KEN - RAd TUBE & LAMP CORPORATION - OWENSBORO, KY.
Manufacturers of all types of radio tubes and Ken-Rad Electric Lamp Bulbs

Say You Saw It in QST — It Identifies You and Helps QST
Your Nearest Dealer Is Your Best Friend

Your nearest dealer is entitled to your patronage. You can trust him. He is equipped with a knowledge and understanding of amateur radio. He is your logical and safe source of advice and counsel on what equipment you should buy. His stock is complete. He can supply your needs without delay. His prices are fair and consistent with the high quality of the goods he carries. He is responsible to you and interested in you.

Patronize the dealer nearest you — You can have confidence in him

<table>
<thead>
<tr>
<th>CHICAGO, ILLINOIS</th>
<th>KANSAS CITY, MISSOURI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allied Radio Corporation</td>
<td>Radiolab</td>
</tr>
<tr>
<td>833 West Jackson Blvd.</td>
<td>1515 Grand Avenue</td>
</tr>
<tr>
<td>Complete standard lines always in stock — W9IBC, W9DDM, W9GEZ</td>
<td>Amateur Headquarters in Kansas City</td>
</tr>
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<thead>
<tr>
<th>MILWAUKEE, WISCONSIN</th>
<th>MINNEAPOLIS, MINNESOTA</th>
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</thead>
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<tr>
<td>Radio Parts Company, Inc.</td>
<td>Lew Bonn Co.</td>
</tr>
<tr>
<td>538 West State Street</td>
<td>1124-26 Harmon Place</td>
</tr>
<tr>
<td>Complete stock Nationally Known products</td>
<td>W9BP — W9TLE — W9HOP — W9DKL — W9LEX</td>
</tr>
</tbody>
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<tr>
<th>OAKLAND, CALIFORNIA</th>
<th>SAN FRANCISCO, CALIFORNIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offenbach Electric Company</td>
<td>Offenbach Electric Company, Ltd.</td>
</tr>
<tr>
<td>2085 Broadway</td>
<td>1459 Market Street</td>
</tr>
<tr>
<td>&quot;The House of a Million Radio Parts&quot;</td>
<td>&quot;The House of a Million Radio Parts&quot;</td>
</tr>
</tbody>
</table>

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<tr>
<th>SEATTLE, WASHINGTON</th>
<th>ST. LOUIS, MISSOURI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Radio Company</td>
<td>Van Sickle Radio Company</td>
</tr>
<tr>
<td>2908 Fourth Avenue</td>
<td>1113 Pine Street</td>
</tr>
<tr>
<td>W7AVC, W7RF, W7AWP to serve you</td>
<td>W90WD invites you to amateur headquarters in St. Louis</td>
</tr>
</tbody>
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<tr>
<th>TORONTO, CANADA</th>
<th>TORONTO, ONTARIO, CANADA</th>
</tr>
</thead>
<tbody>
<tr>
<td>101 Queen Street, West</td>
<td>1133-37 Bay Street</td>
</tr>
<tr>
<td>Canada's foremost radio supply house</td>
<td>Canada's Largest Radio Parts Distributors — VE-3XB</td>
</tr>
</tbody>
</table>

| WINNIPEG, CANADA | |
|----------------| |
| Electrical Supplies, Ltd. | |
| 306-10 Ross Avenue | |
| Western Canadian Amateur Headquarters for leading lines | |

Say You Saw It in QST — It Identifies You and Helps QST
You Are Protected When You Buy From QST Advertisers

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

Quoted from QST's advertising rate card.

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

fine, modern performance, with a reputation on the air. Let this be said of your layout this coming year.

(Above)

RME-69 with DB-20 PRE-SELECTOR

Combined in one cabinet, presenting fine appearance and fine performance. Choice of black or gray crinkle finish. Two chasses mounted in the one housing. Antenna change-over switch standard equipment. A very popular combination.

(Right)

Relay Rack Receiver Combination consisting of RME-69 Single Signal Super Receiver with noise suppressor built in. The 510X Frequency Expander is mounted at the left of the middle panel, and the DB-20 Preamplifier at the right. The 8" permanent-magnet Dynamic Speaker is mounted on the upper panel. A rotary antenna change-over switch is incorporated on both the 510X and the DB-20.

Details gladly furnished on request

RADIO MFG.
ENGINEERS, INC.
111 Harrison Street
Peoria, Illinois
One of the Best Buys in Transmitter Kits

HIGH POWER AT LOW COST

BUY EACH SECTION AS YOU NEED IT

Highly efficient stable circuits—Simple to wire—Large etched panels—Modern chrome fittings—Gray crinkle finish—Compare!

**UPPER SECTION**

**SX-200** The UTC SX-200 transmitter kit is used in conjunction with the SX-80 or any similar exciter having a power output of 40 watts or more, to form a complete 300 watt CW transmitter. When supplemented by the S-100 modulator it becomes a 200 watt phone transmitter. It will operate on all frequencies up to 30 megacycles and incorporates a highly efficient power supply. Tubes required are two 866A's and four 809's. This unit is supplied completely mounted, ready to wire, including cabinet and accessories, less meter, crystal and tubes.

**Amateur Net Price** ........ $43.50

**MIDDLE SECTION**

**SX-80** The UTC SX-80 kit is a complete 80 watt CW unit. Operation on all bands is obtainable with plug-in coils. A rugged power supply is provided. The kit may be used as a complete 80 watt CW unit or as an exciter for a high power final. Tubes required are three 6L6G's and one 83. This unit is supplied completely mounted, ready to wire, including cabinet and accessories, less meters, crystal and tubes.

**Amateur Net Price** ........ $37.50

**LOWER SECTION**

**S-100 AUDIO AMPLIFIER** The S-100 audio amplifier is an ideal low priced high power unit. 100 watt output is provided with gain sufficient for crystal mike. Dual input and tone control is provided and universal modulation output transformer. Tubes required are one 6J7, one 6CS, two 6F6's, four 6L6's and three 83's. The kit is supplied completely mounted, ready to wire; including all accessories, less tubes and dust cover.

**Amateur Net Price** ........ $52.50

**TOTAL COST** ........ $133.50

**UX-25**

The UTC SX-25 kit represents unprecedented value in a low power transmitter. It employs a crystal controlled oscillator of high power output and stability and will operate on all bands from 160 to 10 meters. Tubes required are one 6L6 and one 83. The unit is supplied completely mounted with self-contained power supply and antenna tuning condenser, ready to wire, including cabinet and all accessories, less meter, tubes and crystal.

**Amateur Net Price** ........ $18.00

**UNITED TRANSFORMER CORP.**

72 SPRING STREET • NEW YORK, N.Y.

QST for September, 1938, CENTRAL Edition
This is only a small part of National's complete line of Transmitting Equipment

TO SAVE HEADACHES . . . Completely engineered components such as the NTE Exciter (1) and the NSA Speech Amplifier (5) take most of the grief out of transmitter construction. Both are universal in application, and offer the kind of performance that can be achieved only with the most complete laboratory facilities. Like a good receiver, they represent a long term investment.

Both units incorporate a high gain speech amplifier with 10 watts of push pull 2A3 Class A output for the NTE and 12 watts for the NSA, sufficient to modulate a low power final or drive a high power Class B modulator. The NTE also provides a crystal-controlled oscillator with three frequency-multiplier stages, selected by a push switch on the panel. A control is also provided for selecting any of four crystals, or for tuning a "rubber" crystal.

TO SAVE HARD LABOR . . . National Foundation Units, such as the NT-100PC Buffer and Final (2) and the NT-300PC Modulator take the blacksmithing out of transmitter construction. These chassis come completely drilled, punched, welded, painted, and engraved ready to assemble the parts in place. They are versatile enough to allow the constructor freedom in building to his own particular requirements, yet are based on a standardized design so carefully worked out that even the beginner can proceed with confidence.

FOR BETTER OPERATING . . . Oscilloscopes Type CRR (4) and CRM (6) are typical of National's aids to good operating. Type CRR is mounted on a standard 3½" relay rack panel and uses a 2" tube. Type CRM is housed in a small cabinet, and employs a 1" tube. Both have built-in power supplies and 60-cycle sweeps, and both are very low in price.
HERE'S WHY WITH THE RCA-809

YOU SAVE because your driver stage costs less. For class "C" Telegraphy, two RCA-809's have a power output of more than 100 watts with only 5 watts driving power. An RCA-802 Crystal Oscillator will easily drive two RCA-809's.

YOU SAVE because your power supply and amplifier equipment cost less. Since the RCA-809 is a tube of high perveance, you get good performance with low plate voltage. Your transformers, capacitors, and other power-supply equipment cost less.

YOU SAVE because the RCA-809 costs less. The RCA-809 is a precision-manufactured Transmitting Tube having exceptionally long life that gives you outstanding performance at a Receiving Tube price: Price $2.50. Ask your distributor for full information regarding this winner and money-saver, or write to Commercial Engineering Section, Harrison, N. J.

RCA MANUFACTURING CO., INC., Camden, N. J.

A Service of the Radio Corporation of America

TYPICAL OPERATION (Class "C" Telegraphy—per tube)

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<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Filament Voltage</td>
<td>6.3 6.3 Volts</td>
</tr>
<tr>
<td>D-C Plate Voltage</td>
<td>500 750 Volts</td>
</tr>
<tr>
<td>D-C Grid Voltage</td>
<td>-50 -60 Volts</td>
</tr>
<tr>
<td>D-C Plate Current</td>
<td>100 100 Milliamperes</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>25 25 Watts</td>
</tr>
<tr>
<td>Driving Power (Approx.)</td>
<td>2.5 2.5 Watts</td>
</tr>
<tr>
<td>Power Output (Approx.)</td>
<td>35 55 Watts</td>
</tr>
</tbody>
</table>


RCA presents the Magic Key every Sunday, 2 to 3 P. M., E. D. S. T. on the NBC Blue Network