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Editorial and Advertising Offices
38 La Salle Road, West Hartford, Conn.

Subscription rate in United States and Possessions and Canada, $2.50 per year, postpaid; in other countries, $3.00 per year, postpaid. Single copies, 25 cents. Foreign remittances should be by international postal or express money order or bank draft negotiable in the U. S. and for an equivalent amount in U. S. funds.


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

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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 listed. Mail your S.C.M. (on the 16th of each month) a postal covering your radio activities for the previous 30 days. Tell him your DX, plans for experimenting, results in phone and traffic. He is interested, whether you are an A.R.R.L. member or get your QTH at the news stand; 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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ONE of the valuable services that A.R.R.L. has arranged for amateur radio is the transmission of standard frequency signals. Three specially-equipped stations, W1XP on the Atlantic, W6XK on the Pacific and W9XAN in the middle west, afford the entire country a highly accurate calibration service at frequent intervals. Prearranged schedules are announced in each issue of QST. Week after week, year after year, the highly skilled personnel of these stations is doing a painstaking job to help amateur radio. Thousands of reports from amateurs prove that the service is used and appreciated.

Any amateur anywhere in the country can receive the signals for the calibration of frequency meter, monitor or receiver — that is, when QRM is not too bad. Many of the reports received show calibration points missed because of intense interference from amateur signals and we have received numerous letters protesting the discourtesy of transmitting during these short periods. Remedies are suggested ranging all the way from pleas for coöperation to the suggestion that the Federal Radio Commission declare a compulsory silent period during the transmissions. While not believing in the latter suggestion, we are strong for coöperation, and indeed it does seem a shame that the value of these signals should frequently be lost through transmissions that might just as well be postponed a few minutes. We have often remarked that ham radio consists of people with every conceivable interest in amateur radio and we know that not everyone is interested in calibration signals, and that even those interested do not check their calibrations at every s. f. transmission. Nor is there necessity for all of amateur radio to pipe down during these transmissions. Stations on frequencies well removed from the standard frequencies are not likely to cause interference. But stations operating on or near the transmitted frequencies (round hundreds of kilocycles) are certain to cause serious interference. If the amateur operators of such stations desire to do the courteous thing by the rest of the fraternity, they will watch the schedules of transmission and forego operating their own transmitters during that period. Not during the whole schedule; it is important only during those few minutes that that particular standard frequency is being sent. That isn't too much to do, is it?

It is remarkable how much interference the standard-frequency transmissions will stand without completely losing their value. The reasonably skillful amateur should not abandon a calibration party as hopeless in the face of intense interference. There is small likelihood of a transmission being found completely useless through interference, since only a small part of the total transmission is necessary to make a calibration. During the three-minute transmission there is almost always a lull sufficiently long to identify the signal and tune it in accurately. The transmissions can frequently be identified only by their timing, so that sometimes a calibration point can be got through interference so tough that not a letter of the transmission is actually readable. But under those difficulties how one does wish that the several hundred hams who seem to be squatting on that particular standard frequency would be kind enough to fold up for just a few minutes!

It isn't always possible to receive the particular s. f. station you set out to get, on the band you have in mind. Transmission conditions vary too. It is for the very reason of as-
suring service that there are three stations. For instance, at the moment of writing WIXP's performance is curtailed because of trouble with its primary frequency standard, but W9XAN still supplies eastern needs. It is more difficult, though, and the circumstances make cooperation in minimizing interference even more important.

To you fellows on or near a transmitted frequency: considering the desires of your brother amateurs to receive calibration signals, and considering the thankless grind of service being performed by these three stations to help all of us, how about resolving to consult the schedules and stay off the air those few minutes? It will make a swell New Year's Resolution!

K. B. W.

The Tenth Anniversary of Transocean Work


THE headlines of ten years ago!! "1IMO and 1XAM Work French 8AB. Transatlantic Amateur Communication Accomplished; One Hundred Meters Does the Trick on November 27, 1923."

A decade ago we reached an important milestone in amateur history. Those were glamorous days. Transocean work was a striking, unknown, feat. It marked the discovery and exploitation of the high frequencies, making "spark sets" and "above 200-meter" operation definitely obsolete. The drift to c.w. became a stampede. There was a rush to make new high frequency records, a rush to higher and higher frequencies. On and on it went to new countries, new bands. Commercial "heavy" equipment was made obsolete overnight; 7-mc. band frequencies were popularized; 14-mc. daylight transcontinental work came into its own. All oceans were spanned. On and on, a decade of progress and development in amateur radio has now been completed. It started with A.R.R.L. Tests and the startling news of the first high frequency successes of 1923-1924.

Important tenth anniversaries:

<table>
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<th>Country</th>
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<td>U.S.A.-France</td>
<td>Nov. 27, 1923</td>
<td>u1MO-1XAM-8AB</td>
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<tr>
<td>U.S.A.-England</td>
<td>Dec. 8, 1923</td>
<td>u1MO-g2KF</td>
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<td>Italy-England</td>
<td>Dec. 9, 1923</td>
<td>11MT-g2HF</td>
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<td>Dec. 27, 1923</td>
<td>u2AGB-PCHI</td>
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<td>Canada-England</td>
<td>Dec. 28, 1923</td>
<td>c1BQ-g2BV</td>
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<td>U.S.A.-Italy</td>
<td>Jan. 25, 1924</td>
<td>u2AGB-g1XW-AAS</td>
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<td>U.S.A.-NZ</td>
<td>Sept. 21, 1924</td>
<td>u2CGW-2BCP-z4AA</td>
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We started to list anniversaries, but the list is a long one. In the early months of '24 literally hundreds of transatlantic contacts were made. Schedules were kept night after night, friendships started, traffic handled. It is our suggestion that every individual who had any part in this work, and many are active in amateur radio to-day, attempt to renew these international friendships on the tenth anniversary of their inception, or in the first half of January which has been set aside for general and informal transocean DX work.

We wish every old timer who keeps active would inform us what success he has in renewing his European amateur friendships. A.R.R.L. Headquarters is attempting to notify individuals prominent in this early work, so that letters may be written and formal duplication of the early contacts made on to-day's frequency bands. We are also writing representative European amateur societies to the effect that this announcement will appear in QST. It is hoped that a revival of interesting two-way DX work between W/VE and European hams may take place during this tenth-anniversary season.

It is an opportunity for old timers to stage a real Old Timers DX Party (January 13-15) and we hope many can arrange to take advantage of this occasion. With the cooperation of foreign sister societies, new amateurs in North America and Europe alike may also take advantage of these January tests to reproduce a reincarnation of the days of '23-24. The eleven-year sunspot cycle brings us ideal DX conditions. Let us reestablish old bonds and weld new ones by establishing new trans-ocean friendships in this period. As the old year passes out and brings in the new let us work some interesting international DX to "start the new year right." Don't forget to send the A.R.R.L. Communications Department your QSL with a brief note of the DX calls you worked, with comments on how you celebrated the tenth Anniversary of Two-Way International DX.

— F. E. H.
An Efficient C.W. and 'Phone Transmitter
Using the New Tubes and Circuits

The Speech Amplifier and Class-B Modulator Unit

Part II*

By L. C. Waller, W2BRO**

Two 800's in Class B constitute a suitable combination to modulate the 200-watt input Class-C stage, since they are capable of delivering approximately 90 useful watts of audio power. Two of the new 2A3's in push-pull are admirably suited for the driver stage and are used in this modulator.

Among the more important considerations for any Class B modulator are the input and output transformers. If these transformers are incorrectly designed, a high-quality speech amplifier and a good power supply will be of no avail as far as good quality is concerned. In the tube data sheet accompanying the 800 we read, "The input transformer should be designed to give good frequency response when operated into an open circuit, such as that represented by the grid circuit of the Class-B stage when the signal amplitude is small, and also to handle the required input power for a strong signal." The first stipulation means, in effect, that the inductance of the input-transformer primary should be large enough to provide an inductive reactance at low frequencies equal to not less than twice the plate-to-plate resistance (in this case 4 × 800 = 3200 ohms) of the driver stage; also, since it is difficult to compensate for leakage reactance of the input-transformer without excessive loss of high-frequency response, the leakage inductance of the transformer should be as low as possible. Because leakage inductance is proportional to the inductance of the primary, the latter inductance should not be made greater than necessary to obtain good low-frequency response as outlined above.

If low distortion is to be obtained, the driver tubes should be worked into a load resistance higher than the normal value (approximately twice) recommended for optimum power output as a Class-A amplifier, since distortion produced by the driver stage as well as that by the power stage will be present in the output. The input transformer, since it must handle power when the Class-B grids are swung positive, should have a reasonably high peak-power efficiency. The input transformer used in the modulator has a turns ratio, total primary to ½ secondary, of 2:1 and has a rated total primary inductance of 30 henrys at full signal (higher at low signals). Therefore, the primary's inductive reactance at 60 cycles is 

\[ X_L = 2\pi fL = 2 \times 3.14 \times 60 \times 30 = 11,304 \text{ ohms} \]

Before purchasing Class-B transformers it would be well to check their ratings, since a skimpily designed unit, either input or output, may impair quality and reduce output.

Reading further in the 800 data sheet, "The output transformer should be so designed that the resistance load presented by the modulated Class-C amplifier is reflected as a plate-to-plate load of 12,500 ohms in the Class-B stage for the 1000-volt conditions. The ratio of the output transformers, and any other R-C coupling, should be kept as low as possible in order to keep the output capacitance small."

* Part I, describing the companion r.f. unit, appeared in Dec., 1933, QST.
** RCA Radiotron Co., Inc., Harrison, N. J.
The output transformer used in this modulator was designed to meet these specifications. An idea of its size may be gained from the photograph by comparing it to a 2A3 or an 800. It is obviously much larger than a power transformer of equal rating (approximately 100-watt)—a rough way, incidentally, of checking up on Class-B output transformer design.

It is small wonder, when the more important considerations of high-quality Class-B audio amplification are reviewed, that many Class-B modulated 'phones are noted for fuzzy, rattly and generally poor quality. The trouble is not with the Class-B system itself, except that it may be more critical than Class-A systems as regards the correlation of the various parts. Almost anyone can rig up a tube with any old transformer or choke and get "good" to "fair" quality from a Class-A system. This is fortunate because of the fact that, although many of our fraternity know what to use for a given type of apparatus, they frequently find it necessary to use the parts on hand. As one amateur has put it, "If I haven't got what I want, I'll want what I have." Such philosophy, however, doesn't work with Class-B systems of modulation. Each part, from the driver stage to the high-voltage power supply, is not only important, but its correct functioning depends upon some or all of the other components. Therefore, unless all of the necessary parts are available, it is not a good plan to start building a Class-B modulator. A single weak link in the chain may ruin results.

Now for the more cheerful side of the picture: A Class-B modulator using properly designed parts can be made to give excellent quality (5 to 7% total harmonic distortion). In addition, as has been explained in previous articles in QST, Class-B systems are far more economical than comparable Class-A systems. Compare the size and cost of the modulator shown in the photograph to any Class-A system that will deliver 90 to 100 watts of audio output!

The next important consideration is the speech amplifier required to furnish the voltage gain necessary from the microphone to the grids of the 2A3 driver stage. The amplifier, because of varying voice input levels and to allow for a variation in microphone sensitivity, should have from 30 to 100 per cent more gain than the maximum value determined by calculation. It is always an easy matter to reduce the gain with the volume control, but when the control is wide open and the gain is still insufficient, a new speech amplifier may have to be constructed. On the other hand, an amplifier which has 5 to 10 times as much gain as necessary may cause trouble due to a.f. and r.f. feed-back, with attendant motor-boating and "peanut whistles."

The following procedure for determining the necessary voltage gain is quite simple and is typical regardless of what types of tubes, or how many of them, are used. The microphone used with this amplifier at W2BRO is the W.E. 600-A, which is similar to, and the successor of, the Type 387. The obtainable voltage output of the 600-A, as given by an authority believed to be competent, is approximately 0.015 volts. The microphone transformer has a turns ratio of 1:27, which may be assumed to be the voltage step-up of the transformer. Therefore, the voltage at the secondary is 0.015 × 27 = 0.4 volt. This is the input voltage used in the amplifier calculations.

The 2A3's in push-pull require a bias of -45 volts and likewise a peak grid voltage of approxi-
mately 45 (slightly less than 45, because their filaments are a.c. operated). This is 45 volts per grid, or 90 volts from grid to grid across the total secondary of the push-pull-2A3 input transformer. The overall voltage gain necessary in the amplifier is, therefore, 90/0.4 or 225. A Type 57 as a screen-grid a.f. amplifier is easily capable of a gain of 100.1 This is too little; adding a Type 27 tied together, providing a high-mu triode. A plate load resistance of 15,000 to 30,000 ohms will prove satisfactory, the exact value depending on the plate-supply voltage and the amplifier requirements.

Fig. 2 shows the complete speech amplifier and modulator circuit. Grid and plate circuit decoupling filters are used in both of the 56 stages—

| Resistance-coupled will give approximately 7 × 100; this is too much. Two 56's resistance-coupled are capable of giving a gain of 100, that is, 10 per stage. Now, if the second 56 is transformer-coupled to the 2A3's with a 1:3 input transformer, the overall gain will be approximately 100 × 3, or 300; this gain proves satisfactory. A glance at the voltage gain and voltage output diagram in Fig. 1 shows how the 0.015-volt output of the mike is built up to 60 volts per grid at the 2A3 stage. Since only 45 volts are needed, the gain control may be adjusted to approximately 45/60 or 3/4 of maximum setting, for normal voice levels.

If a gain of 750 had been desired, the first 56 could have been replaced by a Type 53, which is capable of giving a gain of approximately 25. Thus, 25 × 10 × 3 = 750. Two 53's would give 25 × 25 × 3 or 1875. For this class of service, the 53 is operated with the grids of the two triode units tied together and with the two plates also tied together, providing a high-mu triode. A plate load resistance of 15,000 to 30,000 ohms will prove satisfactory, the exact value depending on the plate-supply voltage and the amplifier requirements.


**FIG. 2—CIRCUIT OF THE SPEECH AMPLIFIER AND MODULATOR UNIT**

- T1—Double-button microphone transformer
- T2—Push-pull input transformer
- T3—Class-B input transformer
- T4—Class-B output transformer
- M—Type 690-A double-button microphone
- B—Medium-size 63 volt "B" battery
- L—8 mh. r.f. choke
- R1—100-ohm potentiometer
- R2—50,000-ohm 1-watt resistor
- R3—500,000-ohm 1-watt resistor
- R4—2800-ohm 1-watt resistor

**THE LAYOUT**

The complete speech amplifier and modulator unit is built in breadboard fashion, similar to the r.f. unit. A general idea of the arrangement of the parts can be obtained from the photograph. Trouble from a.f. feed-back due to the proximity of the output transformer to the low-power a.f. stages was half-expected, but fortunately failed to materialize when the apparatus was put in operation. If trouble from this source does occur, the output transformer should be rotated to a

January, 1934
CONDENSERS, RESISTORS AND R.F. CHOKE ARE MOUNTED UNDER THE BASEBOARD ACCORDING TO CONVENIENCE
a check!). In the first test of the speech amplifier, hum was objectionable. Two 8-µfd. electrolytic condensers added to the 300-volt-supply filter system corrected this difficulty. The circuit of the 300-volt supply is given in Fig. 3. A magnetic phone should be connected to the Class-B input-transformer secondary, since the impedance match is fair, and the gain control set at minimum. Headphones are better for this test than a speaker, however, because acoustic feed-back to the microphone is probable with the latter. In this connection it may be of interest to note that the turns ratio of the input transformer is about right for use in grid-bias modulation circuits. With two 2A3 drivers, a grid-modulated 'phone of fairly good quality can be arranged with almost any good c.w. transmitter of the type employing Type '03-A, 52 or '04-A r.f. amplifier tubes.3

If the quality sounds reasonably good at the output of the 2A3's, the Class-B stage may now be checked. For the initial test it is well to substitute a 5000-ohm 100-watt resistor as load across the paralleled secondaries of the output transformer. The two secondaries are marked 1-2 and 1-2; they must be connected 1 to 1 and 2 to 2 (aiding) for a 5000-ohm load, as shown in Fig. 2. The grid bias battery of 63 volts should next be connected and the bias voltage measured between each grid and ground. The 1150-volt supply is then applied to the plate. The no-signal (static) d.c. plate current is about 30 ma. When the gain control is advanced, a reasonable voice signal should swing the d.c. plate current over 160 ma. The secondary load resistor should show signs of dissipating about 100 watts—approximately 140 ma. (0.14 amp.) a.c. through the load circuit, as measured by a thermo-couple ammeter, with steady sound input.

TUNING UP THE CLASS-C STAGE

The Class-C amplifier is next put in operation. Further tests with the 841 buffer show that while it delivers ample r.f. excitation to the final amplifier for c.w. work, it has to be cajoled somewhat to furnish enough for plate-modulated telephony. The 841 is used successfully at W2BRO, but an 800 substituted in its place with 70 watts input delivers the necessary excitation without cajoling! Tests indicate that at least 20 ma. d.c. grid current per tube (40 ma. in the common grid return of the 800's) is necessary for Class-C plate modulation. If the excitation is insufficient, unsymmetrical modulation and poor quality are sure to result in addition to the emission of a broad, interfering signal.

While the modulator and Class-C amplifier adjustments are being made, the antenna coil should be connected to a 100-watt lamp as a dummy antenna, instead of to the antenna feeders. Remember the Golden Rule! A lot of needless QRM in our crowded 'phone bands can be eliminated in this manner, as has been emphasized many times before in QST. The lamp can be clipped across about two turns of the antenna coil; on modulation, the bulb becomes "dangerously" bright.

It should be remembered that the Class-C radio-frequency amplifier in this case is supposed to present a resistive load of 5000 ohms to the modulator; but a Class-C amplifier does not behave like a resistive load unless it is operating truly Class-C. This means sufficient excitation, as indicated by d.c. grid current, with proper bias. Increasing the grid current by reducing the bias is not generally conducive to satisfactory results. If the grid current is too low at rated bias and rated d.c. plate input, the power output of the buffer stage must be increased. The 800's with 1000 volts on their plates, require -135 volts bias. A little more rather than a little less bias is desirable. The 1150-volt supply recommended provides 150 volts for the bias drop through the self-bias resistor and leaves about 1000 volts for the plate. To provide a 5000-ohm load for the modulator, the Class-C stage output load ought to be adjusted to make the plate current,

$$I = \frac{E}{R} = \frac{1000}{5000} = 0.2 \text{ ampere, or 200 ma.}$$

Since the maximum rating of the 800 is 80 ma. per tube, or 160 ma. for two tubes, it is preferable to adjust the amplifier to that value. This makes the equivalent resistance (or "modulation impedance") of the Class-C stage somewhat higher than 5000 ohms, but it is not sufficiently different to impair results.

The output transformer is also designed to take

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the microphone is spoken into is a sure sign of lop-sided modulation and poor quality.

If the antenna current "modulates down" (rare occurrence, these days), there may be insufficient r.f. excitation or too little grid bias on the Class-C stage; or the antenna may be drawing too much power. Loosening the antenna coupling and reducing the feeder current may help. If the excitation on the Class-C stage is ample, an increase in grid bias and the corresponding decrease in plate current may give better results.

All r.f. circuits should be accurately tuned to resonance. The neutralization of the Class-C amplifier should be as nearly perfect as possible. In any event, trouble is more likely to be encountered in the r.f. portion of the transmitter than in the modulator, especially if the d.c. plate current of the latter is swinging to its proper maximum value. If the circuit of the modulator is followed and the parts are properly correlated, little trouble is likely with that unit. As a matter of fact, when correctly designed parts (especially transformers) are at hand, it is as easy, or easier, to get a Class-B modulator to work properly than one operated Class-A.

The complete 'phone transmitter as described is exceedingly light and movable, considering its power output capabilities. When conditions on the 14-mc. band are reasonably good, daylight coast-to-coast 'phone contacts with good signal strength at the other end are nothing out of the ordinary. The quality obtained with this rig is good even beyond expectations. All reports received have been highly pleasing. The best one, however, came from our old friend W2JN (Charles Atwater, of N. B. C.) of ten-meter fame. Said Charlie, "Your quality is excellent"—and with that from Charlie, little is left to be desired!

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Oklahoma State Convention
(\text{West Gulf Division})

\textbf{PLACE:} Ponca City, Okla.
\textbf{HEADQUARTERS:} Jens Marie Hotel.
\textbf{DATE:} January 20th-21st.
\textbf{AUSPICES:} Key Clickers.

R. O. Miles, Convention Manager, 1402 South Fifth St., Ponca City, Okla., will give you further information if you write him.

\textbf{Strays} ♬

\textbf{QST Index (1933)}

The annual index to \textit{QST} for 1933 (Volume XVII) was published as part of the December issue, and sent to every member of the League. News stand readers may obtain a copy of this index for 6 cents in stamps.

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\textsuperscript{2} Lamb, "A Modulation Monitor," \textit{QST}, April, 1933; and note concerning, page 11, May, 1933.
A Practical Transmission-Line System for the Doublet Antenna

A Different Solution of the Impedance-Matching Problem

By E. F. Johnson* and Ralph P. Glover**

EFFICIENT operation of any transmitting antenna system requires that the radiator be hung in free space. But it is probably a matter of universal experience that free space and transmitter location seldom coincide; the amateur is rarely able to base his selection of a home site on suitability for radio transmission. The solution is to put the antenna in the best approximation of free space within a reasonable distance of the transmitter, and then connect antenna and transmitter in the most efficient manner possible. The receiving antenna system comes in for similar treatment.

The connecting link between antenna and transmitter or receiver is most logically a transmission line of some sort, whose function is purely to transfer power without forming a portion of the radiating or collecting system. This article is concerned mainly with practical designs for use with the popular half-wave Hertz antenna (doublet) in transmitting applications.

TYPES OF LINES

Transmission lines in which two conductors are employed fall into two general classifications. The first is the open-wire type, which may consist either of spaced bare wires, either straight or transposed, or of insulated twisted pair. The second type is the concentric tube line, in which the outer conductor is a tube which encloses the concentric inner conductor. Such a line is really a single-conductor cable with a sheath used for a return path. In both types the insulation between conductors may be either solid dielectric, or, what is better for r.f. work, air. Both open wire and concentric lines have well-defined places in radio communication. The open-wire type, however, works out to be the more practicable type in amateur communication.

Let us consider the various forms of open-wire lines. We want the line to be balanced to ground, to radiate as little as possible, and to have minimum electrical losses. Some means for impedance-matching to the antenna—preferably a simple means—must be provided.

TRANSPOSED LINES

Most amateur feed lines, probably through sheer habit, are non-transposed lines with about 6-inch conductor separation. For end-fed Zeppelin systems, where there is a standing wave on the line, this method is entirely suitable and may possibly have advantages over the transposed line. The wide spacing is conducive to peace of mind, especially in high-power transmitters where voltage maxima attain husky proportions.

Transposed lines, however, have several advantages over straight non-transposed lines for feeding symmetrical radiators such as the doublet. Theoretically, frequent transposition makes the capacitance between each side of the line and ground approximately the same, a factor which becomes more and more important as the operating frequency increases. Currents flow not only along the transmission line, but also to a certain extent from the transmission line to ground through capacitance paths. If the capacitance between each side of the line and ground is not the same, differential currents will flow. Then, the transmission line radiation goes up, because the unequal line currents produce unequal fields which do not cancel out. Such unbalances are more likely to exist with non-transposed lines than with transposed lines, especially if the line

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takes an indirect path to the transmitter, or if one of the conductors is appreciably closer to earth or to earthed objects than the other.

Transposition is accomplished by means of insulators, spaced at regular intervals along the line, so that the conductors cross over at each point of transposition. Thus each conductor occupies alternate sides of the line in successive sections. The usual block type transposition insulators have necessitated rather sharp bends in the wires where they pass through the slots, thereby introducing stresses which all too often have resulted in broken conductors after a short period of service. A newer type skeletonized transposition insulator eliminates sharp bends and keeps the wires in a continuous line throughout their length. The skeleton-type construction reduces weight and affords a long surface-leakage path. The conductors are spaced two inches and the line impedance for any particular wire size can be determined from data to be given.

The close spacing of wires with insulators of this type reduces line radiation considerably. Since line radiation is proportional to the square of the spacing, conductors spaced two inches will radiate only one-ninth as much as those spaced six inches.

**LINE IMPEDANCES**

Any uniform transmission line whose length is appreciable, compared to a wavelength, has a definite surge impedance or characteristic impedance whose value is mainly determined by the ratio of inductance to capacity per unit length of the line. The subject of line impedance has been discussed in a number of previous articles in *QST* and the reader who wishes to review the subject should consult these references. The important point is, that for best efficiency the terminal equipment must be arranged to match the line impedance. In other words, there must be an impedance match at the junction of the antenna and line if we make the line exactly a half-wavelength long (current feed), but this length may not be convenient for the particular installation and the line losses will be greater. There are no restrictions on the length of the line when impedances are carefully matched all the way through.

Impedance matching can be accomplished experimentally (which is actually what we do when we adjust coupling at the transmitter end of the line). Or we can calculate the line impedance and then figure out some means of matching the line to the antenna. A few calculations will save a great deal of wasted time. The radiation resistance of a conventional half-wave doublet, plus ohmic and loss resistances, is known to be about 75 ohms. At radio frequencies the impedance of a parallel-conductor two-wire line using round conductors can be computed from the diameter of the wire and center-to-center spacing by means of the well known formula:

\[
Z_0 = 277 \log_2 \left( \frac{2S}{D} \right)
\]

where \(S\) is the separation of wire centers and \(D\) is the conductor diameter, both \(S\) and \(D\) being expressed in the same units (inches, millimeters, etc.). This formula holds only where the dielectric is air and hence cannot be used for twisted pair lines with solid insulation. The results, however, are quite close for the usual types of lines employing feeder spreaders or transposition insulators.

The chart of Fig. 1 shows computed line impedances for practical sizes of wire and copper tubing, plotted against spacing in inches, thus making calculations unnecessary. For example, suppose the feeder spreader spaces the wires 6 inches and the conductors are No. 12 B & S. The ordinate of the curve for No. 12 wire with 6-inch spacing is 600 ohms, which is the line impedance. The curves show that the line impedance goes down as we reduce the spacing or increase the conductor diameter. Now to prevent mismatching loss, we ought to have a 75-ohm line to connect to our 75-ohm doublet; but the curves indicate that we are to be disappointed in this respect. Half-inch copper tubing will bring the
impedance down to a minimum of 160 ohms. If No. 10 wire is used and the spacing made 2 inches, which is about the practical minimum for small wire sizes, the line impedance is 440 ohms or nearly 6 times the value sought! If such a line were connected directly to the doublet there would be a reflection loss of approximately 3 db due to mismatching at the junction of feeder and antenna. This corresponds to a power loss of 50 per cent, which certainly should not be taken without a struggle. And this reflection loss isn’t the whole story, by any means, for the actual transmission losses in the line due to standing waves will be higher (for the same amount of transmitted power) than for the properly matched line.

There are three possible lines of attack on the problem of eliminating this reflection loss. First, by using twisted pair with solid dielectric between conductors the line impedance actually can be brought down to 75 ohms or thereabouts. Solid dielectric lines, however, are not very inviting because of inevitable losses in the dielectric, and certainly some of the gain acquired in matching at the antenna will be offset by increased losses.

Secondly, the feeder length might be made exactly one-half wavelength or some multiple of a half wave, which, due to the standing wave on the line, would make the input impedance of the line appear to be 75 ohms regardless of the actual characteristic impedance. This type of line, however, is not working by best efficiency and the actual power lost in the line is considerably higher than would be the case if matching to the characteristic impedance was carried out at the terminals. The necessity for making the line length an integral multiple of a half wavelength is a serious disadvantage, for if the physical distance between antenna and transmitter should happen to require only a few feet more than a half-wave multiple, there will be nearly a half-wavelength of feeder, or equivalent loading, serving no useful purpose except to build up the line to the proper electrical length.

Last—but by no means least—we can perform some sort of impedance transformation which will allow us to work the line at best efficiency, with impedances matched throughout and no limitations on line length. What is wanted, in effect, is a sort of impedance-matching transformer to couple a line of 500 ohms or so to an antenna impedance of 75 ohms. The problem is something like that of designing a transformer to couple the output of an audio line to a loudspeaker load, except that the use of radio frequency complicates the task, especially when it is considered that the coupling device will be hanging up in the air at the end of the transmission line.

A simple inductive form of r.f. transformer, or autotransformer, has been used for this purpose, but it is a practical impossibility to attain anything like the ideal coupling which is essential to efficient transformer action. Fig. 2 shows the idea. A tuned circuit arrangement is considerably better, as in Fig. 3, but adjustments are rather critical and the construction and suspension of

![QUARTER-WAVE MATCHING SECTION](image)

FIG. 5—A TYPICAL FEEDER SYSTEM USING A QUARTER-WAVE MATCHING SECTION

The dimensions hold only for a 440-ohm line.
missible and such lines have different characteristic impedances at the two ends.

The branched wires of the "Y" system are too widely separated for complete cancellation to occur in the "Y" and hence these branched wires may be responsible for appreciable radiation. The antenna radiation pattern may be somewhat modified. The system, however, has the advantage of simplicity.

THE QUARTER-WAVE SECTION TRANSFORMER

A section of line a quarter-wavelength long acts as a transformer and such quarter-wave sections have been used for some time by the Bell Telephone Laboratories to match antenna arrays to the main transmission line. No one, however, seems to have described its application to the feeder system of the center-fed doublet, where it

![Diagram of antennatermination](image)

FIG. 6.—MECHANICAL ARRANGEMENT FOR THE ANTENNA TERMINAL OF THE QUARTER-WAVE SECTION

admirably fulfills the requirements of an ideal antenna-transmission line system. The antenna performs in true doublet fashion; there is practically no radiation from the line which operates near maximum efficiency; the line can be any length whatever just as long as it is more than a quarter wavelength (and any good horizontal antenna should be at least that high above ground in the higher-frequency amateur bands); impedances are matched throughout and there are no standing waves on the orthodox part of the line.

The theory involved is very brief. Referring to Fig. 4, the impedance $Z_L$ looking into a quarter wave line of characteristic impedance $Z_0$ when terminated by an impedance $Z_A$ is:

$$Z_L = \frac{Z_A^2}{Z_0}$$

Similarly, the impedance at the other end when terminated by $Z_L$ is:

$$Z_A = \frac{Z_0^2}{Z_L}$$

Thus, to match two impedances $Z_A$ and $Z_L$, it is only necessary to insert a quarter-wave section of characteristic impedance, $Z_0 = \sqrt{Z_A Z_L}$. Now, the impedance $Z_A$ can be the antenna impedance, which is approximately 75 ohms for the half-wave doublet, and $Z_L$ can be the characteristic impedance of a transmission line connecting the quarter-wave section to the transmitter.

The success of the idea depends on the feasibility of building a quarter-wave section of the required characteristic impedance. Since it is somewhat more difficult to construct very low impedance lines, because of the close spacing and large conductor diameter necessary, the scheme should be examined for the lowest practicable line impedance which is to be matched to the antenna.

No. 10 B & S wire, spaced two inches, results in a transmission line impedance of 440 ohms. The characteristic impedance of the quarter-wave section to match the 75-ohm antenna will be:

$$Z_0 = \sqrt{75 \times 440} = 182 \text{ ohms}.$$ 

A glance at Fig. 1 shows that we cannot hope to make a 182-ohm line of ordinary size wire. And since the quarter-wave section will be up in the air, it ought to be reasonably light in weight. Still, we know that the way to get low line-impedance is through the use of large diameter conductors. Copper tubing will probably answer both size and weight requirements, with aluminum having less weight, and the curve for half-inch tubing shows the desired impedance with about 1½-inch spacing.

The line-impedance formula probably isn't highly accurate for close spacing because the proximity of the conductors will tend to crowd the current to one side of the conductor and this changes the line constants somewhat. The difference, however, will not seriously affect the practical working of the system. The final result of our calculations is the system shown in Fig. 5.

The reader should bear in mind that the conductor separation of 1½ inches for the q.w. section holds only for use with 440-ohm transmission lines. To save the labor of computations on the reader's part, Table I has been prepared (on the

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QST for
assumption that half-inch tubing will be used in the quarter-wave section), indicating the proper center-to-center spacing of the tubing to match main transmission lines of common sizes of wire with either 2-inch or 6-inch spacing. For example, suppose that the main transmission line connecting the quarter-wave section with the transmitter is of No. 14 wire with 2-inch spacing. The table shows that the quarter-wave tubing should be 1 1/4 inches between centers.

MECHANICAL CONSTRUCTION

Undoubtedly by this time the reader is wondering by what miracle the quarter-wave section is to be suspended from the center of the doublet. It's not as difficult as might appear at first blush. Fig. 6 shows one practical method and modifications will unquestionably occur to the mechanically-minded amateur. The method shown involves flattening the ends of the tubing which are bolted to straps or clamps supported on 7-inch porcelain insulators of high tensile strength. The tubes are clamped firmly to insulating strips located at about two-foot intervals. The strips may be made of impregnated wood or Bakelite and tubing separation would be according to the data in Table I. In the higher frequency bands (5 and 10 meters), the weight of the entire feeder system probably can be carried by the antenna wires themselves. Other arrangements for relieving the antenna of the weight would be advisable at lower frequencies. A short mast, running to the bottom of the quarter-wave section, would answer the purpose.

At 5 meters the quarter-wave system is ideal, for the doublet antenna can be formed by simply bending the tubing at right angles. The whole system could be self-supporting and would require no antenna insulators. For portable work, the structure could be joined so as to occupy small space when out of commission. The transmitting end of the quarter wave feeder might well be arranged to plug into suitable receptacles in the top of the case which houses the equipment.

It is believed that the suggestions outlined in this article open up new fields for the transmitting experimenter, and the writers feel confident that activity along these lines will more than repay the effort expended.

BIBLIOGRAPHY


A NEW HANDBOOK

We feel like celebrating!

As we write this we are just about completing the job of producing an eleventh edition of the Handbook. For three months or more the headquarters staff has been doing work on it—in as much time as could be spared from other duties. For the past month the pressure has been increasing because we had to have the book ready by January 1st. Now, with a final soaking of midnight oil and a final spurt on the part of all concerned, it's ready for the printer.

It seems to us that the new edition will be a hot number. Probably more time has been spent on it than on any other edition except the first. So great have been the changes in technique during 1933 that almost all the technical material has had to be re-written and re-illustrated. Several of the chapters are brand new from stem to stern. Nothing was left in the book unless it could lay claim to being the last word in technique or operating practice.

Anyway, the eleventh edition is off the hook. We hope you'll like it.
A Convertible Push-Pull Oscillator or Amplifier

By R. B. Parmenter, W9PLM*

IN THIS day of high-power multi-stage amateur transmitters there is still need for a comparatively simple, inexpensive and medium-power unit; one which can be put in service in a few minutes' time and used as an auxiliary transmitter when the high-power rig is off the air. High-power transmitters in general are more inclined to fail than their little brothers, and the up-to-date station should be equipped to get on the air quickly in such cases. The ham with the lean pocketbook also finds an inexpensive and simple oscillator unit useful—and particularly so when this same oscillator may be later converted to a neutralized amplifier without making any circuit changes other than supplying r.f. to the grids and going through the neutralizing process.

All of the various oscillator circuits are capable of giving good note and there is but little to choose between them. But when a set is to be used both as a self-excited oscillator and a neutralized amplifier there is some basis for calling one circuit better than another—especially if the minimum number of parts is to be used. For example, the old reliable tuned-grid tuned-plate oscillator is not very well suited for this job because the neutralizing condensers with which it would have to be equipped could not "double" as something else for self-excited operation. On the other hand, a push-pull Hartley oscillator may be used to better advantage as it requires but one coil and the same variable condensers may serve the double purpose of neutralizing and as grid condensers. And there is an additional advantage—by making the grid condensers variable the bothersome taps on the coil may be done away with. By varying the capacity of these condensers it is possible to control the excitation when the circuit is used as an oscillator; and by merely supplying the grids with r.f. and using the same condensers for neutralizing we have a neutralized amplifier.

With these considerations in mind, the Hartley circuit was used originally in the combination amplifier-oscillator unit described here. Power output was good, but it was difficult to keep the signal free from modulation on the 14-me. band, and after some experimenting the circuit was changed to Colpitts. The difference between the two circuits is simply in the center-tap connections to the tank condenser and coil. In the original set-up, the rotor of the split-stator tuning condenser was left free and the plate-feed tap at the center of the coil was grounded to the filaments through a by-pass condenser. Since the feedback in this case is magnetic the circuit is a push-pull Hartley. Now if the rotor plates are grounded to the filament center-tap and the plates fed at the same tap on the tank coil through an r.f. choke, the feedback is capacitive and we have a Colpitts oscillator. This circuit arrangement is preferable to the first because grounding the rotor plates provides a low-impedance by-pass for even harmonic voltages developed at the plates, and the even harmonic output is therefore reduced considerably. Using this arrangement it was possible to get rid of all a.c. modulation on all three bands.

One other feature of the layout described here worth consideration is the method of coupling to the antenna or feeders. This is done by splitting the tank coil at the center—thus making it into two similar coils—and spacing them so that the antenna coil may be coupled between them. This is a decided advantage over coupling at the two ends of a push-pull circuit, because the voltage is high at the ends and this results in capacitive as well as magnetic coupling. Although this may perhaps be tolerated in an amplifier (except for harmonic radiation) where swinging feeders do not affect the frequency, unwanted capacity coupling to an oscillator may destroy its stability. If capacity coupling is absent, the antenna may be coupled more closely—result, more output. Even when the feeders swing badly it is possible to get much more output and still have the frequency stay put. By coupling at a point of low

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* The June 1929 issue of QST for WHAS, the Courier-Journal and Louisville Times, Louisville, Ky.
r.f. voltage less reaction takes place and better efficiency results. The same is true of an amplifier — one should always couple to the cold end of the circuit. Instead of less output there will actually be more — and with less input to the tubes. The same type of coupling could be secured by using a single tank coil and putting a coupling coil of larger diameter around it at the center. The difficulty with this arrangement is that only one degree of coupling can be had unless the coupling coil is tapped, in which case it becomes rather awkward to vary the coupling smoothly and in small steps.

CIRCUIT DETAILS

The final circuit of the combination oscillator and amplifier is shown in Fig. 1. Following the usual procedure, all parts are mounted on a 11½-inch by 14-inch baseboard, on the bottom of which are 1½-inch-high cross pieces which make room for parts fastened beneath the base. The tube sockets are placed at each side of the tuning condenser with the grid and plate terminals facing the condenser terminals; this permits short leads and at the same time crosses the filament wiring, a device which is helpful in preventing a.c. modulation from this source.

The two variable grid condensers are mounted immediately in front of each tube. Instead of crossing the plate leads from the tube sockets to opposite ends of the tank coil, the grids are crossed right at the terminals of the tuning condenser (terminals are available on both sides of the condenser). This makes all wiring short and direct.

The tank circuit is arranged symmetrically behind the tuning condenser and is wired to the condenser with 3/16-inch copper tubing.

The two stand-off insulators which hold the antenna coupling coil are mounted 1½ inches apart and are fitted with two brass "L" pieces to which the ends of the coupling coil are bolted. Elastic stop nuts are used on the bolts to give enough tension to hold the coupling coil in any position. In addition a piece of felt should be pulled between the turns of the coupling coil to prevent it from vibrating and thus modulating the note. Two pieces of Bakelite might also be fastened across the two leads of the coupling coil to give additional strength and prevent movement.

The stand-off insulators which carry each section of the tank coil are mounted 2½ inches apart, the two inside insulators being placed two inches apart to allow room for the coupling coil to fit between them. A short length of ½-inch copper strip is used to connect the two halves of the tank coil; a heavy connector should be used here because it is part of the tank circuit. The plate r.f. choke is mounted underneath this connecting strip. All by-pass condensers are under the base, as is most of the wiring. Since the wiring under the base is only a few inches from the tank coils, care should be taken not to run any long leads where they would be likely to pick up r.f. The wiring from the variable grid condensers should be as short and as direct as possible and should be kept clear of the a.c. filament wiring or some modulation may be picked up from this source.

The tank coils must all be wound in the same direction, otherwise their fields will buck each other. The direction of winding of the antenna coil does not matter.

TUNING CONSIDERATIONS

So much has been said on the subject of stabilizing self-excited oscillators that the subject probably is more than familiar to most amateurs. However, we repeat again — plenty of tank capacity is necessary. Probably the easiest way is to use just enough capacity to keep the drift down to whatever is considered workable. If the tank circuit has too much C there will be some drift caused by heating of the coil itself which will offset to some extent the good effects of the high C tank in the circuit. Also, the efficiency is better with lower C, particularly on the higher frequency bands. A monitor is still the only sure means of knowing what is going on while working on a transmitter, and it should be consulted whenever the adjustments are changed. When testing for frequency drift it is desirable to use a dummy load, because the drift will always be less with a load than with the oscillator running without load.

The input of a self-excited oscillator should be kept down to reasonable limits. Never operate the set with the tube plates showing color, as heating of such magnitude always causes a rapid drift in frequency. Plenty of bias (obtained with a high-resistance grid leak) should be used and the tubes kept cool.
To get a smooth d.c. note and one which keys properly the power supply should be well filtered and have an input choke before the filter to improve the voltage regulation. Poor regulation or insufficient excitation are the chief causes of poor keying. Too tight coupling to the antenna will also give poor keying characteristics, as a little experimenting will easily prove.

To avoid the possibility of a.c. modulation the power supply should not be placed too near the oscillator. Not only mechanical vibration but a.c. picked up by the grids of the oscillator from stray fields will put a decided ripple on the note. In our particular case the power supply was moved from the immediate vicinity of the transmitter to a distance of about three feet and an annoying modulation stopped at once, well illustrating this point. Some modulation even may be picked up by the grids from house wiring which is not in BX cable. This may be compared to a receiver which is built in the open and is unshielded — even though it may be entirely battery-operated there can still be some a.c. hum due to stray fields. Consequently, keep the grid circuit wiring as short as possible and away from any points where modulation might be picked up.

Another source of modulation on an otherwise pure d.c. note is a.c. picked up from the antenna through the feed line. If the feeders or wiring of the antenna circuit are run near the grids, plenty of hum can be picked up. Keep the antenna leads on the other side of the rig. In a test, running one feeder wire on each side of the transmitter near the grid condensers and then back to the antenna coupling coil introduced enough hum to ruin the note. On bringing the feeders in from the back of the set the note was d.c. once more. Evidently the feeders themselves can be a source of a.c. sufficient to spoil an otherwise good note.

In some cases filament by-pass condensers do more harm than good. Different sizes should be tried because such troubles as they may cause generally are due to resonance effects when the wiring and some particular size of by-pass form a tuned loop.

TUNING STATISTICS

After the transmitter is all wired, the coils made and ready to be used, the first necessity is to tune it inside the band. With the particular tank capacity used and the coil sizes given, the 3.5-mc. band is covered with the condenser almost to maximum capacity, the 7-mc. band with the condenser approximately three-quarters of the way in, and the 14-mc. band with the condenser set at one-third capacity. The variable grid condensers then may be adjusted to get the proper excitation. Scales made from white cardboard are fastened to the lock nuts on the condenser shafts and make it possible to return accurately to previous settings. The scales are marked from one to ten, with ten falling at the maximum-capacity end. About 5 on this scale gave the proper excitation for all of the bands. By running more excitation slightly more output is obtained with some sacrifice in the quality of the note. This adjustment should be made carefully with each particular transmitter because correct adjustment makes the difference between a poor note or a good one.

With a 550-volt power supply, slightly more than 30 watts output can be obtained on the 3.5- and 7-mc. bands and about 30 watts on the 14-mc. band — with a steady d.c. note on all of them.

As an Amplifier

To convert the unit to a neutralized push-pull amplifier a pair of 100-µfd. condensers should be connected to the grids of the tubes and the r.f. excitation fed in the usual way. The variable grid condensers now act as neutralizing capacities, with complete neutralization being obtained with the condensers almost all the way out. This point corresponds to the point at which the unit stops oscillating when it is used as an oscillator. Used as an amplifier, the unit makes a good final stage for a transmitter of moderate power. It may be advisable to use 45 or 90 volts of battery bias in series with the grid leak, R, when the unit is separately excited.

M.I.T. Airplane Tests

Delay in the receipt of confirmation of many QSO's has prevented the completion of the M.I.T. test report in time for publication in this issue. It is hoped that the story will appear in the February number.
It's in the Blood!

By J. C. (Felix) Johnson, W5LS*

It all started when I was a coltitch-boy learnin' to be an English prof. I had a couple fifties perking along nice as you please and everything was rosy. Even had a Q5A6 YL that was so interested in ham radio that she learned the code, or started to. But about the time she got down to C the storm broke; she started resonat' with some competition named Thomas who wrote poetry and spent his extra dough on red ties and nut sundaes instead of filter condensers and so the YL ups and reads the Riot Act to li'l Felix in seven different languages, includin' English. It seemed 'twas either her or radio for me, but not both . . .

Well, I kinda missed 'er at that, but, thinks I, what's a mere YL when there's always a chance of puttin' a sig into the cans of an Aussie and Zedder, so for long weeks I poured the soup into the fifties, but no luck at all. And then one day Soupy Groves—W5NW to you—comes breezin' over and with his customary shyness gently breaks the news that he's wkd a coupla Zedders and an Aussie with his 202.

That was the last straw! I was through with radio!

Some several years later finds me as far from radio as it's possible to get, bein' hired by the United Rubber to operate a half kw. sync shore station stuck up the Amazon about three inches further than the map goes. But bein' one-third of the white population of Acapulpa ain't so bad, as I'm quite the hot potato as a representative of the U. S. and am also a full-fledged U. S. consul, which means I've gotta bail out the U. S. sailors that get jugged for bein' off-frequency with some of the Jefe's (Mayor's) OW's, which are about as numerous as clothes-line harmonics on 28 mc. Not a bad life, until . . .

One a.m. I'm sweatin' over some quenched gaps that my noble assistant Juan Jose Alvarez Gomez de Vacua y Nollo has poured some coffee into when I hears a raspy voice I'd heard somewhere before:

"That third-rate sawmill sounds exackly like it looks; lousy, spelled with two 'z's'."

"Yeah?" says I, placin' the voice without even lookin' up.

"Yeah! Reminds me of your manners, Felix me lad."

I looked up. Sure 'nuf it was Soupy himself, only he looked scrawnier'n ever with a duffle bag in one hand, a SW receiver under one arm, and a parrot perched on his operator's cap.

"Meet the Modulator," he says, pointin' in the direction of the bird. In response the bird flaps his wings and squawks out a coupla CQ's, every other one of which is punctuated with some Spanish word you can't find in the dictionary.

"Well, here we are," sez Soupy, tossin' Modu-
meanin'... an' lookit this fifty-watter! The other one in WQOE was kinda soft, or I'd've hauled it along, too. Ain't it a dilly?"

So it came to pass that, Soupy was installed as second op, first assistant consul, and chief worry for the Jefe—it not doin' the Jefe much good to jug Soupy as he was now on the consul staff and could get himself outta jail. And pretty soon we had station "FX" working strong—mebbe you've heard us—sure sounded FB, so we've been told. 'Course it was a bit irregular to work SW, but when the local Chief Shot of Radio Communica.

munications would come around we'd explain it was a new invention to distill Ron Veijo, an' then 'd take off his shoes an' all hands, including the parrot, would hoist a few and everybody'd go home happy.

One day when Soupy and I was down on the Avenita gassin' at the gals through the bottoms of bottles (they look better that way) a spiffy white boat came up the river and anchored in front of us, and a small boat is lowered and puts out for shore.

"Looks like a yacht," says I, idly.

"If you'd 'a read the news from WNU last week, you'd know... ."

"Oh, do you read the radio code?" I asks him.

"... you'd know," continues Soupy, ignorin' me as usual, "that this is some crummy research outfit goin' up the river to study bugs, and to explore some untamed upriver stuff where the foot of white man has never touched, and that they gotta hot radio on board with regular skeds to be fixed up with some outfit in the U.S.A. to keep the home papers fulla news right outta the jungle."

About this time two geezers breeze up to us from the small boat which has landed. These guys are dressed like all sure-enough tropical explorers are supposed to be dressed if you believe what you see in the Sateevost: cork "lion-tamers" hats, khaki shirts, shorts (the kind skeeters and flies adore) and, of course, cameras across their backs. One of these eggs—a tall, jib-nosed, fan-cared jobbie—sidles up and pokes his duke out.

"I'm Jasper Q. Sideband, radioman for this expedition, and this (pointin' to a fat pinkish mug who hasn't got his breath yet from climbin' the hill) is Dr. Schwabstein. We're from the M.S. Palooka; you have doubtless been informed of our expected arrival. We are in search of the American consul, for whom we have several letters."

"I'm the consul," says I, aimin' to be cordial.

"Welcome to our fair city."

"Sure," says Soupy, "squat and bathe your whiskers in some of this Bacchus brew."

But Jasper kinda sniffs and declines sorta haughty-like and says they have important work to do and if we'll kindly accompany 'em aboard they'll outline their project and tell us where we can assist 'em in matters of native aid, etc. I looks at Soupy and he looks at me, and we both sorta sigh, but fellow-Americans is fellow-Americans, so we go out to the boat. On the way our new boyfriend mentions this 'n' that about life in the tropics, etc., but the general thought through the whole gab is that a certain Mr. Jasper Sideband and the word "radio" are synonymous terms and should be mentioned in the same breath.

"By the way," says he, "do you know much about short-wave radio?"

"Not much," I answers, truthfully.

It turns out this rig of his looks like it mighta been a good ham set once 'til somebody sprung the boobyhatch bolts 'n' let this Napoleon of the Heavysides scramble a few patented cabbage-peclin' machines and doorknob displays with it. But according to him it'll do everything but answer your wedding invitations 'n' scratch your back when you take a bath (if and when). He was still in the throes of explaining how you changed frequency when Soupy and I drifted back to the Avenita to gargle a few and restore our good opinion of the locality.

It took 'em about four days to get three lousy little outboard boats started upriver with the radio junk and such other truck as we couldn't persuade 'em to feed the goats. And when the last boatload of cork helmets and patented cook-stoves hove outta sight, Soupy and I heaved a sigh of relief and worked a coupla G's just to sort of get the taste outta our mouths.

Well, we forgot 'em and supposed they were firing lurid bulletins from the jungles straight to the States when one mornin' we hear KXXX just above the 40-meter band callin' his head off for our friends and from the sound of things they'd been doin' it without results for about three-four days. They might just as well have put it on a tape and gone to visit their Aunt Hattie in (Continued on page 65)
Improving the Performance of the Neutralized Power Amplifier

Permanent Neutralization—Higher Efficiency—Harmonic Suppression

By George Grammer, Assistant Technical Editor

E VER since those early days when “short waves” meant 100 meters, stray capacities, especially those inherent in tubes themselves, have been something to battle with. In the light of our present technique, however, such old-time capacity-reducing tactics as taking the bases off tubes and soldering the tuned-circuit right to the lead wires seem absurdities of the highest order. In these days we treat such stray capacities with utter nonchalance even in 56-mc. sets. Yet unwanted capacities, disregarded in oscillators where we intentionally shunt the coils with large condensers to get the stabilizing effect of high-C, present a considerable problem in the operation of multistage transmitters at frequencies as low as 14 mc. Especially is this true when tubes such as those in the “50-watter” class are used. Deservedly popular despite the fact that their basic design dates back to the 200-meter era, tubes of this type probably cause their owners more grief than any others when used as neutralized amplifiers in conventional circuits on 14 megacycles. Many of the troubles can be traced directly to high inter-electrode capacities; most of the others come from the same source, although sometimes through devious routes.

There seems to be a sharp dividing line somewhere between the 7- and 14-mc. bands that keeps a tube from doing as good a job at 14 mc. in ordinary circuits as it does at 7 mc. and lower. One reason is the fact that the losses become greater as the frequency is raised. But another and just as important part can be attributed to poorer circuits—small L/C ratios when we need them high—which are directly chargeable to those neglected stray capacities.

Consider for a moment the garden variety of amplifier coupling circuit shown in Fig. 1-A. Here we have a driver tube, $V_1$, coupled through a condenser to the grid of an amplifier tube, $V_2$. The equivalent of that circuit, insofar as it affects the $L$-$C$ combination in the plate circuit of $V_1$, is shown at the right. In addition to the actual tuning capacity, $C$, the tank is shunted by the plate-filament capacity of $V_1$, the grid-filament capacity of $V_2$, and an unknown capacity $X$ which includes the shunting effect of the neutralizing condenser plus all the other stray capacities in the circuit. The total of all these is far from negligible; 50 $\mu$fd. is a low minimum, and 100 $\mu$fd. or more is not unusual. In the face of such conditions as these, the mere use of a tank condenser $C$ of low maximum capacity does not guarantee a high $L$-$C$ ratio. Such a high minimum capacity may pass unnoticed on 3.5 or 7 mc., but it becomes of importance at 14 mc. and is intolerable at anything higher.

**INTERSTAGE COUPLING**

A step in the right direction is to drop the capacity coupling between stages and use inductive coupling. This confines the stray capacities associated with each tube to its own circuit, and does not add them all up across one diminutive coil. Of course an extra coil and tuning condenser are needed, but the advantages of the arrangement far outweigh the slight inconvenience resulting from the addition of another control. Straight inductive coupling is somewhat messy to handle, however, because it is necessary to provide a means for varying the coupling between the two coils to control excitation and loading. A logical step, therefore, is to use link coupling, as shown in Fig. 1-B, which not only accomplishes the same result but also gives more flexibility. Where this scheme has been adopted

1. Experimenters’ Section, May and June, 1933, QST."
we secure these desirable results: The shunting capacities are reduced; the two stages may be separated by a considerable distance, since the line coupling the two circuits may be of any reasonable length; and the relations—or impedances—between the output circuit of the driver and the input circuit of the amplifier can be adjusted correctly for maximum power transfer. This latter point is one of considerable importance.

Proper coupling between tubes of different character is something of a problem, at its worst when a tube of high plate impedance is to be coupled to an amplifier tube of low grid impedance. The theoretical solution (with capacitive coupling) is to tap the grid lead at some point on the coil which gives the proper match; in practice it is more than likely that doing this will give rise to parasitic oscillation in the amplifier. This can be circumvented by the compromise of using a small grid-coupling condenser with the tap taken directly from the hot end of the coil—but a loss of efficiency. The job can be done in A-1 shape by link coupling.

ADJUSTING THE LINK CIRCUIT

It may be worth while to take a moment to explain how the coupling is adjusted in the arrangement shown at Fig. 1-B. The driver tank circuit, \( L_1 C_1 \), is first proportioned so that it tunes to the operating frequency, preferably with a low value of \( C_1 \). The coupling coil should be wound on the same form as \( L_1 \); the end opposite the plate terminal, using tight coupling. Three or four turns will be sufficient. Next, the tank circuit \( L_2 C_2 \) should be made up, using the same dimensions as at \( L_1 C_2 \) for a starter if nothing definite is known about the characteristics of the amplifier input circuit. Use three or four turns also for \( L_4 \), which should be tightly coupled to the filament end of \( L_4 \). Light the filament of the amplifier tube and connect in the “C” battery or grid leak, but leave off the plate voltage. Start up the driver and tune \( L_1 C_1 \) to resonance, noting the driver plate current. Now tune \( C_3 \) at the same time watching for a change in driver plate current; if \( L_4 C_4 \) can be tuned to resonance the driver plate current will rise and then fall again as the tuning passes through the resonance point. If it is impossible to strike resonance on \( C_3 \) the stray shunting capacity is too high and the inductance of \( L_4 \) should be decreased, assuming that the two tank circuits were identical in the first place. The amplifier neutralizing condenser should be set at the proper point for neutralization if the amplifier has been operated previously; if not, it should be set at about the point which neutralization is to be expected; or if this is too speculative, at minimum capacity. A little juggling with the size of \( L_2 \) eventually will result in hitting resonance on \( C_3 \). When this is done, neutralize the tube in the regular way, readjusting \( C_3 \) for resonance if the setting of the neutralizing condenser has to be changed. Should the neutralizing capacity increase considerably from its value during the first cut-and-try, it may be necessary to make further alterations to \( L_2 \) to keep the circuit \( L_4 C_4 \) in resonance.

Once the tube is neutralized the coupling between the two stages can be adjusted for maximum transfer of power from the plate circuit of the driver to the grid circuit of the amplifier. To do this it is necessary to measure the rectified grid current in the amplifier stage. A milliammeter of suitable range (100 milliamperes full scale is convenient for nearly all tubes) should be connected in the bias lead. Adjust both \( C_1 \) and \( C_2 \)—the tuning of these two circuits is nearly independent—to obtain maximum grid current; then note the driver plate current. If the plate current is lower than normal, the two circuits are not coupled tightly enough; the remedy for this is to add a turn or two to \( L_4 \). Conversely, if the plate current is too high, the coupling is too tight and a turn or two should be taken off \( L_4 \). Adjust the coupling to obtain maximum amplifier grid current (for a given “C” voltage or grid leak resistor) consistent with the allowable plate input on the driver tube. For driver tubes operating at 500 volts or less the tanks \( L_1 C_1 \) and \( L_2 C_2 \) can be wound with fairly small wire—No. 22 or larger—on ordinary receiving coil forms; the losses will be low when the grid of the amplifier is taking power. The plug-in feature is handy if bands are to be changed frequently.

W e should emphasize here that in adjusting excitation a grid meter is just as indispensable as a plate meter. The same meter, fitted out with plugs and jacks, can be made to do both jobs.

A BETTER NEUTRALIZING CIRCUIT

Isolating the driver and amplifier circuits is
certain to go a long way toward increasing the ease of handling the set and eradicating inter-stage parasitic oscillations, as well as decreasing stray capacities shunting the tuned circuit. Still more can be done, however.

In casting about for an amplifier circuit which could be neutralized once and then would stay neutralized even though different coils were put in when changing bands, the idea of tapping the tank tuning condenser instead of the coil presented itself. This arrangement should maintain a constant voltage ratio between the "plate" and "neutralizing" portions of the tank circuit regardless of the dimensions of the tank coil. Then by using parallel plate feed on the amplifier, the feed tap on the tank coil could be eliminated and only two coil connections would be required. To try out the scheme an experimental bread-board amplifier using the circuit of Fig. 2-B was rigged up. Fig. 2-A shows the ordinary neutralizing circuit for purposes of comparison. The connections in this particular layout could be changed readily from one circuit to the other to see what differences in performance, if any, were to be observed. The tube was a 203-A.

Several interesting things developed. The first effect was a very considerable decrease in the stray capacity shunting the grid tuned circuit, \( L_1C_1 \), when the circuit of Fig. 2-B was used. A combination at \( L_1C_1 \) which would tune to resonance using Fig. 2-A was much too small when the circuit was shifted to 2-B; actually it was necessary to use twice as much inductance at \( L_1 \) to hit resonance, with the same setting of \( C_1 \), when the circuit was changed to 2-B. That this reduction in shunting capacity was of some benefit was proved by the fact that the use of the larger inductance at \( L_1 \) increased the grid excitation and, in turn, the output of the amplifier. Of course in shifting between the two circuits the plate tank circuit, \( L_0C_2 \), was left unchanged; the split-stator condenser, \( C_3 \), simply served as a single-section affair in 2-A. The tap on \( L_0 \) in 2-A was adjusted so that neutralization was reached with practically the same setting of \( NC \) as with the split condenser in 2-B.

A second feature of interest was the comparative stability of the two circuits. Both gave all the indications of satisfactory neutralization—no r.f. in the tank circuit at resonance and no tendency to oscillate when in operation—yet when the excitation was shut off and the bias decreased so that the tube drew a plate current of 30 or 40 milliamperes the circuit at 2-A would oscillate readily while that at 2-B could not be made to oscillate under any conditions. That this was no peculiarity of the particular tube used was proved by the fact that four other types of tubes behaved in exactly the same way. The amplifier was later converted to push-pull using a pair of 10's and the same thing happened; the tapped-coil circuit would oscillate while the split-condenser circuit would not. This was not entirely unexpected; previous experiments with a push-pull 25-mc. amplifier had shown that an amplifier having a grounded-rotor split-stator condenser, with the plate voltage fed to the center of the tank coil through an r.f. choke, had much greater stability than the more common arrangement with the center of the coil grounded through a bypass condenser and the condenser rotor left floating. This, incidentally, does not apply alone to amplifiers; it has been found invariably that oscillators—especially push-pull oscillators—are considerably more stable, at the higher frequencies at least, with a grounded-rotor split-stator condenser than with grounded coil taps. Probably the reason is that it is much easier to get a good balance with a split condenser, which not only can be made accurately but is symmetrical with respect to both the circuit and ground. The advantages of this arrangement in oscillator circuits were pointed out in \textit{QST} more than three years ago;\footnote{Lamb, "Advanced Transmitter Design," June, 1930, \textit{QST}.} that similar advantages were to be obtained in amplifier circuits does not seem to have been generally realized.

**Better Efficiency**

Reduction of input capacity and increased stability were not the only effects observed, however. An entirely unforeseen development was a considerable increase in power output using the circuit of Fig. 2-B. Comparisons between 2-A and 2-B, keeping the same plate input on the amplifier tube and the same driver power, always resulted in a higher antenna current with the latter circuit, the increase being as much as 20 percent in some cases. Since a 20-percent increase in antenna current is a power increase of over 40\%, evidently there is something here worth considering! Rechecking with several different types of tubes, some of them being designed especially for very high frequency work, invariably gave the same result.

A possible explanation of the increased power output resulting from the use of circuit 2-B can be found in the fact that harmonics are more effectively shorted out in this circuit than in 2-A. In the latter circuit, the harmonic components in the r.f. plate current must flow through the upper portion of \( L_0 \) to get back to the filament; since inductive reactance is proportional to frequency, this part of the coil offers twice as much reactance to the second harmonic as to the fundamental, three times as much to the third harmonic, and so on. This means, simply, that a fair load impedance is offered for developing harmonic power—useless power except insofar as it is radiated and causes interference on other frequencies, which makes it worse than useless. On the other hand, the reactance of the upper half of condenser \( C_3 \) in circuit 2-B is inversely propor-
tional to the frequency, so that its reactance at the
second harmonic is only half the reactance at the
fundamental, the reactances at other harmonic
frequencies decreasing in proportion to their
numbers. As a result, the load impedance for
harmonics is very low and little harmonic power
is developed. This sort of tank circuit is, in fact,
often used in high-power push-pull amplifiers—
for instance, in transmitters in the broadcast
band—when it is necessary to reduce harmonic
radiation to the absolute minimum. Since power
wasted in harmonics detracts from the total
power output available from a given input, it
seems reasonable to believe that harmonic sup­
pression is the explanation of the increased
efficiency. This is further borne out by the fact
that in a push-pull amplifier the difference in
power output between the two methods of split­
ting the tank circuit is almost negligible—in one
representative amplifier the split-condenser cir­cuit showed a power increase of three or four
percent over the tapped-coil circuit. In the push­
pull amplifier the second harmonic cancels out in
both systems, so any improvement would have to
result from elimination of the third and higher
odd harmonics. Since the effects of these har­monics are small, the differences in performance
between the two circuits also are small. But the
split-condenser circuit for push-pull has plenty
in its favor in the way of increased stability at
very high frequencies.

As intimated at the beginning, these tests were
carried out in the 14-mc. band, using a 203-A
for most of the work and including several other
types of tubes for comparative purposes. To
make sure that the effects weren’t wholly tied up
with the frequency, the scene of operations was
shifted to 7 mc. and the same procedure gone
through once more—with the same results.
Using the circuit suggested, a 203-A is just as
easy to handle at 14 mc. as any other type of tube.

One interesting sidelight has been a compari­
son between the old reliable Type 10 and the
other tubes used, these including the 203-A
and the new 800, 830 and RK-18 types. Of course
a single 10 will not handle as much power as any
of the others, but a pair of them in push pull at 600
volts and 120 ma. can be compared directly to
single tubes of the other types operating at the
same plate voltage and current. The striking thing
about such a comparison has been that in every
single instance the other tubes have given more
output than the 10’s. A 203-A, for instance, gives
20 percent more output at that input, and re­quires
less driving power to do it. One reason, at
least, for the poor showing of the Type 10 tubes is
the dielectric loss in the base; every one of several
 tubes tried showed blisters in the bakelite be­
tween the grid and plate pins after a little use.
On the other hand, the 830, which has the same
pin connections as the 10, was a good performer
in the test circuit—but it has a ceramic base.

The operation of the 10 probably would be im­
proved to an appreciable extent at high frequen­cies by substitution of a ceramic base for the
commonly-used bakelite.

OPERATING CONSIDERATIONS

The split-condenser circuit has been found to
do what originally was intended—the neutraliza­tion stays put when various plate tank coils are
connected in for work on different bands. There
is a possibility of loss of balance if stray capacity
between the tank coil and various parts of the cir­cuit is allowed to enter into the picture, how­ever, so it is well to keep the coil a few inches
away from other apparatus. Also, since the
capacity ratio between the two condenser sec­tions is likely to vary from its normal value when
the condenser is set near minimum, the size of the
tank coil should be adjusted so that resonance
will be obtained with the tank condenser set at
at least 30% of full capacity. If these two precau­tions are observed the neutralizing condenser can
be set once and then forgotten.

The fixed-neutralization feature is also valu­able when the amplifier is to be used as a doubler.
One type of neutralization greatly improves the
efficiency of a doubler because it adds regenera­tion at the second harmonic without going beyond
the critical point at which the doubler would
oscillate of its own accord. This circuit has been
found to operate in a highly satisfactory man­ner doubling from 14 to 28 mc.—even when us­ing a 203-A, supposedly inefficient at such high
frequencies.

The efficiency of the amplifier with parallel
feed will depend considerably upon the effective­ness of the r.f. choke. The small universal-wound
choke such as the National Type 100 introduce
no apparent losses, and stand up well at plate
voltages of 1000 or less. At higher voltages, where
a choke of higher power-handling capabilities
will be needed, special attention should be given
to its construction. It will pay to experiment with
different choke sizes at higher power. On the other
hand, series feed may be used to do away with
choke worries, in which case it will be neces­sary to
introduce the plate voltage through a tap at the
center of the tank coil. Do not ground the center
of the coil through a by-pass condenser, and be
sure that an r.f. choke of some sort is used in the
plate supply lead.

PRACTICAL CIRCUITS

So far we have been talking generalities, prin­
cipally for the benefit of those who already have
transmitters which are susceptible to improve­ment. If a concrete amplifier circuit is wanted,
Fig. 3 should give the necessary information.

These circuits will be good for any type of three­
clement tube, and for all bands with suitable

4 Grammer, “More About Economical Crystal Control,” November, 1931, QST.
condensers with adequate voltage ratings and wire and according to the tuning capacity available.

The choice of values. Regardless of the type of tube used, the only circuit element which is at all critical is the neutralizing condenser, C₅; its capacity must be right. For the 10 and 830 tubes, the neutralizing condenser should have a range from 5 to 15 µµfd. approximately; tubes of the 302-A, 211 and similar types, will require a neutralizing condenser having a maximum capacity of 25 µµfd; the 852, RX-18, 800 and 825 types will take a condenser having a minimum of 2 µµfd. and a maximum of approximately 5 µµfd. Necessarily, the various condensers used must be capable of handling the voltages to be applied. It will be noticed that no plate blocking condenser is shown in Fig. 3-A, the plate spacing in the tuning condenser, C₂, and neutralizing condenser, C₅, being depended upon to withstand without breakdown the d.c. plate voltage plus the developed r.f. voltage. This will be satisfactory at voltages up to 1000 if transmitting or double-spaced condensers are used. In high-voltage circuits it would be safer to insert a good blocking condenser (500 µµfd. or more) in the lead between the tube plate and the tank circuit. The other condensers in the circuit are unlikely to have high voltages on them.

The by-pass condensers should be large enough to do a good job at the frequencies to be used. It is advisable to keep the L-C ratio in the grid tank circuit high, as previously pointed out. The plate tank tuning condenser, C₄, may be any ordinary split-stator condenser; fairly high capacity (250 µµfd, with both sections in series) is desirable if the amplifier is to be worked on frequencies lower than 7 mc, because the tank coils become unwieldy when the condenser capacity is low. On the other hand, a low-capacity condenser is desirable for operation on the higher frequencies. After all there is a considerable difference between 1.75 and 25 mega-cycles, and it is not wholly reasonable to expect that the same apparatus will do a top-notch job over such a large frequency range.

Neutralizing, plate tuning and other routine adjustments are the same as with any other amplifier. Plenty of information on these has been published in past QST's, and also is to be found in the Handbook.

Strays

W2DGU suggests the following method for removing paint from aluminum taken from old auto bodies: Lay the aluminum on a flat surface and cover the entire piece with cloth, preferably wool. Mix equal parts of boiling water and ammonia and add a small handful of washing soda. Soak the cloth with the mixture and let it stand for about an hour. The paint will soften and can be scraped off with a fine-edged tool. Be careful not to apply too much pressure, as the tool will dig into the piece and make unsightly scratches.
Crashing Page One
Helpful Hints for Hunters of Publicity for Ham Radio

By William H. Graham, W9BNC*

Yes, crashing page one. It's easier said than done, brother! But it can be done.

Nearly every amateur radioman and YL, secretly perhaps, has cherished the desire at some time or another of crashing page one of his local newspaper with a picture of himself 'n' everything. As a matter of fact, who hasn't cached away at least one good photo of himself in some secluded spot in the old ham shack, ready to be yanked forth at a moment's notice when the city editor calls, to go into page one alongside some astounding radio feat?

It gathers dust, gets big earthquakish cracks in it and in due time gets younger as we grow older until it doesn't even look like us any more. So we give up in disgust and resolve if it's necessary to go out and bite a dog, we'll stay off page one.

There is no set of rules, no accurate yardstick by which the best newspaperman in the world can measure a news item. What might be of tremendous interest to the individual radioman or his comparatively small circle of friends wouldn't interest one one-thousandth of a metropolitan newspaper's readers. That's what the city editor goes by—what will make a vast majority of his paid subscribers perk up their ears and read. If you can produce it and the city editor hears about it, you'll find yourself and the old rock crusher bursting forth on page one whether you like it or not.

Oftimes it happens that the amateur radioman will do or hear something that will seem trifling and uninteresting to him, something utterly dull and unworthy of even mentioning, according to his standard of news, yet this may be the very item for which the city editor and his pack of news wolves are constantly on the hunt to brighten up their pages.

Take the word of a seasoned newsman for it, one who has served not one but several "hitches" as a news hound before he graduated (?) into the so-called editor class. Believe me when I say that a real, honest-to-goodness, genuine, dyed-in-the-wool news item seldom, if ever, walks into the editor's office and lays itself down on his desk. The city editor has long since learned that he has to scratch for the real live interesting news of the day, and scratch hard.

At the risk of having my ears filed down by some of my brethren of the press should they see this, I am going to endeavor to dissect the elusive news item, as it pertains to the amateur radioman, and see what makes the wheels go round. Let us see if we can't find some way, by hook or crook, by which the amateur radioman can trod that elusive trail that leads right down (or up) to the pinnacle page one.

Club news, election of officers, etc.: That's out! Nine hundred and ninety-nine out of a thousand metropolitan newspapers don't give a tinker's darn about it. Small-town papers (cities of 25,000 and less population) and country weeklies will give fairly good space to it.

New inventions: Not so hot unless the invention is a whiz that will command world-wide interest, such as a static eliminator. Hi! (Don't try to fool the city editor with some trick "invention," for while neither he nor his reporters probably will know anything about the intricacies of radio, they'll send someone who does. I recall one instance of a fellow who claimed to have a new-fangled radio receiver which worked without tubes and gave the volume of a 7-tube receiver. The city editor assigned a radio expert—not me—to the story and he readily found the hidden tubes.)

DX: Null and void unless you work Santa Claus! Of course, if you should get in touch with Stalin or the Prince of Wales while DX-ing, that would be news in anybody's newspaper. Measure your DX news this way, fellows: Ask yourself this question, "Does this DX interest the druggist on the corner, the fellow who works in the broker's office, the day laborer, the school child, the lady

(Continued on page 88)
At the southwest end of the island of Montreal lies the village of Ste. Anne de Bellevue. If we take a stroll down the main street we reach a grocery store bearing the name, "Chas. J. Dawes". On entering, we are greeted by a white-haired man with warm blue eyes and a kindly smile. It is none other than that philosopher and true ham, VE2BB, whose letter back in the November, 1929, issue of QST headed, "As We Sow—" still ranks with the finest expositions of the true amateur spirit. That spirit pervades VE2BB. It appears in the thousands of cards which cover the walls and ceiling. It is manifested by the numerous visitors who each year visit the shack—many of whom contribute their bit in adjusting and building the station. We chat awhile about DX, about the station, about the respectable monthly traffic totals. We have a cup of tea, and then we drive off again down the winding road along the lake back to the city, feeling that during our visit we have glimpsed the real spirit of amateur radio.

Career of a radio amateur: Built a telegraph line with three schoolmates in 1910. First saw a broadcast receiver in 1920. In 1922 duplicated a breadboard receiver seen at Columbia University summer school, paying $7.50 for headphones, $7.50 for a variable condenser, $5.00 for a 201, and $1.25 for a six-ohm rheostat. Learned the code with the aid of a Ford spark coil and buzzer, ruining neighbors' broadcasting reception unknowingly for three years. First saw an amateur transmitter in 1928. Obtained a temporary in 1929. S.C.M. in 1930, O.R.S., A.A.R.S., U.S.N.R., member of four radio clubs. That's the ham record of Hugh Lynn Caveness, W4DW, director of the Roanoke division, who, in 1925, following an A.B. at Trinity and an M.A. at Duke, joined North Carolina State College as Assistant Professor of Chemistry, the position he still occupies.

At the mystic hour of midnight sixty men regathered deep in the bowels of the earth. Down a narrow, treacherous trail, past bottomless pits, through the Needle's Eye—an aperture almost too small for the largest of them to pass—they had come, until finally they entered the mysterious grotto, the Bandit's Hall. This natural subterranean cavern 300 feet below ground already had a romantic history as a robber's stronghold. And now . . . the Young Squirt, his candle's feeble light making weird shadows of the stalactites and stalagmites, pursued his "uncertain journey across mountains of hopelessness, o'er rocks of despair, through rivers of doubt, and along paths beset with enemies" . . . the most impressive performance of the ritual of the Royal Order of the Wouff Hong ever witnessed, staged by Joseph Rohrer, W9EYN-W9EOV, president of the Pike's Peak Amateur Radio Association, in the Cave of the Winds at Colorado National Park during this year's Rocky Mountain Division Convention.

He's a man of the air—aviation, his vocation; radio, his avocation. Nowadays, Ralph J. Gibbons pilots a United Airways' plane along the air lane between Portland, Oregon and Salt Lake City, Utah. Before that, he managed the Walla Walla airport for a year, after having spent sixteen months on active duty with the Third Attack Group of the U.S. Army Air Service, at Fort Crockett, Texas. His aviation career started when he left Whitman College in 1929 to enter the Army Flying School. His radio career started during senior year in high school, with the call 7EE, followed by W7ABY at Whitman. In Galveston, he organized W5AUX and held W5AAR. W7BIX and W7KV were acquired on the return to Walla Walla. Married, Gib has two children. These, with radio, comprise his hobbies. Basketball is his sport. But the air is, and probably always will be, his domain.
The Amateur and Police Radio
By Robert S. Kruse*

WHO started this police radio business? Trace it down as you wish, you will find a radio amateur at the bottom of it; one of that hopeful crew that is always insisting that a new idea will work—and then working it.

Yes, amateur radio has a good right to take pride in police radio. That would be enough reason for telling the story of a fine police radio system; but there are other reasons, too.

The system described here not only illustrates the best in police radio, but also sets standards for operation of any sort of station, 'phone or c.w. As you read the story remember that the operating staff owns the amateur calls WSHP, WSARR, W8FWU and WSBJ, besides having a number of spark alumi from old 8KJ, 8ASY and 9ZN. We are not dead sure of Milo Mainville, who operates on the motorship "Benson Ford," working the land stations; but quite probably one could pull his commercial ticket out of its frame and find a faded amateur ticket underneath.

You have now guessed, of course, that I refer to Detroit's police radio system. The story as told here is partly from the writer's observations, while the remaining facts and the illustrations are due to the courtesy of Lt. E. C. Denstaedt, in charge of both WOK and WPDX. Now to our story itself.

Surely no radio station, 'phone or c.w., is more smartly operated than WCK of the Detroit Police Department. WCK's carrier is never wasted. The instant it appears the dispatcher speaks crisply, the operator repeats and finishes with "... WCK"; ... and that channel is clear. The carrier stopped with the voice. It was done 1,000,000 times in one year. It will be done many more times than that in 1934. And every transmission means that the starting relays operate, the filaments come up, the operator checks readings, the message is sent twice, is recorded in the station log, and the station shut down. Such a schedule demands alertness of the best sort, and even the distant listener soon feels the brisk capability behind the station and its teammates. This is as it should be, for no station has done more for police radio; and, quite literally, scores of police chiefs have in one day at Detroit become stout and permanent converts to police radio, not as something magical, but as a strong auxiliary to other police tools and methods.

Of course radio alone will not make over a police system. In Detroit the radio system was preceded by a highly organized system of "minute cars" and "booth cars," sent out from precinct houses and scattered police booths by telephone. The system was the pride of the department—and it still is to-day. Radio's best work is done when it is used with other means, precisely as wire, radio and messenger work cooperate in other phases of our existence. Detroit's high position in police radio comes as much as anything from the ability to organize personnel and equipment to obtain such cooperation.

This is no attempt to belittle the work of other police radio services, but on a historical basis WCK and its Detroit forerunners make an impressive story. The story begins over 12 years ago when plans were made and apparatus prepared—a 50-watt 'phone bulb and operated by Officer Bernard D. Fitzgerald, under the amateur call 8BNE. In the next year a 500-watt Western Electric 1-A transmitter was added and for several years worked at 200 meters as 8BNE, at 375 meters as 8XAS and as KOP at 360, 286 and 277.8 meters—and finally as WOK. So long transmission had mainly been to fixed points, other police departments, precinct houses and the like, but there had been continuous experimenting in reception in automobiles. The hope was that there could be developed a radio-controlled patrol fleet, capable of such speed as would at last permit the police to strike from the criminal's hand his strongest weapon, surprise. That development was pressed forward constantly and by 1929 there existed the swift-acting

* Consulting Engineer, North Guilford, Conn.
WCK system, in instant touch with 27 "scouts" and 8 "cruisers," as well as with other police departments.

There were difficulties of a serious sort, however. The apparatus, then in charge of Lt. Cox, was largely homemade; for the 1-A transmitter had been outgrown and there were no commercial police receivers. It was a staggering job to build new equipment, to make some 50,000 transmissions per year, to service the existing equipment and to build ahead. This period saw shifts of WOK to 144.8 and 154 meters (as 8FSO), finally 2414 kc. There were also licensing difficulties; but finally a better understanding was obtained and the station allowed to work in peace.

The work for the last several years has largely been under the direction of E. C. Denstaedt, to whom I am indebted for the illustrations here-with, as well as for much of the factual material in this story. The present system can be well presented by information from a report made by him, which may be familiar to some readers as it appeared in an article by Lt. Jett, Assistant Chief Engineer of the Federal Radio Commission, in QST.

"The information broadcast by the police transmitter can be roughly put into three classes:"

1. Runs. Orders to a police car to proceed to the scene of a crime, fire or accident are termed 'a run,' and given precedence over other broadcasts.

2. Station Calls. Cars are often wanted by the precinct station, or perhaps by the police dispatcher. In this case the cars are either told to go into their stations or given whatever other information there may be. This type of message is classified as a station call.

3. Teletypes. The Detroit Police Department uses the teletype to disseminate information from Headquarters to its precinct stations. The radio station is equipped with one of these teletype machines and the teletypes received are broadcast by the operator. They contain information regarding holdups, descriptions of men wanted by the police, missing person reports, stolen car reports, etc.

"The transmitted information is obtained from, (1) citizens by means of the Bell telephone; and (2) precinct stations and the several divisions of the Police Department.

"All sources of information converge in one room in which both the police 'phone board and the Bell 'phone board of the department are located. In this room are the police dispatchers. These dispatchers—two in number—are trained men with long experience in their work. These men and no others dispatch police cars on runs. One of these men supervises cars on the East Side, while the other has the West Side. They have at their fingertips all the resources of the Police Department. Patrol wagons, detective bureau flyers, emergency wagons, booth cars, minute cars and ambulances can be reached by the police telephone system. The radio-equipped scout cars and cruisers patrolling the streets are available instantly by means of regular broadcasting microphones which stand before the two dispatchers; they merely plug in on a 'phone line, the transmitting equipment starts automatically and their voices can be put on the air almost instantly."

Here we interrupt Lt. Denstaedt and make explanation purely of interest to the radio man. This is not a "station description," but as the business of a radio system is to transmit and receive signals we can hardly keep the apparatus out of the story altogether.

WCK is located on Belle Isle, which lies in the Detroit River and is thus at one edge of town. Dwellers in cramped cities can ill imagine the territory covered by Detroit—and most of them hardly suspect that it is fast approaching the 2,000,000 population mark. The 189 square miles within the city limits must be overlaid with a signal that out-shouts the trolley noises; and Detroit depends on surface transit, which isn't all rubber-fired by any means. The problem is complicated by the curious shape of the town, for it has grown around the independent cities of Grosse Point, Highland Park and Hamtramik (if that's the way to spell it!).

Omitting the story of the past experiments, we finally come to a four-station system in which there are four police stations on the same frequency, serving five cities in the same neighborhood. Detroit has WCK outside the city on Belle Isle, using a reflector antenna to spray the signals into the East Side steel-building territory, and also has WPDX in the heart of the West Side,

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serving that territory and Hamtramik. These are 500-watt stations, working sometimes together to cover the city with one alarm, sometimes independently and simultaneously. The latter is made possible by careful adjustment of the power levels so that there is overlapping only in a region which is fortunately fairly free of police work. When that region is to be reached one station

works alone, or the two are tied-in. This takes high-grade dispatching.

In addition there are two 50-watt stations, WRDR of the Grosse Point Police Department and WMO of the Highland Park Police Department. All four stations are tied together with an interlocking relay system so that other stations are warned by lamp-signals whenever any one of the four is transmitting. It is the invariable rule that if a "run" is to be sent the other stations are asked to suspend any secondary messages. It is done by blinking the lamps and is obeyed instantly! If you don't believe it, just listen on that wave and observe how a teletype or station call will stop in the middle of a word while one of the other three stations snaps out a "run"; and then how the first station goes ahead after repeating only the one lost word. Clearly the men in the cars must be alert, too.

Now for the cars and a resumption of the report:

"The radio-equipped cars are of two types, termed 'scout cars' and 'cruisers.' The scouts are light cars (Ford roadsters or coaches) and are manned by two uniformed policemen. It is these cars that are assigned to the patrol districts, into which the regular police precincts have been split. A radio car is assigned to each district and is constantly on watch while patrolling that district. The patrol districts are chosen with the following five points in mind: Density of population; the crime record of the district; the traffic problem; other police protection present; and records of the radio station as to runs made there.

**CRUISERS**

"The cruisers are heavy, high-powered cars (special Lincoln touring cars or sedans) and carry four or five men, two plain-clothes patrolmen, one driver in uniform, one detective and sometimes an additional man. These cruisers are equipped with riot guns, tear gas bombs, etc. Also, they have bullet-proof windshields. A cruiser patrols through an entire precinct and covers territory which is also covered by scout cars, so that in any serious trouble the two policemen in the scout car may be reinforced by the cruiser crew.

**TRAFFIC**

"A citizen calls the Police Department on the 'phone. This call comes into the dispatching room. The police dispatcher plugs in on the radio station and talks into the microphone. His voice is on the air and at the same time is audible to the operator at the radio station, who writes the message down, signals that it is OK or in some cases makes the dispatcher spell out words on which he considers that there might be a mistake. He then cuts in his own microphone and repeats the message until he considers that all possibility of the car missing the run is eliminated." (There is a follow-up system whereby any failure of a prompt report from the car called results in another transmission, and if conditions warrant in a follow-up by another scout or a cruiser. If a car or cars must be gone on a run for any length of time, other cars move in and "cover up" as in a fire department.)

"While most of the publicity given the Detroit system has been written around the spectacular split-minute captures, we believe that many of the writers have overlooked other points:

1. The large mobile force, available to combat serious outbreaks.
2. A commanding officer who need not waste time to get in touch with men out on patrol duty.
3. The many duties that fall to the lot of a police department which are not strictly police work, nor are they emergencies; but that none the less require men and cars. Men in radio cars can do these jobs and still be available for emergencies.
4. The patrol car that is at all times in possession of the very latest information on stolen cars, holdup descriptions, etc., and thus is able to work to better advantage than patrolmen."

**SAFETY DEVICES**

Thus we have a general outline of the system. How well the system works depends on the men
at the dispatcher’s office, at the stations and in the cars, and also, on the forethought against emergencies. *Esprit de corps* cannot be described; but you can assume that it is there in good measure. Now for the forethought.

We have said that WOK is on an island, easily defensible. It has two power lines and an automatic transfer switch to throw to the other line if one goes dead. It has enough power so that if WPDX goes out the city can be covered by simply raising the level from WOK. In addition there is a complete duplicate transmitter at WOK.

At WPDX there are also two power supplies, and two transmitters. There is a 500-watt amplifier feeding the antenna and this may be fed from a master crystal-controlled set of low power, or by a 100-watt set which can itself be put on the air directly if the 500-watt rig fails. There is also another crystal rig, and a complete failure seems remote. The various ‘phone lines are duplicated throughout to both WOK and WPDX.

The radiation systems have been made as good as possible so that the stations can operate with reduced power normally; and if an emergency antenna must ever be used spare power will be available to compensate. At WOK there is a 103-foot vertical antenna, halfway between two 117-foot poles. At one of the poles is a 103-foot nearly-vertical one-wire reflector. Both antenna and reflector go to ground through tuning devices. The antenna current is 2.8 amps and the reflector current 1 ampere. The grounding system consists of rods and wires in earth whose surface is only 3 feet above permanent water level. The two wires are spaced $\frac{1}{2}$-wave apart.

Since it is possible that a car receiver may fail it is standing practice for any car to call in and ask for a test when it does not hear signals. Ordinarily the four stations provide ample signals for tests, but extra ones will be sent on request.

Should a car miss a run, reports are made out by the car crew, radio operator and dispatcher, so that periodical analysis may expose any weak spots. Do not think, however, that this is a report-writing organization. That comes later. At the moment the main thing is to get the car back into service. If the car misses a run or fails to hear a test it is reached by radio, or by another car, and the receiver is serviced. The service and battery cars are busy—and fast. They carry spare batteries and sets. Things that can’t be repaired at once are exchanged and taken in for bench service.

As a result of this less than $\frac{1}{2}$ of 1% of the runs are missed, and the record is equally good on messages and teletypes.

**The Spirit of the Service**

Having just abandoned the attempt to define the spirit of the organization I may yet say that the men at the stations and in the cars seem thoroughly to believe in the thing they work at. The car work is hard, but it may lead to emergencies, though the cruisers are sometimes commanded by lieutenants. In passing it seems noteworthy that the orders may come from a dispatcher of lower rank; but the fact that the orders are executed willingly none the less is good evidence that there is a proper appreciation of the necessity for a cog which is radio-trained rather than police-trained.

**Results**

It has been found that the radio system materially improves the percentage of arrests in which it is necessary to catch the offender on the spot. This applies to holdups, housebreakings and sex crimes especially. The number of holdups has not greatly decreased; partly they are often “amateur crimes” caused by hunger or other acute distress and the times have been such as to encourage such things. But Detroit holdups have not increased as in almost all other major cities.

The “professional” or “habitual” crimes, such as housebreaking, banditry and sex crimes have decreased for several reasons. Partly this has followed because a professional criminal leaves a town that is made bad for his business. The supply of such men is not unlimited and many of them have been caught. Finally, the threat of the thing may deter a few; courts seem more inclined to convict the criminal who is caught quickly.

(Continued on page 65)
How to Get a Class-C License

By K. B. Warner, Secretary, A.R.R.L.

The new amateur licensing procedure is so intricate that it is going to be some time before we all settle down into a full understanding of it. When we at headquarters ourselves are puzzled over some new angle and have to engage in research and deduction for the answer, we appreciate that it must be pretty tough for the ordinary ham. This article is intended to help that situation. While it is a reliable guide for a new amateur going after his Class-C license, that is by no means its primary purpose. Its intention is to illustrate and explain the case of a new Class-C application because that is the basic case of which all the more complex forms of application are derivative. Understand the simple Class-C situation thoroughly and you understand most of the others.

The operator portion of amateur licenses is now either Class A, Class B or Class C. Class A carries every amateur privilege; that is, it is the same as the old "unlimited 'phone." Unless otherwise qualifying under F.R.C. Rule 405, an applicant for it must have held an amateur license at least a year and must appear before an inspector for personal examination. Class B carries every right except 'phone in the 80-meter and 20-meter bands. To get it, the applicant must appear before an inspector for personal examination; and either this class or Class A is compulsory if the applicant lives within 125 miles airline of any of the 32 examining cities named in Rule 30. In both these cases the applicant writes for forms to the inspector of the district in which he lives, files the forms, and later appears for examination. Under such circumstances he has the assistance of the inspector in getting things straight. If the applicant lives more than 125 miles airline from all the 32 examining cities, he does not have to appear for examination. He can get a new license by mail. It carries the same operating privileges as the Class-B but is known as Class C. This applicant will have no contact with the inspector except by mail, and one particular purpose of this article is to help him to proceed correctly. A very great deal of the procedure applies in the other classes of license too, but a Class-B applicant of course should follow the printed instructions he receives even when they deviate from this article, which is primarily to help the fellow who must go it alone.

Old amateur station licenses run at least until early 1935. Your operator license, if you have one now, probably expires sooner. When it does, you come up for the new class ticket. If it is of a grade other than the Temporary, you are eligible, if active, to Class B—see the licensing notes in November QST. In fact, if your present license authorized unlimited 'phone you are entitled, if active, to Class A. If it is a Temporary it is not subject to renewal and you must be reexamined. Not every Temporary holder, however, is eligible to relicense by mail. If a TA lives within 125 miles of any examining city, he is eligible only for Class B (or possibly A) and must appear in person.

Let us imagine that you are going up for your first amateur license or have an existing Temporary operator license which is about to expire, and you think you're eligible for Class C. We're now going to determine just how you go about it.

First is the question of actual eligibility. Get a reliable map of large scale and, by careful reference to the scale of miles, draw a circle of 125 miles radius with your town as its center. Then examine the area inside this circle and see if it contains any of the 32 examining cities: Washington, Boston, New York, Philadelphia, Baltimore, Norfolk, Atlanta, Miami, New Orleans, Galveston, Dallas, Los Angeles, San Francisco, Portland (Ore.), Seattle, Denver, St. Paul, Kansas City (Mo.), Chicago, Detroit, Buffalo, Schenectady, Winston-Salem, Nashville, San Antonio, Oklahoma City, Des Moines, St. Louis, Pittsburgh, Cleveland, Cincinnati, Columbus (Ohio). If it does, you are not eligible for Class C. You must apply for Class B and appear in person.

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As an additional guide to you, F.R.C. has published a limited number of maps showing 125-mile circles around the 32 cities, and a copy of this map and of the new regs is going to every A.R.R.L. director and S.C.M. and to every club affiliated with A.R.R.L. Ask your S.C.M. or club where the "official circle" hits if it is a close shave.

But let us say there is no examining city within your radius and that you’re therefore eligible for Class C. The next step is to write to the U. S. Radio Inspector in Charge of the district in which you live. QST for last December, the A.R.R.L. Handbook and the License Manual and Rule 30 of the new F.R.C. regs all contain this list of districts and inspectors’ addresses. You write to yours and request the necessary papers for taking out a Class-C license. You then receive from him an application form called Form 610, an instruction sheet, a return envelope addressed to the Commission at Washington, and a sealed envelope containing a set of examination questions. Read the instruction sheet carefully.

As part of the Class-C examination you have to have yourself examined in code by some licensed operator with whom you make an arrangement to that effect. He must hold a license to operate radio-telegraph stations and the license must be of a grade higher than Class C or the former temporary amateur class. (Specifically, the classes acceptable for this code examining are commercial extra first class; radiotelegraph operator first, second and third class; commercial operator first and second class; amateur extra first class; amateur class; amateur Class B.) You also have to provide yourself with a witness who will open the envelope of questions and certify that you wrote the answers without assistance. There is no reason why the code examiner and the examination witness may not be the same person. If you do not know a licensed operator in your vicinity, communicate with the nearest radio club or write your A.R.R.L. Section Communications Manager (directory in front of every QST). You must know the name or names of your examiner and witness before filling out the application. There is, in fact, a specified sequence: First you fill out the form, which includes the data on examiner and witness, and then you swear to it before a notary. Next you get your code examiner to give you the code test and to fill out and swear to a statement of your code speed, for which a space is provided on the application form. Then, and only then, are you ready for the written examination. If you do not pass the code test, you must return the examination envelope unopened, and wait 90 days before trying again. But if your examiner swears that you did at least 10 words per minute, your witness may then open the examination envelope. He examines it and sees that it consists of five sheets of paper, each bearing a printed question at the top of each side, ten questions in all. He hands these to you. You proceed to the answering of the questions, using the space below each question. You must write with ink, not typewriter or pencil, although you may draw any necessary diagrams with pencil. Your witness must remain constantly present, and at the conclusion sign and swear to a statement that he opened the envelope and that you wrote out the answers in his presence and without assistance from any source. There is space for this also on the application form. Then you put both the application form and the examination sheets in the envelope provided, and mail them direct to the Federal Radio Commission. If you have passed, your license will come to you in about three weeks. If you have failed, don’t be too discouraged—study some more for the examination and after 90 days try it again.

(An applicant for Class B or Class A uses the same application form but fills it in only through the place where his affidavit occurs. He does not provide himself with code examiner or examination witness, since the inspector performs these functions when the applicant appears in person, and in these cases, too, the application is returned to the inspector, not to the Commission.)

The application form is a double sheet of four pages. The first page, 16 questions, relates to an operator application, while questions 17 to 39 on the next page and a half relate to the station application. The remainder of the space is taken up by the affidavit or jurats. You may apply for an operator license, on the first part, even though you have no station—in which case you leave the second part all blank. You may not apply for a station license unless you have or are also applying for an operator license.
The application form may be filled out at your leisure, and you may refer to QST articles to help you. It is the written examination itself, for which you receive the questions in the sealed envelope, that you must do without assistance, in one sitting, in the presence of a witness who has opened the envelope. The application form, as already stated, must be filled out and the code test completed before the envelope containing the examination questions is opened.

(Not only does this application form cover both operator and station; it is used for new applications or for securing renewal, modification or duplicate of either or both licenses. In any application relating to renewal or modification of any existing license except Temporary operator, both the existing station license and the existing operator license must accompany the application, since a new combined license is to result.)

On the first line of the application form you state whether this request is for a new operator license or a renewal of an old one, etc. You, as a Class-C applicant, either have no license now in force, or only a Temporary, which is not capable of renewal. You therefore request a "new" operator license with Class C privileges.

The next succeeding questions relate to your name, address, age, citizenship, whether recently examined or not, until we come to Item 12. Here you list all operator licenses held in the past five years. Item 13 requires you to supply data concerning three amateur stations with whom you have been in radio communication during the past three months. If you haven't had a license, obviously you haven't communicated, so you leave this blank. It relates particularly to applications for modification or renewal. In Item 14 you give the name, address and license data of your code examiner, and in Item 15 the name and address of your examination witness—which is why you must determine upon these people in advance. Item 16 relates only to duplicates. So much for the operator application.

Part II, about the station license, starts off in identical fashion, the first questions being easy. Item 27 is a legal question that must be asked, since the law forbids licenses to those convicted of monopoly. Items 28 and 29 list the calls you now hold and those previously held but expired, respectively. Item 30 is similar to Item 13 but with this distinction: to obtain renewal of an operator license it is merely necessary to show activity as an operator, using anybody's station over which to transmit; but in this Item 30 you must show the activity of your own amateur station (as operated by you) if you want renewal of your station license. Renewals will not be granted inactive stations. You have to wait 90 days and then apply for a "new" station license. If you are a new applicant, obviously you leave this item blank. Item 31 again relates only to duplicates.

Item 32 calls for simple data on whether the station has ever before been licensed. Partly this is to bar attempts to get a new license merely to shift call letters, and partly it is to avoid confusion between applications for new and for modified licenses. The beginner wants a "new" license, and so does the old-timer who let his previous license expire.

Item 33 shows whether the existing equipment is or has been under previous license. This item is not to be understood as referring to second-hand equipment which you bought from another amateur who once used it at a different address. Its purpose is to check up on evasions and "ringers."

Licensees must control their equipment. If they do not own it, they must submit a statement from the owner showing that the applicant has control, so that he is lawfully able to assume responsibility for its performance. Item 34 covers this.

Item 35: Apparatus must be designed to prevent changes other than in amplitude. Filtered d.c. plate supply must be used below 14,400 kc. The applicant must state by what means he proposes to keep his frequency within an amateur band, as by heterodyne frequency meter, monitor calibrated against standard-frequency signals, crystal, etc.

Item 36: The station must not be on premises controlled by an alien. The station location is that of its radiating antenna.

Item 37 relates to distant-control, a subject that will hardly interest the new applicant. Those interested should carefully consult Rule 213 and arrange their station to comply, if one-man operation is desired.

Item 38 relates to applications from a trustee on behalf of an amateur club. The applicant must be an individual, himself a licensed operator. He

(Continued on page 88)
I

NASMUCH as the cathode circuit of the tri-tet oscillator works best at high L-C values (although with small L for the fundamental frequency), it was reasoned that the old idea so familiar in the TNT grid-coil should perform just as well here, the distributed capacity of the coil itself furnishing the needed balance for the oscillatory circuit. A coil was inserted in place of the coil-condenser combination and, with a minimum of turn shifting, all was well. Thus the tuning was reduced to the selection of the desired harmonic in the plate tank. Various crystals work equally well.

Keying at W5BDB is done in the negative plate supply to the crystal stage. With the insertion of an old broadcast 30-henry choke shunted by a variable carbon-pile resistance, it gives no interference in several broadcast receivers operated in the same room with the transmitter, which has 250 watts input to the final stage. Hence it was desired to maintain this freedom from interference in the new unit. The key was inserted and a check made, with results as in the old unit. Next the bug was tried. Here the results were more pleasing than ever. With the weights off and the bug going full speed the response was all that could be desired, which had not been true in the older unit.

Our experimenting had been from the standpoint of producing a crystal unit capable of delivering frequencies for the commonly used bands and the elimination of doubler stages which never have appeared desirable. The 59 tube had been selected for the use and all had gone very well—with the exception of a tendency for double resonance dip when the plate tank was tuned to the fundamental frequency. One dip was considerably more pronounced than the other. First, this was greatly reduced by placing the two coils with their axes at right angles and fairly well separated. Another trick later on eliminated any tendency for the double dip. (This should not be mistaken where a crystal with two frequencies also gives this double dip.)

Plate and screen milliammeters had been inserted as well as a hot-wire galvanometer in the low side of the crystal circuit. The current-squared galvanometer would have been much more useful had not its thermocouple expired in a previous experiment. The work so far had been done at plate voltages of 400 and screen of 200 volts. The power delivered was not all that could be desired and so the plate voltage was raised to 550 while the screen was held at 200.

Attention was returned to the screening action of the tube and the tendency for double-dip when the plate was at the fundamental frequency. It was decided to try and make the 59 into a full-fledged screen-grid tube—if it might be so called. This was done by applying a good heavy coat of aluminum airplane dope, containing plenty of aluminum, to the envelope of the tube except for the flat portion of the dome. A couple of turns of bare No. 26 copper wire had been placed around the bottom of the envelope with a lead to the

(Continued on page 84)
W6AXN, Calexico, Calif.

This station, a typical example of the type of equipment to be found in amateur stations all over the country, is owned by D. C. Strawn, of Calexico, Calif., who got his start in radio in the Service during the war. Dropping out of the game about the time when the rotary gaps and DeForest unit-panel receivers were in their heyday, a long period of retirement ended when W6AXN was issued in May, 1931—proving once again that old saw, "They always come back."

Left to right in the photograph are a dynatron frequency meter, a three-tube a.c. receiver, and a monitor. The latter is fitted out with a switch that controls the transmitter power supply, the receiver "B" supply, and connects the 'phones in the monitor whenever the transmitter goes on so that all transmissions are monitored. The transmitter, a push-pull tuned-plate tuned-grid outfit, is operated in the 7- and 14-mc. bands. The power supply has mercury-vapor rectifiers and the usual brute-force filter. Reports are always p.d.c. or "xtal."

The transmitting antenna is a 7-mc. Zepp. A cage is used for receiving. All continents except Europe have been worked.

W9BUY, Independence, Kans.

W9BUY, owned by Clifford W. Johnson, 1305 North 8th St., Independence, Kans., has been on the air since 1920. Having passed through all the usual phases associated with amateur activity over a period of thirteen years, the station is now equipped for c.w. operation in all bands and for 'phone on those frequencies on which 'phone operation is permitted.

The transmitter is crystal-controlled, starting with a 10 oscillator, 10 doubler, 865 buffer, and a final Class-C amplifier using a 211. The modulator is a 212-D, fed by a three-stage speech amplifier ending up in a pair of 45's in push-pull. Separate power supplies are used for the high and low-power stages, the former having a Thor transformer and 86G rectifiers and the latter an Acme transformer with a pair of "S" tubes which are still going strong after many years of service.

A three-tube a.c. receiver modeled after the one described in January, 1933, QST, takes care of the receiving end. A monitor and electron-coupled frequency meter handle the frequency and signal checking. Both carbon and condenser type microphones are available for 'phone.

W9BUY served four years in the U.S.N.R., is an O.R.S., and also belongs to the R.O.W.H. and R.C.C.

The fellows who own the two stations shown here this month and those shown last month all confess to an interest in amateur radio dating back before 1920. Nothing less than an old-timers' reunion!
A.C. from D.C. Generators
By Wilbur Jackson, W4AVR

AMATEURS who are isolated from a.c. or might like to have an auxiliary a.c. power supply for portable or emergency use may be interested in the system used at W4AVR for obtaining a.c. from a d.c. generator.

The only source of power here is a 750-watt 32-volt Delco farm-lighting plant. By a slight alteration of the generator, however, enough a.c. is obtained to run all filament and supply plate power for all but the final stage of a crystal controlled 'phone-c.w. transmitter ending up with a 75-watt tube. Dynamotors supply the plate voltage for the final stage, since I was already in possession of them and saved the trouble of building an a.c. power supply for this stage.

It is possible to obtain 350 watts of 60-cycle a.c. from a four-brush 750-watt d.c. generator (25-cycle if it is a two-brush job), and at the same time get d.c. at the rated voltage of the generator.

To accomplish this a pair of slip rings and a brush rigging must be added to the commutator end of the armature. An extension shaft, 5 inches long and ½-inch in diameter, threaded at the free end, was attached to carry the rings. The shaft here was made from an old Chevrolet fan shaft. A number of discs, 2½ inches in diameter, with ½-inch holes in the center, were cut from old bakelite panels and slipped over the extension shaft. They are held securely in place by the nut on the end of the shaft. The slip rings were made from brass tubing of 2-inch inside diameter with ½-inch walls. The rings are 1½ inches wide.

The group of bakelite discs, or drum, was turned down while the generator was running so that the slip rings would fit tightly on the insulated shaft. The rings are separated about ½-inch so that there is no danger of a short circuit. A ½-inch hole is drilled through the insulating material parallel to the shaft to carry the wire from the commutator to the outside slip-ring. A 1-16-inch hole is drilled ½-inch deep in one of the commutator bars near the hole in the insulation. No. 14 copper wire is used to make the connection between the commutator segment and the outside slip-ring; it is threaded through the insulation and the connections well soldered. The connection to the other ring is made to a commutator bar exactly one-fourth the way around the commutator from the other segment.

The brush rigging here is made from old automobile generator brush holders, two regular auto-generator brushes being used to each slip-ring. The brush rigging must be insulated from the frame of the generator.

The d.c. voltage taken from the armature is of the order of 35 volts at a speed of 1800 r.p.m. The r.m.s. value of the a.c. voltage (which must be used in making calculations for winding transformers) is, therefore, approximately 27 volts. As there is some loss in the windings the transformer primaries are designed for 25 volts. Wire of sufficient size to carry the current must be used, No. 14 being about right for the primary of a 300-watt transformer.

If the d.c. generator is a two-brush job, the slip-ring connections should be made to commutator segments exactly opposite each other on the commutator. The a.c. taken from such a generator will be of the order of 25 cycles at a speed of 1500 r.p.m. The transformers will, of course, have to be designed for 25 cycles. Additional dope on transformer winding may be found in The Radio Amateur’s Handbook.

About 75 watts of 60-cycle a.c. may be taken from a Ford power-house type auto generator, which is of the four-brush variety. This is about the only four-brush automobile generator available. The a.c. r.m.s. voltage from such a generator is about 5.6 volts, so the transformer primary should be designed for 5 volts. The current will be about 12 amperes, so the wire used in winding the primary should be No. 12 enameled. A transformer with a core cross-section of one square inch is large enough to handle the output of a 6-volt auto-generator, and if standard core material is used 7 turns per volt will be about right for the windings. The primary should consist of 35 turns and the number of turns on the secondary would be the desired voltage multiplied by 7. The size wire used in winding the secondary is, of course, determined by the amount of current taken from the secondary winding; No. 30 is OK for 300 volts each side of the center tap.

If the generator is left running all the time while on the air it will be found necessary to use some means of suppressing the interference caused by the brushes. At W4AVR a 1-µfd. condenser is used across the d.c. brushes; the frame of the generator also is well grounded. Two ½-µfd. condensers are connected in series across the a.c. brushes and the center tap is run to a separate ground. If severe interference is
encountered it may be necessary to use heavy r.f. chokes, consisting of 150 turns of No. 10 wire on a 2-inch form, in series with each of the leads carrying the output of the generator.

'Phone Monitor Using a 55

The circuit shown in Fig. 1 has been found to be very satisfactory for audio monitoring of an amateur 'phone transmitter. It utilizes a Type 55 duplex-diode-triode tube. The diode is used as a rectifier or detector and the triode as an audio amplifier. The diodes may be connected either for half- or full-wave rectification; the necessity for carrier frequency filtering can be eliminated by the use of full-wave rectification, the circuit being balanced so that the carrier frequency is not applied to the grid of the triode. When the diode is used as a half-wave rectifier (diode plates in parallel) the output will be approximately twice that of the full-wave rectifier, but theoretically carrier-frequency filtering will be required. Experiments carried out here indicate a decided increase in signal level when the half-wave rectifier is used, with no noticeable differences in other respects between the two systems. Methods of output coupling other than that shown may be used; for instance, an output transformer can be coupled to a 200- or 500-ohm line for remote monitoring, etc. The pickup coil is placed in inductive relation to the tank inductance of the modulated amplifier or the antenna inductance, the degree of coupling depending on the signal level desired.

A simple monitor of this type together with a dummy antenna will provide an adequate means of monitoring the modulation quality as well as indicating the character of the carrier. Hum, ripple and other extraneous noises due to improper filtering in the various r.f. and a.f. stages of the transmitter or other causes may be discerned readily and can be remedied without the usual in terminable testing while the transmitter is on the air. The component parts of the monitor are shown below the diagram. The values of C and L will depend on the operating frequency. For the 75-meter 'phone band, 12 turns of No. 18 d.c.c. on a three-inch form, tuned by a 50 µfd. condenser, have been found satisfactory.

— S. E. Newman, W3HN

Notes on the Locked P.A.

The following letter from Yardley Beers, W3AWH, will be of interest to those who have been experimenting with the "Goyder Lock" system described in the Experimenters' Section in August, 1933, QST:

"I was very glad to see the paragraph on the Goyder Lock in the Experimenters' Section. . . . I have used this circuit occasionally and have gathered a few facts which I should like to add to those published.

"The version shown to me in England is slightly different in that the coupling between the C.O. or last F.D. and the final oscillator (known in England as a 'locked P.A.') is done by a different method, as shown in Fig. 2. The advantage of this method is that the two parts of the transmitter can be separated by several feet. The fact is that in the stations I visited this separation was about six or eight feet, probably to minimize the back-wave, or spacer as it is called by the British. The size of the coupling coil is not critical.

"The method of tuning is exactly the same as described except that the clip on the plate tank of the exciter tube must be adjusted for normal plate current. I might make, however, a few remarks on the tuning. One who had never used this circuit will probably wonder what happens if through tube heating the natural frequency of the output oscillator differs slightly from that of the crystal. The fact is that if the two differ only by a slight amount, dependent on the strength of the lock, the frequency of the output oscillator will be attracted by the other, and the lock will take place as well as ever. On one occasion I had the two so far apart that with no
coupling between them I was unable to hear them both at the same time on the monitor; yet when the lock was applied, there was only one frequency audible.

"Though the plate supply to a t.n.t. oscillator may have a good filter, it may when tuned for maximum output have a very rough r.s.c. note. Usually when a Goyder lock is applied to such an oscillator, the note will be cleared up to p.d.c. Thus it is possible to get a little more out of a t.n.t. when locked than alone, for one does not have to pay much attention to the note until the lock is applied. However, if the t.n.t. is overloaded too much, it may jump out of lock. Another thing to be noted is that when the lock is applied, the antenna current will rise slightly.

"In England this circuit is very popular. I was told that in South London, where are located many of the leading stations, nearly everyone was using this type of crystal control. However, the 'driven' (the kind generally used in America) also has a large following. Consequently this question is of frequent debate over there. Each has its advantages, nearly all of which are obvious. However, it must be pointed out that there is one very important advantage to the Goyder lock: that is, it is possible to work crystal control on a frequency lower than that of the fundamental of the crystal. For example, one can use a 3.5-mc. crystal to work 1.7-mc. crystal control. The method is exactly the same except that the t.n.t. is tuned to one half the frequency of the crystal instead of to the same frequency. In this arrangement every cycle of the t.n.t. locks with every other cycle of the crystal oscillator. As a general rule, I personally prefer the driven method, but in this one case, of course, the Goyder lock is the only one which will work.

"My British friends tell me that the locked p.a. has to be a t.n.t. or t.p.t.g. However, I coupled a locking coil to one side of p.p. unity-coupled oscillator and found it would lock. I did not, though, try it on the air."

Wiping Out the Harmonic

Operating r.f. amplifiers at high efficiency means plenty of harmonic content in the output, usually. R.f. harmonics from the output stage do nobody good and can bring plenty of trouble down on unsuspecting heads. Many signals heard off-frequency are actually from transmitters whose intended output is on some lower-frequency band—which is really no valid excuse for off-frequency operation because it's up to the operator of the station to see that harmonics are suppressed. The following excerpt from a letter from B. P. Hansen, W9KNZ, outlines an inexpensive and satisfyingly simple method of wiping out the harmonic:

"One result of all this going over to crystal control is that the gang are using fairly efficient final amplifiers—high bias and excitation, low-C tanks and high plate voltage—with the result that harmonics have been raising the old merry heck. The stunt shown in Fig. 3 is simple and wipes 'em out.

"The idea is simply to feed the harmonic into a trap circuit and let it do the old merry-go-round there instead of going up the flue and blocking somebody's receiver on the harmonic frequency—or getting into some nice AGSX in one of Uncle Samuel's monitoring stations. It works every time, and while in some cases it won't completely eliminate the harmonic, it will reduce its strength so much that it no longer bothers anyone. So far as I've been able to determine, low-C is better than high-C in the trap, probably due to better Q or something. An extension insulating handle about a foot long should be put on the trap condenser shaft to get away from body capacity. Also, the trap should be pretty close to the transmitter to prevent radiation of the harmonic from the feeder. Tune in the harmonic on the monitor and, listening closely (with key down of course), tune the trap over the scale. As it passes through resonance, POOF! out goes the harmonic, and out it goes at the other fellow's receiver. That's all there is to it.

"Yes, I've heard of traps in series with the feeders and all that, but they invariably introduce losses and most fellows won't stand for that even though it means giving others something of a break. But so far as I've been able to see, this stunt doesn't react on the final amplifier at all—and even if it does the loss is so slight as to be negligible. I've tried tests time after time, while working all bands, with both local and distant stations, and the reports are invariably the same—no change in strength of fundamental signal and complete obliteration of the harmonic. I had a 20-meter harmonic from my 40-meter rig strong enough to get R-7 reports from the east coast, and could wipe it out 100% with this stunt."

While you're about it, it might be a good idea to pay some attention to the third as well as the second harmonic, especially if the output stage is a push-pull affair.

Strays

W9K—wants to know who plays the music on the Official Organ at W1MK.
STRAYS

The color coating on the neon Christmas tree lamps (no need to point out what a ham can use these lamps for) can be removed by dipping the lamp in acetone for half a minute. When the coloring is wiped off it is much easier to see the neon glow.

--- W8CMW

A new edition of the RCA Radiotron-Cunningham Tube Manual, Technical Series RC-11, is just off the press. Besides giving complete operating conditions and characteristics, including the most important characteristic curves, on all standard types of receiving tubes, this 154-page book contains much interesting and valuable information of a general nature. There are chapters on vacuum-tube fundamentals—excellent reading and highly informative; on tube applications, including methods for securing automatic volume control and automatic noise suppression; on tube characteristics, in which the methods of calculating power output and other uses of the curves are explained; on tube testing; and there is also a section giving a considerable number of receiver circuits for all sorts of tubes, r.f. and audio systems.

The tube data in the book will be up-to-date for a considerable time, since a year’s moratorium has been declared on the production of new receiving types. The new edition carries the same price as last year’s, twenty-five cents. It is obtainable from RCA Radiotron-Cunningham at Harrison, N. J.

W5PY says that a pair of surgeon’s forceps makes a most useful addition to the ham’s tool kit. Besides being long and thin enough to get into those almost-inaccessible places, the forceps are provided with a locking catch on the handle by which they can be clamped on the nuts and screws which are forever slipping out of ordinary pliers. Your family doctor probably has an old pair which are rusted and of no value to him.

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In a hidden transmitter hunt held in Philadelphia, W3QV located the transmitter, which was on 3.5 mc., in exactly forty minutes by taking four bearings and plotting the intersections on a large map. Second place was won by W3CTB, who arrived at the right spot in 55 minutes. The excellent work of these two fellows proves that it is not at all impossible for hams to locate those outlaws who appropriate other people’s calls, provided they set about doing it.

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Vibration in a copper-tubing coil can be squelched by stuffing a rubber bath sponge inside it. The sponge should make a snug fit, of course.

--- W7GTX

Those fancy “tune for greatest swing” meters which have a moving shadow for an indicator and sell for about six bits really set off the small transmitter whose owner cannot afford a flock of Westons. They can be used to measure relative amounts of excitation when put in series with the grid bias of each amplifier stage. Several different full-scale deflections are available. They can be adapted to tubes drawing heavy grid current by providing them with shunts.

--- W6BCX

Here we have none other than W3JZ, well-known to ham conventions in the East as expositor of the deeper principles of things in general and stuff in particular, in costume for delivery of enlightenment on the finer art of street cleaning before a civic club of his home town, Philadelphia. Woody is the figure at the left of the vehicle, his apostle in cleanliness being the dope at the right.

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CORRECTION

An unneeded (and unwanted) connection between one tube plate of the 7-mc. transmitter and the junction of the antenna coupling coils appears in Fig. 1, page 22, October QST, in the article “Inexpensive Individual-Band Transmitters.” The coupling between the tank circuit and the antenna should be purely inductive.

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Northwestern Division Director Gibbons reports a Jr. op at W7KV.
On January first a new call system goes into effect in Spain. No longer will we hear the familiar EAR followed by a numeral of two or three. Instead, the prefix will consist of two letters, EA, a district numeral, and two identifying letters, as has become common practice in other countries. Nine districts have been arranged, in conformity with the district representation in the U.R.E., as follows:

- EA1 Northwest region (Galicia and Asturias) and Castilla-León
- EA2 Basque region (Vizcaya, Guipuzcoa) and Aragón
- EA3 Catalonia
- EA4 Central region (Castilla la Nueva and Estremadura)
- EA5 Levante region (Valencia, Castellón, Alicante, Murcia Albacete)
- EA6 Balear region (Mallorca, Menorca, Ibiza)
- EA7 Andaluza region (East and West)
- EA8 Canária region (all of the Canary Islands)
- EA9 Marroqui region and all African possessions

Existing Spanish calls are to be converted into the new two-letter identifications by a definite system. The two letters following the district numeral in the new calls will be letters representing the same place in the alphabet that the old numeral formerly indicated, starting AA to AZ, VA to BZ, CA to CZ, etc. Thus EAR12 in Madrid will become EA4AL, Madrid being in the 4th call area and AL being the 12th two-letter indication. Other calls can be worked out in the same way.

Conducted by Clinton B. DeSoto

TBTOC:

New members of this order are stepping up regularly and taking their bows. First came Henry J. Walsh, W1CPB, whose qualifying QSO's were with F. W. Miles, G6ML.

Nicholas C. Stavrou, W3AWB-W2DFN, worked across the Atlantic on three bands with Maxwell Whyte, G6WY. Mr. Whyte has also been in contact with W2CUQ on the three intermediate frequency bands.

The next two applications bring us up against an interpretation of the rule requiring that the qualifying QSO's be across an ocean. Does this mean that one of the major oceans must be entirely spanned, from continent to continent? Presumably it does. Yet the following instances are undeniably deserving insofar as the distance covered and the work done are concerned, even though they do not strictly follow this rule, and we therefore make mention of them as well.

Everett W. Mayer, K4KD, worked on three bands with J. H. Reynolds, VE3DA, more than two years ago.

The contacts between R. W. Collins, W8EUY, and Otis Hill, K6AJA, are equally interesting. Both a continent and an ocean were spanned and the greatest bedlam of interference on this earth pierced during these QSO's.

General:

New WAC record! On November 2d Charlie Perrine and Herb Becker, W6CUH-W6QD, worked the six continents in 1 hour and 58 minutes. The stations QSO'd were J1FF, ZS2A, VK5FO, W6MJ, G5YH, and OA4J. This feat climaxied three days of WAC activity. Inci-
dentally, Africa has been visiting Manhattan Beach regularly this year—108 QSO's with 27 stations so far, and the end not yet in sight . . . . The R.S.G.B. has organized a Contact Bureau Group to deal with the problems of television, especially in connection with ultra-high-frequency work. Overseas amateurs interested in this problem are cordially invited to cooperate; write the R.S.G.B., 53 Victoria St., London, S.W. 1 . . . . We have just learned from Dr. J. M. Cruikshank, formerly VP2NA, of Nassau, that word has been received from the Secretary of State for the Colonies advising that the prefix for amateurs in the Bahamas henceforth will be VP7. Dr. Cruikshank's official call now is VP7NA. The VP2, which is replaced, was only a temporary assignment pending the final decision which has now been given . . . . A number of amateur prefixes will of necessity be changed when the governments of their countries ratify the Madrid convention, which reassigned several blocks of call signals. We urgently request that amateurs in these countries advise us as soon as any change is made, in order that the information can be passed on for the benefit of all . . . . . The licenses of two Czechoslovakian amateurs, OK1KX and OK1FX, were cancelled for the relaying of a third party message recently, which action conflicts with the state telegraph monopoly. No warnings are issued in such cases, according to reports; violation of the regulations results in instantaneous revocation of the license . . . . .

Amateur Radio in Poland
By Adam Gac, Hon. Sec'y, PZK

After regaining its independence and after a successful war with Soviet Russia in 1920, Poland obtained a proper place amongst the great European powers. Although in some respects we were much behind the great Western European states, as regards the latest scientific and technical research and achievements, however, we could from the start favorably compete with other nations, as equal with equal.

The first Polish scientists to study radio technique came from the Polish Army, in which an early interest in radio developed. Among these pioneers can be mentioned Lieutenant Engineer Machewicz, prematurely deceased in Paris in 1923, and Lieutenant Engineer Groszkowski, at present the professor of radiotechnics at the Warsaw Polytechnic. His works on the cathode tube have appeared in a large volume which has been translated into many foreign languages.

In 1924 the first Polish transmitting station was founded and in 1925 was established the first Polish factory for the manufacture of cathode tubes and all component parts for transmitting and receiving stations. From that time on we could look bravely ahead of us.

Progress in radio was followed by growing numbers of radio amateurs. The majority of them were demobilized soldiers of the radio-technical army corps, and boy scouts. In 1921 the first Polish amateur transmitting stations were established using long waves only. In 1922 and 1933 the number of radio transmitters increased to about a hundred, and short wave experimentation had begun. Such names as Trembinski, Hatkowski, Piotrowski, the Danilewicz brothers, Lieutenant Goraliski Heftman, Kruczkowski, Engineer Lubinski, Morzycki, Wysocki, Zielnski, Ziembinski and many others, perhaps less known but also well deserving pioneers of Polish amateur radio transmitting, belong already to the history of our movement. Many of them participated in the First General Polish Radio Exhibition, in May of 1926, and exhibited their own creations. The jury of the exhibition awarded gold medals to the Danilewicz brothers and Messrs. Heftman and Wysocki, and the Ministry of War awarded them bronze medals.

At this time the first radio relay organization was being founded in Warsaw under the name of the "Polish Wireless Transmitters Club," and in 1927 was also founded the "Polish Radio Transmitters Club" in Poznan. At the beginning the whole movement developed very well; later, however, it was handicapped by the lack of proper governmental regulations. The laws of 1924 did not take into consideration the possibility of such a splendid development of the amateur radio transmitting movement and thus the activity of amateur transmitters was greatly handicapped, as the Ministry of Posts and Telegraphs, basing themselves upon this regulation, refused to issue licenses to the extended circles of amateurs, so that many of them worked in secrecy and illegally. In 1928 was founded the Polish Short Wave Amateur Radio Club, District Lwow; and in 1929, the Polish Short Wave Amateur Radio
Club, District Wilno; and also the Polish Short Wave Amateur Radio Club, District Krakow.

Although radio amateurs were associated in five clubs, their work was nevertheless haphazard, without proper assistance on the part of people and institutions which should and could have contributed towards the proper development and regulation of this movement, which had great importance both for the progress of Polish radio and for the interests of the Polish State.

Left to itself as it was, the movement developed mostly in an illegal way and could not overcome all the difficulties of internal and external nature. The particular clubs did not coordinate their activity and they even competed between themselves because of an unhealthy local patriotism which, during a period of about two years, put obstacles in the way of the Polish transmitting movement.

It was only in 1929 that the Vice-Director of the Radiotechnical Institute founded in 1929, Professor Engineer D. Sokolew, started to reorganize the movement on his own initiative and began concrete work in this direction. With assistance from the Ministry of War there was created a "Commission for Short Waves" which consisted of Colonel Engineer Zygmunt Karafia-Kraeuterkraft, a special delegate of the Ministry of War, Major Engineer Goebel Kazimierz, the chief of connecting lines of the Ministry of War, and Professor Sokolew Dymit, a representative of the Radiotechnical Institute. This commission worked out the general organization of Polish short wave transmitting, adopted a plan of modification of the regulations to permit amateur radio stations, and also initiated the first general Congress of Polish Short Wave Amateurs, in Warsaw, on the 22nd and 23rd of February, 1930.

To this Congress came the official delegates of all the existing amateur clubs, and all the problems of the movement were discussed.

At this Congress there was organized the Polski Zwiasek Krotkofalowcow (P.Z.K.) or Polish Radio Relay League, with headquarters in Warsaw. The Constitution stipulated that all existing clubs would automatically form branches of the P.Z.K. Officers were elected, including Prof. Dr. Eng. Janusz Groszkowski, director of the Radiotechnical Institute, president; Engineer K. Siemicki, vice-president; W. Cichowicz, secretary; and Prof. Dymit Sokolew, member of the board. The most important problems put before the newly elected board of the P.Z.K. were, first of all, the question of drawing up a list of the amateurs which were not associated with the new organization, and further, the question of modification of the regulations according to the suggestions of the "Commission for Short Waves." These matters were successfully settled after removing many difficulties.

In the constitution it was stated that the Polish short wave movement would be represented before the central state authorities and abroad by the Headquarters of the P.Z.K. However, in 1929, the Lwow Club of amateur transmitters had applied to the I.A.R.U. to become its member-society from Poland, and thus a situation was created whereby the Lwow Club, although only a branch organization of the P.Z.K., represented Polish amateurs before the foreign organizations.

This was changed in 1932 and at present the member society of the I.A.R.U. is the P.Z.K.

Polish radio amateurs were represented in 1932 at the International Radiotelegraph Conference in Madrid by the present president of the P.Z.K., Colonel Engineer Karafia-Kraeuterkraft, who during the Congress held several conversations with Mr. Warner and Mr. Segal, the delegates of the I.A.R.U., to whom he described the existing situation of the Polish relay movement and presented its future program.

In 1932 it was found necessary to reorganize our Union. With this aim in view, several meetings of the Constitution Commission were held, and at last a new Constitution was submitted to the General Meeting in 1933, which was accepted. This Constitution stipulates that the organization of the P.Z.K. be that of a federation of independent Clubs. The number of members has been increased to eight:

The Polish Radio Transmitters Club, Warsaw
The Lodz Radio Transmitters Club, Lodz
The Lwow Radio Transmitters Club, Lwow
The Krakow Radio Transmitters Club, Krakow
The Wilno Radio Transmitters Club, Wilno
The Czestochowa Radio Transmitters Club, Czestochowa
The Bydgoszcz Radio Transmitters Club, Bydgoszcz
The Poznan Radio Transmitters, Poznan.

Each member-club has its allotted territory, and the amateurs residing in each district must belong to its club. The clubs have their own statutes, under the terms of the P.Z.K. Constitution. This permits the development of the individual clubs, and at the same time makes it possible for the Headquarters of the P.Z.K. to look after the whole organization.

ZL1AR, FOUR-BAND TRANSOCEAN STATION OF L. M. MELLARS, AUCKLAND, WITH W6FFP
Contact has been established across the Pacific on the four lower-frequency bands. An attempt is now being made to QSO on 25 mc.

January, 1934
Suggesting Further Interpretation of Signal Strength Scale

By William W. McLain, W8BOW-W8EXP

Some amateurs are dissatisfied with the present way of reporting signals, if QST articles are any indication. Most agree that many reports are meaningless. If one receiver is better than the next, or conditions permit better reception, the QSO with the ham who has the best receiver and the ideal conditions will bring in the most favorable reports. The copyability or readability of signals is, after all, the issue of greatest importance in carrying on communication. The present scale of QSA-definitions stipulated in the international regulations for indicating QSA is sometimes too vague.

The definition of QSA1 is: "Hardly perceptible; unreadable." The definition of QSA2 is: "Weak; readable now and then." The definition of QSA3 is: "Fairly good; readable but with difficulty." The definition of QSA4 is: "Good; readable." The definition of QSA5 is: "Very good; perfectly readable.

By adopting this system of indicating receptibility and readability, instead of QSA, the possible range of reportability is greatly extended, which is the object of any proposed definitions, or interpretations.

Signal strength might well be supplemented and given additional meanings based on an estimate of just how much of what is sent can be understood or copied. Such ratings of course would not apply to lid operators, but would apply strictly from the standpoint of readability of signal by the theoretically 100% capable operator.

The use of such ratings would undoubtedly eliminate much unnecessary transmission. It is possible that hams might use "Most OK" in addition to a QSA-report. If there is much trouble from QRM-M it would be more understandable to come back at the start of the transmission with QSA3. With suitable interpretation, a better general understanding will be possible, and superfluous words and conversation actually eliminated. This same idea of supplementing our QSA definitions might also be used to substitute for or replace the R-system of indicating audibility.

Announcement to O.P.S.

The first QSO Party for Official Phone Station appointees is also announced for dates of January 20th and January 21st. The Official Phone Station field organization will be held all available to qualified phone station operators. See details page 37, November, 1933, QST. If interested write your Section Manager (address on page 5, QST) for application forms.

As of December first, about 40 phone appointments were held, reports on this received from only 18 of the League's 69 Sections. This is a remarkably good showing in view of the short time the application forms and certificates have been available, and augurs well for a good number of contacts, and an enjoyable activity in our first Phone QSO Party test in January. Many additional applications for O.P.S. appointment have been received and are being handled currently by S.C.M.s.

The first bulletin to those stations that have received Official Phone Station appointment will be sent from League Headquarters in January. This will include the complete list of phone appointees for use in the January operating activity. Copies of this bulletin will be sent to new appointees as rapidly as their addresses are received from Section Managers.

January 20th—21st—Announcement for O.R.S.

The next quarterly QSO contest for O.R.S. only is the tenth O.R.S. QSO Party, and will be held January 20th/21st. The official and up-to-date list of O.R.S. and stations eligible to take part will be mailed all appointees just before the dates of each contest period. Non-O.R.S. may make application for appointment by writing the proper S.C.M. (See address page 5 this QST.) The qualifications for O.R.S. appointment are indicated in the new Handbook and in the "Rules and Regulations of the A.R.R.L. Communications Department," the 1934 (new) edition of which will be sent to any A.R.R.L. member requesting same on a postal.

In the January O.R.S. Party the Fort Wayne Radio Club, W9LWK, announces that it will present the winner of the contest with a 3.5-mc. band crystal, ground by W9BKIJ.
Highest Scores—October O.R.S. QSO Party

This get-together of all O.R.S. was the second largest since radio activities of this nature were announced. Forty Transcon messages were started, about twenty from each coast, and added to the "doings," several mailing excellent time. Typical of the comments received were: "One of best times in three years ham radio. Can hardly wait until Jan. for next party." "W7AYV, "Will give the winner a run for his money next time." "Enjoyment beyond words . . . the thrill of the contest . . . working one skilled operator after another." "W6JAL," "W7BYE worked 3 O'S in last ten minutes." "Handled 1000 words with KAIXA during ORS Party." "W6AM," " Renewed old and added new acquaintances at W7QY." "Will bet a stack of 1919 Q's I win the next contest." D.R. W9— "Had a heck of an old party go by with me not in it." win, lose or draw, let's have more of 'em." W9AUL led, working 125 stations in 42 Sections, and logging 52 other O'S. The highest scores, of the several hundred participating stations:

W9AUH 24,528 W1MK 8070 W6GBC 6100
W1YU 11,028 WSBQY 7742 W3ADE 5742
W3ZD 6960 W9IYA 7656 W2DQK 5720
W3SN 6960 W8BUY 7650 W8KD 5000
W8ETT 8850 W9ICN 7832 W9AEY 5439
W2BY 8858 W5DZ 7475 W1BF 5320
V6EGT 8738 W8KIG 6500 W8BHV 5358
W1F0 8658 W5KR/OOS 6123 W2EKM 5103

Byrd Antarctic Expedition—KJTY-WHEW

NY1AB, Darien, C. Z., maintains a twice-daily schedule with KJTY, the Jacobi Support, and daily schedule with WHEW, the Bear of Oakland, and handles about 30 to 50 messages daily with them. This information comes via W9BLC. We are also advised that all amateur traffic from the Hydrid Expedition for the states is now coming through NY1AB, W9BLC, W6MR, and W3CXL have regular schedules with NY1AB and clear the traffic from him. When KJTY and WHEW have difficulty in making contact, NY1AB acts as an intermediate, or relay point between the two ships. A. H. Waite, Jr., WDTL, is now Chief Operator of the Bear of Oakland, and he and Dick Watson, W1BCL, keep WHEW humming. Latest word received from Operator Waite states: "We shall try to test with all hams calling us on 7-ma band between 10:30 and 11:30 p.m. on Mondays and Tuesdays. We will be on about 8250 kes. . . . about half way between CKS and WCO on the 36-meter channel."

Traffic Briefs

W6QI/1D says conditions were unusual on Oct. 31st. Nov. 1st and Nov. 2nd, days on which he was trying for a WAC record. Also, "the times for each day were 7½ hrs., 6 hrs. 20 min., and finally 1 hr. 58 min., breaking GSRF's 2 hr. 5 min. record—the best world record to our knowledge. Best U.S.A. was W6FYT's 2 hrs. 26 min. Those working for the record were W1JFF, ZS2A, VK6FO on 7 mc., and W6MJ, G5YH and OA4J on 14 mc., from 6:55 to 8:53 a.m. PST."

KAINA has been heard regularly on several Sunday morning tests at W2BRS, Riverhead, L. I., N. Y. QSA4 R4 on Nov. 5th, 7 mc.

ON4CSI is an American and the only active ham in the Belgian Congo. W2BFR schedules him Saturdays. VE3GT and W2BFS both report South Africans rolling in FB on 14 mc., starting right after noon daily. W2BFS operates 284M, ON4CSI and ZS1H as particularly outstanding.

WIRLV, Woosneck, R. I., reports hearing ZL2FR and ZL2NY at about 2:30 a.m. E.S.T. for three consecutive mornings on 0600 kes. during late November. PABASD works phones and c.w. on 3770 kes. and is attempting two-way work with W and VE hams at 0400 Greenwich every Sunday morning. He reports hearing dozens of W/VE stations on the 3.5-mc. band.

KHEVE-VE3GT QSO

After obtaining special permission to use 36.2 meters, VE3GT on July 25th maintained successful communication with Commander Frank Hawks' plane, NR-12255, radio call KHEVE, over 250 miles of the Commander's non-stop flight from New York City to Regina, Sask. KHEVE was flying at 10,000 feet! VE3GT-KHEVE established two-way contact soon after 2:40 E.D.S.T., and two-way work was held until 3:58 p.m. when Comdr. Hawks advised that he was averaging 193 m.p.h. and was over Lake Huron. VE3GT transmitted weather reports and other data through the cooperation of the Meteorological Service of Toronto. WIFGV advises that Comdr. Hawks is a radio amateur, and that W1EMV schedules KHEVE.

With the arrival of 1934 don't forget to start a new series of numbers on your originated messages. The systematic operator uses a number sheet! crossing off each number as used.

"Q Code" changes effective January 1, 1934 (with the Madrid Convention), were run on page 55, December QST. A complete Q Code list appears in the 11th edition of the Radio Amateur's Handbook, the 1934 edition.

The Lancaster Short Wave Club, A.R.R.L. affiliated club at Lancaster, Pa., held a QSL Contest from October 1 to October 15, 1933. The object was to see which club member could receive the greatest number of QSLs confirming two-way communications during that period. W3CHY was first prize winner (a year's A.R.R.L. membership) with 75 cards to his credit. W3DVE with 74 cards, and W3AAL with 58 cards were in second and third place. An "SWL" Contest for unlicensed members held in conjunction with the QSL Contest was won by Richard Ford.

RADIO OPERATOR EXAMS

Cleveland, Ohio, December 28, 29, 30, 1933—Examinations for radio operator licenses will be conducted in the Civil Service Examining Room, Federal Building, Cleveland, on each of these dates beginning at 9 a.m. and again at 2 p.m. The morning of December 29 is reserved for commercial operator examinations.

Kansas City, Missouri—Examinations are given in the Federal Building, K. C. the first and third Friday and Saturday of each month. If examination is desired at any other time write the Radio Inspector in regard to specific dates.

St. Louis, Missouri—1934 Examination days: January 26, 27; April 27; July 27, 28; October 26, 27.

Des Moines, Iowa—1934 Examination days: February 23, 24; May 25, 26; August 24, 25; November 25, 26.

The dates given for each month fall on Friday and Saturday. In each case commercial and amateur examinations will be given on Friday, but only amateur examinations will be given on Saturday. All examinations begin at 9 a.m.
### BRASS POUNDERS’ LEAGUE

(October 16th—November 15th)

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A total of 500 or more, or just 100 or more deliveries will put you in line for a place in the B.P.L. Make more schedules with reliable stations. Take steps to handle the traffic that will qualify you for B.P.L. membership also.

### Traffic Briefs

The Federal Radio Commission is cancelling licenses for failure to acknowledge "discrepancy reports" and for failure to correct whatever discrepancy is reported. Upon receipt of discrepancy reports it is necessary to make reply to same in accordance with F.R.C. rule 24 on the forms provided for this purpose stating what corrective steps have been taken. Immediate correction will prevent further embarrassment and possible cancellation of licenses.

An Illinois Traffic Net has been organized under the leadership of ORS W9KJY, Glen Ellyn. At this writing 36 stations are included, representing nearly as many Illinois cities. Outside schedules and Trunk Line connections hook this net into the national network.

Raymond Goodrich, W1BWK, is laid up in the hospital with a broken back. It is suggested that the gang send him a word of cheer. A QSL card or letter from any of the gang would be much appreciated. Address Raymond Goodrich, W1BWK, Care of North Adams Hospital, North Adams, Mass.

Late evening November 23rd W8ZVY gave W18Z a message originating in Jamaica. It was dated the same day and nature made it imperative that it be put into New York City as soon as possible. The next morning it was given to W2CRR on 3.9 mc. 'phone, but the address could not be located at the address given. The message referred to relatives in Buffalo, N.Y., so WASDR in Medina, N.Y., was recruited to help out at that end. Within an hour W8BAWE at Buffalo had been given the information, and the Police Department in Buffalo put out a broadcast to the relatives. This was all accomplished in less than three hours from the time the message started that morning; delivery was effected one day after origination!

During the last week in October, 1933, the University of Colorado Radio Club, Boulder, Colo., gave a demonstration of a complete amateur radio station operating under the call W9NRA. The equipment, installed in a store window of the J. C. Penney Co. in the center of the town, was in operation for about 18 hours daily. Over 60 messages were handled and several foreign countries contacted. The local paper, The Boulder Daily Camera, cooperated in giving publicity.

The Houston Amateur Radio Club had a booth at the South Texas Exposition October 27 to November 5, 1933. On the night of October 27 the club transmitter was put on 7 mc. and was dedicated by Mr. J. H. B. House, Mayor pro tem of Houston, and by Mr. Laird of the C. of C. over station KXYZ. The time for this broadcast was donated by Frank Smith, W5VA, chief engineer at KXYZ.

"CQ TFC" is the general call used in the GENERAL TRAFFIC PERIOD—6:30–8:00 p.m. (local time). Use this period to move your traffic through reliable stations. Operators who sign "ORS," "TLS," "RM" or "SCM" after their call are sure to be "reliables." The very use of "CQ TFC" by any operator indicates an interest in reliable traffic work. Cooperate with the stations using the TRAFFIC HOUR!
Relative Standings of the Ten Highest Sections—October-November

<table>
<thead>
<tr>
<th>Messages Per Station (25%)</th>
<th>Stations Reporting Traffic (25%)</th>
<th>Gain or Loss (25%)</th>
<th>Traffic Total (25%)</th>
<th>Standing Based on Average of All Four Ratings (%)</th>
<th>Section/Communications Manager</th>
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MISSOURI climbs up into the Banner position this round, closely followed by L. A. N. Y. C.-L. I. places a good third. For the October-November month we can report a gain of 150 in "stations reporting traffic." The following Sections lead all other Sections in their Divisions, order of listing is by number of members: Ill., P. I., N. J., E. Pa., N. Tex., Conn., Ore., Colo., S. Minn., B. C., Ala., Va. During the October 16th-November 16th month: 1617 stations Originated 21,910; Delivered 19,850; Relayed 72,038; Total 113,608. (85.6% Delivers.)

*The Section A.R.R.L. membership (approx.) is shown parenthetically, so that the degree of traffic reporting activity may be indicated by comparison.

Traffic Briefs

WIFIL, installed and operated by WICRP and WICPT, was in operation the latter part of November, 1933, at the Maine Progress Exposition, Portland. The transmitter was a breadboard rig using a 24 e.a. oscillator and 46 final. With only 15 watts input stations were contacted all over New England, New York, New Jersey, Penna., and in Canada. 247 messages were started on their way. Local Portland amateurs, WICHF, WICPT, WIDJ and WIDOE, took some of this traffic to their own stations and handled it from there. WIVS, West Medford, Mass., took over 75 messages direct from WIFIL, and handled many more which he picked up from other N. E. amateurs. WIBLV, WIERQ and WIBS also helped by taking a string.

While Cecil B. DeMille, well-known movie director, and a company of 87 people were in Hilo, Hawaii, filming "Four Frightened People," W6AIA maintained a schedule with W6BWF, Hollywood, handling several hundred messages.

On November 4, 1933, the Hamblen (Mo.) Amateur Radio Club honored its secretary, W6FQJ, on the occasion of leaving for Nashville, Tenn., at a farewell party in the form of an "all-night QSO party." The eighteen amateurs present were: W6CGW, FNT, ECZ, DZT, OAB, FAU, AEX, FLD, EFU, CCU, EFZ, FSB, GBS, GEC, HBB, JRR, and the guest of honor W6FQJ.

The Los Angeles Section Quarterly Banquet will be held January 20, 1934 starting at Noon at the Masonic Temple, 200 S. Euclid Ave., Pasadena, Calif. The ladies will assist MC. W3ADM and EZ 251 EM 1934 started the program. This Banquet is sponsored by the Federation of Radio Clubs Southern California and is being given under the auspices of the Pasadena Short Wave Club.

The Ogle County Radio Traffic Association (Oregon, Mt. Morris, and Polo, Illinois) lists among its members a doctor, a druggist, and an undertaker. One member has a station license issued on Valentine's Day, another issued on April Fool's Day, and his operator's license issued on St. Patrick's Day! Further, a member has a 7 mc. Zepp. 50 ft. high with both 65 ft. top and 35 ft. feeders of 1/2 inch copper tubing. What a club!!

atlantic division

Eastern Pennsylvania—SCM, Jack Wagen­saller, W3GS—W3ALX has been appointed RM to assist MC. W3ADM and EZ are new ORS. W3AXD and W3FWO report for first time. W3ATF, Univ. of Penna., has five new ops. W3CUI reports in person. Over 200 hands attended PB Hamfest held by Chester Radio Club, W3BQK. W3CFP has MOPA. W3CSS has first-class BC ticket. W3BOH is Army NCS. Skip scheduled for W3COL and AAGN. W3WNR got $3 in Richmond; found ant. on roof. W3FLA visited W3VD. W3ABK visited Washn. and was taken through WAR and NAA by W3CQL. W3DQX has pair '08A as in final. W3MC has new 60-watt rig. W3EVS is ready for ORS. W3AOK rebuilt. W3CMF is putting out 95 watts on 7 mc. W3QAR is QRL Army Net. W3DZJ joined Army Net. W3BRA is at Lafayette College. W3ECN has SS Super. A new radio club, the Allentown Amateur Radio League, has been formed. W3CQN press, W3BVE press, W3DMO across­tours. Club has 13 members to start. Results of contest not until next issue QST. Heartiest greetings to the gang.

Traffic: W3BQK 730 ALX 634 OK 371 CL 334 AKB
242 ADM 215 ABT 181 EZ 141 AZQ 143 ADX 118 ADV 56 5C 55 AFZ 50 GS 47 EDA 26 DJ 25 DXQ
20 DWZ 10 CPY 7 AGK 4 CHU 3. W3FLA 168 CVS
115 VD 105 ROR 77 FKO 44 IWT 22 CFF 14 CMF 2.
W3ABT, Univ. of Penna., has five new ops. W3WNR got $3 in Richmond; found ant. on roof. W3FLA visited W3VD. W3ABK visited Washn. and was taken through WAR and NAA by W3CQL. W3DQX has pair '08A as in final. W3MC has new 60-watt rig. W3EVS is ready for ORS. W3AOK rebuilt. W3CMF is putting out 95 watts on 7 mc. W3QAR is QRL Army Net. W3DZJ joined Army Net. W3BRA is at Lafayette College. W3ECN has SS Super. A new radio club, the Allentown Amateur Radio League, has been formed. W3CQN press, W3BVE press, W3DMO across­tours. Club has 13 members to start. Results of contest not until next issue QST. Heartiest greetings to the gang.

Traffic: W3CQL 2570 DWZ 488 SN 265 BND 181 A SO
111 BAK 59 CDG 54 BHI 40 BBE 8 IL 2 CTD 69 CIZ
25 DML 19.

Southern New Jersey—SCM, Gedney M. Rigor, W3QL—W3SDC fell off roof and broke his right arm putting up a zep. W3APV is no RM. W3UT is on 56 mc. W3AJ is getting out well. W3BYR went to "Chi," sent a message to the SCM, which was delivered next night; less than 24-hour service! W3BER is DXing. W3AWL had new frequency meter. W3DQO reports Atlantic Radio Club has 37 members. W3DRP puts a good check in by order of FRC. W3AEJ handles his usual total. W3AVJ handled transcon ORS message. W3CSW joined A.A.R.S. W3ZI reports gang of hams en­
listing in Trenton in 112th Field Artillery. WSCQO is our first OPS. W3ZK and BGP also get OPS. W3SBF is chief ops for W3QAM. W3AYA reports Cape May County Club getting under full swing. W3PC has gone to Fin. W8DNU and CLW want ORS.

Traffic: W3AVJ 5 AOV 34 CQO-ATJ 2 CWL 73 AEJ 10 DDF 5 BDO 4 EZ 22 APV 65 AWL 8 KW 12 BET 4 DVS 12 78

WESTERN NEW YORK—SCM, Don Farrell, W8DSP --W8GZM is new ORS. W8BN and W8DKQ are QRL at Cornell. W8SGO reports his '83 is over ten years old. The Mohawk Valley Brasspounders purchased an 8-BUS. W8DEZ reports he sees nothing but split status condensers in P.P. r.f. amplifiers. W8AXW is for ORS schedules. W8SU (Andrew C. Dreier) was drowned while fishing in Sodus Bay, Nov. 11th. His loss will be greatly felt in the Section. W8JXZ says skip is terrible. W8GPM is working all bands. W8SET uses a pair of 10's P.P. W9EBA has 211 final. W8JUO has a 46 rig on 1.7 me. 'phone. W8GBK has stopped 85-me. experiments for time being. The Rochester Club had a booth at Electric Show. New hams in Rochester: JNE, KMO, KXW. W8SP is working at WHEC. W8CPI passed radiophone exam. W8BSL is at WPDR. W8ERU is handling traffic on 'phone. W8BBK has new SW-3. W8WBY QTA all schedules. W8JFEDY is back at W2WQ. W8WPS is high 'phone traffic man. W8AFM secured first ORS in the Section. W8BBR is getting the rig dusted off. W8TBD is a member of Boy Scout Amateur Radio Net. W8WSW is interested in RM appointment. W8RJL at nice Lincoln tour on a hunting trip. W8HRS is a FB-7. W8IEN is all set for Sweepstakes contest. W9EJD is busy fixing up all the aches and pains common to this time of year. W8SF is QRL school. W8HUI has a new c.c. rig. W8EWM has pair of 50-watters. The S.R.T.A. had a fine harvest with attendance of 61. Talks were given by Karl Brandt (Veteran Operator), W8BAM and the SCM. W8GWZ has nice schedules. W8WGZ is going strong on ops. 'Phone W8JUG reports regular amount of traffic. W8CCJ wants Florida traffic. W8EYU is building a tri-tet. W8BRD has good Canadian schedules. W8EVX has a new pole. W8BHX purchased a new house. W8GPT reports traffic. W8JT handled traffic with K8AJU. W8JAX is high traffic man. W8IVS is handling a lot of traffic. W8BFG is on 14 me. The S.R.T.A. is having winter meet and feed at W9HUI's place on Lake Keuka. W8DSS now has more time for radio. W8AGS' FR-7 stopped peering. W8DMS spent the summer at his Owassa Lake camp. W8DIQ has new impedence coupled transmatch to his antenna. W8JDJ is on 7 me. W8KJO is at new QRA at Fulton. W8CSW turns in nice traffic. W8RJL is on in the Section. W8BBZ has FR-7. W8BDC is on in pair of '10s. W8DES is at CCJ Camp in Alabama. W8ERZ is working nights and sleeping days. W8DSP is building a 200-watt rack and panel 'phone for W8FML. Starting Feb. Ist the SCM will be held every Saturday afternoon a.m. from 9 a.m. to 11 a.m. for the purpose of working any stations who are interested in obtaining A.R.R.L. appointments. Frequency 3836 kc. Want ORS: W8KMC, GPR. First reporters: W8GHQ, DNO.

Traffic: W8JAK 51B 737 21 WBY 59 IDJ 60 FSY 112 HVS 100 EBK 23 GWY 27 BB-DMJ 10 FYF 13 DEU 44 FMI 60 GW 32 PDI 47 FUG 36 CQO 13 EYF 30 BKL-DBX 11 GPT 21 KMI 22 JTT 12 GYF 54 BAL-COG 81 W9ASL 28 W9BXL 28 2 DNO-BOGO-ERU 5 DSP 7 BFG 7 DQH 11 AGS 6 W8BN 14 DQK 2.

WESTERN PENNSYLVANIA—SCM, C. J. Grosbeer, W8SCG—W8SCG's schedule with W8GAM great on him top. WSJU is troubled with skip. WM8GBC is giving 1.7 me. a workout. A.A.R.S. keeps WSDYY busy. W8ZFG is new ORS. W8PLN landed a job in a brewery! W8SCCD finds it harder to get the bugs out of his second-hand W8QAM. W8AEY says things going better in Unoltown. W8CCQ joined NCR. W8SGX gives good account of himself. W8IQB pounded lot of brass during QSO contest. W8JKA tells us about Midnight Fat Chefs Assn., a swell gang of Sweetley and Cornopolis boys. "Still re-building," says W8SCMP. W8KQK changed to c.c. W8HJH made a lot of new friends during the contest. W8ERU, also, QRY is now a FORO. W8JEY marks they were too few stations in QSO contest. W8XUU finds "Comet Pro" an improvement over his old receiver! W8DLG will be on by Xmas. W8SCMT likes FB-7. W8MTS has been after 14-me. DX. W8KXP is new ham in M. W8JIOH visited W8SP for 7 me. W9LO is building for 1.7 me. W8HGG reports football activity. W8JSM and ABS applied for OPS. W8CQG has been busy with contest reports; next issue of QST will be chock full of them.


CENTRAL DIVISION

ILLINOIS—SCM, F. J. Hinds, W8AHP—W8RME: Chief W8DDE, W8CRT, W8ERU, W8KJY and DDE have organized an FB Illinois Net. W8BKH's trunk lines are well greased. W8AIV wants to be OPS. W8ATY is new ORS. W8NVY finds 3.5 me. for traffic. W8MAJ keeps excellent schedules. W8MKK says "three cheers for high power." W8SG gave up his ISG call. W8NXN of Greenville, Ky. wants a good 'phone for the Chicago end of his Florida to Chicago 'phone relay trunk line. W8HSP says the C.R.T.A. is going strong. W8WHU operates on Porcia—thanks to W9LF. The Lewis Radio Club has membership of W9ATG, AGB, QJC, GGV, GEF, HUS. W8IU's schedules work like clockwork. W8LZU says he has started him to work on traffic. W8BIK has new superhet. W8FYZ, CGV, KJX and GSB are doing fine A.A.R.S. work. W8MVE has six excellent schedules daily. W8NWM is recovering from a broken arm. W8VH has 1.7 me. 'phone under call KNC. W8DUO/WL is new ham. W8IOJ wants to be OPS. W8KMY has 1.7 me. 'phone. W8DBX has private line for the transmitter. W8VQG and IUU left for Reformation Camp. W8BIC has new receiver. W8FZX is a new reporter. W8GBS received Macom's autograph while he was in Chicago. W9HJX increased power. W9AEZ has '10 final. W8ACU is working 14 me. and 4 me. 'phone. W9AKK's receiver needs new tubes. W9BXB has a steel rack case. W9KQD is building for 1.0 me. W9MDN is putting in 50 watt crystal. W9ERU says NCR enforcements will be held in Rockford soon. W9EYU is moving to new quarters at Gen1 Del., Lewmburg, Penna. W9JWS has organized an FB Illinois Net. W9BKE's trunk lines are well greased. W9AIX wants to be OPS. W9AY has new c.c. rig. W9MIM has 1.7 me. 'phone. W9HJX has private line for the transmitter. W9PFX is a new reporter. W9GSB is working 14, 7, 3.5 and 1.7 me. W9BEK is working 14, 7, 3.5 and 1.7 me. W9AKJ is returning

QST
from Mich. W9AXH has a WE203B modulation indicator, W9BTR uses low power on 315 mc. W9CHA is arranging schedules. W9DCT is trying to get local club air time.

W9DJI has new 'phone rig. W9DJJ joined A.A.R.S. W9DPL of Huxley, Iowa, is on air at Valparaiso. W9EGV says ship getting ready to send code Ind. Tech. College. W9HTX is coming on with pair of 'phones. W9HSF will use portable at A.A.R.S. W9DPL of Huxley, Iowa is on air at Valparaiso.

practice on 1948 kc. W9HPQ has a new pole. W9HML

TE 14 HTP 12 LLV 16 HIU 8 NOT 2 MPR 7 OMS 2 full swing. W9DJJ has new 'phone rig. W9DJU joined

9.5 JJA 50 MMY 63 HML 53 HBK 38 JRR 40 HSF 23 is getting better. W9AHL is experimenting with photo

W9BQQ throws away buffer stages. W9FJG is building new receiver. W9FJL reports for first time. W9MQQ is c.c. W9OPV, ex-W8EL, is getting back soon! Applications invited for ORS and OPS. Reports welcome from stations member of A.A.R.S. or not.

Tralfic: W8FTW 432 DVC 278 BIN 236 CEU 224 QT 166 BMG 135 AEQ 126 DNM 124 GUC 101 BGY 97 CPF 67 EGY 61 FX 49 IOR 41 COQ 35 GDR-JYH 32 CET-DLK 34 IXT 31 FAY 30 HA-INN 30 COW 29 IFQ 25 CA 21 FDX 18 CFM 16 AFE 15 BFL 14 TMO 14 EGI 61 FX 49 IOR 44 COQ 43 GDR-JYH 39

W9FQQ does FB. W8JKX has FB7A. W9HLE's total

1.7 me. rig. W9JQJ has FB6-M. W9LLV lost

C:PY fl7 EGI 61 FX 49 IOR 44 COQ 43 GDR-JYH

67 BFL 97 BGY 97 CPF 67 EGY 61 FX 49 IOR 41 COQ 35 GDR-JYH 32 CET-DLK 34 IXT 31 FAY 30 HA-INN 30 COW 29 IFQ 25 CA 21 FDX 18 CFM 16 AFE 15 BFL 14 TMO 14 EGI 61 FX 49 IOR 44 COQ 43 GDR-JYH 39
No text available.
crystals. They are W4AFM, BOZ, RO, OV, AFI, AEP, BQK and B7Q. W4BAO is a Boy Scout Netter. W4BCA is active in ncn. W4OI had meter stick stung pulled on him during Memphis Convention! East Tenn. Amateur Club elected officers for forthcoming year: W4AOX, pres.; W4AD, vice-pres.; W4BZK, secy.; W4BZ0, treas.; Eugene Jones, Activities Mgr. W4BM is ops at WROL. W4BUD installed rig at East Tenn. Fair, Knoxville. W4ADX handles traffic on 14 mc. W4BOZ made a long trip through middle Tenn. and acted as chief pioneer player for a widow’s fan dance. W4AAD is using automatic phone service. W4AM organized a fine A.A.R.S. ‘phone net. Chattanooga Radio Club witnessed a demonstration of a 3.6-meter transmitter at University of Chattanooga. W4MU will transfer his ‘phone activities to 14 mc. W4CAP is our big ham-burger ham. W4AM purchased new home. W4ACU "Major" is back on active ‘phone list.


HUDSON DIVISION

EASTERN NEW YORK—SCM, R. E. Haight, W2LU—W2BLU BPls. BF results at W2EBG. W2BMK visited W1MIX. W2EQD is recruiting for A.A.R.S. W1FIM/2 is pushing out in hockey. W2FPE reports FVU news. W2EAF’s W2FST operates EZI Wed. nights. W2ULU breezes to Schenectady without week-end traffic for WAC. W2FRU tackles traffic. W2GNI reports DNN revamping for c.e. W2WB3 is QRL NCR. W2BRS is organizing 3.5 mc. QSO party for S.A.R.A. W2GLI, CLL, FPP, OEO, DCC, DQG and CTT in good shape. W2FRS is vice-pres. of Union College Radio Club. W2BJA is lining up stations for A.A.R.S. Red Cross Annual Roll Call to W2EH. W2EZO reports traffic reports for A.A.R.S. Radio Club.


WASHINGTON—NEW YORK—SCM—A. G. Pfeiffer, W2CWI This is greatest traffic month since the SCM took over the job, with 30 stations reporting 4548 messages handled, and W2DIU, BCX and EKM all making the BFL. Congratulations! New stations reporting: W2GGW, GNF, GMP, GAI, GCR and BOZ. W2DIU reports for ERH and EQH. W2FRK visited the gang in the feminine sex! The Memorial Radio Club of Englewood had a good turnout at the third appointee as charter member. W2DLW schedules KJTY (9500 kc.) the Byrd Expedition. W2AQT has unlimited ‘phone. W2CPY is rebuilding. W2DRQ is trying to outdistance GEZ, his cousin. W2AOL after 10 years of operating is now an ORS. W2ETG reports new man, GAO. W2AZV has been conducting successful 56 mc. tests between an aeroplane and an automobile. W2BEG swapped his car radio for a heater.


January, 1934
Let's hear from everyone next month!

Traffic: W9ZZF 1107 ABE 265 BFL 317 BIV 214 LEZ 129 AXU 174 LCNX 161 JSO 128 NUC 103 EPA 60 GP 78 DPO 63 CGW 57 GFT 49 FYX 41 10 FSC 35 FFD 22 FLI 19 NTV-ERY 13 GST 22 NDN 7 GXU 6 CYL 5 DEA 2 NVF 2 DFF 4 CZY 6, W6ZBL 28.

Kansas: J. J. Speicher, W9KQG and W9CFN CW RM. W9EKL phone RM. W9EKG leads the state with a grand total. W0L9V is licensed to operate at State Sanitarium. W9GJF is operator at WREN. W9K9J stimulates traffic with pads in hotels and drug stores with much success. W9HJS is QSL manager for W9JXV. W9HJS gave a talk on radio at Iola Junior College. Dick West of Hartford, Kansas, has gone into the ministry. W9QGO goes to Radio school at Fort Arthur. W9EAH worked one "G" and a "CZ." W9HQF is licensed to operate in C. C. W9QGO is QSL manager. W9GOZ uses 48 watt swlky new wire. W9HHT and OZV have a contest on. W9B4J, DMF and OY build new station at North High. W9CCO is instructor in Radio at East High. Stations heard on the air in Wichita: W9BSX, GNO, PGL and LVZ. W9FGG worked several states on phone. Wichita Club is now affiliated with A.R.R.L. W90PDV puts up new Zep GOOD W9EMT has new SW3, W9QFZ is building MOPA. W90DJ is now in Ellsworth. W9QG uses 47 crystal osc. W9PB is responsible for a family reunion on the air. W9OHF, ex-CWZ, reports on A.R.R.L. card so old we are going to frame it. W9CRU has new 20 watt rig. W9LGR reports W9DR still chasing OK. November 6th. Ex-FMZ is now at Moran, KS. W9CWW proves his mettle with death message. W9OBV is moving to Quenemo. W9WMW passed Radiotelephone First. Imperial Radio Code practice every Monday night. Osage County Amateur Radio Club is affiliated with A.R.R.L. They meet every Monday night. W9LFN has new 100 watt phone and c.w. rig. W9FLG lost high voltage filter and rectifiers. The Sunday Morning QRS schedule is now in effect. Get in. W91OL is now QSL. Rebuilding: W9AWP, ABG, BKN, BEZ, OKA, KUO, OUU, KDR. New rigs at: W9N1EZ, GDS.

Traffic: W9KG 1227 NMR 413 LFG 208 IOL 242 ODV 106 NJS 103 CKY 97 KQF 77 AW 76 CWN 65 BYM 66 FRC 64 PB-KR1 82 EFE 54 FMY 50 TEL 46 CFN-IRE 40 BQW 39 MUY 38 OFP 38 KRD 28 OQC 25 KQF-BYX 22 HSN 17 AHR-GRN 15 HJF 14 DMF 12 CWW 11 EY 10 LAX 9 GMZ 8 3 GV 30 FZ 18 NN 17 MC 16 BNT 14 MZD 12 DPN 11 MV 10 EY 9 AHD 8 G7 7 EWE 74 HZ 68 AON 64 EY 63 DQJ 52 BNDX-63.

Missouri—SCM, C. R. C. Cannady, W9EYG—W9FPT, W9BMA and W9CJR, RMx. The "Bull" seems to be doing the work! A bigger report for this month and thus far not a single complaint on this system of handling our reports. In fact, the gang seem to like this system better—it allows more space for each man in his personal column! REMEMBER, AN ACTIVITY REPORT BRINGS YOUR COPY OF THE SWL TO W90PP, DMF, W90PDV, W9QGO and W9HJS. SEND YOUR COMMENTS ON THIS REPORT AND BE THE "BULL." Let's hear from everyone next month!

HAM RADIO CLUB. WIAQG has been QRL. WICK is a Portland ham. WIAQW is going to Bates. WICRP is a successful hamfest on Nov. 18th. OPS appointments are limited. WILM finds his schedules working rather poorly. WIEFA has been hunting. WITO is also a newly-licensed ham. WIRE heard the East Boston plane on 56 me. WIAQX shot a nine point deer. WIGJP is A.R.S. WIFLA wants a Maine schedule. WIFQZ has a new 2x2 modulator. WIBZQ is a new West End ham.

Traffic: WIBOP 121 EF 85 EBM 58 CHF-OR 50 KFA 96 HJP 88 DHH 89 CDX-BNC 16 APX 10 FJP-DX 93 HVS-BO 3 BTA 105 CRP.

EASTERN MASSACHUSETTS—SCM, Joseph A. Mullen, WIAST—WIAST attended a meeting of Framingham Radio Club. WIABG has been QRL. WIKR is agitating more activity on 26 me. WIFW says DX conditions are poor. WIAQA has trouble with schedules due to skip. WILM finds his schedules working rather poorly. WIBBX is hanging on tight to his VE schedules. WIBJY says any stations interested in joining Atlantic Seaboard net please write him for schedules. WIAFB is awaiting liming regulations. WIDPS is editor of NOR paper. "The Interceptor." WIZBO has phone going on 1.7-mc., thanks to DNL. WIRE heard the East Boston plane on 56 me. WIFOU is building new super 2-mfd. condenser. WILBA has RF service man. Actives: W1FFZ. WIHQS is new Manchester ham. W1BQF is the smallest ham in Manchester. W1APK is busy with Grange Convention traffic. Members active: W7BRU, DEQ, YA, AXY, DXY, CUG, ASA, AYP and members Boise Hi Radio Club. W1TBAR has 32. WIAJY, CSP, BAR are on 28-me. phone. W7GU is QRL radio service and pheasants. W7CMD burned out transformer. W7BHN has 3.9-me. 'phone. W7BLT and CFX attended police radio meeting in Reno. K7BAQ has FB7. K7AYQ is holding pan-handle down at Bonners Ferry. W7KJ is QRL referee. W1CMD is new RF for southern N. H. Get schedules with him. W1AHD has 55-foot mast. W1FRC has new 50-me. receiver. W1HJZ and HKE are on 50-me. W1CVK has a new job. W1FPW purchased a new key nights and a new condenser. W1WJZ is building new 2x2 mod. condenser. W1BLA has RF everywhere except in his antenna. WIEUIH is building c.e. rig. W1BRT changed to "tritet." WIBOP is going to have Class "B" phone. W1EAF has a very high mast. The So. N. H. and So. Maine Radio Assn. meets the 1st and 4th Friday each month. W1ERF is working 14-me. ragged. The St. Paul's School Radio Club is on with an 103A and an F8XA. WICFQ showed the SCM the W1EAF rig. W1AQY, EAW, EX and W1AUY holds OPS Number 1. W1AVJ is an expert bridge player. W1AVL is DXing. W1GEK is on 7 me. W1HIO plays in an orchestra with W1DMD as leader. W1DCT is a radio service man. Actives: W1FZZ, W1EIQS is new Manchester ham.

Traffic: W1EQQ 17B FT 165 UN 150 DMI 80 FFL 58 BIF 56 FEX 53 APK 29 CUN 19 EZF 17 FTV 47 BOD 15 EBM 5 GDE 19.

RHODE ISLAND—SCM, Stanley Atkinson, W1AFO—W1CAB is the proud father of a new Jr. op. Congratulations, OM. W1EIOF resumes schedules with new transmitter. W1XAI is building a c.e. job. W1GTYN has superhet bug. W1GPE has been appointed A.A.R.S. DCS. W1DIX works W1GTYN recently. W1GQG sends code practice on 8.5 me. W1DYY has a 212 on 14-me. W1G7S sticks to 7 me. W1CPV has a 5-stage c.e. rig. W1VGY is learning radio service business. W1EZW reports his rig on 8.5 me. W1AXL applies for O.P.S.

Traffic: W1CAB 244 EOP 89 AXS 52 AFO 42 GTN 19 DGP-JX 16 GOG-DY 13 GTS 12 CGV-GY 5 EZW-ASZ 7.

VERMONT—SCM, Harry Pace, W1ATF—W1BD is w.c. OBS. W1DQK and JPS are 'phone OBS. VT. OBC include last-minute Vt. ham news in their regular transmissions. W1DQC is building c.e. rig. W1BJP, RM, is liaison station for c.e. and 'phone lines. W1AXN has new "tritet" rig. W1EZV reports action on 7 me. Reports are solicited from every Vt. ham.


NORTHEASTERN DIVISION

LASKA—SCM, Richard J. Fox, K7PF—K7CCL has gone to Fairbanks to college. K7BNR is back on the air. K7DFV left for Stanford. K7CP and AOC have gone south. K7PF put porcelain spiders on his zep peppers. K7QDF has 50-mc. VE. reports from Ross Inlet during the winter. K7BAQ has FB7. K7AYQ has Collins 32. K7AVU gets good results on 7 me. K7BNR is on his way to States. K7BMY is now at Love-luck, New Hampshire.

Traffic: K7VF 16 RZX 19 BWN 22 BWA 30 PQ 81 BND 144.

IDAHO—SCM, Don Oebertil, W7AVP—Boise—Gem State Amateur Radio Club is busy with Grange Convention traffic. Members active: W7BRU, DEQ, YA, AXY, DXY, CUG, ASA, AYP and members Boise Hi Radio Club. W7BAR has 32. W7AYZ, CSP, BAR are on 28-me. 'phone. W7GU is QRL radio service and pheasants. W7CMD burned out transformer. W7BHN has 3.9-me. 'phone. W7BLT and CFX attended police radio meeting at Boise. W7GL, DZQ, BAA, AAX, AYX do fine work in Police broadcast. W7BDZ is working A.A.R.S. W7AYZ and NH hold open house for hams. W7DD has new rig. W7CVH is ready for winter. W7CSW reports for first time. W7APT receives police broadcast. W7DMM, Moscow, reports. W7CDJ, W7CRL got married. W7CCF, CQX and AYD attended U.S. Navy reports football game at Walla Walla to CQG at Moscow. W7AGD MM have SW3s. W7DJM worked K6. W7AYQ is holding pan-handle down at Bonners Ferry. W7KJ is QRL refrigeration equipment.
operators. W7BMP applies for ORS. W7EAY is QRL Debate team. Now e.c. rigs at: W7DQC, CBT, CAT.

Traffic: W7AYV 189 BAA 21 IT 4 CAP 2 CHT 18 C3M. MONTANA—SCM, O. W. Viers, W7AAT—W7CCR takes traffic honors. W7AOD, ASQ and CRH have nice schedules. W7BVE is working bugs out of his rig. W7BDE wants early morning traffic schedules. W7CIE has got to work this week! W7CEG is rebuilding receiver. W7AFS is having the YL-cows (on farm). W7AHF gets more time in at KGEZ. W7CDK will soon be on near Kalispell. W7AT is on again. W7OW will soon be on at 720 mc. W7CFH is using a 90 crystal oscillator. W7AOR moved to new shack. W7AFU is building c.r.i. rig. W7BCA blow transmitter tubes. W7CMH is working lots of Ws and W6s. W7CUK is on 1.7-mc. phone. W7DST has dead receiver batteries. W7AUF, CME, AOI and CUE are going to take unlimited 'phone exam. W7AT finished new e.c. job. W7COX may boom forth soon with a 50-watter in final. QRL: W7BYR, CTP, BTL.

Traffic: W7CCR 222 AOD 43 BDJ 26 BYR 20 BVE 70 ASQ 29 CAT 2 CCEG 3 CRH 13 CRU 5. OREGON—SCM, Raymond W. Cummins, W7ABZ—Nov. 18th, the Valley Radio Club was host to about 50 hams from all over Oregon. W7FZ, BKS, QT, RD, CEJ, ABW and FBU made the trip to Eugene and attend the first of these semi-annual hamfests. W7WJ turns in largest total of the year. W7BEG is Airways operator at Skiyumon Summit. YLs are claiming W7BEE and BAX. W7BDE has pair of '10s. W7BKG is hunting going months and months. W7AST is reporting traffic 100% of membership. W7TEQ is getting eons of BQR. W7DRX is on daily. W7DGX is DGY 8 CRN-AOI 5 ALM-CBA-BOO a DEA-AXO-DAV-station! I BWD 15 CUV-BMA-AVB 14 COU 13 AIG 12 CIK-LT

WASHINGTON—SCM, William Fest. W7HJ is experimenting with 56 mc. W7LI got in on time. W7AMF is back again. W7DKI and DHZ are new Central Point operators. W7A VB and CMK are working lots of DX. W7CWH and W7CUV’s receiver pulls W7DAV is in CCC. W7DXC is new Astoria ham. W7CHB is paid SCM a call. W7BWD worries about getting reports 100% of membership. W7BYR, W7BHH has ben, seen at Radio Club and other places with a rer­ nunna when he has to buy a ticket to Abyssina and DZR report

PACIFIC DIVISION

HAWAII—SCM, C. D. Stelen, K6COC—K6BDC is on with single '10, K6CRT is pounding, K6HOO is rebuiiding. K6COC is taking up fishing with GQF. Traffic: K6EQQ 1094 FAB 747 AQG 575 AYA 375 DQA 348 JPT 319 COQ 263 GQF 99 CIB 81 G2I 34 HOO 29 EDJ 14 TSP 8 JRN-CRJ 4. NEVADA—SCM, Keaton L. Ramsey, W6EAD—W6UO is c.e. W6YAR at U. of N. handled traffic on Homecoming Day. W6BYR handled all his with 'phone! W6BTJ is experimenting on 28 mc. W6AJP has two daily schedules. W6BRYR 158 UO 89 YAR 82 AJP 7 TOY 17 HGL 10 GXY 6.

LOS ANGELES—SCM, Francis C. Martin, W6AAN—The Federated Clubs put over well attended baseball game at San Bernardino. W6CL and W6CQ applied for ORS. W6CQ is MDL 15 PAE 14 212 19 13 9 8 7 5 3 1. W6CQ gets out FB on 7 mc, sister to W7BCS. W7CCX is trying 1.7-mc. phone. W7CDN is planning new receiver. W7APC and W7AIT report. W7AG/SU, AAA/STN apply for ORS. W7BNU gets more r.f. in his antenna when AK5 is on than when his own rig is going! W7BK5 is now ALL. W7CXY has status of A. W7CXX is on a trip to South America. W7DHU has been seen at Radio Club and other places with a certain Miss "B ..." or is it Mrs. Beach? ... W7RT will have to buy a ticket to Abyssina when he reads that W7AVM is busy making Xmas presents. W7DXZ gets out FB on 7 mc. W7BEX, ANZ, and DZ report via W7FWY. W7FWY makes BPL with plenty deliveries. W7LD is president of Rho Alpha Radio Frat. at U. of W. W7AYO got back on the air Armistice Day. W7CZV 465 WY 403 LD 377 ABU 145 ALH 139 CQJ 110 BHE 92 CCHI 86 AWF 81 IG 78 DRY 54 CHAI 52 CON 51 CPE-APE-9 AKZ-AKZ 28 38 27 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1. W7CZV takes traffic honors. W7AOD, ASQ and CRH have nice schedules.
Schedules north, south, and east. More TP traffic from W6AMM. W6BMW has FBXA. W6DBB rebuilt 1.7-mc.

GNZ-HAE-IFC-JJU-JMJ
CXW-HAH-HJW 4 AGF-CDM-CPM-DOJ-EK-FEX-
GMA-GTE-MA

quired a new shack. W6HZW built new 1.7-mc. 'phone. IIK-IWO-PD-EMY 1 OUH/QD 5.

ing past month. We are indebted to the following who

Bay outlet for consistent traffic to Orient. W6RJ is now

bell, Calif. W6YG again leads the Section. W6FBW

took time to report: W6ALQ-ALR-ANN-CQG-DIX-

17 GOZ 12.

January,
with all Trans-Pacific traffic. W6GXL is on 1.7 mc.
W6AME has c.c. W6FFU worked 33 miles on 50 mc.
W6GEI keeps schedules on 7 mc. W6EXH’s new QRA:
Ripon. W6EPQ schedules KAIEM. W6QDP reports Bakersfield
Club (600ZP) operators on air with code.
BF. W9LS is now 7.25 mc. daily expense. W3ROQ worked
Zeder on 3.9 mc. ‘phone. W6AEW has new ‘phone.
W6AOA blew tens. W6RBP is rolling up ‘phone
rig. W6JIC is newcomer to Fresno. W6KX is new ORS.
W6BB is now owner. W6FLS is home after year
in China. W6SP built new Super. W6GJO is QRL NCR.
W6JNL is confined to bed. W6ARK is fighting bugs in
super. Rebuilding: W6BXB, FYM, DZN. Active:
W6WA, AGY. SCM wishes you all a Happy New Year.
Traffic: W3DGT 132 EXH 35 W6ZK 30 W6ZQ 25 BCE
G3E GYD-BDQ 18 AGV 42 FFN 11 JLN 10 GEI-GQZ 6 SF-BTF 4 CVA 3 JIN 2 BCC-AME-FFU-
FYM-DZN-GXL-JIC-FRH 1.

ROANOKE DIVISION

NORTH CAROLINA--SCM, G. H. Wright, Jr.,
W4AVT--W4ABT Chief RFM. W4PWF Phone RM. A
large number of N. C. Fellows attended the big
Virginia Hamfest in Norfolk on November 25th-26th. “Big Feet”
Hege lost his title to Mr. Kimmel of Charlotte! W4MR
and ORS are very busy. W4DX is going strong on
3.5 mc. W4CDQ worked a VK. W4CP copies the QST
from W1MK eleven times during month. W4RE says
14-mc. hand is NG. W4CPG is burning down pair of
‘phones. W4RF and BFR send nice traffic reports.
W4BT is using ‘45 TNT. W4AFW is subscriber and booster of “Tar Heel Ham.”
Sample copy of same will be forwarded to any ham
in the United States upon receipt of 25 cents stamp for
postage. Club worked a Russian on 2-meter. All ORS
are ready for winter. W4ALK blew filter condensers.
W4ALT says the OW wants to become a ham.
W4CJM is building c.e. rig. W4ATY has transmitter to tune
in both 7 and 3.5 mc. W4CPA is new Wilmington
ham. W4BHR and W4ANZ 10 years on the air. W4OJ
has an ‘03A. W4A4K and AAh have new mast poles.
W4BHR is giving code practice on 1.7 rue. W4BV has
3.9-mc. ‘phone schedules. W4BRS built new Super. W4BGT operates at WMMN. W4HCL worked
Spain. W4SEJ worked all districts. W5KDP had 180
QSOs first 2 months’ operation. W5ELO schedules
W3OYA, W5OBE, W5QYX and W5TU. W5EJE, W5EJF,
W5S, HD visited Chicago. W5GPH worked VK. W5DAS
is teaching school. W5BP was operated at Marshall
County Fair in Moundsville. W5WIL built “Tritet.”
W5AIF, CFM and DSQ desire OPS. W5EZR and BDD
are running class at Y.M.C.A., teaching 10 will-be hams.
W5OK is constructing PA. W5EWM is building permanent
rig. W5CMJ schedules W5CCD, W5FPZ, W5DWN, W5SN.
W5QFB/JCX will handle traffic from WVU. They desire schedules with W. Va. stations. W5TJ
got from W3QG on 25 mc. QSOZ 76 DCU 52 CYK 49
APT 30 AHC 23 CMJ 22 CJF 19 AHC 18 CCU 11
BDD-KSJ 9 DMF 8 ILY 7 DFC-EWM 4 AFB 2

ROCKY MOUNTAIN DIVISION

COLORADO--SCM, T. R. Becker, W9BTO--The
Denver Boulder radio club reports fine progress. W9QJ
reports fine total. W9CDE is building MOPA. W9NRA
was heard in Germany on 3.5 mc.
W9LEK changed QRA. W9FRK is “part on the air.”
W9SPN made the BPL. ‘The Spring,9 gang report FB
results with the “tritet.” Take a look at W9ESA’s total.
W9LF’s fle power is working full. W9YL handled a
few. W9EHC is building “tritet.” W9FFY worked three
Britishers. W9IPF is now O.O. W9LYE has new oper-
ator-station license. W9ITU will be on 12 mc. W9BYK
has a battery. W9EMU are on ‘phone. W9GFR is installing
Class B ‘03A modulator. W9ABA has new sky sticks.
W9GWN is working in Almas. W9CND has FBX.
W9C0W uses a new ‘phone rig.
Traffic: W9EHC 4 YL 24 NRA 38 31 UHE 17 LPI
CDE 86 8JQ 327 GMC 17 KZ 513 ELH 43 EBA
1067 APZ 1.

UTAH-WYOMING--Acting SCM, Arny W. Clark,
W9CQG--RM W9EKL. Members of Utah-Wyo.
are to be commended on reliability and efficiency.
W9APN S.L.C. is Control Station; other members: W6AHD,
Cedar City; W6FYR, Ogden; W6GQR, Park City. Join
QST for
up, gang, and get in on the fun. W6FJU built new shack. W6CRS has 1 kW 3.9-mc, 'phone, W6CLUD and CRX are on 'phone. W6CMM and AWY have c.e. W6DJQ visits W6, W6AVT and W6CMM are equipped for 3.9 me. W6EEX is on 3.9 me. W6EEX applies for OPS, W6BQC signs into HPL. W6CDE is helping W4UW. W6AIS is back in Seattle. W7COI keeps FB schedules with '01As P.T. W7AMU took portable to Cheyenne. W7AUO built 50-watt e.c. rig. W7NY is working on new rig.


SOUTHEASTERN DIVISION

ALABAMA—SCM, L. D. Elwell, W4EP—W4BOU


EASTERN FLORIDA—SCM, Ray Atkinson, W4NN—The 'phones handled the bulk of the traffic this month. W4BHE and W4ATC are at 'phone and c.w. W4BTC is a newcomer. W4SN invites all states to report monthly, and is especially interested in getting dope on all clubs. W4BDT is new Abilene ham. W5BKII is busy RN’ng. Thanks, gang, for reports this month; we broke the record with 38 traffic reports. The SCM would like to hear from prospective ORS, OPS and OBS. W4AGB makes WAC on 7 me. with '10s! W4CDE is going on seven months’ of 'phone. W4BOA RIS MJ 43 KB 30 BE A 6 COG 8 BGA 10 ACD 12 AQY 19 MS 27 BPI-ARV 4 AUW 6 CDE 7 AXF 5 QR 3.

GEORGIA—SOUTH CAROLINA—PORTO RICO-VIRGIN ISLANDS—ISLE OF PINES—Acting SCM, G. A. Long, W4AUL, W9CQG, W4CGR, W4APP are on 'phone. W4CBY worked Africa five times in a week! W4AW gave a "swellgate" talk on crystals at convention. W4UT copped an RK-18 tube for prize. At regular meeting of Atlanta Radio Club, J. Gardner of local IRE contingent gave an excellent talk on the vacuum control of All Georgia hams are urged to attend these monthly meetings. The annual old-timers’ get-together and banquet will be held by the club some time in January. For information write W4MO, GM2RA asks QRM from bombs and guns make radios useless. Communication impossible in Habana. W4CTC is operating Naval Net (NDJ) tri-weekly on 3610 kc. The Palmetto Amateur Radio Club of Columbia, S. C., held a hamfest with Augusta, Ga., club in Columbia. W4CE is Connas. Officer, 4th Fleet Div., Georgetown, S. C. W4GCR will soon be on with '12A in Hartley.


WEST GULF DIVISION

NORTHERN TEXAS—SCM, Glen E. Talbott, W5AUJ. W5BII, C.R.M. District 1: W5BII is DNCS A.A.R. Mrs. W5NW is W5DRU. W5ASU reports new club at Athens. W5BTJ wants 1.7-mc. schedules. W5YL is on at Palestine. W5ARG is on 1.7-mc. 'phone. W5BII is on at Beaumont. W5ASU reports new club at Palestine. FBI reports W5BII and W5CMJ at Jacksonsville signing W5AJO. W5ANU, RM, has 52 e.c. freq. meter. W5DAA has nice traffic. District 2: W5AMX reports by radio. W5CMS wants ORS. W5DFU is on at 1.7-mc. 'phone. W5DAA wants new schedules. W5CSD says his beam is 45-kw. W5AVU has big DX list. W5CAV visited San Antonio. W5IA, RM, has MOPA. W5BKL says new club starting in Ennis. District 3: W5IT worked K6 on 3.5 me. W5BCW is building e.c. rig. W5CVY is using ‘03A. W5CGB fell off antenna base. W5CPI says '03 is 1500 watts and 1500 watts. W5CFW is on at Wichita Falls. W5BIS, RM, has 6 schedules. District 4: W5AUJ worked Hong-Kong. W5CYU and SP are on 3.9-me. 'phone. W5BAY is building new rig. W5AORG erects new antenna daily. W5BSN is at Fort Sill, Okla., until further notice. W5BBK says new ORS from South America.

Traffic: W5BII 345 ARS 151 ANU 123 AUL 117 DAA 111 CCD 63 AW 77 AJG 71 IA 66 CAY 60 AUU 55 BEK 47 CYU 34 CJS 32 CPX 29 FT 27 AHC 28 A1D-BJX 26 AMK 20 BOW 18 CY 17 DEK 16 OJ 11 CMX 10 AYA-BMS 10 BMS 7 AFT 6 SBJ 4 JSN 3 BES 2 BPK 2 64U-BH 2 64U-DR 2 BKO 2 BWM-ARV-CLJ-CEE 1.

OKLAHOMA—Acting SCM, R. F. Hinck, W5BQA—Our SCM, W5YQ, has been transferred to 8th bombardment squadron, March Field, Riverside, Calif. Sorry to see you go, OM. Best of luck. W5CEZ holds the list again this month. While on vacation he visited W9DMY, W9GIE and Grand Island monitoring station. W5AIX has new ORS. W5BIX has new ORS. W5BIX is on at Palestine. W5CGB is making WAC on 7 me. with '10s! W5AUI is on at Palestine.

ONTARIO AMATEURS

WINTER CONTEST FOR ALL ONTARIO AMATEURS
Contest starts Jan. 15th, 18:01 a.m. and ends March 15th, 11:59 p.m. Simply report to your SCM on Feb. 18th and March 16th: 1. Your traffic handled. 2. Copy of your log of: (a) all VEs worked outside of 50-mile radius; (b) all stations worked off of your SCM list; (c) all W/E or W_RM's worked. Points to be based on your standing in each of the five groups. Five useful prices for which your own Rams and SCM's are not eligible.

QUEBEC DIVISION

ALBERTA--SCM, C. H. Harris, VE4EM--4GJ lost his mast. 4XM and EA super works well. 4EW is back in Edmonton. 4EC is building c.c. rig. 4KU is QSO to Maine. Many traffic went down in that storm. 4BG is W1MF and W1BSQ visiting him. 4EM wants 56-mc. enthusiasts. The "Sky-Wire" is available to all VE2's--if you don't get it, send me your QRA. DXers: 2CA, EX, DR, HE, GL.

Traffic: VE4EO 6 BT 24 AP 32 CA 1 BG 95 BB 146 CX 101 DG 8 AC 19 HK 36.

VANALTA DIVISION

ONTARIO--SCM, B. T. Banks, VE3TO--Many thanks, fellows, for electing me your new SCM. I hope, with your help, I may continue the good work. VE3QD, Ont. QSL, Mgr., requests that all stations that have worked DX in the past year send him stamped envelopes for their QSLs. 3HI reports good club in Palermo. 3RI visited OD, 3TM and JT operated at c.c. rig. 3RI reports good club at Palahlow. 3XM is QSO to Maine. 3JAQ is pushing 'phone out on 14 mc. 3LT is looking for new QRA. 4L is looking for good stations. 4GL is considering an FBX. 4NF is on 1.7-me. 'phone. 4MY is building MOPA. 4JP is honorary president of MWEA. 4NF and MV are building c.c. rigs. 4EXX is pushing 'phone out on 14 mc. 4LT is QRL. 4LN is awaiting new transformer. The MWEA held a banquet at the St. Charles, and a good time was had by all. Rebuilding: 4LI, HP. DXers: 4NW, DJ, Active: 4CP, FT, OB, NM, DZ, OU, NI, TA.

Traffic: VE4ALX 21 HM 11 NB 7 DX 6 EO 5 KT 3 IQ 2.

BRITISH COLUMBIA--SCM, J. K. Cavalsky, VE5AL--The B.C.A.R.A. operated a station at Vancouver Radio Gala. 5BN's two ops keep station on the air. 5BY is active. 5GJ plays chess by radio. New officers are elected: 5FE moved to Victoria. 5EC increased his power to 500. 5HF has QSO party every Sunday morning on 3.5 mc. 5GO worked his first ZL. 5BJ works TD 100%. 5KJ works PB 100%. Points won: 5AI, 5BQ, 5DU, 5EF, 5EH.

Traffic: VE5EHE 18 GI 8 AC 56 JD 8 AO 48 AI 24 FG 42 DP 38 HR 19 JA 19 JC 13 HP 134 EO 31 EU 62 HI 200, VE5AJ 103.

ONTARIO DIVISION

ONTARIO--SCM, B. T. Banks, VE3TO--Many thanks, fellows, for electing me your new SCM. I hope, with your help, I may continue the good work. VE3QD, Ont. QSL, Mgr., requests that all stations that have worked DX in the past year send him stamped envelopes for their QSLs. 3HI reports good club in Palermo. 3RI visited OD, 3TM and JT operated at c.c. rig. 3RI reports good club at Palahlow. 3XM is QSO to Maine. 3JAQ is pushing 'phone out on 14 mc. 3LT is looking for good stations. 4GL is considering an FBX. 4NF is on 1.7-me. 'phone. 4MY is building MOPA. 4JP is honorary president of MWEA. 4NF and MV are building c.c. rigs. 4EXX is pushing 'phone out on 14 mc. 4LT is QRL. 4LN is awaiting new transformer. The MWEA held a banquet at the St. Charles, and a good time was had by all. Rebuilding: 4LI, HP. DXers: 4NW, DJ, Active: 4CP, FT, OB, NM, DZ, OU, NI, TA.

Traffic: VE4ALX 21 HM 11 NB 7 DX 6 EO 5 KT 3 IQ 2.

SASKATCHEWAN--SCM, Wilfred Skalife, VE4EL--Your SCM visited 4EV, 'phone, and had PB QSO party with 4GA, OB, ID, DC, GL, FA and KJ. 4GA handles traffic of raft from Van. to Chi. 4KJ works ID 100% with 183 nigs. 4EP and 4A apply for OQS. 4JT worked his first ZL. 4EF is QSO FY. 4JF is building 50-watter. 4GR handled traffic with QRH from 7 locals. 4IM is on nightly. 4EM is trying a.c. receiver. 4BH visited 4JF, JX, 4KJ, 4EJ and 4M. 4HM and 4JF sent QSLs to P. 4PF is transferred to Ontario. 4EL is coupling his P. 28 mc. Osc. to final AMP. 4ML built handy cabinet to take both
transmitter and receiver. 4DB is completing rig with e.c.
and 4CN visited 4AZ, 1J, and GW. 4OE works all W.
districts with 4 watts.
Traffic: VE4IB 53 MH 31 GR 23 GA 22 BF 13 KJ
10 EL 3. 4DB 4CN 4AZ 4OE 35.

LATE AND ADDITIONAL REPORTS

WS5M2 wants all traffic possible. WS5CLV is c.e.
WS5AW increased power. WS5CTI has 200-watt rig.
WS6MM is on regularly. WS5LD, LaPlace Radio Club,
schedules W5CL and W4BOU.

Traffic Briefs

W2BSR worked XW4PDA on Oct. 17th on 14 mc.
XW4PDA is the ship Ripple of the Hammond Research
Expedition, at the time 70 miles from Ciudad Bolivar, in
the Orinoco River, Venezuela.

For poor farts, use QSD . . . your keying is bad, signals
unreadable. Of course the signal QSD is equally appro­
priate for the signal in difficulty due to trouble with cold
rectifiers, sluggish keying relays, wrong grid bias for
keying, defunct relay batteries etc. too. Irrespective of the
cause, QSD will inform an operator of keying difficulties.

The Amateur and Police Radio
(Continued from page 37)

All this is machinery and men, from which
may be built drama. It is unfortunate that you
have the wrong writer for that purpose. I will
make a feeble stab at it by a few examples and
for any radio transmission.

It's in the Blood!
(Continued from page 80)

Hoboken for all the good—it did 'em; but they
needn't have felt hurt, 'cause we listened and
can't find Jasper hurt. However, Soupy
manages to hook him one a.m.; he was twaddlin'
around in the 7000-ke. band with a sig that
sounded like the ghost harmonic of a goober-tube
long since gathered to its fathers, and a note
about as stable as a Y.L.'s mind. When Soupy tells
him he's in the ham band and that we are hearin'
XKKX and can work him and handle all their
traffic he tells Soupy he can't be in the 7000-band
because his crystal is ground to 6826 kc. and
what's more we are QRMing him and he doesn't
need any help and will we please get off the air.
So we tell him he can go places on a one-way
ticket, and go back to our business of snaggin'
Zedders in the early mornin' hours and don't
bother with him for the next coupla weeks.

By this time the crew of the M.S. Palooka was
tearin' their hair wonderin' where the outfit
could be upriver and WNU's press was gettin'
full of the missin' expedition—none of which
caused Soupy and me to miss our Cafe Royal
every a.m. So it goes for a coupla more days until
one day about the time you can work K7's I
hear a scratchin' on the window. Thinkin'
maybe that one of the native gals I'd been
latin' English to had forgotten a word and
come to the ole maestro to review her lesson I
gets up for a looksee, and who is it but J. Q.
Sideband in person—none other.

"Listen," says he, "maybe I was a bit hasty
when I worked FX that last time; the mos­
quitos, you know, were nearly driving me in­
sane." He points to his swollen dogs. "Could you
chappies help me with my set?" says he. "I can't
seem to make it work."

Well, after I'd booted Soupy into as near con­
sciousness as he ever gets we have a parley and it
seems the idea is we should muck among the
mangroves with this egg and scam upriver to
get his set working without lettin' the guys on
the m.S. Palooka know about it, thus keepin'
Jasper's name unsullied so's he could go back to
the U. S. A. and endorse phoney statio-elimina­
tors and cigar-box antennas. Why we agreed to
do it I dunno; guess we were (and still are)
screwy. But we did. Just before we sneak out,
Jasper points to our rig.

"Shouldn't we take that set along, as a sort of
auxiliary rig?" he asks, pointin' at FX all nicely
haired up. "Of course I know there's nothing
fundamentally wrong with my set . . . some
more trick feed-over from the last stage to the
second doubler, but . . ."

"You will NOT!" yells Soupy. "You may get
me to lose a qt. of blood to the flies, an ear to the
'gators, and several days' drinkin' time, but you
don't get your dukes on this rig!"

When we come up to the expedition some days
later they didn't look quite so natty as when

January, 1934
Hawks Enters Hamdom
The Texas Company, 
135 E. 42d St., New York, N. Y.
Editor, QST:
I have hesitated to write any comments on my entry into the ham fraternity, but it might perhaps be amusing and interesting, and, possibly, of some constructive value.

I was thrilled beyond words in passing the examination and receiving certificate and station license. I could not wait until I could finish my flea-power transmitter. I say flea-power because my good friend W2GKM and I both agreed that we would start in with very low powered outfits until we have gained experience in the field of both construction and operation of the equipment.

All hams have experienced the thrill of constructing their outfit and the first night of trial. That anticipation of an answer to continued calls can last just so long and then there is bound to be a bit of disappointment and even resentment. Personally, I spent my first three nights between careful observation of A.R.R.L. recommendations, sent very few CQ's, twiddled the dials religiously to pick up others. I was not in the least optimistic of my own outfit, so I called only stations within my immediate district. Needless to say I was very disappointed on the third night that I had raised nobody.

Finally, to make sure of the signal's strength, I enlisted the aid of W2GKM to operate my rig while I climbed into my airplane and worked with him. KHEVE, which is in the plane, is a decidedy proven outfit. I circled my home until I picked up my own station and then flew in radiating circles about the house for a distance of some 50 miles in all directions, keeping in constant contact with home.

With this information I was fired again to go after the boys in my own district. Needless to say I was very disappointed on the third night that I had raised nobody.

Finally, to make sure of the signal's strength, I enlisted the aid of W2GKM to operate my rig while I climbed into my airplane and worked with him. KHEVE, which is in the plane, is a decidedy proven outfit. I circled my home until I picked up my own station and then flew in radiating circles about the house for a distance of some 50 miles in all directions, keeping in constant contact with home.

With this information I was fired again to go after the boys in my own district, knowing that I was actually getting out and that surely somebody would answer.

Time has elapsed and I have had the pleasure of a few QSO's (very few). I have talked with several prominent amateurs who have been at it a long time and find that it is rather difficult to QSO with a ham in your own district; most of them pay no attention to local calls as they are after DX. Now, I cannot blame them for their eagerness to get distance, but I do think that

when some weak and perhaps modulated signals are discerned, some of the hams should feel a spirit of charity and answer those calls with a definite intention of giving a thrill to the other fellow who is so eager for an answer, plus helpful suggestions regarding tone or any other defect that might be noted on the signals.

W9ZZAF wrote a very helpful article in October QST along these same lines, and I am merely elaborating on it. My giving specific instances is just a more concrete manner of helping rid the air of thoughtless and inconsiderate hams. I would not be so bold as to mention specific calls. In working one chap I was hampered with considerable QRM plus his none-too-good signals. He was going a little faster than I could take it under the circumstances, yet each time I managed to catch enough to come back and give an intelligent reply along with which I asked him — five times — to QRS. He paid no attention whatever to my request and the completion of the QSO was rather disappointing. I worked another chap to whom I asked for a slight repeat due to QRM and he never answered me at all and never even signed off. The next thing I heard was his QSO and I was decidedly at a loss to know just what could possibly be in his mind by treating me in that manner.

Of course, they have not all been that way. I have had the pleasure of contact with a few very courteous hams who have been most helpful. I am new, eager to learn and eager to cooperate.

I was impressed with the article by W6ZI on the classification of pests, in November QST. It would not hurt any ham in the world to peruse that article and take inventory of his own station and the operation of it.

I am extremely interested in amateur radio and will only increase the power of my outfit as I gain in experience and ability to operate it effectively with as little hindrance to others as possible and to the satisfaction of those in the fraternity with whom I may have the pleasure of coming in contact, and to the best interests of the A.R.R.L., with which I am proud to be affiliated.

—Frank M. Hawks, W2GKL

Hot Cat
City Hall, Lake Worth, Fla.
Editor, QST:
It was a nice quiet night in a certain commer-

(Continued on page 70)
There is a NATIONAL Velvet-Vernier Dial for every application in Amateur radio where consistently smooth and fine operation, precision control and precision logging are requisites.

FULL VISION DIAL
U. S. Pat. Nos. 1,656,532 and 1,713,146
The Amateur can note instantly just what part of a band he is working, when he uses this dial on his receiver. The ample 7" illuminated scale permits a high degree of accuracy in reading and logging. Mechanically this dial has all the fine quality that has always been found in NATIONAL Velvet-Vernier Dials. The drive is smooth and positive. The pointer is vertical on all parts of the scale. Escutcheon is finished in antique bronze.

TYPE "NW"
U. S. Pat. Nos. 1,744,675; 1,653,875; 1,656,532; 1,713,146
Outstanding precision-vernier instrument dial for monitors, frequency meters, oscillators and a wide range of other uses where extreme accuracy of control and reading are necessary. It is a parallax German-silver machine divided dial and parallax eliminating flash vernier read directly to 1/10 division and may be estimated to 1/20 division. Equipped with Standard Velvet-Vernier drive, of the type used in the NATIONAL Type "B" dial, with three-point variable-ratio. No finer dial is made, either in accuracy or appearance.

TYPE "N"
U. S. Pat. Nos. 1,744,675; 1,653,875; 1,656,532; 1,713,146
This 4" instrument dial of solid German silver is equipped with unexcelled NATIONAL Velvet-Vernier, Type A mechanism. This is the dial used on the AGS Receiver. It has 5-1 ratio and vernier index, reading to 1/10th dial division. Here is a precision control mechanism fully suitable for many uses for which as large a dial as the "NW" would be unnecessary or impracticable.

TYPE "A"
U. S. Pat. No. 1,744,675. Others pending
This is the original NATIONAL Velvet-Vernier Dial, more widely used by Amateurs than any other dial ever made. Its smooth and matchless mechanism is permanently free from backlash, the drive is always even and positive. Ratio is 5-1.

TYPE "B"
U. S. Pat. Nos. 1,653,875 and 1,656,532 and 1,713,146
One of the most popular Velvet-Vernier Dials. Equipped with variable ratio of 6-1 to 20-1. Pitted with black Bakelite shell. May be equipped with dial illuminator. Also available in new midget size, type BM.

TYPE "G"
U. S. Pat. Nos. 1,744,675; 1,656,532; 1,713,146. Des. pat. 79,378
Disc Projection Dial for condensers with shafts at 90° to panel. Dial numbers are projected in magnified size on dial screen. Also available as Type "H" Drum Projection Dial, for operating condensers with shafts parallel to front panel.

These and other types of NATIONAL Velvet-Vernier Dials and Dial Lever Indicators are fully described in Catalogue No. 220 (see QST, October, 1933), are also licensed under Federal Telegraph and RCA patents.

NATIONAL COMPANY, INC.,
MALDEN, MASS.
EFFICIENCY! APPEARANCE! VALUE!
The New GROSS Transmitters possess all these features
The transmitters described here were designed to fill the requirements of the most discriminating purchaser. Many novel constructional features are incorporated in this equipment.

The GROSS "CB-25" Kit
A complete class "B" Phone and C.W. Transmitter kit. Output 25 watts maximum Phone or C.W. Separate Power Supplies for Speech Amplifier and Crystal—heavy duty Supply for Class "B" and Class "C" Amplifier—Speech Amplifier is self-contained. A quality job throughout. "CB-25" $66.00

The GROSS "CW-25" Crystal Control Transmitter Kit
$13.95

The GROSS "CW-100" Kit
$24.50

The smooth and easy handling of the "CW 100" even on 20 meters will be a revelation.
100 TO 150 WATTS OUTPUT
'47 osc. — '10 buffer or doubler — output stage choice of '03-A, RCA 800 or Raytheon RK-18.
Special jacks are provided so that entire transmitter can be tuned with one milliammeter. All parts are supplied including one set of coils for either 20, 40, 80 or 160 meter band. Any additional coils are 75 cents each.

The smooth and easy handling of the "CW 100" even on 20 meters will be a revelation.
100 TO 150 WATTS OUTPUT
'47 osc. — '10 buffer or doubler — output stage choice of '03-A, RCA 800 or Raytheon RK-18.
Special jacks are provided so that entire transmitter can be tuned with one milliammeter. All parts are supplied including one set of coils for either 20, 40, 80 or 160 meter band. Any additional coils are 75 cents each.

The GROSS "CW-25" Power Supply Kit
$8.75

Mounted on shrivel finished metal chassis which matches the "CW-25" transmitter. Heavy duty power transformer, chokes, condensers, bleeder, etc. supplied. Uses one '83 rectifier. This unit and the transmitter make a neat combination as well as an efficient one.

GROSS RADIO, INC. \\
51 VESEY STREET \\
NEW YORK CITY

Say You Saw It in QST — It Identifies You and Helps QST
The “EAGLE” Three-Tube Short Wave Receiver

“Band Spread” over any portion of the tuning range—only finest material used throughout. Employs one ‘39 R.F., one ‘32 detector and one ‘33 Pentode Audio—15 to 200 meters—four coils supplied. The “EAGLE” is economical—two dry cells will operate the filaments. See March or April OST for full description of this most excellent value in short wave receivers.

“Eagle” completely wired and tested......$11.95 Three tubes tubes in your receiver. $3.00

GO-DEVIL

The new Mechanical Key Sensation. Has many features—will do anything the highest priced key will—come in and try it. Price, $6.00

JOHNSON 12" Antenna Insulators.............$.50

1/2 inch thick--per square inch.............$.50

Filament transformers shielded in metal cases, center tapped secondaries. 2.5 Volt 10 amperes for 656's. $2.50

Special 10-12 Volt 7.5 ampere filament transformer, extra special.........1.10

GROSS CLASS "B" TRANSFORMERS $4.95

A pair of coated high grade transformers for 46's.

SILVER DIPPED ALUMINUM

cut to size specified

1/16" thick—per square inch.............7/10c

1/8" thick—per square inch............1c

GROSS SPECIAL TRANSFORMER

600 volts each side of C.T. 200 MA

9/16" V. 10 amps. 5 V. 3 amps.

7/16" V. 3 amps. ..........$3.95

Multiple phone plugs take one to four pairs of phones. $1.15

5 slot wood choke forms. $1.65

Bakelite dish 5" diameter, 1/2 shelf. $1.15

5-meter oscillator coils. $1.15

GROSS cased double button mike transformer .........$2.35

Single or Double button mike transformer ..........$.99

New Bliley constant temperature crystal oven...$7.50

Compact, efficient, inexpensive.

CARDWELL CONDENSERS

123-8 0.0006 mf. ..................$2.35

104-8 0.0022 mf. ..................2.35

147-8 0.0044 mf. ..................4.10

7-6 0.0001 mf. ..................5.30

1-183-0.0011 mf. .................5.30

Gross Special Power Transformer for use with ’33 tube will give an output of 500 volts D.C. at 350 MA with choke input. Run your entire R.F. and Class B off this transformer. The regulation for the Class B is about 5%. Filaments are two dry, and one special.............$5.75

A transformer having the same filament windings as above—at 300 MA having 750 volts each side of C.T. Special.............$6.00

750-1500 V. each side of C.T. 300 watts. Extra special.............$6.60

675-1350-1500 V. each side C.T. 400 MA. $9.95

1500-2000 V. each side of C.T. 800 Watts ..........$11.95


1000 ohms. $9.99

2500 ohms. 1.05

5000 ohms. 1.05

10,000 ohms. 1.11

15,000 ohms. 1.20

25,000 ohms. 1.29

50,000 ohms. 1.35

100,000 ohms. 1.44

600,000 ohms. 1.49

900,000 ohms. 1.59

1000,000 ohms. 1.65

Cased 6.3 V. 2 amp. transformer.............$1.25

1.5 V. 5 amp. (Unidical).............1.80

5 V. 3 amp. C.T. ‘for 83’ (unidical)............1.80

9/16" – 7/16 and 5 Volt C.T. 1.45

9/16" – 7/16 and 7/16 Volt C.T. 1.45

9/16” – 5 and 7/16 Volt C.T. 1.45

9/16” – 5 and 5 Volt C.T. 1.45

Hammarlund Crystal "PRO"

Transportation prepaid anywhere in U.S.A. ..........$111.75

BAKELITE TUBING (any length)

1/8" diameter—per inch.............4c

1/16" diameter—per inch...........5c

1/32" diameter—per inch...........6c

1/64" diameter—per inch...........7c

BAKELITE TUBING (any length)

1/8" diameter—per inch.............4c

1/16" diameter—per inch...........5c

1/32" diameter—per inch...........6c

1/64" diameter—per inch...........7c

Thord. 30 H 75 MA choke. $0.69

Thord. 15 H 250 MA.........9.95

Thord. 30 Henry 500 MA choke. 9.95

Thord. No. 1-2458 double 18 H 250 MA 6.50

Gross and 30 H 200 MA choke 2.85

500 H. plate chokes for Screen Grid detectors (cased).............0.95

70-WATT CLASS B MODULATOR

UNIT KIT $50.00

Uses 1-57, 4-45, 9-45, 5-46's or 46's in P.P. Parallel Circuit B. All parts including power supply and metal chassis furnished. less tubes. Will fully modulate a 50 watt tube with an input of 140 watts. Parts sold separately.

SOLID ENAMELED ANTENNA WIRE

No. 14 (any length) per 100 ft. ..........$0.35

No. 18 (any length) per 100 ft. ..........$0.55

No. 16 (any length) per 100 ft. ..........$0.65

No. 8 (any length) per 100 ft. ..........$1.03

MIDGET DOUBLE SPACED NEUTRALIZING CONDENSERS 35 mmf.

A real buy. Oil imregnated condensers. $0.69

Oil imregnated condensers

1400 volts D.C. 2-2 mfd. 1.85

Pilot J-93 100 mmf. condensers. 60

COMPBINATION FILA.

TRANSFORMER $3.65

216 V. C.T. 10 amps. 200 MA

10 V. C.T. 7 amps. For '50's or '52's.

10,000 volt insulation.

204-A type sockets per pair $1.95

Porcelain base 50 watt sockets 1.19

Side wiping contacts 0.24

110 volt Jewell pilot lights red, green 0.20

Jewel pilot lights, red, green 0.20

HOYT moving coil 3" 0-1 MA meters

Special $3.95

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

GROSS RADIO, INC. 51 VESY STREET NEW YORK CITY
‘RME-9’ SUPER
540 KC to 22,000 KC
SINGLE SIGNAL RECEIVERS
Incorporate every known feature desired by present operators.

TO MENTION JUST A FEW:
- Effective single control tuning with accurate logging of stations made possible.
- All plug-in coils eliminated through the use of an efficient 5-position band selector switch.
- Heterodyne oscillator for CW reception with variable beat note control on the panel.
- High selectivity RF circuit providing high gain ahead of the first detector tube.
- Automatic and manual volume control.

500 KC crystal furnished with the receiver.

NEWEST DEVELOPMENTS ADDED:
- A monitor circuit — built in — to quickly determine at all times the quality of the modulated carrier.
- A bridge meter — calibrated to read R values. The full scale is used, O reading indicating a carrier strength of R-0, and full scale a carrier strength of R-9. No more guessing. Every report accurate.

NO INCREASE IN PRICE
Details fully described in our pamphlet, available for 10c, which also contains other important information to amateurs relative to new RME PRODUCTS.

ANTENNA MATCHING NETWORKS
will give your transmitter that high percentage of radiated energy. No harmonics can get out. Easily installed. Quickly and readily adjusted. No tuning of transmission lines necessary. Low in cost. Complete data found in pamphlet.

RADIO MFG. ENGINEERS
147 Cooper Avenue
PEORIA ILLINOIS

Editor, QST:
Many QSL cards are lost because the address contains neither the operator’s name nor street number. The postal directory clerks cannot help because most amateurs fail to file the station call and address at their local post office. Post cards are not returned to writer, if undeliverable.

Address QSL’s as completely as you can. File your station address with your Postmaster — there is no charge.

File Your Address
Grand Island, Nebr.

The “X” Club
Cherokee, Kans.

Editor, QST:
Have given some little thought lately to the idea of organizing an “X” Club — an order for the mutual entertainment, rag chewing, etc., of the members. The membership is to be restricted to those “W” hams who have at some time held some ham call other than U. S. The idea was suggested some months ago by a QSO with W5VQ, a fellow I have worked many times when he was KA1CM, and I was KA1BD. Most of the old KA1 gang were Americans, and probably most of them are back in the States by now. I think probably many of them would be interested in finding out what the other fellow is doing now, and where he is. The same would be true with “X” hams from other countries. I know I would much like to meet old AC8NA, who was a U. S. Marine in 1928, and numerous others.

Would like to hear from any eligibles who are interested. If enough fellows interested, we will get together and do something about it.

— Harry I. Hall, W9FLQ

Hot Cat
(Continued from page 60)

cial shack, with a few hams and whatnot paying a quiet visit. They were enjoying a ragchew when there came a crash that sounded like three or four Fourth-of-July celebrations. Everybody took one look at the clouds of smoke billowing from the back of the transmitter, especially from the vicinity of the 851’s, and organized a stampede for distant parts, making doors where the contractors hadn’t intended any to be.

After a period of time a few came back and cautiously peeped in the door and were assailed by clouds of smoke and an unspeakable odor that again caused their departure.

After much airing and fumigating it was possible to conduct an investigation into the mysterious explosion. It seemed a little pussy cat had gotten chilly and feeling the heat radiated by the p.a. tubes, tried to snuggle as close as it could. All would have been well had not furry tail and head connected with the high-voltage leads and caused a dandy short circuit. Results: one very much mangled cat and a bunch of sick radio ops. Hi! Shades of the electric chair!

— Floyd Hermanon, W4ASA-ZZQ

— Frank J. Alexander

Files Your Address
Grand Island, Nebr.

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Would like to hear from any eligibles who are interested. If enough fellows interested, we will get together and do something about it.

— Harry I. Hall, W9FLQ
A Power Supply Engineered
TO THE NEW TUBES
For the Amateur Who Is Hard to Suit

Acme-Delta Power Supply Equipment is designed and built for the Amateur who is not easily satisfied.

It is made for the man who wants the ultimate in ripple-free power, thus complying to the limit with the present radio law.

It is intended for the Amateur who secretly thrills to the remark that his station is as quiet and his modulation as good as a broadcast station.

And it is made for those who want to be sure of the ratings and the excellence of every component which they build into their equipment.

Purchasers of Acme-Delta Equipment do not have to return it for repairs or replacements. We know this for our factory records show less than 1% returns for any cause whatsoever.

If your standards and expectations are high... Acme-Delta Power Supply Equipment is offered you in full confidence that it will measure up to those standards and expectations.

A 1250 or 1000 VOLT
ACME-DELTA POWER SUPPLY

Ripple .15%—Regulation 11%

AD-15 FILAMENT TRANSFORMER. Lights the filaments of two '66's. Output volts 2.5 CT, amps. 10, insulation 4000 volts. VA 25 Wt. 3¾ lbs. List price $6.40

AD-26 PLATE TRANSFORMER. D.C. Output from filter 1250/1000 volts @ 400 MA Output A.C. r.m.s. 1500-1500-0-1500 volts @ 300 MA. Power Output 675 VA, SEC VA 900 — Ins. 7000 volts. Wt. 28 lbs. List price $29.00

AD-35 SWINGING CHOKE. Inductance 5/25 Henries — Input Choke for rectifier whose D.C. output does not exceed 1250 volts @ 400 MA. Ins. 3500 volts. Wt. 16 lbs. List price $18.50

AD-46 SWINGING CHOKE. Inductance by Bridge Measurement. 8.5 Henries @ 400 MA. D.C. Res. Ohms 50 — Energy Storage 0.68 watt Secs. Weight 16 lbs. Ins. 3500 volts. List price $18.50

LIST PRICES ARE SUBJECT TO 40% DISCOUNT TO AMATEURS AND EXPERIMENTERS

To obtain 750 or 600 volts for Sylvonia 830, 210 and 825 tubes, use Delta Auto Trans. AD92 in plate transformer primary. List price $16.50. Ripple values given will be secured when recommended apparatus is used throughout circuit.

SEE COPY ACME-DELTA CATALOGUE IN QST FOR DECEMBER, 1933, for specifications and list prices of complete Acme-Delta line. (All list prices subject to change without notice.)

F. S. Dallenbaugh, Jr.
Pres. & Chief Engr.

G. E. M. Bertram
Treas. & Gen. Mgr.

DISTRIBUTORS

Acme-Delta equipment is obtainable through selected distributors, through whom Amateurs and Experimenters may receive a discount of 40% from list price given in this catalogue. We recommend that you deal directly with the distributor in your territory for obvious reasons of greater convenience and service to you. If your regular distributor is not able to supply you, please write us direct.

COUPON:

This coupon will bring you complete engineering data on the construction of LATEST TYPE OF CLASS "B" AMPLIFIERS, with outputs of 20, 100 & 200 watts. Enclose 5 cents to cover mailing costs and write your name and address in margin below.

Say You Saw It in QST — It Identifies You and Helps QST
WESTON PERFORMANCE

in a matched line

There is economy and satisfaction in equipping with accurate, reliable electrical measuring instruments. That’s why amateurs the world over, standardize on Weston Instruments in transmitting, experimental work and radio servicing.

The matched lines of Weston 2 and 3¼ inch panel meters provide Weston accuracy and dependability in a wide range of DC, AC, thermo-couple and rectifier type instruments. They are built to the high standards of design and workmanship for which Weston Instruments are known the world over, and are furnished in flush or surface type, as well as with rugged Bakelite cases if desired.

Keep your instrument costs down and improve results by equipping from the preferred Weston line. Full details on these and other Weston Instruments are yours for the asking . . . Weston Electrical Instrument Corporation, 602 Frelinghuysen Avenue, Newark, New Jersey.

HEROES OF THE HOUR

New York, N. Y.—Jasper Q. Sideband (see photo pg. 11), son of Mr. and Mrs. Otto Y. Sideband, wealthy cheese merchant, has given every reason for his parents to be proud of him.

Jasper, with his frail short-wave radio, which he designed himself, served as the only connecting link between the — Expedition in the heart of the South American jungle, and the outside world. His set was smashed and he was injured when the canoe he was in overturned while shooting treacherous rapids the second day after the party left the base. Although sorely wounded, young Jasper patched the pitiful fragments of his set together and finally got in communication with the outside world. Such pluck is commendable and characteristic. Imagine this frail youngster standing his lonely vigil, hovering over a few tubes, coils and batteries, while the bloodthirsty etc., etc., etc . . .

“Well,” says Soupy, “howzat for you!”

“ Heck,” says I, disgusted, “may I see nine-toed blue redbirds with yellow tails if I ever
Every Needed Fact, Figure, Formula—Every Shortcut and Special Method

in the

WHOLE FIELD OF MATHEMATICS

Now in ONE Handy Volume!

For the first time you can have this wealth of practical mathematical information, covering every trade and business, condensed into one handy book for quick reference. This volume puts right at your fingertips instant facts and formulas for making every kind of mathematical calculation. From hundreds of different sources, this priceless information has been gathered together, boiled down into brief, simple language, and applied to actual problems. Every man in business, every man in the mechanical trades, every man who ever uses a tool or has to make calculations or estimates in office, shop, or home, will find here a treasury of money-making, money-saving ideas.

THE HANDBOOK OF APPLIED MATHEMATICS

No previous knowledge of mathematics is needed. No study is required. The specific information you want is easy to find, by looking it up in the index. The book takes up every trade and gives you practical methods, easily-worked formulas for solving every problem. Thousands of specific examples show you just how to make your calculations. If your work involves mathematics in any way this complete reference handbook is an indispensable part of your equipment. It is an amazing time-saver for any one concerned with engineering, architecture, electricity, mechanics, construction, automobiles, machinery, printing, or any other industrial work; or with accounting, auditing, manufacturing costs, taxes, or any other business mathematics. No practical man, no house-owner who makes an occasional repair, no one who has a home work-shop can afford to be without the valuable information quickly found in this book.

Save Time—Be Sure of Your Facts

One quick turn to the index in this complete reference volume and you find at once all the facts about your subject—the best methods of doing the work, the easiest formula for making the calculations, completely worked out sample problems that show you just what to do. You avoid the expensive errors that handicap the man who merely guesses. Think what an advantage it is to have all this information gathered into one handy book that you can carry in your pocket. Act today and take advantage of your opportunity to examine this book as soon as it is published, and save 17½% off the regular price.

EXAMINE THIS BOOK FREE

SEND NO MONEY—MAIL THIS COUPON

D. VAN NOSTRAND CO., 250 Fourth Ave., New York

Send me as soon as ready THE HANDBOOK OF APPLIED MATHEMATICS, at the Special Pre-Publication Price. Within 5 days after I receive the book, I can return it and owe nothing. If I keep it I will send you $1.25 as first payment and I will pay $2.00 monthly thereafter for 2 months—$5.25 in all. (Cash with order $1.95) Q.S.T. 1-34

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

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

73
To Our Readers who are not A.R.R.L. members

You should become a member of the League! That you are interested in amateur radio is shown by your reading of QST. From it you have gained a knowledge of the nature of the League and what it does, and you have read its purposes as set forth on the page opposite the editorial page of this issue. We should like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio. You will have QST delivered at your door each month. A convenient application form is printed below — clip it out and mail it today.

A bona fide interest in amateur radio is the only essential qualification for membership

American Radio Relay League
West Hartford, Conn., U. S. A.

I hereby apply for membership in the American Radio Relay League, and enclose $2.50 ($3.00 outside of the United States and its Possessions, and Canada) in payment of one year's dues, $1.25 of which is for a subscription to QST for the same period. Please begin my subscription with the .......... issue. Mail my Certificate of Membership and send QST to the following name and address.

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may send him a sample copy of QST?

Thanks
an Xmitter Frame
with BC class
... surprisingly
delightly
low-priced

"HAMS" who have seen this new frame say it's FB. With four adjustable shelves, there is plenty of room for power supply, crystal control, freq doubler and amplifier stages, without crowding.

Eight 3½-in. covered instrument holes are provided in the front panel, which is finished in true BC style in black baked-crackle lacquer. The inside is aluminum lacquered. All steel parts are copper-plated under the finish, to make the losses negligible at high frequencies, and to provide a good ground.

Two RF bushings are provided in the top of the cabinet. A hole for incoming power and control leads is in the bottom plate. The entire frame is rigidly constructed of ½-in. steel, spot-welded and bolted to angles and tees. The front panel and rear shield are bolted to the frame while the two side covers are hinged to the rear shield.

The size?—19 in. deep, by 27 in. wide, by 49½ in. high ... exclusive of RF bushings and shield handles.

Price?—Frame, panels and shelves, only $20. The protective safety shield, $7 additional. F.O.B. Chicopee Falls, Mass.

Just send certified check. Your frame will be shipped promptly.

Westinghouse

Quality workmanship guarantees every Westinghouse product
YOU CAN'T AFFORD to Pass Up This Opportunity

We need more customers! To build up good will, we have arranged with a reputable manufacturer to make for us a line of tubes to fit the depression pocket-book of the amateur fraternity. These tubes are first class products and carry our absolute guarantee for 90 days.

210 - 15 w. $1.15 866 - H.D. $1.50
281 211 7.75
250 203A 8.95

POWER SUPPLY — 1200 v. — 250 ma and 600 v. — 250 ma

Uses four 83’s in a bridge rectifier — completely filtered in both voltage legs.

$35.00

WESTON

301 MILLIAMMETERS

Reconditioned like new — guaranteed.
0-2, 0-10, 0-150, 0-200, 0-500 mals. $3.75

SYLVANIA

Graphite
210 — $4.75
830 — 8.75
825 — 10.00

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PLATE TRANSFORMER — two 7½ and two 2½ volt fil. windings — 750-750 v. — 160 mals. $3.50

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The West Gulf Division Convention

NOTWITHSTANDING the heavy downpour the night before the opening of the convention, with many roads impassable, representatives from over ten affiliated clubs registered on the first day of the convention being held at the Hilton Hotel, San Angelo, Texas, October 13th and 14th.

Without any frills Chairman Ray Samberson, W5BFA, started the proceedings by introducing Mr. Dean Chenoweth, managing editor, San Angelo Standard, who gave the welcoming address. Director Frank Corlett, W5ZC, responded in well chosen words. A.R.R.L. Treasurer Hebert brought the greetings of headquarters and discussed the F.R.C. Regulations.

During the two-day convention fine instructive lectures were given. Mr. W. J. Kantenberger of Morrissey-Kantenberger, Dallas, spoke on “Photo-Electric Cells” and gave an “Infra-Red Ray” demonstration; and, moreover, a good talk on the use of Supreme Testing Instruments. Mr. Robert S. Van Cleve of General Engineers, Dallas, gave a fine demonstration on “Cathode-Ray Oscillographs” and also talked on modern and advanced testing methods. Mr. Dan Whitaker, W5BAY, West Texas Utilities Co., Abilene, was in his glory when he talked on the subject of “Interference on Amateur Frequencies and Its Elimination.” During the technical talks a good address on the good address on the NRA was given by Mr. B. C. Deal. Glen Talbutt, W5AUL, and Dave Calk, W5BHO, SCM’s for north and south Texas, respectively, assisted by Fieldman Herbert supervised the Traffic Meeting where many subjects came up for discussion. It showed that traffic activities are still paramount in the amateur field.

The inspection tour on Saturday morning proved of interest, especially to the ladies, and consisted of visits to the West Texas Utilities’ Plant, the San Angelo Telephone Exchange and Broadcasting Station KGKL.

Bill Green, W5BKH, in the absence of Lieut. Fischer, spoke on the Naval Reserve and Glen Talbutt, Alternate Corps Area Control, did justice to the Army-Amateur network. These two organizations are becoming firmly entrenched in amateur radio and should be considered seriously by those who desire to acquire a thorough training in both army and navy procedures.

Many fine contests were held and worthwhile prizes won. The youngest ham at the convention was W5AHZ (15), the oldest, W5BSC. Director Corlett’s wife and Mrs. Groves, W5NH, who has her own ticket, and that very active secretary of the Corpus Christi Club, Ethel Henderson, were among those present. We are unable to mention the names of those two fine ladies from Wichita Falls, who so well represented their radio club, because some one forgot to return the memorandum to this reporter.

The big event of the whole convention was the spirited bidding for the 1934 convention; San Antonio, Corpus Christi and Wichita Falls having strong delegations. Final vote of the dele-
MAKING IT EASY FOR  THE BEGINNER TO BEGIN

It's the elementary things that are discussed in the League's carefully prepared book for beginners, "How to Become a Radio Amateur." Now in its third edition, completely done over in 1934 style, its 32 pages are filled with concise, clearly written material telling how to build the first receiver, a simple transmitter, an inexpensive monitor — in fact, the entire beginner's station.

"How to Become a Radio Amateur" (No. 8 in the A. R. R. L. series entitled "The Radio Amateur's Library") is the standard elementary guide for the would-be amateur. 25c (no stamps, please) postpaid anywhere.

A necessity for the beginner — equally indispensable for the already licensed amateur. Going after your first ham "ticket"? You need the manual for its instructions on where to apply, how to go about it in the right way — and, most important of all, for the nearly 200 typical license exam questions and answers. Already got a license? The manual is still necessary — for its dope on renewal and modification procedure, the Class A exam (with questions and answers), portable procedure, etc.

All the dope on every phase of amateur licensing procedure, and, of course, the complete text of the new regulations and pertinent extracts from the basic radio law.

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American Radio Relay League
West Hartford, Connecticut
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OF QST
WITH INDEXES

THE LIST given below shows many exceptions, and as time goes on each yearly list becomes more incomplete. The 1931, 1932 and 1933 sets will not be complete when next presented. You'll be sorry some day if you don't stop, look, and ACT now — Right Now!

HERE THEY ARE

<table>
<thead>
<tr>
<th>Year</th>
<th>Issues (Dates)</th>
<th>Price</th>
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<td>Only November and December</td>
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West Hartford Connecticut

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

The Committee's discrimination was well reflected in the fine menu served, the inspirational talks, awarding of prizes, and dancing. The convention formally closed with everyone expressing appreciation to the convention committee. See you in San Antonio.

— A. A. H.

The Pacific Division Convention

FROM the mountains, valleys, deserts — from the large metropolitan areas of three western states, nearly 500 amateurs gathered in San Jose, Calif., at the Hotel Sainte Claire, on September 2d, 3d and 4th for the Pacific Division's largest convention to date.

General Chairman Eugene R. Booker and his assistant, Harry Engwich, president of the Santa Clara County Amateur Radio Association, had obtained a number of authoritative technical speakers for the three days. They were: Milton A. Ausman (Audio Amplifiers); Earl R. Meissner (Velocity Microphones); Frank C. Jones (Ultra-Short Waves); Norris Hawkins (Electron-Coupled Oscillators); Dr. F. E. Terman (Directional Antennae); Ralph Heints (Development of the Gamatron); Arthur Halloran and A. H. Brolly (Television) and D. B. McGown (New Tubes).

Looming largest in the minds of those present, however, was the open forum, set for the afternoon and evening of the second day. Labeled by Chairman Booker as the "time and place for constructive action," it was to offer every one an opportunity to help in shaping the future of the Pacific Division. Many subjects were discussed and recommendations made to be transmitted to A.R.R.L. Headquarters.

Other features of the convention included a smoker under the chairmanship of George Call, W6BHY; ladies' entertainment arranged by Mae Amarantes, W6DHV; a phone meeting headed by Charles Holdiman, W6AGJ; a Naval Reserve meeting under Lieut., Frank Quement, W6NX; a bus trip to Moffett Field, home of the Maccon, and Ryan High-Voltage Laboratory at Stanford University, and code contests under supervision of Elbert Amarantes, W6FBW.

More than $1200.00 worth of prizes were distributed at the closing banquet. Chairman Booker approached manufacturers and dealers with a "new deal" — a pro rata share of convention receipts after all expenses were paid. (This turned out to be $330.00 which was divided among prize donors in proportion to prize value.—Editor.)

Visitors had the use of the official station at convention headquarters, where five-meter equipment was used to remote-control the half-kilowatt transmitter at W6HTB about three miles away. A leased wire was installed as a stand-by and was used part of the time for the same purpose. This phase of the convention was under the supervision of Terry Hansen, W6KG, one-time ship operator and widely known California amateur.
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(Note: OB-101 for 8000/cycle f-e-a m.p. Sec. for 200/100 MA d.c. Response flat + or - 2 db, 40-10,000 cycles.)

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Bernard H. Linden, supervisor of radio at San Francisco, was among those in attendance and made a brief address at the banquet. Fresno was chosen as the 1934 convention city and it is reported that the gang there is planning to hold it in November.

--- W6CFK

Standard Frequency Transmissions

<table>
<thead>
<tr>
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<th>Station</th>
<th>Date</th>
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STANDARD FREQUENCY SCHEDULES

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<td>7000</td>
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<tr>
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<td>7100</td>
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The time specified in the schedules is local standard time at the transmitting station. W1XP uses Eastern Standard Time. W9XAN, Central Standard Time, and W6XK, Pacific Standard Time.

TRANSMITTING PROCEDURE

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

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


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The 5000-kc. transmissions of the Bureau of Standards' station, WWV, are given every Tuesday continuously from 12:00 noon to 2:00 p.m., and from 10:00 p.m. to midnight, E.S.T. The accuracy of these transmissions is to better than 1 cycle (one in five million).

--- J. J. L.
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Better act quickly — only a few copies available.

QST
38 LaSalle Road
West Hartford, Connecticut

I.A.R.U. News
(Continued from page 46)

In 1932 the Ministry of Posts and Telegraphs issued a regulation concerning private broadcasting stations, operated both for scientific and amateur research. This regulation is most liberal, as every Polish citizen and even a loyal foreigner belonging to the P.Z.K., can apply officially through the Headquarters to the Ministry of Posts and Telegraph, submitting the technical qualifications of the station and a certificate of examination passed before the authorities of his League, and on the basis of this he obtains a license.

The Headquarters works not only in this country. In 1933, wishing to assist our neighbors in the organization of the short wave movement, we initiated the organization of a Radio Short Wave Union of Poland, Czechoslovakia, Jugoslavia and Roumania. This Union, consisting of the respective national societies which act as independent organizations and are at the same time member-societies of the I.A.R.U., has as its object mutual assistance in the development of the short wave movement in the member-nations, similar to the cooperation existing between these countries in cultural, economic and even political fields. Jugoslavia and Roumania show a slow development of the radio short wave movement, as the local regulations make it difficult for amateurs to have transmitting stations. The common initiative of the Headquarters of the P.Z.K. and of the C.A.V. caused the proposed change of the existing regulations in Jugoslavia and Roumania, and thus it is hoped that in these countries the amateur movement will develop considerably.

The plan of this Union and its Constitution was discussed in detail at Cieszyn in July, 1933, by the delegates of the P.Z.K., C.A.V., and U.J.R.A., when a special organizing commission was formed, consisting of Colonel Engineer Karaffa-Kraeuterkraft of Poland, acting as the chairman, Col. pil. Jaroslav Skala of Czechoslovakia, and Lieutenant Adam Gac from Poland, honorary secretary of the Commission. At the end of 1933 or during the beginning of 1934, there will be called an Organizing Congress, at which the Union will be definitely formed. A report of the meeting at Cieszyn was sent to all the interested parties on August 11, 1933.

As there are many Poles and sympathizers in other countries, most of all in the A.R.R.L. and R.E.F., the Constitution of the P.Z.K. also provides for foreign members, the number of which amounts to about 400. Foreign members receive our official organ: "Krotkofalowiec Polski." Our QSL office situated at Lwow sends out the QSL cards. The number of foreign cards in 1932 was more than 50,000 thus giving an idea of our work. This year the P.Z.K. organized on several dates international and local contests and the results of them will be made known to all other national societies.

The development of the amateur movement in Poland has its future assured. Our numbers are
The Bargain of the Year
ONLY A FEW LEFT

Famous NATIONAL SW 45 Sets $19.75
AT OUR SPECIAL PRICE
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A 5-tube, Tuned R.F. Set, using two Type 35, one 27 and two 45 Tubes
Coils available from 9 to 2000 meters. Short Wave and Band Spread Coils, $3 per pair

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Kaythereon RK18.... 10.95
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Sylvania 835....... 10.00
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CODE PRACTICE
SET . . .

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Can be used as High Pitch Buzzer, Telegraph Sounder or Night Blinker. Runs on two Flashlight cells obtainable anywhere.

International Morse Code on large etched top plate. Key in correct practice position. Can be connected to second set and signals sent or received.

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Because:—

» You Are Proud of Amateur Radio and Your Part in It
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Radio Operating

Say You Saw It in QST — It Identifies You and Helps QST
How to Get a Class-C License

(Continued from page 83)

must here present evidence of his authority to act for the society, preferably by a certified copy of resolution so appointing him. This relates to his authority to act as license-holder, in distinction to Item 34 which relates to his control of apparatus. Both must be evidenced in the case of club trustee applications.

One has no option about the waiver in Item 39—the law requires it.

The examination itself consists of ten questions, five of which relate to the theory and adjustment of apparatus and five to the requirements put upon amateur licensees by radio treaty, law and regulations. The Commission has several hundred questions which are shuffled around so as to make thousands of differing sets of ten. Your examination may not remotely resemble that of another applicant next door; again it may partly coincide and partly diverge. All are supposed to be of the same stiffness. Each question counts 10 and a passing mark of 75 is required. It is impossible to suggest in this article the answers to these questions. The applicant must study, and he is properly expected to know something about radio and its regulation. The new examination is indubitably more difficult than the old. To aid old-timer and newcomer alike in passing it, the A.R.R.L. has prepared an inexpensive 32-page booklet called The Radio Amateur's License Manual, advertised in QST, which will be found of the greatest possible value both in the intricacies of procedure and, more especially, in preparing for the examination itself.

See September QST for the complete regulations and an interpretation.

Reference has been made to some F.R.C. Rules by number. The complete regulations and an extensive interpretation of them appeared in September QST.

Crashing Page One

(Continued from page 88)

who lives around the corner who doesn't even own a radio?" It may interest you, but does it interest them? If it meets this acid test, take the item to your city editor and he will print it.

Traffic and emergency work: If your station is the only one or one of a very few stations in touch with some area cut off from the world by a disaster or catastrophe, get word to your city editor as quickly as possible. That's news! On ordinary traffic work, don't bother him. He's a busy, barking, son-of-a-gun.

Visiting dignitaries to your local club: First-rate news, if the visiting dignitaries are really somebody. Oddly enough, the city editor will listen to an account of amateur radio from him quicker than he will from you. Example: If Hiram Percy Maxim pays you or your club a visit, that's news. If John Jones, president of the radio club in the next town pays you a call, that isn't.
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when GR unit-panel construction gives you a completely laid out panel with all holes neatly cut. All that costs you but little more than finished stock of comparable surface and quality.

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The photograph at the left shows something of what can be done, but

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BLAN, the Radio Man, Inc. 177 Greenwich St. New York City

ALUMINUM BOX SHIELDS

W2GT

Radio and romance: Don’t laugh, it’s honest-to-gosh page one news, the very best kind. Here’s how: Suppose Bob Smith at W9XYZ meets Sadie Blake at W5PDQ, a romance buds over the air and they get married. But nill’s hells, what’s the use, you’d probably want to keep that away from the city editor and then be the first to grumble that he won’t print your news!

Strays

Back in the old days 5EK was one of the mightiest sparks in town. He used to adjust clips on his OT to where the cards came in the largest number. One day he called out the photographer to take a shot of his noisemaker. In opening the glass-fronted transmitting enclosure, the OT, which was held up with a string, tumbled out on the floor. It took 5EK over three months to find the old setting where the cards came in the largest number.

—Delta Division Convention Program

W2BNX worked W6BOW and shortly afterward heard W6DOG. Now he’s trying to figure out why he heard the bark before the dog.

The mark of a high-power rig is the size of the arcs that can be pulled off the tank. W6DSZ says that his 52’s release only a 4-inch arc against a poor conductor like a hammer, but that with a good conductor, like a soldering iron, the arc stretches out a full 8 inches. They have 5000 volts on the plates.

—Delta Division Convention Program

Club Directory Available

A directory of the local amateur radio societies affiliated with the League, showing their times and places of meetings, is available to members upon request, enclosing three cent stamp, please. Address the Communications Manager. Traveling amateurs will find this list helpful in visiting other clubs.

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The complete list of available QST back copies are to be found on Page 78 of this issue.
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are invited to apply for rates, etc., to Advertising Department, QST

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.

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.

- See Editorial April Issue of QST

For Your Convenience
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HAPPY NEW YEAR O. M.

To our large and far-flung host of friends that LEEDS has served during the past years — Many Thanks.

We will endeavor to express our appreciation in service of increased scope during the coming year.

NATIONAL FB.7 A $34.20

Have you received \textit{GENERAL RADIO Bulletin No. 935}. We will be glad to send you one listing the complete line of amateur apparatus. We carry a complete stock at all times.

\textbf{Announcing new LEEDS mounted transformers; 10v. 4 amp. C.T. with tapped primary, ideal for 1-20 JA or 1 or 2 Sylvania 830. Special...} Two 7\textsuperscript{3/4} v. — C.T. windings at 5 amps each for 4 R.K. 18" or 800's.

\textbf{Special...} $3.95

New cased plate transformer 1250 v. E.S.C. 400 m.f. Special... $16.50

For other LEEDS transformers see Dec. issue.

\textbf{5-Meter Enthusiasts}

2 RED HOT items by G. S. Wing. \textbf{FIRST} — The answer to the antenna problem. A complete assembly, including a Picard type matched impedance coupler and two 40" brass tubing radiator rods. Complete only... $2.50

SECOND — A real transceiver, employing 176 and 141 tube, ideal for use in auto,sell contained in heavy cast aluminum case. SIZE 3 x 6 x 9. Truly the finest 56 m/c. unit we have seen in our experience. Only... $16

\textbf{Special RELAY Bargain}

Operates on one dry cell, two pole, one pole make and break, the other break only. Contacts will handle... $29

- 250 MA. A BUY at each... $2.29

LEEDS does not publish a catalog. We will be glad to furnish manufacturers' bulletins on any apparatus advertised by us if you will specify those you are interested in. We will be glad to quote our lowest prices on any equipment by return mail.

\begin{itemize}
  \item C.R. in radio, is like "sterling" on silver. It is the best. Here are a few C.R. products. We carry the complete line.
  \item 374-B. 125 m.mf., S.L.F. $1.25
  \item 374-N. 350 m.mf., S.L.F. 1.25
  \item 374-K. 250 m.mf.  .75
  \item 247-M. 250 m.mf., vernier.  .95
  \item 387-A. Speaker filter. 49
  \item 387-B. Power speaker filter.  .49
  \item 389. Impedance 90H. 15 v.  .95
  \item 373. Double impedance with coupling condenser.  .95
\end{itemize}

\begin{center}
\textbf{Triplet Meters}
\end{center}

We had a hunch that the boys would appreciate quality instrument at reasonable prices. Our sales of the new Triplet Meters have certainly proven we were right. For example — all the 3\textsuperscript{3/4}" bakelite cased milliammeters illustrated, from 0-5 to 0-1000 MA at only $3.75.

A.C. Voltmeters — 0-5 v. — 0-10 v. — 0-15 v. Each $3.75

Thermo coupled meter... $6.67

You are missing a bet if you don't have a Triplet Bulletin handy. \textit{Write today.}

\begin{center}
\textbf{Apparatus of Distinction — now carried in stock. See Dec. issue for their list prices. Our wholesale prices are 40% less.}
\end{center}

\begin{center}
\textbf{Jewell Meters}
\end{center}

Another special buy enables us to offer a few more Jewell 2" meters.

No. 190 A.C. Meters

0-8 v. (each) $3.50

No. 165 Thermo-ammeters 0-1 amp. and 0-2 amp. each $4.95

The new Western-Jewell dealer's bulletin is now available.

\begin{center}
\textbf{LEEDS\textsuperscript{\textregistered} precision crystal holder... $1.25

V cut crystal 10 KC 80 or 160 meters with crystal holder... 3.50

V cut at 1 of 1% accuracy... 3.00

With crystal holder... 4.00
\end{center}

\begin{center}
\textbf{The New Hammarlund "Pro"}
\end{center}

Standard Chassis... $79.38

Metal cabinet, add... 8.52

Crystal filter, add... 25.52

Automatic vol. con., add... 17.64

Complete set R.C.A tested tubes, add... 7.17

Tubes for A.V.C model... 8.35

$30 — $8.75 825 — $10 210 — $4.75

YES — we have the THREE ACES! and all the other transmitting tubes manufactured by HYGRADE SYLVANIA. Descriptive bulletin and complete price list furnished on request.

\begin{center}
\textbf{Birnbach Insulators}
\end{center}

We carry the complete line

\begin{center}
\textbf{DUMONT"B" Eliminator}
\end{center}

Uses 280 rectifier, 3 taps 180 v. maximum... $3.95

We are pleased to announce that we are New York Headquarters for the new line of McMurdo-Silver products.

\begin{center}
\textbf{Western Electric Phones}
\end{center}

Type P-11 Signal Corp phones. These would ordinarily sell at $7.50. All new — all perfect. Here's a genuine bargain at...

$3.95

\begin{center}
\textbf{Navy Type Telegraph Key}
\end{center}

List $3.60.

Navy knob—No Tungsten contacts. Only a few left at...

$1.25

With regular knob...

$1.10

\begin{center}
\textbf{Aficionados de Español}
\end{center}

Están Vds. interesados en el radio americano? Nuestro anuncio en QST, de noviembre, página 68 les dice como obtenerle en el modo más pronto y menos costoso. Valdría la pena de obtener una traducción de nuestro proyecto.
THE "TRIM-AIR" MIDGET
AN ALL-PURPOSE, ISOLANTITE INSULATED QUALITY
CONDENSER OF UNUSUALLY SMALL DIMENSIONS.

"Trim-Air" Midget receiving condenser showing possible combinations for various uses as described in text. Note tapped rotor shaft with screwdriver slot and rotor locking nut for permanent adjustment. If used for knob control, the extension shaft is screwed into the tapped hole in rotor shaft.

Transmitting type, fitted as "Trim-Air" condensers are regularly furnished.

SIX DISTINCTIVE FEATURES
1. May be Panel mounted by single nut, and knob-controlled by shaft extension.
2. May be Panel mounted by single nut (without shaft extension), screwdriver-adjusted, and locked.
3. May be Panel mounted by means of mounting posts, keeping screwdriver adjustment slot and locknut behind panel.
4. May be Shelf mounted by means of bracket (which can be supplied), either knob controlled or permanently adjusted and locked.
5. May be ganged and mounted for use in any of the ways suggested above.
6. May be mounted with a coil in a can or shield as small as 2" in diameter.

NOTE: When mounted in any other manner than by single hole method (as by means of mounting posts or brackets) both sides of the condenser will be completely insulated from the panel, chassis or shield.

For tuning high-frequency receivers and tuning and neutralizing low-powered high-frequency transmitters, the "Trim-Air" Midget will be found eminently satisfactory. In addition, it may be used as an air dielectric padding condenser, as an air dielectric trimmer for ganged units and for air dielectric condenser tuned I. F. transformers.

PRICES and ADDITIONAL DATA
RECEIVING TYPE (Airgap between adjacent rotor and stator plates .031", except RT-100 which has .020" airgap).

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<tr>
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<th>MAX. MIN.</th>
<th>NO. of PLATES</th>
<th>DEPTH BEHIND PANEL</th>
<th>PANEL SPACE DIMENSIONS</th>
<th>LIST PRICE</th>
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<tr>
<td>RT-15</td>
<td>15</td>
<td>1.5</td>
<td>5</td>
<td>3/4&quot;</td>
<td>1-7/16&quot; x 1 1/4&quot;</td>
</tr>
<tr>
<td>RT-25</td>
<td>25</td>
<td>2.0</td>
<td>7</td>
<td>7/8&quot;</td>
<td>1-1/16&quot;</td>
</tr>
<tr>
<td>RT-35</td>
<td>35</td>
<td>2.5</td>
<td>9</td>
<td>1-3/16&quot;</td>
<td>1-3/16&quot;</td>
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<tr>
<td>RT-50</td>
<td>50</td>
<td>2.8</td>
<td>13</td>
<td>2&quot;</td>
<td>2&quot;</td>
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<td>RT-75</td>
<td>75</td>
<td>4.0</td>
<td>21</td>
<td>1-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>RT-100</td>
<td>100</td>
<td>3.7</td>
<td>19</td>
<td>1-1/2&quot;</td>
<td></td>
</tr>
<tr>
<td>RT-140</td>
<td>140</td>
<td>7.0</td>
<td>39</td>
<td>2-3/4&quot;</td>
<td>1 1/2&quot; x 1 1/2&quot;</td>
</tr>
</tbody>
</table>

TRANSMITTING TYPE (Airgap between adjacent rotor and stator plates .070")

<table>
<thead>
<tr>
<th>TYPE NO.</th>
<th>MAX. CAP.</th>
<th>MIN. CAP.</th>
<th>NO. of PLATES</th>
<th>DEPTH BEHIND PANEL</th>
<th>PANEL SPACE DIMENSIONS</th>
<th>LIST PRICE</th>
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<tr>
<td>XT-30</td>
<td>30</td>
<td>2.0</td>
<td>17</td>
<td>2-3/4&quot;</td>
<td>1-7/16&quot; x 1 1/4&quot;</td>
<td>$1.70</td>
</tr>
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</table>

Manufacturers: Quotations will be submitted on request for TRIM-AIR condensers having any desired combination of accessories. Send your requirements for our quotation and quantity discounts.

THE ALLEN D. CARDWELL MFG. CORP'N.
83 PROSPECT STREET, BROOKLYN, N. Y.

The supplier who tries to discourage you, or attempts to substitute, or refuses to supply CARDWELLS, has not your interest at heart. He can get CARDWELLS for you if your service means as much to him as a little more profit. Get what you want—insist on CARDWELLS. Order direct from us if your dealer will not supply, or let us tell you where you may buy.

"THE STANDARD OF COMPARISON"
Proof of high performance is not lacking in the "AGS". Hundreds of these receivers were in full time commercial use months before the first was sold over the counter, and their impressive reputation among commercial operators was firmly established before the first amateur told his friend about the "AGS".

For the original specifications for the "AGS" were written by Government engineers, the first production receiver was tested in Washington, and Government stations have been a merciless proving ground where no flaw could escape criticism.

The "AGS" is no longer an experiment. The receiver which we offer today is the polished product of the combined experience of National and Government engineers, and no detail of design or craftsmanship has been overlooked which would improve its spectacular ability.

Whether a prospective customer or not, we cordially invite you to inspect the "AGS" at your dealers. And if you cannot conveniently do this we shall be glad to send a copy of our booklet "The National AGS Communication Type Short Wave Superheterodyne" containing fifteen pages of concise technical information on design and operation for high performance.

**Outstanding Features**

- Tuned R. F. stage preceding first detector. (Image suppression — improved signal-to-noise ratio — improved "weak signal" response.)
- Electron coupled oscillators.
- No frequency drift—air padded oscillators.
- Air dielectric tuning condensers in I. F. amplifier.
- Single dial straight frequency line tuning (270°).
- Calibration curves and station chart on panel.
- Coil change from front of panel.
- Automatic volume control or manual volume control, by throw of switch.
- Extremely rigid mechanical construction from very heavy aluminum plate.
- Relay rack or table mounting (panel size 8¾" x 19¾").
- Frequency range 1500 to 20,000 k. c. Band spread coils available.
- Heterodyne oscillator for cw reception.
- A. C. or battery operation.
- Panel switch for phones or speaker.
- Mechanical filter for single signal reception (in AGS-X).
NEW

THE RADIO AMATEURS

HANDBOOK

ELEVENTH EDITION

PRICE: $1.00 POSTPAID

AMERICAN
RADIO RELAY LEAGUE
WEST HARTFORD
CONN.
ON CHOOSING DIELECTRICS

No single dielectric universally suitable for all applications has yet been tested in National's Laboratories. Four materials have been found to have outstanding merit, however, and these four have been extensively used in National Products.

We have recently completed an agreement with the several manufacturers of these dielectrics, enabling us to design and offer the new line of insulators shown on the following pages. In this line, the selection of material has been based upon its fitness for the particular application, and upon its H.F. performance, and in no case has "special electrical porcelain" or other inferior material been used.

The properties of two of the materials chosen, Isolanlite and R-39, are well known to users of National products. The two new and as yet comparatively unknown materials, Steatite and Victoron, have only recently become available. Their rather remarkable properties are described on Page Six of this bulletin.

Like other National Products, the new dielectrics will be available exclusively through our authorized distributors.
STAND-OFF INSULATOR. This well-known little insulator is now offered in two lengths. Long and slender, the larger model is shaped for extreme electrical efficiency. It is an excellent core for H.F. solenoid chokes. (Isolantite)

Type WGS-1 (L=1%"), List Price $ .25
Type WGS-2 (L=2%"), List Price $ .35

STAND-OFF INSULATOR. Metal mounted like the smaller units, these heavy Isolantite stand-offs combine electrical efficiency with strength and convenience. The insulator is 3/4" diameter and is available in two lengths.

Type WGS-3 (L=2%"), List Price $ .80
Type WGS-4 (L=4%"), List Price $ 1.00

STAND-OFF INSULATOR. This popular style of insulator is offered in three sizes, all of low-loss Steatite. The smallest model is tapped 8-32 each end, the larger 10-24.

Type WGS-5 (A=½", B=1½", C=1") List Price $ .25
Type WGS-6 (A=½", B=2", C=1½") List Price $ .35
Type WGS-7 (A=3¼", B=3", C=1½") List Price $ .65

STAND-OFF INSULATOR. Another small insulator suitable for a variety of applications. Being made of Steatite, it is eminently suited for Low Loss H.F. circuits. It is available in a special model with a jack for mounting plug-in inductances.

WGS-8 List Price $ .25
WGS-9 (with jack) List Price $ .35

TRANSPOSITION BLOCK. Wafer-thin, and made of Victron, these blocks have but a fraction of the weight of conventional types. They remove weight where it is most objectionable, as well as reducing losses to the minimum value.

Type AA-1 List Price $ .30

NATIONAL COMPANY, INC., MALDEN, MASS.
SPREADER. Conventional in design, unusual in efficiency, these Steatite spreaders will more than justify their slight extra cost. They are at present available only in the six inch length.

Type AA-3 ............... List Price $ .30

STRAIN INSULATOR. This aircraft-type insulator, in spite of its short leakage path, has a variety of uses in small portable, mobile and police installations. Being loaded in compression, the insulator provides great mechanical strength.

Type AA-5 ............... List Price $ .18

ANTENNA INSULATOR. This insulator is particularly suited for general use by the amateur. Its length provides ample leakage path, while its cross-section provides ample strength for all but the heaviest loads. The use of Steatite assures excellent electrical performance.

Type AA-6 ............... List Price $ .25

ANTENNA INSULATOR. Designed for sustaining heavy loads, this insulator combines great strength with low losses. The Steatite bar is ¾” diameter and has a leakage path of 8½”. The fittings are of bronze. The weight of the complete insulator is approximately one pound.

Type AA-7 ............... List Price $5.00

ANTENNA DRAIN SWITCH. Primarily designed for draining large antenna systems during lightning storms, and outstanding for its low loss features, contributed by Steatite insulation, this switch is suited to a variety of applications where positive contact and high insulation are necessary.

Type AA-9 ............... List Price $4.50

NATIONAL COMPANY, INC., MALDEN, MASS.
COIL FORM. Suitable for 20 and 40 meter amplifiers and 80 meter self-excited oscillators, this Steatite transmitting form is threaded for No. 10 wire or smaller and drilled for wires and supports. A similar form for 80 and 160 meter use is in preparation.
Type XR-10, form only. List Price $3.75

COIL FORM. These well-known R-39 coil forms are machinable, permitting the experimenter to groove and drill them to suit individual requirements. They are available in 4, 5 and 6-prong types, and plug into the sockets shown on the opposite page. A = 2 1/4", B = 1 1/2".
Type XR-4, XR-5 or XR-6. List Price $0.75

COIL FORM. National Midget coil forms are now offered in two sizes.
Type XR-1 (A = 1 1/2", B = 1", with 4 prongs) List Price $0.50
Type XR-2 (A = 1 1/2", B = 1", without prongs) List Price $0.35
Type XR-3 (A = 3/4", B = 9/16", without prongs) List Price $0.25

COIL FORM. This Steatite Choke Coil Form is ideally suited for small choke coils and precision resistors. The winding is divided in four sections by partitions. A slot is provided for leading the wire from section to section, and to the terminals.
Type XT-8 List Price $0.50

5 METER COIL. Consisting of a heavy copper air-spaced winding and mounted on a Steatite base, this coil is specifically designed for 5-meter transmitters, receivers or transceivers. They are usually used in pairs.
Type XR-9, complete, per coil List Price $0.45

NATIONAL COMPANY, INC., MALDEN, MASS.
H.F. BUSHING. This small Steatite bushing has a variety of uses in transmitter construction, not only as a neat and efficient means of bringing H.F. leads through partitions, but as a support for coils, etc. Each pair of cones includes suitable metal fittings.

Type WX-1 (A=1”, B=1 1/16”) per pair .......... List Price $ .60

Type WX-2 (A=1 ½”, B=1 3/16”) per pair .......... List Price $ .80

H.F. BUSHING. Larger in size than the bushings described above, and shaped to conform to the lines of electrical stress, these Steatite insulators are suitable for higher H.F. voltages. Prices are per pair, with metal fittings.

Type WSX-3 (A=2 3/4”, B=2 5/16”) List Price $3.30

Type WX-4 (A=3 ¾”, B=2 25/32”) ........... List Price $6.00

H.F. BUSHING. A heavy bowl-type lead-in, suitable for large transmitters, this Steatite insulator provides a weatherproof joint for antenna lead-in purposes. Leakage Path 3 ¼”.

Type WX-5 each .......... List Price $7.50

Type WX-5, with fittings, per pair List Price $15.50

RECEIVING SOCKETS. The National Line of receiving sockets are now available in either Isolantite or Steatite. The six prong coil socket has been redesigned for four hole mounting.

Isolantite sockets, all models List Price $ .60

Steatite sockets, all models List Price $ .70

50 WATT SOCKET. An unusual socket, it cannot break down by arcing from contacts to metal shell, for there is no shell, nor will it arc downward from tube prongs to chassis, for the socket has a solid base. One piece, all Steatite, with positive electrical contacts.

Type XC-50 ................ List Price $3.50
HIGH VOLTAGE SHAFT COUPLING.
Isolantite insulated, rugged, and free from backlash, this coupling is made in three lengths, bored for $\frac{3}{8}$" or $\frac{1}{2}$" shafts. Leakage path is $\frac{7}{8}$" less than over-all length.

Type TX-3 \( (L = 3\frac{3}{8}) \ldots \) List Price $7.00
Type TX-5 \( (L = 5") \ldots \) List Price $7.75
Type TX-7 \( (L = 7\frac{1}{2}) \ldots \) List Price $8.50

HIGH VOLTAGE SHAFT COUPLING.
Also Isolantite insulated, but smaller than the models described above, this coupling possesses their excellent design features. For $\frac{1}{2}$" shafts only. Leakage path $\frac{7}{8}$" less than over-all length.

Type TX-1 \( (L = 1\frac{3}{8}) \ldots \) List Price $1.00
Type TX-2 \( (L = 3\frac{1}{4}) \ldots \) List Price $1.10

VICTRON SHEETS
The ease with which Victron can be machined makes it an ideal material for experimental work. Its remarkable properties are described in detail below. Dimensions of standard sheets are shown in the blueprint, but $\frac{1}{8}$" sheets are also available.

Victron $\frac{3}{16}$" thick, per sheet List Price $6.00
Victron $\frac{1}{8}$" thick, per sheet List Price $5.00

NATIONAL COIL Dope
National Coil Dope is a special R.F. lacquer, specially prepared to give low power factor. It may be used as a cement for holding windings in position without spoiling the low-loss features of the coil support. It provides a tough, protective film, seals surface pores, and gives a moisture-repellant surface. The Coil Dope is applied with a brush, and dries in air without baking. List Price, per can, $1.50.

THE NEW DIELECTRICS
VICTRON, a development of the United States Rubber Company, possesses almost incredible electrical properties. Its Loss Factor (0.2) is one-eighth that of "Low Loss" Hard Rubber, and one-ninetieth of that of the usual R.F. Insulators. Its Power Factor is .06%-.08%, compared to .09%-.20% for Steatite. In color it is a transparent amber. It may be readily drilled or sawed. Being non-hydroscopic, it is suitable for outdoor use. Its Tensile Strength is about 6,500 lbs. per sq. in.

STEATITE is a white ceramic material specially developed for use in H.F. circuits. Generally speaking, it is similar in properties and uses to Isolantite. However, materials of this class are often influenced considerably by manufacturing requirements, and pieces of different sizes and shapes often vary considerably in properties. For this reason, Steatite and Isolantite, which are manufactured by somewhat different processes, are not always equally suitable for all applications. For example, National Sockets made of Steatite have shown a considerably lower power factor than those of Isolantite, though this is by no means true of other items in our line. In every case we have chosen the material which seemed best adapted to the particular application.

NATIONAL COMPANY
61 SHERMAN STREET
MALDEN, MASS.