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Technical Data

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FREQUENCY RANGE — Standard — 15,000 Kc. to 1500 Kc.

CATHODE RAY OSCILLOSCOPE — At a glance, over or under modulation or distortion can be detected. Used as a percentage of modulation indicator, it is possible to maintain 100% modulation, either trapezoidal or envelope figures can be had.

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Editorials .................................................. 11
Roanoke Division Convention ..................... 12
Coming Examinations for Amateur Operator License .... 12
Plate Modulation of Pentodes .......................... George Grammer 13
An All-Purpose S.S. Superhet with Turret-Type Automatic Coil Changing. Part II Charles Fisher, W3PX 17
Technical Topics ........................................... 21
What the League Is Doing .............................. 22
DX Contest Results ...................................... E. L. Battey 24
A New Ultra-High-Frequency Transmitter ........ Ronald King 30
A Frequency-Lock Multi-Vider ....................... J. A. DeYoung, W1HHW 32
A.R.R.L.'s Field Day, 1935 ............................ 34
Army-Amateur Notes ................................... 37
A Flexible E.C.-Controlled Transmitter. Alpha Learned, W1FUB 38
Amateur Radio Stations ................................. W3A4J, W1BPX, W8GHA 40
Experimenters' Section ................................. 42

AN AUDIO OUTPUT STAGE FOR THE REGENERATIVE S.S. RECEIVER — BLOCKED-GRID KEYING — DUPLEX 'PHONE — TWO-BAND U.H.F. TRANSCEIVER

I.A.R.U. News ............................................ 45
Operating Notes ......................................... 47
Correspondence Department ............................ 57
Silent Keys ............................................... 72
Dakota Division Convention ......................... 72
The Hudson Division Convention .................... 78
A New Filter-Speaker .................................... 80
A.R.R.L. QSL Bureau .................................. 82
Midwest Division Convention ......................... 84
Standard Frequency Transmission .................... 90
WWV Schedules .......................................... 90
Ham-ads .................................................. 91
QST's Index of Advertisers ............................. 94

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*See Technical Article P. 36 August Q. S. T. Magazine.

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★ Corrections in the text concerning permissible 'phone bands and portable privileges, as have been amended by these changes June 18th.

★ Additions to the text about licensing, to incorporate the existing arrangements in Alaska, Puerto Rico and Hawaii, the right to have code tests administered by government radiotelegraph operators; and a similar paragraph extending to cripples the right to have their material dictated or typewritten.

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

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

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

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

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Address all general correspondence to the executive headquarters at West Hartford, Connecticut
IT IS of course a fundamental of the federal government's administration of amateur radio that it assigns to all radio amateurs certain bands of frequencies and then permits the amateurs to operate at will within those bands. We have a few regulations stipulating the minimum acceptable qualities of our signals, regulations which we have actually sought in our own good: requiring stable signals, the use of direct-current power supply, freedom from parasitics, and so on. Each of us is required to have a clean signal and to take up no more space in the spectrum than is required with good engineering practice. We mustn't interfere with other services nor broadcast entertainment nor send false signals, nor engage in indecent or profane language. But aside from those things we are pretty much our own masters. We can operate all day and all night if we wish and in any place in any amateur band. No one has an exclusive channel, interference is the rule rather than the exception, and we are left strictly to our own devices to organize our internal economy as we see fit.

The American amateur has long displayed a very remarkable ability to cooperate with his fellows, to coordinate his activities with those of other amateurs so that all may obtain the maximum benefit from the pursuit of the art. One of the chief functions of our A.R.R.L. is to act as a medium for the improvement of our mutual operating conditions. It provides the required machinery for studying our situation, collecting ideas, passing them around for examination, and agreeing upon courses of conduct and methods of operating that will minimize our troubles and provide us the most enjoyment. There are few rigid rules within the fraternity of amateur radio, inside the limiting figures of our frequency bands. Although we have constantly demonstrated the inestimable values of cooperation, we are essentially an aggregation of individualists. And as such we sometimes drift into bad operating habits, which, being copied by others, result in our being more or less collectively foolish.

When a considerable number of us commence employing an unwise operating procedure we all pay the penalty in increased interference and mutual annoyance. There are so many of us these days that a small contribution of unnecessary interference from each of us amounts to a considerable portion of the unbelievable bedlam in our bands. Conversely, a little care on each individual's part and a tremendous improvement is evidenced. Our A.R.R.L. Board at its last meeting gave consideration to these subjects and pointed its official finger at three unwise common practices in amateur radio which ought to be eliminated, and issued a plea to all amateurs that they give their cooperation to the elimination of these evils. Only one of these undesirable operating practices is illegal and that one in actuality a questionable case. Permitted by our regulations, these are things that we will cure only by our own willingness and determination to effect a cure:

First, we use the wrong bands frequently. Thereby we cause an immense amount of needless QRM. East Coast stations working amongst each other ought not to be roaring signals on the West Coast, and vice versa. When they are, it shows that the wrong band was used. The wrong band was used because someone found it too much bother to shift to another band more suitable for short-distance work, and instead continued on his old adjustment despite the obvious fact that the band used did not lay down the best signal to his correspondent and that it did cause severe and unnecessary interference between fellows communicating from coast to coast. This is but a single example in a list that every amateur can amplify for himself from his own experience. We all know which bands work best for the work we have in mind. The difficulty has simply been that in the past it has taken some minutes of time and effort to shift to another band. Any of us would willingly shift to the proper band if it were instantly available. In the last year or so we have gained a lot of knowledge on arrangements for rapid band-shifting in transmitters. QST has presented numerous articles on the subject, will have more. The A.R.R.L. Board urges members of the League to equip themselves for speedy band-changing and to employ the same to the reduction of our interference problem.

Second, we don't trim our power to the requirements. Almost every amateur station has just one power adjustment—its maximum. The 40-watter is always 40 watts, the kilowatt fellow is always 999.9. The reason we need S5 signals now is because everybody else is trying to be S5, and when everybody does that the signals reach for hundreds or thousands of unnecessary miles, with attendant unnecessary interference. We
never stop to think that when conditions make a signal perfectly readable at any moderate strength, there is no need for it to be S5. The Board of Directors urges every amateur to equip his station with means for reducing power and then in each QSO to crank down the watts to those just necessary to insure good communication. A rich improvement in operating ease is certain to follow the general adoption of this recommendation.

Third, we test on our radiating antennas. Sure, we have the right to, for all amateur radio is a great experimental school. But we ought not to, in our own interests. When 15,000 amateurs are testing, the other 15,000 can't do much communicating. Transmitters can be tuned up and tested on non-radiating or dummy antennas. Remember how much harder you gnash your teeth over testers than you do over more legitimate interference? Well, that's how you make some other fellow feel when you test. The League Board therefore recommends and urges that all amateur transmitters be equipped with dummy antennas for testing purposes that do not require radiation.

We can add another suggestion that we believe valuable: that local traffic be handled on 56 mc. rather than on 3.5 or 1.75. Faster, less interference experienced and less interference made.

It is strictly up to us whether we get any improvement in these respects. The appeal is to our sense of cooperation and our pride in doing jobs well. QST bespeaks an acceptance of the Board's recommendations by all amateurs and points out that the job starts with the individual, the reader of these lines, you!

K. B. W.

Roanoke Division Convention
October 5th and 6th—Hotel Charlotte, Charlotte, N. C.

ONCE again the Charlotte Amateur Radio Association is sponsoring the divisional convention and the program prepared by the committee has one point in view—a convention to be remembered by those attending. J. L. Reinartz, well known to the amateur fraternity, will be present with new ideas. Roy C. Corderman, of Washington, D. C., will represent the A.A.R.S. Frank Key of our own division, who always has something interesting to say, has promised to come. A.R.R.L. Headquarters is sending A. A. Hebert, treasurer-fieldman. Director H. L. Caviness with all the SCM's is coming with the intention of getting acquainted with everybody. There will be plenty of entertainment and a most cordial invitation is extended to the ladies. Registration fee is $3.00 for the men and $2.00 for the ladies. Gordon S. Smith, Convention Secretary, 1716 Thomas Ave., Charlotte, N. C., will furnish further information on request.

Coming Examinations for Amateur Operator License

FOLLOWING is a schedule of examinations for amateur operator license to be held by F.C.C. inspectors during October, November and December at points other than their home offices. Where dates or exact addresses are not shown, write the Inspector in Charge of the district headquarters as noted. All examinations begin promptly at 9:00 a.m. local time. For schedule of the examinations held at the district offices themselves, and the addresses thereof, see the listings under this heading in either June or July QST.

Little Rock, Ark., some time in October. Particulars from Inspector at New Orleans.
Phoenix, Ariz., some time in October. Details from Inspector at Los Angeles.
Boise, Idaho, some time in October. Details from Inspector at Portland, Ore.
Billings, Mont., some time in October. Details from Inspector at Denver.
Des Moines, Iowa, October 25th and 26th. Details from Inspector at Kansas City.
Cleveland, Ohio, some time in October. Details from Detroit.
Winston-Salem, N. C., November 1st and 2nd. Details from Norfolk.
Nashville, Tenn., November 15th. Details from Atlanta.
Jacksonville, Fla., November 15th. Details from Miami.
Oklahoma City, Okla., some time in November. Details from Dallas.
Butte, Mont., some time in November. Details from Seattle.
Spokane, Wash., some time in November. Details from Seattle.
St. Louis, Mo., November 22nd and 23rd. Details from Kansas City.
Cincinnati, Ohio, some time in November. Details from Detroit.
Troy, N. Y., some time in December. Details from New York City.
San Antonio, Texas, some time in December. Details from Dallas.
Columbus, Ohio, some time in December. Details from Detroit.
Pittsburgh, Penna., December 19th, 20th and 21st. Details from Buffalo.
Plate Modulation of Pentodes

Linewidth—Operating Conditions—Modulator Requirements

By George Grammer*

The ease with which pentode-type power tubes can be used for radiotelephony by introduction of the audio frequency in the suppressor grid circuit has more or less masked the fact that these tubes can be plate-modulated as well. A contributing factor has been the lack of definite information on pentode plate modulation—specifically, what to do with the second and third grids in the tube—although it is true the manufacturers have given a set of curves and operating conditions for the RK20.

If pentodes can be successfully plate-modulated—and they can—the chief point of interest, in comparing their performance with that of plate-modulated triodes, is whether or not the excitation requirements are still as low as with ordinary c.w. operation. To determine this, and also to find what were the optimum operating conditions for plate modulation, we set up an experimental amplifier rig in which various types of pentodes could be used. It was arranged so that the modulation could be applied to the screen and suppressor grids as well as the plate, so that combinations of plate and either one or both of the other elements readily could be tried. The resulting modulation characteristic was then checked on the oscilloscope so that the set of operating conditions giving optimum linearity could be determined by simple measurement.

It has been known for a long time, of course, that the only way successfully to plate-modulate a screen-grid type tube is to apply the audio frequency to both plate and screen. It seemed reasonable enough to believe that this would apply to pentodes as well, since the plate current is more sensitive to changes in screen voltage than in plate voltage. The tests confirmed this; skipping a detailed description of what was done, we can say that in general, modulation of the plate and screen in proper proportion will give a characteristic equally as good as that of a plate-modulated triode. Also, modulation of the suppressor, either with the plate or with both plate and screen, is not only unnecessary but at times undesirable. The suppressor may be operated either at zero voltage or a fixed positive voltage, depending upon the type of tube used. From the data obtained it seems necessary to differentiate between tube types in this respect. Operating conditions of the smaller tubes such as the 802 and RK23-25, differ somewhat from those obtaining for the RK20, RK28 and 803.

Modulation of Small Pentodes

A typical circuit diagram for plate and screen modulation of tubes of the 802-RK23-RK25 type is shown in Fig. 1. From an r.f. standpoint the circuit is the same as would be used for c.w. work; in the supply circuits, the screen voltage is obtained from the plate source through a dropping resistor, R. While a voltage divider could be used, it is not recommended since it would increase the load on the modulator and do no particular good so far as the modulation characteristic is concerned. The modulation transformer secondary is introduced in series with the common supply lead to the plate and screen, the screen dropping resistor being on the set side of the transformer secondary. Plate and screen by-pass condensers, C2, should be of the order of 0.001 µfd.—large enough to provide a low-impedance path for the r.f., but still not so large as to affect the high-frequency audio response. The suppressor by-pass, C1, should be 0.002 or larger.

An optimum value for the dropping resistor, R, is about 25,000 ohms. Using a plate-supply voltage of 600, the screen current under the operating conditions to be specified later will be of the order of 20 milliamperes, giving a drop of 500 volts and leaving 100 volts d.c. on the screen. Higher d.c. screen voltage does not seem to be of any particular value, actually causing a slight reduction in output, although leaving the modulation characteristic unaffected. The characteristic is likewise unchanged with lower screen

* Asst. Technical Editor.
too great or the characteristic may not be linear. The remedy for the former is obvious, while the latter can be cleared up by adjustment of the power output standpoint. With low excitation the suppressor voltage should be reduced. With the suppressor at zero the tube can be modulated linearly with less than one milliamperes control-grid current, control-grid bias being from a 22-volt battery. Power output under these conditions is of the order of ten watts. The excitation power is very small: the tube actually was driven by a 47 crystal oscillator with only 120 volts on the plate, the input to the oscillator being only about one watt. On the whole, the suppressor voltage does not have a very great effect; chiefly, it influences the linearity under certain critical excitation conditions. If the excitation is readily adjustable, the suppressor may be operated anywhere between 0 and 100 volts positive with good results, slightly more power output being obtained at the higher figure.

Control-grid bias is not critical. A 22-volt battery is entirely satisfactory for linear operation. More bias may be used, requiring a corresponding increase in excitation. It is not necessary to use a battery, however; a grid leak of about 2000 ohms will give equally good results. The rectified grid current either with the 2000-ohm leak or 22-volt battery will run between 10 and 20 milliamperes at optimum excitation. It is not critical in this region, but both too-low and too-high excitation will cause a departure from linearity. For this reason it is desirable that the excitation be readily adjustable, either by a coupling control such as a tap on the exciter tank, or by voltage control on the exciter.

A typical set of operating conditions for these tube types (all give identical performance) is as follows:

| Plate voltage | 600 d.c. |
| Plate current | 50 ma. |
| Suppressor voltage | 50-100 d.c. |
| Screen dropping resistor | 25,000 ohms |
| Screen current | 20 ma. |
| Grid voltage | -22 (or 2000-ohm leak) |
| Grid current | 10-20 ma. |
| Power output | 15-20 watts |

The plate current should be adjusted, by means of antenna coupling, to 50 ma., approximately, the plate milliammeter being inserted at X on the diagram. The plate current should not change during modulation. If it kicks, either one of two things may be the case: the audio swing may be too great or the characteristic may not be linear. The remedy for the former is obvious, while the latter can be cleared up by adjustment of the excitation.

It is interesting to note that while all the tubes tried (several samples of each type) showed uniform characteristics when modulated on both plate and screen, one particular tube gave a linear characteristic when modulated on the plate alone, probably because of some individual peculiarity. This performance could not be duplicated in any of the other tubes.

**THE RK20**

The same series of tests run through on several RK20 tubes gave the same order of results, showing that optimum operation was obtained with combined plate and screen modulation. With the RK20, however, the suppressor is preferably operated at zero voltage. Using the circuit shown in Fig. 2, positive suppressor voltage has practically no effect on the output or linearity. In another type of circuit to be described later, positive suppressor voltage caused the characteristic to take a bad bend.

Using a 1000-volt plate supply (the manufacturer's rating for plate modulation is 900 volts) the optimum screen dropping resistor again was found to be in the neighborhood of 25,000 ohms. Under these conditions the screen current averaged 35 to 40 milliamperes, giving an effective d.c. screen voltage of about 200 volts. Somewhat lower than rated screen voltage seems to be the inevitable result of using a screen dropping resistor. However, the output is about the same as with fixed screen voltage for c.w. operation.

Control-grid bias and excitation are again not critical, although there is an optimum region. Fixed bias of 22 or 45 volts can be used, or the bias can be obtained from the flow of grid current through a leak of about 10,000 ohms. With proper excitation the grid current will be of the order of 5 to 10 milliamperes, the larger value with the lower bias voltage. The modulation characteristic is the same with either method of biasing. Either too much or too little excitation can cause a departure from linearity, the criterion being the steadiness of the plate current, in the absence of an oscilloscope. The excitation power required is of the order of one or two watts.

To compare the RK20 with a triode of equivalent rating, the set-up was changed slightly so that an RK31 could be used in its place as a neutralized triode. Although the power output from the two tubes was the same and the modulation characteristics were identical, the triode required considerably more excitation than the pentode. Expressed in amateur language, the RK20 could be excited fully with a 47 oscillator with about 300 volts on its plate; in fact, it was not necessary to load the oscillator to its full output. With the RK31, however, it was necessary to use 450 on the plate of the oscillator and to take out all the power it was capable of giving.
The oscillator inputs were about 6 watts and 18 watts, respectively.

Adjustment is much the same as with the smaller tubes. The antenna coupling is adjusted to make the plate draw about 80 milliamperes. A typical set of operating conditions is:

- **Plate voltage**: 1000 d.c.
- **Plate current**: 75 ma.
- **Suppressor voltage**: 0
- **Screen dropping resistor**: 25,000 ohms
- **Screen current**: 15 ma.
- **Grid voltage**: 10 d.c.
- **Grid current**: 0 to 10 ma.
- **Power output**: 50 watts (app.)

There should be no change in plate current with modulation. The screen current likewise should be steady.

### HIGH-POWER TUBES

The high-power tubes, the RK28 and 803, are capable of being operated satisfactorily under similar conditions. Ratings have been placed on the RK28 only for 1500 volts plate, although we have used the tubes at 2000 volts without running into difficulties. However, for the same d.c. input, plate modulated service is harder on the tube than c.w., so it may be that the life would be adversely affected to some extent when operated at full plate voltage. The 803 has not carried recommendations for this type of work, but the tube operates well. A typical set of operating conditions for the two tubes at 1500 and 2000 volts is given below:

- **Plate voltage**: 1500 d.c.
- **Plate current**: 110 ma.
- **Suppressor voltage**: 45 volts
- **Screen dropping resistor**: 40,000 ohms
- **Screen current**: 25 ma.
- **Grid voltage**: 90 (or 20,000-ohm leak)
- **Grid current**: 10 to 15 ma.
- **Power output**: 125 watts (app.)

The figures given above are subject to slight variation with the two types. The 803 takes slightly higher grid current than the RK28 for the same power output and linearity. The screen currents also may vary somewhat, although they will be in the region specified. Again the plate current should be constant with modulation.

### MODULATOR REQUIREMENTS

Since both screen and plate must be modulated, it is obvious that some of the audio output of the modulator will be consumed in the screen circuit, where it is "wasted" in the sense that no r.f. output results therefrom, although it is vitally necessary to give linear performance. In pentode transmitting tubes the screen current usually has a value from one-third to one-half that of the plate current, although the screen voltage of course is much lower than the plate voltage. However, when screen power is taken from the plate supply, a considerable amount of power, both d.c. and audio, is consumed in the dropping resistor. The total power, both d.c. and audio, consumed in the screen circuit may be as much as half the plate input.

In the circuits of Figs. 1 and 2, therefore, the d.c. power consumed in the plate and screen circuits is the terminal voltage of the plate supply multiplied by the sum of the plate and screen currents. In the case of an RK20, for instance, these currents will be 75 and 35 ma., respectively, at 1000 volts. The d.c. input is therefore 110 watts. Of this power, 75 watts is the d.c. input to the plate, 35 watts the input to the screen circuit. The screen itself takes about 7 watts, the other 28 being used up in the dropping resistor. The audio power supplied by the modulator divides in the same proportions. The modulator must supply audio power, on a pure-tone basis, of 55 watts, half the total input, although only 37.5 watts is taken by the plate and 3.5 watts by the screen itself. The other 14 watts is dissipated in the dropping resistor.

Using the operating conditions previously specified, the audio power required to plate-screen modulate a single 802 or RK23-25 would be 21 watts, since the plate and screen circuit inputs would be 800 volts multiplied by 50 plus 20 milliamperes, or 42 watts. This is on a pure-tone basis. A pair of 46 tubes would be capable of doing the job satisfactorily. The equivalent load impedance of the r.f. tube would be 600/0.70, or 8560 ohms. Since the optimum load impedance for the Type 46 at this order of power output is about 5500 ohms plate to plate, the primary-to-secondary impedance ratio of the output transformer should be 5800/8560 ohms, or 0.677 to 1. This corresponds to a turns ratio, total primary to secondary, of 0.823 to 1. The modulator tubes can be operated at 400 volts. On the speech basis discussed in August QST, the same pair of tubes, operated at 500 volts as described,1 could be used to modulate two of the small pentodes in parallel or push-pull.

For the RK20, a modulator consisting of a pair of graphite-plate Type 10's operated at 600 volts would be required, since the modulator has to supply 55 watts. The load impedance is 9000 ohms, approximately, and the plate-to-plate

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load on the modulator should be 8000 ohms. The impedance ratio is therefore 8000/9000, or 0.89 to 1, total primary to secondary, calling for an output transformer having a primary-to-secondary turns ratio of 0.943 to 1. This is again on a pure tone basis. Two RK20's would require a modulator having an output of somewhat over 100 watts. Several types of tubes, such as the 800, RK18, RK31, and 830-B, are capable of outputs of this order. The output transformer ratio can readily be calculated as above, using the rated load impedance for the particular type of modulator tube chosen. The load represented by the pentodes will of course be just half that of one tube alone, or 4500 ohms.

In the case of the higher power pentodes, the RK28 and 803, the audio power required will depend upon the operating plate voltage. On the 1500-volt, 110-ma. basis, the screen should take about 35 ma., making the total d.c. input approximately 220 watts. The pure-tone audio power required is therefore 110 watts. A pair of RK31's, 830-B's, or 100-watt type tubes can easily supply the power.

With 2000 volts on the plate, the plate and screen currents total 195 ma., representing a total d.c. input of 390 watts. A pair of S83 tubes will modulate this input nicely. Ordinary output transformers designed to work into a 10,000 ohm load from 203-A or S83 tubes will be close enough in turns ratio to work with entire satisfaction.

CONSERVING AUDIO POWER

From the foregoing it is apparent that a good deal of audio power must be used up in the screen dropping resistor. This is pure waste, since the only function of the resistor is to keep the screen voltage near the proper operating value. At least four-fifths and possibly more of both d.c. and audio power supplied the screen circuit is lost in the dropping resistor and not in the screen itself. The power lost in the screen grid is fairly low even in the high-power tubes.

The logical step to take in eliminating the waste of power is to get rid of the dropping resistor. This can be done quite readily by supplying the d.c. screen power from a low-voltage supply—from the oscillator or a buffer power pack, for instance—and introducing the audio frequency in the screen circuit through the medium of a second output winding on the modulation transformer. Since the audio power taken by the screen grid is only about 10% that taken by the plate, the extra drain on the modulator tubes should not affect their operation very greatly, even if the screen winding is ignored in computing the load on the audio tubes.

To try out this method of swinging the plate and screen of a pentode, the cooperation of the Thorarson Electric Mfg. Co. was secured in making up a transformer having two output windings, multi-tapped to fit various types of pentodes and Class-B tubes. A typical circuit diagram using this type of transformer is shown in Fig. 3. It is necessary, of course, that the two output windings be poled correctly so that the voltage increases on plate and screen simultaneously. Tests have shown that the modulation characteristic with this type of coupling is equally as linear as with the dropping resistor. A considerable saving in the d.c. and audio power results from its use—to say nothing of the elimination of a "high-powered" dropping resistor. A quite husky resistor is required to drop the voltage for even the smaller pentodes, while a power-dissipating capacity of about 100 watts is required for the RK28 and 803 at full plate voltage.

The number of turns on the screen winding of the transformer should bear the same relation to the turns on the plate winding that the d.c. screen voltage bears to the d.c. plate voltage. In other words, if the d.c. plate voltage is 1000 and the screen voltage 200, the screen winding should have 20% as many turns as the plate winding. This is a maximum figure; it should not be exceeded since a larger number of turns would cause the screen voltage to be zero over a portion of the cycle on the down-swing instead of reaching zero only for an instant. If the relation is exact, the screen voltage will swing to twice its d.c. value at the same instant the plate voltage swings to twice its steady value. However, it does not seem to be necessary to swing the screen over as wide a range as the plate, relatively speaking. Screen modulation to the extent of 75% seems to be ample. This simply means that the audio swing on the screen is not at all critical, so it should be possible to build a transformer having slightly less than the maximum usable number of turns and thereby have a unit which will fit a number of different operating conditions. With less than complete modulation of the screen, also, the audio power used in the screen will be reduced, further lightening the load on the modulator.

(Continued on page 35)
An All-Purpose S.S. Superhet With Turret-Type Automatic Coil Changing

Combining the Efficiency of Plug-in Coils and the Convenience of Switching

In Two Parts—Part II†

By Charles Fisher,* W3FX

All coils, except those for the standard broadcast range, are wound on bakelite tubing, which was the only insulation available in the form required for this job. With these forms performing so satisfactorily, it is wondered whether special "low-loss" insulations would improve the performance to any extent.

A set of purchased universal-wound coils is used for the broadcast band. These are supported by the bus-bar leads to the bakelite mounting of Fig. 4C. It would probably be just as easy to wind these coils on one-inch tubing, and many hams probably would not want to bother with the broadcast range at all. The coils used were designed for an i.f. of 465 kc., so a few turns had to be removed from the oscillator grid coil to suit the i.f. of approximately 500 kc. The tickler was also cut down considerably. One or two turns were also removed from the r.f. and first-detector grid coils.

The 4- and 7-mc. coils are wound on 1½-inch diameter tubing, while the 14- and 28-mc. coils are wound on 1-inch tubing. Fig. 4A shows the details of the coil forms. The coil leads are soldered to five 6-32 brass or nickel-plated brass screws which are placed in line along the length of the tubing. The threaded ends of these screws should be filed bright so that they will take solder easily. A slight notch filed in the end helps to hold the wire in place. Before each screw is put through the tubing, a nut is tightened up against the head to raise the head higher. The screw is then put through the tubing, a nut placed on the inside and tightened up. If the inner screws are slightly longer than the outer ones the soldering will be made easier. The leads of the 28-mc. grid coils are not soldered inside because the wire is too heavy to thread through. The wire is simply looped around between the screw head and a washer, and tightened up. The tap is soldered to the proper turn on these two coils. The entire job could no doubt be made easier by extending the screw heads about 1/2-inch and soldering the leads right to the threaded part of the screw outside the tubing. But this would require more clearance within the shields and would necessitate making them longer and higher.

In winding the grid coils, it is best to start at the tap. Calculate how much wire will be required and cut off a piece of that length plus a couple of feet extra. Drill the holes in the bakelite tubing for the leads to pass through. Now scrape off the enamel where the tap should be, tin the wire, bend it double, and thread it through the hole in the tubing provided for the tap. Now solder it to the outside screw. Then wind the longest end first. The writer fastened the end of the wire to a door knob, then wound the wire on the tubing while walking toward the door. When the proper number of turns has been wound, the wire is scraped or cleaned with emery cloth where it will contact the screw, and is threaded through the tubing and soldered to the screw. The other end from the tap is then wound in like manner. If the spacing is uneven, the turns can be slipped slightly until the spacing is nearly uniform. Then the windings can be doped with collodion or other coil dope but this had better not be done until the coils have been adjusted in operation. Collodion applied sparingly makes a good coil cement. The windings for \( L_1 \) and \( L_2 \) are bunch wound between the screws as shown in Fig. 4A. A few drops of collodion cement holds them in place. \( L_4 \) is wound between the grid turns of \( L_6 \), starting at the ground end. Where a tracking condenser is used, the ground end of the oscillator grid coil is soldered to screw "X" and the tracking condenser is mounted inside the coil between the screws "X" and "Y", small moulded

* 447 Chestnut Street, Pottstown, Pa.
† The first part appeared in August QST.

September, 1935 17
• condensers being used. Two or three in parallel may be needed to build up the right capacity. The capacities required are larger than usual, probably because of the rather long leads from the oscillator coil and the higher minimum capacity of two tuning condenser units. The 4-mc. r.f. and first-detector coils are almost close-wound. The coil table gives the approximate lengths of the windings.

It will be seen from the coil table that the 14-mc. and 28-mc. oscillator coils are wound with

the same number of turns. In the 28-mc. range the second harmonic of the oscillator is used to beat with the incoming signal in order to overcome interlocking—and the 2A7 refused to oscillate properly at 28-mc., anyway. To reach 30 mc. the oscillator must tune to 15,250-kc., the second harmonic of which is 30,500 kc. The higher frequency required for the 30-mc. range is secured by slightly wider spacing between turns. In all cases the tickler should be spaced as evenly as possible between the grid turns. Some of the bakelite was cut out of the r.f. and first detector forms of the 30-mc. range by drilling and filing, leaving about six slats around which the wire is wound. This was done in an attempt to lower losses at the highest frequency.

Now for the coil assembly. From a 3/8-inch bakelite panel, cut six discs four inches in diameter. This can be done with a circle cutter. Then lay out one of the discs as shown in Fig. 4B. The exact spacing between the coils is not critical but the idea is to get fairly equal spacing. Four or five holes can be made, according to what is desired. Even if only three or four bands are desired, the assembly might as well be made for five. They are bound to be wanted sooner or later. These also can be cut with a circle cutter but a better job will result if the discs can be taken to a machine shop where the holes can be made with a counterbore. In either case the discs should be bolted together through the center and the pilot holes drilled through all six at once so they will all be exactly alike. Flanged bushings having a %"-inch hole and setscrews must be provided on each disc, one on each side. A small pulley made for a %"-inch shaft can be used and part of it cut away if too large. The hole should be made to take the shaft very freely, so the assembly will go together easily.

The coil forms should fit tightly into the holes in the disc. Most bakelite tubing seems to be a few thousandths oversize, which is a help. In the assembly shown, the forms are made ever so slightly egg-shaped as they are pushed into the discs. The forms are not fastened in any other way and they will not move out of position. It is surprising how quickly this entire assembly can be taken apart and put together. It was done many times while finding the proper number of turns for the coils.

The discs are spaced just far enough apart to fit snugly within the shield boxes. This keeps the entire assembly in position. The coil groups are placed in the shields, the brass rod is pushed through, the setscrews tightened up, and there you are. A large knob is needed on this shaft as it turns rather hard when the coils come in contact with the springs. The knob was made from an old 4-inch dial by sawing and filing away the outer part.

The spring contact assembly is shown in Fig. 5. Some may think these contacts will not make good connection with the screw heads, but in four months not one bit of trouble has been
experienced. If they become dirty, the entire assembly can be removed in about two minutes and they can be cleaned easily. Bronze more than 0.010-inch in thickness should not be used because the combined pressure of fifteen contacts becomes quite great.

Before the copper boxes are fastened to the chassis, the coil assembly should be set up with coils in it for at least one range. The contact spring assemblies should now be held on the chassis and moved about while rotating the coil assembly until the spot is found where a satisfactory contact is obtained. Then the two holes can be marked on the chassis through the holes in the bakelite strip. It should be remembered that the boxes will raise the springs about \( \frac{1}{2} \) inch. The boxes are held down by two screws near the left corners and by the contact assembly. The chassis holes can be drilled first and the boxes can be marked through these holes. The coils should be about \( \frac{3}{4} \) inch above the base when in the operating position. The spring bronze can be obtained from a machine shop, although possibly not in the desired width; but it can easily be cut down. All plate and grid leads from the r.f. coils are run above the base, so holes for these should be drilled in the ends of the boxes in line with the respective contacts. Holes for the other leads should be drilled through the bottoms of the boxes and through the base.

THE I.F. STAGES

The intermediate frequency used is approximately 500 kc. The first i.f. stage incorporates both regeneration and adjustable coupling, providing a very selective circuit.\(^2\) The coupling is not intended to be continuously adjustable, but is meant to be set near the critical point and left that way. Additional selectivity is then provided by the controllable regeneration. \( T_1 \) and \( T_2 \) can be standard 500-kc. transformers, or they can be made by using one-millihenry coils and 100-µµfd. air-type padding condensers as described previously in QST and in the A.R.R.L. Handbook. Fig. 6 shows the details of \( T_1 \). It was constructed from a mica-compression tuned transformer designed to operate at 405 kc., the mica tuning condensers being discarded and 100-µµfd. Hammarlund air padding condensers used instead. The unit now tunes to 500 kc. with the condensers about half meshed. After discarding the mica condensers, the wooden dowel was sawed through between the plate and grid coils. Enough of the dowel was then sawed off so that the plate coil could be rotated. The grid coil is fastened rigidly while the plate coil is adjustable. If the nut is fairly tight against the bakelite, the screw can be rotated a quarter-turn or so and will hold the position. An extra \( \frac{3}{4} \) inch length of dowel is fastened to the grid.

\(^2\) See description of the regenerative type S.S. receiver in April, 1933 QST, and in Chapter Five of the A.R.R.L. Handbook, eleventh and twelfth editions.

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September, 1935
The dowels. The tickler coil, \( L_7 \), was bunch wound over one layer of paper wrapped around the dowel. It was doped and when dry the paper was pulled out. The coil could then be slid along the dowel. It should be spaced so that the tube is very close to the point of oscillation with the regeneration control at maximum. It must be connected with the proper polarity of course. This is all covered in the Handbook. After the proper spacing is found, the coil can be cemented to the dowel.

The shield for this assembly is made from sheet copper and measures 2/4 by 28 by 5 1/2 inches high. Flanges are bent at the bottom for mounting. The base of the shield is cut from 1/16-inch aluminum, to which the transformer unit is fastened by means of the bracket. The 3/82 mounting screws are placed up through the base, 1/4-inch bushings slipped over them, and the nuts are tightened down on the bushings. The assembly and shield are then put in place and held down with additional nuts. This makes it possible to remove the shield to adjust the tickler, reverse leads, etc., without the mounting screws dropping out. Holes are drilled in the shield in line with the condensers and plate coil adjusting screw so that these can be adjusted with the shield in place.

\( T_4 \) was also made from a 465-kc. mica-tuned transformer with the mica condensers discarded. The unit is plate-tuned with a 75-µfd. mica trimmer plus a two-plate midget variable condenser which is controlled from the front panel. The assembly is fastened to an aluminum base bent into an angle on one edge for mounting under the subpanel. An aluminum coil shield fits over the assembly. The two-plate midget must be insulated from the aluminum base on which it is mounted. The 75-µfd. trimmer is so mounted that it can be tuned through a hole in the shield.

**AUTOMATIC VOLUME CONTROL**

This a.v.c. system has been used in various forms by several manufacturers. \( C_{13} \) is a 1 1/2-inch length of copper braid pulled tight over the lead from \( T_4 \), the braid being soldered directly to one contact on \( SW_4 \). This capacity is large enough to apply sufficient signal on the 24-A grid, yet not large enough to detune the secondary of \( T_4 \) when \( SW_4 \) is thrown. \( C_{17} \), \( SW_4 \) and \( R_{24} \) are mounted within a small copper box, and \( SW_4 \) is controlled from the front panel. A.v.c. and regeneration cannot well be combined in the first i.f. tube, so this tube is not controlled.

It will be seen that the grid returns of three tubes pass through \( R_{22} \) to get back to the cathodes. The plate current of the 24-A also passes through \( R_{33} \). When a signal is applied to the grid of the 24-A, plate current flows, creating a bias voltage across \( R_{22} \), \( R_{24} \) is the manual r.f. gain control. \( R_{24} \) depends somewhat upon the 24-A tube and the voltages obtained from the voltage divider, although a value of about 150 ohms is correct. It should be large enough to cut off plate current in the 24-A when \( R_{21} \) is set at maximum. A 0-1 d.c. milliammeter connected in the plate circuit can be used to check this. Strong stations in the broadcast band drive the 24-A plate current up to 0.1 ma. With \( R_{33} \) set at minimum, the current is about 0.15 ma. With the antenna disconnected and no signal, the current should not change with the a.v.c. switch either way. Closing \( SW_4 \) cuts out the a.v.c. action, but \( R_{33} \) still controls the gain. \( SW_4 \), when closed, reduces the gain to a point where the operator can listen to his own transmitter with the antenna disconnected. This a.v.c. works quite well on code reception, but the receiver's sensitivity is reduced somewhat because of the signal from the beat oscillator.

**WIRING NOTES**

The plate and grid leads from the r.f. coils are run above the base and taken through the base at the tube sockets. The r.f. and first-detection circuit can be used to check this. Strong stations in the broadcast band drive the 24-A plate current up to 0.1 ma. With \( R_{24} \) set at minimum, the current is about 0.15 ma. With the antenna disconnected and no signal, the current should not change with the a.v.c. switch either way. Closing \( SW_4 \) cuts out the a.v.c. action, but \( R_{24} \) still controls the gain. \( SW_4 \), when closed, reduces the gain to a point where the operator can listen to his own transmitter with the antenna disconnected. This a.v.c. works quite well on code reception, but the receiver's sensitivity is reduced somewhat because of the signal from the beat oscillator.

**TABLE OF VOLTAGES**

<table>
<thead>
<tr>
<th>Measured with 300 v. 1 ma. meter from cathodes</th>
<th>Plate Screen Osc. Anode</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R.F.</strong></td>
<td>200 90 170 250 90 120</td>
</tr>
<tr>
<td><strong>1st Det.</strong></td>
<td>220 70 210 90 130 80</td>
</tr>
<tr>
<td><strong>1st I.F.</strong></td>
<td>210 90 210 90 135 80</td>
</tr>
<tr>
<td><strong>2nd I.F.</strong></td>
<td>210 90 210 90 135 80</td>
</tr>
<tr>
<td><strong>Audio</strong></td>
<td>250 265 300 175 175</td>
</tr>
<tr>
<td><strong>A.V.C.-24A</strong></td>
<td>50* 17 50* 17 50* 17</td>
</tr>
</tbody>
</table>

All voltages measured with volume control at maximum and no signal.

* Measured at voltage divider end of \( R_{33} \).

Voltage across entire divider at full load is 280 volts.

(Continued on page 64)
Frequency Modulation

Although more familiar to us amateurs as an undesirable companion to amplitude modulation, particularly in radiotelephone transmitter operation, frequency modulation in its unadulterated form has attracted interest, even in higher technical circles, at recurrent intervals during the last fifteen years or so. In fact, there was a time when it was speculated by some of the higher-ups of the day that frequency modulation might be the ultimate; that it might supplant amplitude modulation entirely; even that it might provide more economy in use of the frequency spectrum. For, it was argued, might not adequate modulation be obtained by “wobbling” the carrier only slightly? And could not a wobble of, say, but 500 cycles, be made to satisfy requirements then met by 10 times as much frequency occupancy with amplitude modulation? Unfortunately, attention first from the mathematical analysts and later from experimental runnder-downers found the all-important flaw in this argument and demonstrated conclusively that the band-width required for frequency modulation is at least as great as for equivalent amplitude modulation. Worse yet, frequency modulation has an inherent distortion, under classical conditions, its character being such that the degree involves not just the amplitude of the modulating signal, but rather the frequency of the modulating signal as related to frequency variation of the radio carrier. The “index” of frequency modulation, which corresponds to the simple “factor” or “percentage” familiarly associated with amplitude modulation, is equal to the absolute shift (plus or minus) of the carrier frequency, divided by the modulation frequency. Hence it varies inversely as the modulation frequency, even though the modulating signal amplitude be constant.

Major Armstrong

With frequency modulation thus requiring proportionately greater slices of the frequency spectrum per station and demanding more complicated equipment for both transmission and reception than amplitude systems in their present state of development, but without promising compensation sufficient to warrant adoption, the future of pure frequency modulation has not been very bright either for program broadcasting or for amateur ‘phone—on the lower-frequency bands. But, enter television, the ultra-high frequency bands, and Major Edwin H. Armstrong, the pre-war amateur who made regeneration work to revolutionize radio communication. The already-wide band requirements of television and adaptability of the u.h.f. region make the lesser spectrum economy of frequency modulation a secondary consideration. On the other hand, the greater receiver band-width imposed and the reduced amplification per stage which are inevitable make the noise problem one of major importance. Here it is that Major Armstrong finds justification for frequency modulation, as he explained to us during a recent visit to A.R.R.L. headquarters. By employing frequency-modulated transmission and suitable receiver circuits for properly translating frequency back to amplitude modulation (as must be done, since present detection devices are amplitude operated), a worth-while improvement in signal-noise ratio and, consequently, in effective receiver sensitivity, is claimed.

Although considerable non-technical press publicity has been given to the development, up to the present time no authoritative information on the details involved has been released in this country. And the Major has assured us that no details are to be divulged prior to presentation of his paper before the I.R.E. this fall. However, as not unusually occurs with announcement of American developments through theEuropean connections of their sponsors, foreign reports would seem to be somewhat more illuminating than the domestic releases so far available. Our esteemed English contemporary, Wireless World (June 14 issue), apparently on good authority although not specifying the source, reported as follows:

“Major Armstrong attacks the problem first at the transmitting end, where he replaces the usual amplitude-modulation by a system of frequency-modulation. Having once produced a frequency-modulated sub-carrier, he increases the spread of the resulting sidebands by a process of repeated frequency-multiplication, until they cover a much wider area than the normal 10 kc/s used in ordinary broadcasting. Although such a system is, of course, unthinkable in the more congested parts of the ether, it is, at all events for the time being, practicable in the fairly uncrowded region below 10 metres.

“Valve noise, being of the nature of an amplitude variation, is limited to the usual 10 kc/s band on each side of the carrier, which is relatively insignificant, by contrast with the frequency-spread of the transmitted signal.

“For reception Major Armstrong uses a circuit of the superhet type with a second-detector stage consisting of two valves fed in parallel from the IF amplifiers. The input circuit of one detector has a reactance characteristic which varies from

(Continued on page 74)
Election Notice

To all members of the American Radio Relay League residing in the Dominion of Canada, Atlantic Division, Dakota Division, Delta Division, Midwest Division, Southeastern Division, Revised Pacific Division (old Pacific Division minus portion now constituting Southwestern Division), Southwestern Division (the counties of Imperial, Inyo, Los Angeles, Mono, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara and Ventura of the State of California, and the State of Arizona).

You are hereby notified that, in accordance with the constitution, an election is about to be held in each of the above-mentioned regions to elect both a member of the A.R.R.L. Board of Directors and an alternate thereto. In the case of the Dominion of Canada the election is to choose a Canadian General Manager and an alternate Canadian General Manager, for the 1936–1937 term. In the case of the United States divisions except the Southwestern, the election is to choose a division director and an alternate division director for the 1936–1937 term. In the case of the Southwestern Division the election is to choose a division director and his alternate for the single year 1936. Your attention is invited to Sec. 1 of Article IV of the constitution, providing for the government of A.R.R.L. by a board of directors; Sec. 2 of Article IV, defining their eligibility; By-Laws 11 to 21, providing for the nomination and election of division directors, and By-Law 12 providing for the simultaneous election of an alternate division director; By-Laws 25 to 31 providing for the nomination and election of a Canadian General Manager, and By-Law 26 providing for the simultaneous election of an alternate Canadian General Manager. Copy of the constitution and by-laws will be mailed any member upon request.

Voting will take place between November 1 and December 20, 1935, on ballots which will be mailed from the headquarters office in the first week of November. The ballots for each election will list, in one column, the names of all eligible candidates nominated for the office of director by A.R.R.L. members residing in that region; and, in another column, all those similarly named for the office of alternate. Each member will indicate his choice for each office.

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

(Place and date)

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

Gentlemen:

We, the undersigned members of the A.R.R.L. residing in the ........ Division [or in the Dominion of Canada], hereby nominate ........ of ........, as a candidate for director [or for alternate director, or for Canadian General Manager, or for alternate Canadian General Manager, as the case may be] from this region for the 1936–1937 term [in the case of the Southwestern Division, for the year 1936].

(Signatures and addresses)

The signers must be League members in good standing. The nominee must be a League member in good standing and must be without commercial radio connections: he may not be commercially engaged in the manufacture, selling or renting of radio apparatus or literature. His complete name and address should be given. The nominees for Canadian General Manager and alternate thereto must be Canadians. All such petitions must be filed at the headquarters office of the League in West Hartford, Conn., by noon of the first day of November, 1935. There is no limit to the number of petitions that may be filed, but no member shall append his signature to more than one petition for the office of director and one petition for the office of alternate director. To be valid, each petition must have the signatures of at least ten members in good standing.

Present directors from these areas are as follows: Dominion of Canada, Mr. Alex Reid, VE2BE, St. Lambert, P. Q., Canadian General Manager; Atlantic Division, Dr. Eugene C. Woodruff, WSCMP, State College, Pa.; Dakota Division, Mr. Carl L. Jabs, W9BVH, St. Paul, Minn.; Delta Division, Mr. M. M. Hill, W5EB, Natehitoches, La.; Midwest Division, Mr. H. W. Kerr, W9DZW-W9GP, Little Sioux, Iowa; Southeastern Division, Mr. Bennett R. Adams,
Argument for the Amateur

The Cairo Committee of the Board of Directors continues its studies, with a mass of ideas and suggestions under consideration, but we have no advice of specific decisions arrived at in the past month. The Chairman, Dr. Woodruff, writes for QST the following argument for the amateur as seen by the Cairo Committee:

The points usually advanced in favor of the radio amateur having a place in the spectrum seem reasonable and sufficient but, after all, are not fundamental and wholly convincing. These minor arguments come under two headings: first, contributions to the progress of the science and art of radio; second, service to the rest of mankind in the exercise of the art under special conditions.

Contribution to progress on the part of the rank and file of amateurs at times has been questioned. Given individuals of limited resources, lacking training in research, and of an average degree of maturity precluding a suitable background, it is sometimes wondered how such individuals can compete to any advantage with the trained experts in the laboratories of the universities and larger factories. Of course such wondering may be due partly to an arrogant assumption of superiority on the part of the critics, and to that extent are fallacious. However, granting that there are some grounds for such criticism, there still remain many matters of development in any art that are completely solved only when repeated attempts are made under a great variety of conditions, especially under conditions that arise when resources do not permit an exact copying of apparently successful procedures. This is especially true in the art of radio. Likewise there are many tests the success of which depends on a large mass of statistical data. The numbers and wide distribution of the amateurs, and the great variety of conditions under which they operate, make them of special value in these connections.

Under the head of service to the rest of mankind come such items as Army and Navy Net activities and emergency work in connection with storms, floods, and such like. These matters are not to be belittled in importance, yet they are not wholly indispensable.

A third talking point often advanced for amateur activity is the "hobby" plea. But pursuit of a hobby for the fun of it, for the thrills and the "kicks," is not an argument in any way. It is simply an incentive.

The major argument for the amateur's existence, however, is implied in the expression "Citizen Radio." In this there is a two-fold implication:

First, the citizen is an individual. Whatever contributes to the development of independence, initiative, resource and ingenuity is the best of schools for the individual, especially as in this school the pupil must be his own teacher. Second, the citizen is a member of the social group. Whatever contributes to securing for the group the minimization of the individual as a "social problem," and whatever furthers the contributions of the individual to the welfare of the group, such may be of incalculable value. The happiness, security and effectiveness of the social order depend upon the security, effectiveness and happiness of its component parts, the individuals.

Group support of individual activity is a sort of insurance for the group, an insurance of peace and security, and as such amateur radio deserves the very limit of support by the rest of mankind. In return, each amateur operator should check his individual activities and see that they measure up to the standards hereinbefore mentioned.

Alaska

Amateurs in Alaska who have difficulty in locating a notary public to administer the oath in connection with amateur applications will be interested to know that to the list of officials in Alaska authorized to administer oaths there may be added the commanding officers of vessels of the Coast Guard.

Our Cover Illustration

W E GRABBED the shot this month in the lab, on the bench where Ross Hull is doing some development work on ultra-high-frequency receivers. The interesting feature is the picture on the oscilloscope of super-regeneration in full swing. The quench frequency is the heavy and relatively smooth trace. Superimposed on it is the envelope of the oscillation period at the signal frequency. It can be seen that the super-regenerative detector breaks into oscillation slightly after the peak in the quench frequency swing and continues to oscillate for a brief portion of the quench cycle. This trace, of course, is only one of an almost endless variety available. It is, though, an honest-to-goodness un-faked

(Continued on page 78)
THE sporting event of the year for the DX-minded amateur is the A.R.R.L. International QSO Party. The “Seventh International Relay Competition,” March 9-17, 1935, was the greatest contest ever held in the history of amateur radio. New records galore, greater participation, fellowship with brother hams all over the globe, endless possibilities for good operating fun, all made the 1935 DX-fest the most outstanding QSO-get-together in the annals of our hobby.

1490 operators are represented in the final tally of scores—1069 in the United States and Canada, 421 in 65 foreign countries and outside localities! It is estimated that stations were active in more than 90 foreign countries. The figure 1490 represents only those operators whose work in the contest was actually reported to headquarters. There were hundreds more who affected DX QSO's as a result of the contest but who did not report their accomplishments. It is conservatively estimated that total participation in the “Seventh International,” including both the reporters and the non-reporters, was at least 2500!

Scoring was essentially the same as in previous years, serial numbers being exchanged to confirm contacts (which counted a possible three points each), total points being multiplied by the number of countries worked (in the case of VE/W participants) and by the number of W/VE licensing districts worked (in the case of foreign and outside locality contestants). One change in the scoring system was an addition of a band-factor, depending on the number of different frequency bands on which a given transmitter was operated for participant’s contest contacts; 500, 1000, 2000, 4000 or 8000 points were added to the score for successful number exchanges on one, two, three, four or five different amateur bands. The second change was the addition of a Time Limit. For more than 90 hours of operation a compensating factor was applied to the score. For example, if a station operated 100 hours the Grand Total Score was multiplied by the fraction \( \frac{9}{10} \) to give the corrected score. This factor was initiated to permit operators to enjoy the DX possibilities to the maximum throughout the nine-day period without causing serious loss of sleep, working hours, irregular and hasty meals, etc. At the same time, an operator could operate the entire nine days (24 hours per day) and then correct his score as indicated to equalize his work with the work of those unable to put in the full time.

**HIGH W/VE SCORES**

The highest score, national and foreign, was made by W3SI, Charles G. Meyers, Harrisburg, Pa., who rolled up the breath-taking total of 40,808 points!! He made 234 contacts with 56 countries in all continents! This is an all-time record in DX contests and a feat indeed. W3SI, we salute you!

In addition to W3SI's achievement, we are proud to report the commendable performance of numerous other “W’s,” who surely made a name for their stations: W2BHZ scored 36,650 points on the strength of 241 contacts in 50 countries! W1SZ burned holes in the ether to 210 stations in M countries for a total of 35,588! A record in its own right is the work of W6GRL, who absolutely squelched all previous west coast contest claims with 35,250 points—231 contacts in 50 countries!! The one remaining claimant of a 30,000 score is W2UK whose 185 QSO's in 54 countries brought him the glory of 30,646!

Other record scores are W1FH 29,162, W9IJ...
28,324, W9TB 26,530, W6CXW 25,092, W2BXU 19,994, W8Z2Y 19,680, W2A1W 19,066, W9AEEH 18,888, W1BPX 18,877, W2GJK 18,335, W6AWA 18,170. The highest scoring “VE” is VE2AX—15,406. Seventy-eight W and VE scores went over the 10,000 mark!

Included in W3Sl’s achievements is credit for working the greatest number of countries—56. Each of W2DC’s contacts was with a different country, and he made 55 QSO’s! W1FH, W1SZ and W2UK each worked 54 countries. W2BWF worked 51, W2BHZ, W2BXU and W6GRL 50 each, W1BUX 48, W9I.J and W9TB 46 each, and W2GJK 45. Twenty other hams worked stations in 40 or more countries.

Normally west coast scores do not run quite as high as those in other sections of the country. Good 14-mc. conditions this year enabled the V6’s and W7’s to snag more countries than is usually the case. W6GRL’s score was fourth high in the W/VE group and fifth high world score. Other high W6 and W7 scores will be of interest: W6AWA 18,170, W7BB 16,940, W6GRX 16,732, W6ADP 13,540, W7BYW 10,550, W6A1HZ 10,156, W6GRL worked 50 countries, W6CXW 38, W6GRX 36, W7BB 36, W6AWA 34, W7DL 31, W6ADP 30.

W2BHIZ made the greatest number of QSO’s, 241, followed by W3SI 234, W6GRL 231, W6CXW 216, W1SZ 210, W9IJ 201, W9TB 189, W2UK 185, W1FH 169, W6AWA 169, W8CNZ 163, W2AIW 158, W8ZY 158, W4CBY 158, W8CTE 154, W1BPX 153, W6GRX 152. Forty-eight other contestants made more than 100 contacts.

The highest scoring station in each W/VE district: W1SZ, W2BHZ, W3SI, W4CBY, W5APX, W6GRL, W7BB, W8CNZ, W9IJ, VE1EA, VE2AX, VE3WA, VE4DU, VE5BL.

Certificate awards are being made to the highest scorers in each A.R.R.L. Section within the United States and Canada and in each foreign country and outside locality.

HIGH FOREIGN SCORES
Significant, perhaps, is the fact that the leading score outside of the W/VE group was made by a YL! Miss Judy Leon operating HC1FG led the lads a merry race to the tune of a 35,782 total!! She worked 810 stations in all 14 W/VE districts. Better not tell your YL’s about this, OM’s, or you might not hear the last of it! Excellent work, HC1FG. Next in line is XLAY—777 QSO’s, 14 districts, 34,326 grand total—and “grand” is the right word! Going along down the list we find ON4AU, 24,030 points, 395 contacts, 14 sections; EA4AO, 23,304—607 QSO’s, 12 districts; X2C, 22,860—500 QSO’s, 14 districts; K6HLP 21,604—588 QSO’s, 12 districts; and X1AA 20,707, X1AX 20,408, ZL3AN 19,927, D4BAR 18,870, F8FC 18,050, F8EX 17,246, CT2BK 17,236, VK3GQ 17,210, ZL3AN 16,490, VK7RC 16,301, X2N 16,288. Others over 14,000, in order of scores: CM2JM, X1AM, ZL2BN, K4KD, G5BY, VK3MR, FM8BG, K6ESU. Fifteen others had scores above 10,000. In all, 40 foreign scores were over 10,000.


The popular and recognized “DX bands”—7- and 14-mc., were the mainstays of all contest-

September, 1935 25
The special credit for work on other bands, however, caused many to rally forth to explore other territory—1.75-, 3.5- and 28-mc. Three different bands were used by 130 operators. Of these three bands, 14- and 7-mc. constituted two, and in practically every case 3.5-mc. was the third band. In the case of X1AY, however, he successfully transmitted his serial number to W0TJ on 28-mc! W9TJ was transmitting on 14—listening on 28 mc. The only one of the 1485 operators who successfully used five bands was ON4AU. W9TJ gave ON4AU a 28-mc. contact in the same manner that he helped X1AY. ON4AU also worked W2EKN and W2ATT on 3.5-mc., and W1BB on 1.75-mc. These contacts added to his work on 7- and 14-mc., entitled him to add 8000 points to his score—for work on five bands! Contacts on four bands were established by G5BY, VE1EA, W1BB, W1CLX and W6AH. In addition to contacts on 7- and

**SCORES**

(Station first-listed in each Section and Country is winner for that territory, unless otherwise indicated. . . . Number of countries-prefixes (in case of W/VE participants) and number W/VE Districts worked (in case of non-W/VE participants) is given with the score. . . . Likewise, the number of frequency bands on which successful contacts were made is listed. . . . Asterisks denote stations not entered in contest, reporting to assure that stations they worked get credit. . . . Example: W3SI 40808–50–3, or Final Score 40808, number of countries 506, number of frequency bands 3 . . . .)

<table>
<thead>
<tr>
<th>Connecticut</th>
<th>W1GLF</th>
<th>7768–10–2</th>
<th>W1MDM</th>
<th>7562–27–3</th>
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<tbody>
<tr>
<td>W1ZZ</td>
<td>35385–8–2</td>
<td>W1AXA</td>
<td>35567–17–5</td>
<td>W1AVJ</td>
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<tr>
<td>W1AA</td>
<td>11364–9–3</td>
<td>W1W</td>
<td>5377–27–3</td>
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<td>W1AY</td>
<td>11345–9–2</td>
<td>W1C8Z</td>
<td>3092–7–3</td>
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<tr>
<td>W1DLX</td>
<td>8830–19–2</td>
<td>W1BD</td>
<td>2465–1–5</td>
<td>W1BE</td>
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<tr>
<td>W1VCH</td>
<td>9675–6–2</td>
<td>W1B</td>
<td>10892–33–3</td>
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<tr>
<td>W1EWD</td>
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<td>W1AQR</td>
<td>2480–20–2</td>
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<td>W1D</td>
<td>1013–15–1</td>
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</tbody>
</table>

**Connecticut**

**W1GLF**

| 7768–10–2 | W1MDM | 7562–27–3 |

**New Jersey**

| W2B | 720–9–1 | W2W | 781–5–6 | W2W | 2615–19–2 |

**W1F2**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1T**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1C**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1D**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1E**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1F**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1G**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1H**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1I**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1J**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1K**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1L**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1M**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1N**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1O**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1P**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1Q**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1R**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1S**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1T**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1U**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1V**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1W**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1X**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1Y**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |

**W1Z**

| 1048–2 | W2B | 781–5–6 | W2W | 2615–19–2 |
14-me. their "other-band" contacts were as follows: G5BY worked W1BB on 1.75-me. and a number of amateurs on 3.5-me. VE1BA worked G2II on 1.75-me. and VO4Y on 3.5-me. W1BB's first two QSO's in the contest were with ON4AU and G4BY on 1.75-me. and he later worked VP5C on 3.5-me. WC1LX's contacts were with VO2C on 1.75-me. and VP6MO on 3.5-me. On 1.75-me. W6AH1 worked K6CRU and on 3.5-me. K6BJP. ON4V0's work in the contest was confined to the 3.5-me. band; he worked 11 stations with 58 watts input. VK3ZC, using a single '45, worked W6NT on 3.5-me. ZL2HI, using 45 watts input, got a report of R6 on 3.5-me. from W9IEL. EA4AO was heard knocking 'em off in "one, two, three" fashion on 3.5-me. one night of the tests.

CLUB AWARDS

The special certificates offered to the highest scoring station on each A.R.R.L. affiliated club where three or more individual members took part.

- **Ohio**
  - W8WQ, Cincinnati
  - W8VY, Columbus
  - W8JW, Dayton

- **Illinois**
  - W9OE, Chicago
  - W9IY, Rockford

- **Wisconsin**
  - W9LM, Milwaukee
  - W9KJ, Green Bay

- **Minnesota**
  - W9OE, St. Paul
  - W9ER, Minneapolis

- **South Dakota**
  - W9OE, Sioux Falls

- **African countries**
  - VE2AX, Nairobi
  - VE3HT, Johannesburg
  - VE3UC, Cape Town
  - VE8I, Lagos

- **Marvime**
  - VE3I, Melbourne
  - VE3K, Sydney
  - VE3M, Adelaide

- **Japanese**
  - VE3L, Tokyo
  - VE3N, Osaka
  - VE3R, Kobe

- **European**
  - VE3I, London
  - VE3J, Paris
  - VE3K, Berlin

- **South American**
  - VE3I, Buenos Aires
  - VE3J, Santiago
  - VE3K, Lima

- **North American**
  - VE3I, Denver
  - VE3J, Phoenix
  - VE3K, Seattle

- **Oceania**
  - VE3I, Sydney
  - VE3J, Melbourne
  - VE3K, Brisbane

- **Egypt**
  - VE3I, Cairo
  - VE3J, Alexandria
  - VE3K, Luxor

- **South Africa**
  - VE3I, Pretoria
  - VE3J, Durban
  - VE3K, Cape Town
A New Type Ultra-High-Frequency Transmitter

By Ronold King*

THE modern ultra-high-frequency transmitting system consists, in general, of a modulated oscillator, a primary radiator, and a more or less elaborate array of secondary antennas to serve as directors or reflectors. Although a system of this sort may be made highly directional, its construction is not simple, it occupies much space, and it is not convenient where portability is desired. A new type of loop transmitter, on the other hand, incorporates in a single, extremely compact unit a multi-oscillator and a directional antenna system. Its construction, moreover, is very simple, and its directional characteristics are of a useful form. In the following brief discussion the construction and the operation of two typical working models will be considered.

In Figs. 1-4 are shown photographs and circuit diagrams of two laboratory models which have been used for experimental and demonstration purposes. Model A (Figs. 1 and 3) is the original design; it operates on a carrier wavelength of 293.6 cm. Model B (Figs. 2 and 4) operates on 176.6 cm.; it uses four of the "acorn" type 955 tubes. The circuits for the two models are essentially the same, although they differ somewhat in appearance. The oscillating-radiating part of each consists of a square of brass tubing connected at each corner to the plate and grid of a triode as shown in the diagrams. Under proper operating conditions each triode introduces a negative resistance into the circuit, and in this way sustains undamped oscillations around the square. Mathematical analysis shows that the input (plate-grid) resistance of each triode will be negative if sufficient mutual inductance is provided between the grid and plate connections. In the case of model A (Fig. 1), the rather long parallel conductors from the tube base through the 56 bulb...
to the electrodes provide this coupling. The somewhat different construction and mounting of the 955 tubes in model B (Fig. 2) requires the insertion of single-turn coupling coils in series with each tube.

The frequency of the oscillations is determined by the dimension of the square, by the reactance of any lumped impedance in series with it, and by the input (plate-grid) reactance of each triode. It is to be noted that the four parts or segments of the oscillator between the points Q must be kept electrically similar. The frequency equation is

$$\omega L + 4X = 0$$

Here $\omega = 2\pi f$, $L$ is the inductance of the entire square, and $X$ is the lumped reactance, including the triode, in series with each quarter of the square. The calibration characteristics of Fig. 5 reveal that the generated wavelength is practically independent of the plate voltage even over the low-voltage range here plotted. This means that when plate circuit modulation is used (and both models were successfully modulated in this way) distortion due to simultaneous frequency modulation is inappreciable.

The non-oscillating part of the circuit may be arranged in several ways. That shown in Fig. 2 and 4 is perhaps the most convenient. In this the only connection to the grids of the tubes is through a resistor connected between $+B$ and the grid sides of the square. The size of this resistor depends upon the type of tube used. The 56 tubes operate best with $R$ between three and four thousand ohms. The 955's, on the other hand, must have a resistor in the neighborhood of 20,000 ohms. Both types of tubes will oscillate, though somewhat less stably, without resistor and with the grid connections joined directly to $-B$ in a more conventional way.

The directional properties of the loop transmitter are best brought out by the field characteristics of Fig. 6. From these it is clear that the transmitting patterns of the loop transmitter are entirely similar to the receiving characteristics of the familiar loop receiving antenna. A maximum energy is radiated in all directions in the plane of the square (the irregularities due to the square shape disappear in the wave zone), while zero energy is radiated at right angles to the plane of the square. Since the transmitter is very compact (model A has an overall dimension of 18 inches, model B of 10 inches), it is readily transported and rotated into whatever direction it is desired to transmit.

The power output of the device depends upon the type of tube used, and upon the fraction of a wavelength represented by the dimension of the

(Continued on page 39)
A Frequency-Lock Multi-Vider
An Interesting Circuit for Multiplying and Dividing High Radio Frequencies

By J. A. DeYoung,* W1HHW

It is a well-known fact that frequencies can be doubled or tripled, etc., but above the second harmonic the output falls off rather badly. As is also known, frequencies can be divided, as by the multivibrator, for low frequencies which have been described previously in QST and elsewhere.

The interesting fact about the circuit described here, however, is that it will give controlled frequencies either above or below the fundamental control frequency. With a crystal oscillator at 40 meters, one can obtain harmonics at 40, 20, 13.33, 10 or 8 meters and sub-harmonics of 40, 80, 120, 160, or 200 meters. This may sound fantastic, but it is true, especially regarding the sub-harmonics.

It can be seen from Fig. 1, the control oscillator may be of any type, such as crystal, electron-coupled or magneto-striction oscillator, etc. In this circuit the crystal oscillator is a Type 47 tube and the "changer" is a Type 46 tube. The Type 46 works very well and has sufficient output to drive any moderate-power amplifier.

The output from the controlled oscillator feeds the screen grid of the 46 tube through a condenser which is not critical. A 100-µfd. condenser will work for all the amateur frequencies. The screen grid is brought to the cathode or ground through a choke. This choke should have a low d.c. resistance but it should have high impedance at the frequency of the oscillator. An 8-millihenry G. R. choke worked well at 40 to 80 meters, but a choke of less inductance could be used, as for instance, about 120 turns of No. 28 d.s.c. wire on a ½-inch dowel. The rest of the circuit is nothing more than a form of the Hartley self-excited oscillator.

**DIVIDING FREQUENCY**

First we will describe the action that takes place as the circuit is used as a sub-harmonic generator. The 46 tube has two grids. With either grid at zero potential, the plate current is quite low. If we have a crystal oscillator putting out a frequency of 4 mc. and the frequency lock is tuned to the second sub-harmonic (2 mc.), it can readily be seen that the screen grid on the 46 tube must go positive two times every time that the control grid goes positive. But the control grid is negative during one of the positive peaks on the screen grid and the tube is blocked. Thus one of these positive peaks on the screen grid has no effect upon the output frequency and the controlled oscillator gives the output frequency a kick every cycle though the output is at half the frequency of the controlled oscillator.

The wave-forms in Fig. 2 show how the second sub-harmonic is in step with the controlled frequency. Fig. 3 shows the third sub-harmonic in step. At the points marked "X" in Figs. 2 and 3 the frequency lock gets a kick working either at a harmonic or at a sub-harmonic. For sub-harmonics Curve A is the sub-harmonic and Curve B is the oscillator frequency. For harmonics, Curve A is the oscillator frequency and Curve B is the harmonic. It can, of course, be used as a fundamental frequency lock. Since the frequency lock is an oscillator, no neutralizing is required. The tuned-grid tuned-plate oscillator may be used, but this requires another tuning element and may need some capacity connected between the control grid and plate to make it work. Plate voltage of 350 volts on the frequency lock and about 90 volts on the second grid makes a satisfactory working arrangement. Too high a voltage on the screen grid will make the output of the frequency lock dip down when it locks at the harmonic or sub-harmonic. The apparatus will work with no voltage on the screen grid, but the output is considerably less.

Thus far, only harmonics and sub-harmonics have been mentioned, but other controlled frequencies have been obtained, such as two-thirds, three-fourths, one and one-third, or one and one-half times the fundamental frequency. The outputs of these frequencies do not have the amplitude of the harmonics or sub-harmonics. In Fig. 4 it can be seen why this takes place; the output...
frequency gets a kick at the points marked "X." From a 120-meter crystal a controlled frequency of 180, 160, 90 or 80 meters can be obtained as well as the harmonics and sub-harmonics. By replacing the r.f. choke in the screen grid of the frequency lock with a tuned circuit which resonates with the controlling frequency, the output is increased slightly.

FURTHER POSSIBILITIES

Two or more of these frequency locks could be used in cascade to get a much higher harmonic or sub-harmonic; for example, possibly 80 meters to 5 meters, with two tubes. Five-meter output to excite a 5-meter amplifier should be easily obtainable, from a 40-meter crystal Tri-tet oscillator with a 20-meter output, by letting the frequency lock operate on the fourth harmonic, or 5 meters. (How does this sound to the 5-meter gang?) With proper tuning condensers, the frequency lock is not at all critical to tune.

With some indicator to show the action, such as a pilot lamp with one or two turns of wire placed near the coil of the frequency lock or a milliammeter in the grid of the amplifier, a great increase in output will be noticed when the frequency is tuned through a harmonic or sub-harmonic. It may be well to mention here that if too great a load is placed on the frequency lock it may refuse to oscillate, especially when operating above the third harmonic or sub-harmonic with no positive voltage on the screen grid. This will not occur if there is some positive voltage on the screen grid.

When the frequency lock is driving an amplifier there is no danger of the amplifier drawing too much plate current from lack of excitation when the screen grid of the frequency lock has a positive voltage applied to it, as the frequency lock is always exciting the grid of the amplifier at some radio-frequency. Care should be taken, however, to prevent radiation when the frequency lock is not locked to the desired frequency.

The coupling condenser should be of less capacity if the output frequency has a tendency to upset the oscillator. The ideal coupling circuit would consist of a choke or impedance from the screen grid to cathode which has high impedance to the control oscillator frequency and low impedance to the frequency of the frequency lock. Thus the screen grid will be at or near the r.f. ground potential of the frequency lock.

The 47 and 59 type tubes have also been tried, but very little difference was noticed, so the 46 type was used. It is a simpler tube to use and will stand a fairly high voltage on the plate.

This circuit has been used at frequencies from 15 kc. to 30,000 kc. and it worked well throughout this range. However, it seems that the system is not limited to this range. The 46 type of tube may easily be adapted to the 5-meter range, but it has not been tried at the time of this writing.

The values of the component parts of Fig. 1 depend, of course, upon the range of frequencies at which it is desired the system should work.

Plate Modulation of Pentodes

(Continued from page 10)

With a transformer of this type the chief disadvantage of pentode plate modulation, the extra power capacity required of the modulator with the screen dropping-resistor method, is overcome to the extent that the audio power taken by the screen circuit can safely be neglected. From this standpoint the pentodes are placed on a competitive basis with triodes. The ease with which the pentodes can be excited gives these tubes a very definite advantage over triodes. Plate efficiencies compare favorably with those obtainable from three-element tubes as ordinarily operated in modulated service. It is expected that suitable output transformers will be made available in the near future. All in all, it appears that even in the plate-modulated field, long held almost exclusively by three-electrode tubes, the pentodes have something definite to offer.
The Third Annual F. D. proved itself the "best yet." More hams than ever before took part, and many new groups. Higher scores as well testify to the fact that equipment and operating technique has been improved, based on the experience of former years. More of us are better equipped to render public service in a communication emergency than ever before!

Field Day rules were given in detail on page 22, June 1935 QST. Any amateur frequency could be used, voice or telegraph at will, from a portable station in the field. The object was to work as many other stations as possible between 4 p.m., June 8th, and 7 p.m., June 9th. According to the W6CSO /6, W6HLF, W6HAQ AND W6ERT Commissary, BO-meter tent and 5-meter tent of the United Radio Amateur Club's winning setup,

reports, the Field Day gang considered the 80-meter and 40-meter telegraph bands the most effective for all-around communication using portables. A large number divided operating time between these two bands, and some used 5-meter 'phone to get extra points and fun. Analysis of logs indicates the division of operation approximately as follows: 53%-80-meters; 32%-40-meters; 12%-5-meters; 2%-20-meters; 1%-160-meters.

"Winning" an A.R.R.L. Field Day is no easy accomplishment, as many who surpassed last year's best records now realize! The United Radio Amateur Club of Wilmington, Calif., has the honor of again topping the list of contacts for 27 hours of portable operation. This work was in competition with 30 other clubs and many more individual ham groups. Equipment and plans were perfected as a result of experience in previous outings testing individual capability for emergency communications operation. W6CSO /6 used two sets, a 41-10 on 80-meters (6C6 and 37 receiver) and P.P. 112A's modulated by a pr. of 41's on 5 meters (super-regen. receiver), powered by batteries and a gas-driven 500 v.d.c. generator. Nearly one-third the 124 QSOs were made on 56 mc. W6CSO /6 was located half way up the north slope of the Palo Verde Hills, 5 miles south of Lomita, elev. 600 feet, and 10 miles from the Torrence oil fields. Due to mutual QRM the two rigs were not operated simultaneously. The photo of the excellent setup shows what thorough advance planning of portable equipment and operation can do, as attested by the 1116-point score!

W5EHM /5, operating from the highest point near Dallas, was kept on the air for the whole period by hourly shifts, in spite of sun and blistering heat. 103 QSOs resulted, all but one 5-meter contact, on 7 mc. Best reports were from the 8's and 9's worked. Two m.g. sets from car radios provided the power. A Tri-tet with two 42's push-pull, and TNT 45's were both used at different times. The sky wire was supported on 24-foot poles. A score of 927 attests to the wonderful performance of this station, which all but took the lead from our California friends.

W4NC /4, at Hanging Rock Mountain (30 miles from Winston-Salem, N. C.), with a 700-watt power supply (gas-driven) to light the scene of operations, wins the honor of making the highest eastern score, 783 points, for the Winston-Salem Amateur Radio Club. 87 stations were worked, a schedule for operating being posted for each ham. A 59-46 line-up working on 7 mc. was used throughout, with SW3 receiver. All hands had a big time camping out, too. WSYC /8, Buckeye Shortwave Radio Association, Akron, Ohio, had three 80-meter c.w. rigs and two 5-meter 'phone sets and made next highest score. W3QV /3 en-
The South Cleveland Radio Club, WSCMB/8, operated on 1.7, 3.5, 7 and 56 mc., working 2, 35, and 12 stations respectively, or a total of 80 contacts for 720 points. W8LZP, W8IKP, W8IBE, W8LEM, W8KZX, W8NZD, W8LJY, W8LYQ, W8SIC, W8LXR and W8LWO participated with WSCMB in the fine records made by this station.

Canada was represented by six different groups reporting in the Field Day. The Hamilton (Ont.) Amateur Radio Club, VE3KM, made the most outstanding VE score, using both 3.5- and 7-mc. equipment, making 66 contacts with truly portable equipment for a total of 594 points! A dozen or more licensed operators pushed the key at VE3KM. Other VE work is recorded under the following calls: VE3GT, 360 points from 40 QSOs; VE3TM, 160 points, 40 QSOs; VE3GJ, 116 points, 29 QSOs; VE3SG, 52 points, 26 QSOs; VE2CO, 12 points, 4 QSOs.

W8KWN/8, portable in every respect, was kept on the air near Cambridge, Ohio, by four operators. Generator power to TNT '10 on 3.5 mc. and to TNT '45s on 7 mc. resulted in 64 contacts and 576 points. W9AIU/9, the Egyptian Radio Club's station, was all set to put the event in the bag—same location as last year. There was trouble with the gas-driven generator and delays in getting going. 61 stations were worked for 549 points, and the club plans to be back stronger than ever next year. W9LED/9, representing the Wausau Radio Operators Club (Wisconsin), used 3.5 mc. exclusively, six members setting up the equipment on Rib Mt. Two 71A's in a battery-powered crystal rig made 61 contacts, 549 points score, in spite of terrific QRN, rain and wind storms. W9NTW/9, using a vibrator-transformer set for the Northeast Iowa Ham Club and a pair of 80's, was also operated by W9RDK and W9XMC and worked practically all districts. Made 59 QSOs, 531 points. W9SUJ/9 represented Chicago on the air in the Field Day. Six hams with W9MIR's 47-10 crystal rig run from W9ORO's 250-watt alternator (home built from a Ford generator) got on location, set up in two hours, and by continuous 3.5-mc. operation

made one of the high scores—85 QSO's, 510 points. W9KWP/9-W9KJY also did excellent field work on 3.5, and 11 mc. in this area.

50-mc. rigs were used exclusively by four participants and incidental use of 5-meters was noted in many reports. W1HDQ/1 made 49 contacts, W1FGC/1 44, W6AM/6 39 and W2DWW/2 14, all exclusively using this band, and HDQ's work being the most outstanding. —F. E. H.

**FIELD DAY PARTICIPATION**

<table>
<thead>
<tr>
<th>Club</th>
<th>Station</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>W6CSO/6</td>
<td>United Radio Amateur Club 1</td>
<td>124-A</td>
</tr>
<tr>
<td>W4NC/4</td>
<td>Winston-Salem Amateur Radio Club, Inc. 2</td>
<td>87-A</td>
</tr>
<tr>
<td>W8YCY/8</td>
<td>Buckeye Shortwave Radio Ass'n</td>
<td>84-A</td>
</tr>
<tr>
<td>W3QV/3</td>
<td>York Road Radio Club 3</td>
<td>83-A</td>
</tr>
</tbody>
</table>

**W3QV/3 WITH EQUIPMENT IN CAR (LICENSE VY73) MADE A LEADING SCORE**

W9SUJ/9 *KEEPS AN EYE ON THE LINE VOLTAGE DURING THE 27-HOUR CONTINUOUS RUN*
INDIVIDUAL AND GROUP SCORES

W5WEM/5 W5ENE-W5EBC-W5ESC-W5DYH-W5EHM 103-A 297
W8KWN/8 W8KYX-W8NRM-W8MQA-W8QYN 64-A 570
W9SUI/9 W9ORO-W9SUD-W9RZU-W9SUI-W9TMR-Gus 85-B 510
W8R8B/8 W8RB-W8MHH-W8LZK-W8ME 80-B 480
W8DMK/8 W8DRW-W8HMK 79-A 474 T
W1HPG/1 E. P. Tilton 49-A 441
W1RGC/1 Robert M. Slavin 44-A 390
VE3GT VE3JT-VE3GT 40-A 360
W110G/1 W. T. Silver, E. S. Davis 40-A 360
W1GME/1

W8CHM/8 W8BJK-W8HJU-W8CHM-W8DMF-W8LRE-W8CBS 39-A 239
W9NNG/9 W9UTLC-W9MKG-W9NNG 37-A 323
W9KGK/9 W9VOU-W9KGK 36-A 324
W8KZL/1 Bud Keller 34-A 306
W8H7J Edward L. Miller and W8FD-E8F2-W8FPO 31-A 279
W3DPK/3 W3CZT-W3DCB-W3C3Y-W3DPK 28-A 252
W6AM/6 Don C. Wallace 29-A 254
W9AB/9 W9CRZ-W9AB 23-A 207

"power classification" used in computing the score is indicated by a, b, c or d after the number of QSOs shown. A indicates power up to and including 20 watts (multiplier of 3); B indicates power over 20 up to and including 60 watts (multiplier of 2); C indicates over 60 watts (multiplier of 3). More than one letter indicates over 60 watts, but different power inputs fall under different classifications. An R or T after the score indicates that relays or transmitters were supplied from the public mains; no indication after scores where work was entirely inde-
The Army-Amateur Radio System was organized "to provide additional channels of radio communication throughout the continental limits of the United States that may, in time of emergency, be used to augment or replace the land lines, both telephone and telegraph, that might be seriously damaged or destroyed by flood, fire, tornado, earthquake, ice, riot, or insurrection." Although it has many times, during the period of its existence, fulfilled the provisions under which it was organized, including the one above, it was not until recently that any part of the system had to prove in advance that it was ready to meet an emergency.

This test was applied to various organizations in the state of Florida which were expected to render emergency communication should conditions arise similar to those experienced during September 1926. It was during the 1926 hurricane and the hectic days that followed that the people of Florida first appreciated the value of the radio amateur to the community. Among those upon whom this fact was impressed was the Roehling estate of Lake Placid, Florida. They not only realized the value of the amateur but they recognized the need for better equipment and organization than was available during that hurricane.

Soon thereafter they established a fixed amateur station at Lake Placid under the call W4LS and obtained an amateur to act as technician and operator. No expense was spared in establishing the best possible station. A portable station was established in an "Aerocar" trailer. Accommodations for living in the trailer were provided for four men. The facilities so established were tested periodically in the field and kept ready for immediate use. All went well until the Federal Communications Commission changed its license requirements. Under the new regulations an amateur station license must be held by an amateur operator. The Roehling estate could not obtain such a license. This situation made it impossible for the estate to continue the operation of the emergency station. It was decided that the equipment would be presented "to the group best showing to the satisfaction of the donor its ability to make the proper use of the donation."

Many organizations, including various radio clubs, military and naval units, Red Cross units, etc., presented their credentials and offered records of past performance as proof of their ability to operate the emergency stations. After very careful consideration of all of the facts in the case, the Lake Worth Radio Club of Lake Worth, Florida, was chosen as having the best plan of organization to meet future emergencies and the best record for having met past emergencies. All of the equipment, both fixed and portable, was thereupon presented to the club as an outright gift.

The Lake Worth Radio Club operates the station under the call W4AWO. As WLRO the station is operated as state net control station in both the c.w. and 'phone nets of the A.A.R.S. The operators, who are members of the A.A.R.S., are J. G. Graham, W4CNT; A. Litschauer, W4ACZ; F. G. Carroll, W4OK; George P. Aldridge and James W. Exline. Mr. Aldridge, who is president of the club, has been appointed chairman of the communications section of the South Florida Red Cross Safety Committee.

The total value of the gift is $10,000. In addition the club previously owned equipment valued at $3,000. The fixed station has been installed in the storm-proof auditorium, capable of withstanding 250-mile-per-hour winds. It consists of a 'phone station on 75 meters, a c.w. station on 40 or 80 meters, all capable of operating at full 1 kw. power. Special power lines have been installed from the city lighting plant to the auditorium. The portable equipment consists of two complete stations: one in the Aerocar, which can be operated on the 75-meter 'phone band or on either 80 or 40 meters c.w.; the other in another trailer can be operated on 80 or 40 meters c.w. Both trailers are equipped with gasoline-engine-driven generators.

(Continued on page 60)
A Flexible E.C.-Controlled Transmitter

By Alpha Learned, W1FUB

Amateurs may be interested in the following description of the outfit at W1FUB in which a calibrated e.c. oscillator is so used as to permit transmission on any desired frequency in the 14-, 7- and 3.5-megacycle bands. The diagram of Fig. 1 gives the complete circuit. A 24-A tube is used as the e.c. oscillator and at all times operates on the 160-meter band with its plate circuit tuned to the second harmonic, the strength of oscillation being controlled by a panel knob which varies the plate voltage from 0 to 300. In operation this knob is advanced until sufficient excitation is obtained; that is, until further advance causes no increase in final output. The oscillator and its plate circuit are individually in boxes of rugged all-steel construction to insure frequency stability. The oscillator box is built of one-eighth-inch sheet stock, held together at all edges by quarter-inch square rods and plenty of machine screws.

The calibrated electron-coupled oscillator gives this transmitter unusual flexibility with high stability and provides full diversification in use of frequencies in three amateur bands, as outlined in the text.

The oscillator frequency-shift control is the precision National dial at the right in the lower row variable condensers having well-centered and widely-spaced plates are used in the oscillator to

![Diagram of the transmitter using a calibrated electron-coupled oscillator](image)

**FIG. 1—CIRCUIT OF THE TRANSMITTER USING A CALIBRATED ELECTRON-COUPLED OSCILLATOR**

| L₁ | 22 µh., tuned to 160-meter band always | L₁₀ | Same as L₃ | C₁₀ = 2 pfd. | C₂₀ = 100 µfd. |
| L₂ | 16 µh., tuned to 80-meter band always | L₁₁ | 5 henries | C₁₁ = 0.05 µfd. | C₂₁ = 400 µfd. |
| L₃ | 16, 4 or 1.5 µh. on 80, 40 or 20 meters | L₁₂ | R.F. choke | C₁₂ = 250 µfd. | C₂₂ = 50 µfd. |
| L₄ | R.F. choke | L₁₃ | Same as L₃ | C₁₃ = 0.01 µfd. | C₂₃ = 100 µfd. |
| L₅ | R.F. choke | L₁₄ | Same as L₃ | C₁₄ = 100 µfd. | C₂₄ = 0.002 µfd. |
| L₆ | Slightly greater inductance than L₃ | L₁₅ | R.F. choke | C₁₅ = 0.002 µfd. | C₂₅ = 1 µfd. |
| L₇ | Same as L₃ | L₁₆ | R.F. choke | C₁₆ = 0.002 µfd. | C₂₆ = 100 µfd. |
| L₈ | R.F. choke | L₁₇ | Slightly greater | C₁₇ = 0.002 µfd. | C₂₇ = 100 µfd. |

24-A cathode tap and 59, 841 and 203-A neutralizing taps at about one-third total turns from end of coil.

C₁₉, L₁₁, R₃ and C₁₄ constitute the key-click filter.

By varying C₁₉ the so-called “bell” tone may be adjusted to suit the operator.
reduce changes in capacity due to any vibration or movement. The reason for this can be understood by considering a simple condenser consisting of one rotor plate midway between two stator plates. If the rotor plate moves slightly towards one of the stator plates the total capacity will be unchanged, for the capacity increase on one side is balanced by a decrease on the other side. However, if the rotor moves very close to one stator, then the total capacity will increase, for the capacity of one side is increased greatly and the capacity of the other side is decreased only slightly. Also, these condensers are of comparatively high capacity (total max. 500 µfd.), so that any unavoidable change will be a small part of the whole. No temperature control or compensation is used since tests indicate that the total fundamental frequency drift from cold to hot is but slightly more than one kilocycle.

The 58 buffer tube acts as a straight amplifier, doubler or quadrupler, and is equipped with grid-leak bias in an attempt to take advantage of the vari-mu feature of this tube, whereby the amplifying power increases as the bias (excitation, in this case) decreases. The following stages are straight amplifiers with battery bias.

The tabulated data show typical operation on the 7-mc. band, the various currents being approximately the same on 14 and 3.5 mc. except for the oscillator which usually runs with plate voltage of 250 and 100 volts on 14 and 3.5 mc., respectively. When transmitting on 3.5 mc. a final input of 450 watts may be obtained with as little oscillator screen input as one-fourth of a milliampere at fifteen volts. The original 24-A has never left its socket and it is apparent that long tube life may be obtained, unless the set is operated on 14 mc. a great deal. This is important because it is somewhat of a task to make an accurate frequency calibration. The oscillator was calibrated from WWV by the method described in past issues of QST.

The set is far from being a perfect model to be copied in detail by others, but amateurs interested in this type of transmitter can and will, I hope, build better ones. Improved methods and the use of some of the newer tubes such as the 802 should make possible a more powerful yet less complicated transmitter.

**Strays**

A glued strip of yearly labels (marked from 1919 to 1938) is now being furnished with each QST binder. The labels are attractive, and may be easily cut and placed in the date space provided for on the binder. Free upon request to those having binders without labels.

![Diagram](image-url)
Amateur Radio STATIONS

W3AAJ, Richmond, Va.

BOB EUBANK, W3AAJ, has long been an active and well-known member of the Communications Department field organization, while his QST contributions probably have made him equally well-known to QST readers not participating in organized activities. A ham since 1914, holding a commercial first ticket since 1922, he was for many years SCM for Virginia, resigning just recently, and holds appointments as ORS and Chief Route Manager for Virginia. Another of the gang who make radio their profession as well as hobby, Bob is Transmitter Chief at WRVA, the Edgeworth Tobacco Station at Richmond, and was instrumental in having code practice lessons sent out over that station in past seasons.

W3AAJ’s station layout is shown in the accompanying photograph. The frame-mounted transmitter consists of a 47 crystal oscillator working at 350 volts, a 46 doubler and 10 buffer, both operating from the same 500-volt supply, and a Western Electric 242-A power amplifier. Input to the 242-A is 175 watts from a power supply using 866 rectifiers. In the photograph, the power supplies occupy the two lower panels, oscillator and doubler-buffer the third, power amplifier the fourth, while the top panel contains an antenna matching network of the type described by Collins. The antenna is the vertical arrangement originated by W3AAJ and described in QST for March of this year.

The receiving equipment includes a National FBXA used in conjunction with a Peak preselector. A monitor sits on top of the receiver, while a frequency meter is between the receiver and transmitter. The station works on the 20-, 40- and 80-meter bands.

W3AAJ has been awarded a public service certificate for work during storm emergencies in Illinois and Maryland. He also holds the rank of Lieutenant in the USNR.

W1BPX, South Brewer, Maine

AN UNASSUMING but highly effective DX getter is the layout of W1BPX, owned by Paul D. Palmer, South Brewer, Maine. Using a power input running between 200 and 300 watts to a 203A, depending on the frequency, this station had 17 contacts with Asia during the past winter, which is something to make most of New England, where Asian signals are nearly as rare as comets, prick up its ears. Blame it on “location” if you will, nevertheless W1BPX is the man who’s been doing the work.

The transmitter occupies the frame to the left of the operating table. Starting out with a 7-mc. 47 crystal oscillator, the second stage uses a Type 10 tube as a doubler. This in turn excites a buffer stage using an RK-18 with 750 volts on the plate. The final is the aforementioned 203A, link-coupled to the buffer. Oscillator and buffer are run at 300 and 400 volts, respectively, from one power supply. The last two stages are supplied from a 1200-2400-volt center-tapped pole transformer used with a pair of 866’s and a filter consisting of six µfd. and a double choke.

W1BPX’s receiver is a duplicate of the set
described in January, 1933, QST, the constructional work having been done by W1EBJ. The owner swears by its DX-getting ability. The transmitting antenna, a 7-mc. Hertz, single-wire fed and 60 feet high, also is used for receiving.

W1BPX went on the air in August, 1931, and after six months of alternating between 3.5 and 7 mc. went down (or is it up?) to 14 mc., where most of the work has been done since. WAC was made in 1932 with a 10 Hartley, and since then 72 countries have been worked. Palmer attends the University of Maine and is an amateur astronomer as well as radio amateur. W1BPX expects to spend considerable time on 28 mc. this summer, with the particular ambition of working Europe on that band.

W8GHA, Harrison, Mich.

W8GHA is the station of the 677th Company, C.C.C., located at Camp Harrison, P-113, Harrison, Mich. It is under the charge of Robert E. Kearney, 1st Lt. Engr-Res., formerly 2FB, and since its installation in January of this year, has made many contacts in different parts of the U.S. and Canada on 160-meter 'phone. The photograph gives a general view of the station. The transmitter is of frame and panel construction, equipped with an r.f. end having a 47 crystal oscillator, 46 buffer, and a pair of 46's in parallel in the final amplifier. Speech equipment includes a crystal microphone working into a 57 first stage, resistance-coupled to a 56 which in turn is transformer-coupled to a 46 Class-A amplifier driving a pair of 46's in Class B. Normal power input to the Class-C stage is 40 watts.

The antenna system at W8GHA is a 243-foot Hertz, end fed, 67 feet high at one end and 45 feet high at the other. It is supported at the high end by a 40-foot pipe mounted on top of a water tank, and at the other by a similar pipe 20 feet long on top of a telegraph pole. The antenna length is chosen to be resonant at the operating frequency, 1929 kc.

The receiver shown in the photograph is a model 89 Philco used chiefly for monitoring. Communication is usually carried on with a Patterson PR-10. Schedules are kept with W8HZV, Camp Huron-Hayes, Clinton, Mich., and with W8AEQ, at Camp Fife Lake, Fife Lake, Mich. The latter is the northernmost camp of the Fourth Forestry District, while Camp Harrison is the southernmost, and constant daylight 'phone contact has been maintained between W8AEQ and W8GHA, an arrangement which has proved very satisfactory to the District Commander and the Company Commanders concerned. Outside traffic can be cleared through the Army-Amateur net, of which W8AEQ is a member. In general operation, the station has contacted stations as far west as California, south in Texas and east in Maine.

A 20-meter c.w. transmitter is under construction. W8GHA would appreciate reports from other C.C.C. camps hearing its signal. Lt. Kearney has formed a radio class in the camp, and several of those enrolled are about ready to take their ham examinations.

A New Type Ultra-High-Frequency Transmitter

(Continued from page 31)

square. Since it is desirable to have this as large as possible, tubes with small input (plate-grid) capacitance should be used. In the usual case at short waves, for which the dimension of the square a is less than a sixth of a wavelength, the radiation resistance is given by the expression

\[ R_r = 20(2\pi a/\lambda)^4 \text{ ohms} \]

with the wavelength generated. The radiation resistance of model A is about 14 ohms; that of model B only 4 ohms. High-frequency currents approaching an ampere are possible in model A with plate voltages of 200 volts or more. For large power output, however, more powerful tubes than the 56 type might well be used, though a much larger plate-grid capacitance might reduce their advantage at the shorter wavelengths.

Numerous modifications in the design and construction of the loop type transmitter are readily imagined. For example, there would seem to be no reason why six tubes arranged in a hexagon, or any number of tubes suitably spaced around a circle or regular polygon might not be used. It is probable that grid-plate coupling coils would be necessary in such cases even with 56 type tubes. However, no attempt will be made in this article to do more than outline the construction of the working models. Further developments are left to the ingenuity of the experimentally inclined reader.
An Audio Output Stage for the Regenerative S.S. Receiver

Several months ago I constructed the regenerative single-signal superheterodyne described in the eleventh edition *Handbook* but found that while the set functioned just as the data said it would, the total gain was not sufficient to bring in all signals with the sock I desired. Naturally, before building the set I had carefully planned the layout, making it similar to that shown in the *Handbook*; I did not, therefore, leave any additional space where another tube might be added.

The obvious solution in such a case as this would be to substitute another tube for the 2A5 used as a second detector, and then use the 2A5 as a straight audio amplifier, but this would have necessitated drilling another socket hole and this in turn would have ruined the appearance of the chassis and also crowded things considerably. However, the problem was solved by using one-half of a 53 as the second detector and the other half as beat oscillator. Since the beat oscillator is coupled to the second detector, this was the logical combination of circuits. The whole audio and second-detector end of the receiver was then wired as shown in Fig. 1. It was found that the audio output was many times greater with this arrangement than when the 2A5 was used as a combination audio and second detector tube.

The circuit of the beat oscillator half of the 53 differs considerably from the former circuit using a 57. The connection that formerly went to the 57's cathode is grounded and the connection that was grounded is coupled through C1 to the plate of the oscillator half of the 53. The grid connection is the same except that the lead is brought out under the chassis. It was found that both parts of the tube worked very well with their common cathode grounded and there was therefore no necessity for inserting cathode bias.

There is really nothing unusual about the rest of the circuit, and the diagram is self-explanatory. The oscillator coupling condenser was made in this instance of about five inches of twisted wire with the dead ends insulated and the other two ends soldered to the two grids of the 53. This was found to give very good results since it did not overload the second detector but still produced a very good beat note.

I am convinced that this change will be welcomed by fellows having one of these receivers, as the gain in audio volume is well worth the trouble.

---Lewis Van Arsdale, W9NQV

**Blocked-Grid Keying**

If separate power supplies are used for the exciter and final amplifier stages, blocked-grid keying of the final can be accomplished quite easily without any auxiliary equipment except an inexpensive resistor and possibly a by-pass...
condenser. The idea is simply to use the exciter plate supply to furnish blocking bias for the amplifier.

An arrangement used by Peter Fakkema, W7AJ, with a two-stage transmitter consisting of a 59 Tri-tet oscillator and 10 amplifier, is shown in the upper diagram of Fig. 2. With the key open, the 300 volts from the oscillator supply is connected in series with the amplifier grid return to filament center-tap through the high resistance $R$. $R$ is 100,000 ohms or more; its value is not critical, but it should be high. $R$ acts in the combined capacity of a very high-resistance grid leak for the amplifier when the key is open and as a current-limiting resistor for the 300-volt supply when the key is closed. With the key closed, the amplifier grid bias is supplied solely by the regular grid leak. The filament by-pass condensers, $C$, should be capable of standing the oscillator plate-supply voltage.

A somewhat similar scheme has been used by the editor for some time with the general-purpose transmitter described in January 1935 *QST*. In this case the low-voltage supply for the oscillator and buffer tubes supplies both operating and blocking bias for the final stage. The lower circuit diagram of Fig. 2 shows the essential details. With the key open, the grids of the 801 amplifier tubes get the full 450 volts of the low-voltage supply through $R_1$, a 50,000-ohm 2-watt resistor. With the key closed, that part of the low-voltage bleeder between negative and the tap to which the key is connected serves as a combined grid leak and bias supply. A few slight changes are necessary in the circuit diagram given on page 17 of January *QST*. The grid leak, $R_3$, should be removed and a separate bias terminal brought out. For insulating purposes a fixed condenser should be connected in the common r.f. line between the final and exciter stages, as shown at $C_1$ in Fig. 2 herewith. In operation, the tap on the low-voltage bleeder should be set to cut off the amplifier plate current with excitation removed; when excitation is applied the bias will increase beyond cut-off because of the flow of grid current through the biasing portion of the low-voltage bleeder.

Key thumps can be eliminated quite readily with these keying arrangements. A filter consisting of two air-core chokes, connected in series with each key terminal, with a 1-µfd. by-pass condenser across the chokes on the line side, has been very successful. The chokes were simply windings from some old 30-kc. i.f. transformers, or some 80-mh. chokes of the type used in receivers.

**Duplex *Phone***

There comes a time in every ham's life when he feels the urge to have a two-way QSO for test purposes. There are so many details when reporting through a test transmission that most of the substance is forgotten. Regular duplex operation is not very desirable in our present crowded *phone* bands, however, especially when the transmitter is left on continuously, hence I suggest the following method to be used for test purposes only. A direct reply is obtained on each test and much time is saved.

Dig down in that old junk box and get a pair of...
250- or 350-µfd. variable receiving condensers of the broadcast type, also two dials and a 1 ½-inch diameter coil form for the plug-in coil. The system is, no doubt, applicable to any band, the frequency being about proportional to the number of turns for other bands, hence the plug-in coil. The specifications given under Fig. 3 apply to the 160-meter 'phone band.

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**2-Band U.H.F. Transceiver**

Fig. 4 is the circuit diagram of a 5- and 2½-meter transceiver which has been used successfully by Eric W. Crusor, W2DYR. Its unique feature is the elimination of the special audio-microphone transformer usually required by transceivers, and the provision of a method of monitoring the transmissions. W2DYR writes:

"The vital difference between this and the ordinary transceiver circuit is that no special combination mike and audio transformer is necessary so that the same tube may be used as both a modulator and audio amplifier. The circuit is simple and the parts required are of the variety that are usually found in a ham's junk box. The tubes used are a 56 oscillator-detector, and a 56 modulator-amplifier. 27's and 37's will undoubtedly give good results. However, on 2½ meters super-regeneration was only obtainable with certain tubes (evidently some of the newer models with solid plates and spiral heaters).

"To change from 'send' to 'receive' requires no more switching than in the ordinary transceiver, and a double-throw triple-pole jack-type switch does the whole job. Provision is made in the circuit so that the signal can be monitored while transmitting.

"When used on 2½ meters the tuning condenser which proved most satisfactory was one improvised from two small copper discs about ¾-inch in diameter, one stationary and the other soldered to a screw and mounted so the distance between the two could be varied."

Condenser C₄ makes possible monitoring of the transmissions. A small amount of audio signal gets through C₄ to the 'phones, although with the small capacity specified the power consumed is so small as not to affect the modulation. C₄ has no effect on the operation of the set or a receiver.

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**Strays**

W9EGQ varies the well-worn CQ story by reporting the BCL who asked him where station LOCQ, whom everybody seems to be calling, is located!
Internationally-Minded:

Few better expressions of the fundamental practical importance of organization, not only national but international, in amateur radio have been made than the following editorial excerpted from the June, 1935, issue of "Break-In," official organ of the N.Z.A.R.T.:

"Webster in his well-known dictionary defines an amateur as 'one who is attached to or cultivates a particular pursuit, study, or science from taste without pursuing it professionally.' That this is correct, the Radio Amateurs need not be told.

"Unfortunately, like many other words in the English language, the true meaning of the word has been lost to many. They construe the word amateur to mean 'one who is a novice; one who is new, unskilled, or inept at an art or science.' That this is also true is indisputable and only too apparent. Ask a disinterested person what he understands by the term 'Radio Amateur.' You will be surprised at the answers you receive. Think over the replies and then ask yourself whether you are doing your utmost to correct these misapprehensions. Do the people who listen to you on the air, and in person, think you are a trifler or tinkerer?

"What can be done to stop these misapprehensions that the general public have? We suggest that as a start you correct any faults you have in your pursuit of the greatest hobby of all. Help the other amateur who does not realize what he is doing. Tactfully draw his attention to his transgression and unconsidered remarks, that may be offending and doing untold harm. Then get all you know and contact to become 'radio-minded' and join N.Z.A.R.T. We will need the support of the general public throughout the world, if we are to carry weight at the International Convention to be held in Cairo in 1937. As a start in this campaign, you will realize that we cannot claim 100% representation of the Radio Amateurs whilst one remains outside N.Z.A.R.T. All must be members. We are and will be fighting for more privileges, wider bands of frequencies, fewer restrictions, more recognition, and all the other vital matters that affect the welfare of all Amateurs. Your Ham friends are letting you down whilst they do not belong to our Association. Be Internationally-minded. You may not like some of our habits, but the big thing is that you are joining I.A.R.U.
and B.E.R.U., the two bodies which do carry
weight.”
We heartily endorse these remarks as applying
not only to the N.Z.A.R.T. but to all societies
and all amateurs everywhere.

Bolivia:
From L. H. Tejada F., who is now working
c.w. and 'phone on the high-frequency end of the
14-mc. band under the call CP4ANB, comes the
following information concerning present-day
amateur regulations in Bolivia:
1. Two kinds of licenses are issued, amateur
and experimental. Amateur stations use the pre­
fix CP3 and experimental stations the prefix CP4.
2. The maximum power allowed amateur sta­
tions is 100 watts output. The power of experi­
mental stations can be any value, subject to
authorization by the Direcci6n de Correos y Telé­
grafos.
3. All Madrid treaty bands are allowed.
4. All amateur stations are required to observe
quiet hours between 2100 and 2400 Bolivian
Standard Time (0100 to 0400 G.T.). This does not
apply to experimental stations.

HB9Y, ARTHUR V. WATTENWYL, ZURICH, OUT­
STANDING 3.5-MC. DX STATION
On the air first in 1931, HB9Y's initial QSO was with
an LU. Now, four continents have been worked on
80 meters; South America and Oceania are needed for WAC
on that band. Two '10's in the final deliver 100 watts to a
40-meter Hertz. HB9Y seeks 3.5-mc. skeds with stations
everywhere.

5. It is prohibited to exchange messages with
stations of other countries which do not permit
such exchanges.

General:
Mostly on DX:
On June 23rd ON4AC, Reseau Belge's secre­
tary, was QSO W6GRX. This was not unusual,
but W6GRX said he had not been to bed for the
last 24 hours and was very tired. His wife had, a
couple of hours before, given birth to a son. The
OM, needing some rest himself, had turned on
his transmitter! ON4AC changed over to voice

and, QSA5 R8 on the speaker, felicitated Mrs.
W6GRX on the happy event, the message being
relayed direct to the hospital. (Tnx, ON4CC.)
VQ4CRP will henceforth be silent. S. G. Fisher
has been transferred to Mozambique, and as soon
as he is settled will be on with a new CR7 call.
(Tnx, W1G Dy.)
A.R.R.L.'s Emergency Corps—Join Now

At least one amateur station in every community should be equipped with auxiliary station equipment for use in emergency. For real preparedness such equipment should be designed to operate from power supplies other than the regular a.c. or d.c. lines. Although it is true that much of the most valuable emergency work is done using equipment operating directly from a.c. or d.c. mains, it must be remembered that the 'static area' itself is usually without current from the power company. This means a wait until lines are repaired. "Wait"s are inexcusable in emergencies. Communication should be established at the earliest possible moment. To guard against delays the "emergency set-up" must operate from auxiliary power, and the operator must at all times know where he can secure the auxiliary power (if he does not have emergency power himself, arrangements can usually be made with local hardware dealers, radio stores, etc., for the loan of batteries when the need arises).

The "A.R.R.L. Emergency Corps," of which this is the first announcement, will comprise those amateurs who have available at their stations transmitting and receiving equipment suitable for use in an emergency, and capable of operating from power auxiliary to regular a.c. or d.c. mains. All amateurs are invited to enlist at once in this "Corps."

How to Join the "A.R.R.L. Emergency Corps": Every member of the Corps will be required to "register" at headquarters on the emergency equipment available at his station. Appointment to the Corps will remain in effect only during the time when such equipment is on hand and in operating condition. To join simply send a post card to the Communications Department, A.R.R.L., West Hartford, listing what emergency equipment you have (transmitter, receiver, frequency band(s) it works on, auxiliary power—whether on hand or whether arrangements have been made to secure power quickly if emergency arises). If your application proves O.K., you will be issued a membership card, and your availability will be registered on a headquarters record.

Fine emergency work in Nebraska, Colorado and other midwest points included many hams stations recently—report in August QST. A Western N.Y. flood (40 lives lost, millions damage) with hams filling the communications gaps is being featured in our Hartford papers as we write. Our A.R.R.L. Field Days have stressed "emergency preparation" and stimulated development and trial of successful portables. Now we aim to go further.

Every member of the "A.R.R.L. Emergency Corps" will be expected to make known his availability for emergency communication to local Red Cross officials, railroads, military units, police departments, representatives of press associations and the like. All Corps stations should be on call, and with such organizations and other competent authorities so that they will be called upon to assist when emergency communication is necessary.

The goal of the "A.R.R.L. Emergency Corps" is: AN AMATEUR RADIO EMERGENCY STATION IN EVERY COMMUNITY!! Will you help us achieve that aim? Amateur Radio as an emergency communication system is invaluable. Every red blooded ham should want to do his part! Send your application to the Emergency Corps as soon as possible. We need you! And your community needs you! Clubs working in the interest of amateur radio and their communities have a real opportunity in this field too, and we shall be glad to enroll club stations in the A.E.C.!!

Briefs

Major H. J. Conners, U. S. Army, of Schofield Barracks, Hawaii, was reported as missing and possibly dead by the press on July 15th. Discovering the rumor, Major Conners on July 18th desired to relieve the minds of relatives in Laurel, Md. He filed a message with K6DV/WQVB, it was relayed by W6GXM/WLM1 to W3CXL/WLM and 'phoned from there. An answer was returned via the same route, total time for round trip being nine minutes! Another feather in amateur radio's 'public service cap'!

Hams Afloat

Add to the news on "Sparks" in August QST: W4AKH is operator on the S.S. Fairfax, KGC6. W4UX sails with the S.S. Maguerie, KQJS. In the radio shack on the Yacht Vanda, WQDS, you will find W4AEM. W1AF is Sparkes aboard the S.S. Dorothy Bradford, sailing out of Boston to Cape Cod and vicinity. W1BN6C had a pleasant chat with ABF recently and reports the rig on the Bradford is a 2-kw. spark, the receiver an SW7! W0BBP is pounding brass on the Steamer Ishpingon, KFLL. All amateurs who are ship operators are invited to send in the dope on their activities.

In the 1935 C.M.T.C. Signal Company at Fort George G. Meade, Md., there were fifteen hams! Count 'em: W3DZX BVV EWJ FIF WS3KPU NFD LBD IFB KUK KJY KTI LOQ GSH NFV ASW.

Multiple QSO's are quite popular these days. W2EGG tells of a seven-way one on 50-mc. 'phone recently. It started with W2HPD's CQ, which was answered by five stations. HPD got them all and designated the order in which they should come back. A good evening of rag-chewing followed, during which still another station entered the get-together. The participants were W2HPD GKP IPY IAG EGG GNL and GIT.

A three-way confab was enjoyed on July 15th by W0BFH, 3990 kc.; W9ECF, 1974 kc.; and W0DFW, 1010 kc. W0DFW relayed W9ECF to W0BFH and BFH to W9ECF. W9ECF worked break-in while BFH and WFW worked duplex.

K6BAZ Operator on Schooner Kinkajou

The Dr. Dana Coman Scientific Expedition has sailed from Honolulu on the Schooner Kinkajou, WOFV, for the Jarvis, Howland and Baker Islands. Kenneth L. King, K6BAZ, is radio operator with the party, which consists of fourteen. WOFV will operate on 8220 kc. for amateur contacts. Schedules have been arranged with K6GAS, K6KEF, K6BAZ and W5AJJ. K6BAZ portable will operate on one of the above-mentioned islands for two months while the expediters explore. Watch for WOFV on 8220 kc. and K6BAZ on amateur frequencies. Please report any reception or contacts to A.R.R.L.
Why Is an O.R.S.?

By Robert Castle, W8BTT

E V E R Y once in a while when talking with some operator that is more or less new in the game but who has been heard consistently, and who seems to have a good sound, workable understanding of radio communication as it is practised by the amateur the subject of his becoming an O.R.S. is brought up. In some cases the operator seems reluctant to consider the matter. He protests as an excuse the fact that he doesn't have the necessary time; and besides practising in the O.R.S. class would entail some limitations and remove liberties that he now enjoys. He says amateur radio is his hobby—he is in the game because of the enjoyment that he gets out of it— he believes that if he can get the pleasure to follow a few rules? Is not also part of the enjoyment? Contributions on any phase of amateur communication activity are solicited, and may win you a bound volume of DX Notes. Let us have your article, and mark it "for the C.D. Contest," please.

F. E. R.

Why didn't you do it that way in the first place? I think something of this nature has happened to all of us. Do you think that when the Federal Communications Commission first issued an order compelling amateur operators to keep a log of their traffic and to conform to any rules in regard to operating periods, the amount of traffic handled during a month's time will reach a sizeable figure? In regard to not having time. Of course there are some who, because of their work or other reason, do not have much time to transmit. But those who find it possible to be on the air two or more times a week have the time to be O.R.S. The thing they must do is make this time count. By setting aside certain periods during the week for operating it is easy to keep other things from interfering. Then, if a few good traffic schedules are maintained in conformance with those operating periods, the amount of traffic handled during a month's time will reach a sizeable figure.

Handling traffic is an excellent method of increasing code speed and obtaining a knowledge of how messages are set up and transmitted. The A.R.R.L. message is not radically different from the commercial form. Recently the A.R.R.L. official check was made the same as regular land count—the text-only check. Not long ago they were having a convention in a nearby city. An amateur station had been built for the occasion and messages were solicited. For several hours I kept track of this station, sending out an endless stream of traffic. The messages were sent at a good fast speed, but I heard no repeats. A message would be sent out—the station would stand by for an OK—a few seconds later they would start on the next message. The preamble of these messages was abbreviated until it was meaningless to the inexperienced, yet it contained all the information for the proper handling of the message. This traffic was being handled with a speed that it seemed could not be bettered. It was being handled by O.R.S.

To those operators who are past the experimental stages in amateur radio—those who have had about enough ordinary operating and who are beginning to look around for something that has some importance attached to it—I would recommend their applying for appointment as Official Relay Stations.

T H O S E amateurs who have been inquiring about the authenticity of the VU2CP they have been worked will be interested in information received from the secretary of the Indian Radio Amateurs' League. Mr. U. S. Jayaswal of Muzaffarpur, India, who is the legal holder of VU2CP, advised the I.R.A.L. secretary that he has not been on the air for some time, and that some one must be pirating his call. . . . Cards for unknown VA and CBS stations may be sent via the QSL Bureau, Indian Radio Amateurs' League, Bally's Bazar, Santa Cruz, India, W2CQX QSL lately worked his 110th country—W8FRO with ZB91, Malla, at 6:30 p.m. EST, May 21st; frequency about 14,280 kc. . . . 119Q was worked by W3MG, May 25th, at 8:45 p.m. EST, and is reported coming consistently just outside the high-frequency end of the 14-mc. band. . . . Add to the many hams who have worked EAAA on 3.5 mc.—W8FKO . . . USAG and U4LD were worked by W8NBM, Rock Island, Ill., around 10:30 p.m. CST on June 4th and 15th respectively. USAG on 14,280 kc., U4LD on 14,300 kc., . . . W5ERV, Brookhaven, Miss., claims a QSO, the "long-way-around," with J2CL on 14 mc. . . . W6DBT, Randolph, Utah, . . .

* Swanton, Ohio.
worked eight Europeans in five countries in three hours on 14 mc. between 10:30 p.m., May 8th, and 1:30 a.m. May 9th. WSKKG in West Virginia says to tell the gang that 14 mc. is hot for Europe and Asia between 2:00 and 4:00 a.m. EST. J70J was heard by WSKKG on phone working a W7 about 3:30 a.m. EST. W8MGK worked K6JFD at 3:30 a.m. and J2CN at 2:45 a.m. . With only 15 watts input, W8WQ worked V22EO at 2:00 a.m. June 17th. . . . W8UWA worked V22EO "both-ways-around" twice on 14 mc. and once on 7 mc. all within one week without a schedule of any kind. . . . European QSO's from the west coast have been extremely plentiful of late. During June W8UWA had 86 different Europeans. On the 22nd alone he had 23 European QSO's, 17 being during the evening. F8SEO had 240 west coast QSO's during June! This was all on 14 mc. W6OHH has worked Europe twice on 14 mc. and once on 7 mc., all within one week with only one hour of the day from 7:00 a.m. to 11:30 p.m. . . . A nice bit of DX work is reported by W3AMP. Trenton, N. J. From May 2nd to June 8th, 38 days straight, he had at least one contact with a station on a continent other than his own each day. Every continent was worked, contacts being with 30 countries, all on 14 mc. Japan was worked four times. . . . W5AMN reports YTT7VH, Belgrade, Jugoslavia, putting a T5 signal through on the 14,400-kc. end of the band. . . . Between April 25th and June 2nd, W5AMN made six contacts with Japan. He QSO'd with 3041, U8A6, April 9th, U8A6, May 15th, U1CR, May 17th. . . . W8EPY suggests that stations outside of W and VE make more use of the high frequency end of the 7-mc. band, avoiding the highly congested low-frequency end.

A message from Q5QV via W2EJO, W8RBO and W1EAO reports a new Siamese station, HS1A, worked there August 1st. Frequency, 14,100 kc. Crystal p.d.c. note. . . . W3GOX advises that ZL2HY is enroute to the Union of South Africa where he will go on the air as a ZS. . . . W7BB, operating under the call K7BC at Mist Harbor, Alaska, has recently WAC'd. Stations QSO'd for W.A.C. from K7BC: VK2OJ, XU3ST, USAG, ZC9AL, W7DL, LU4BC. . . . On July 11th, 8:00 a.m. EDTST, W7THS worked a rare one—VU4BA, Solomon Islands, d.c. note on 14,325 kc. . . . The following list of Asian frequencies, compiled by W8BTI, are submitted by W8MAB: J2LX 14,372 kc., J2LB 14,304, J2G2X 14,316, J3DP 14,175, J2LU 14,145, J2GW 14,350, J2KJ 14,150, J2EQ 14,370, J3C2 14,340, V8SA 14,274, XU6F 14,355, XU8AL middle of 14-mc. 'phone band, self-excited. . . . W8MAH reports the frequencies of active Russian stations: U1ON 14,420, U18S 14,420, U3AG 14,430, USAH 14,300, U1CA 14,410, U3BY 14,370, U3CG 14,370, T2DBN 14,380, U3DI 14,270, U3CT 14,420. . . . On the morning of July 13th, for over one hour W2FEG worked VR4BA, who was using only 3 watts input! He was QSA5 R5 at W2FEG. . . . W1ISOR, Redwood City, Ca., had worked ZL2HY at 3510 kcps at 3:30 a.m. ET. That's DX! . . . Some notes from W8MAH: ZE stations are on 14 mc. between 1:30 and 4:00 p.m. . . . V4ACRO has been coming through almost daily on 14,090 kc. with a TX9 note between 1:30 and 4:00 p.m. EST. . . . VQA8 has been heard close to 14,370 kc. He was heard between 1:30 and 3:00 p.m. . . . FS8M2 was heard to say he is located near Casablanca, Morocco. He has a rather rough signal in the 14-mc. band. Z1R1E's frequency is about 14,320 kc. . . . SU1KG is to be heard around the high-frequency end of the 14-mc. 'phone band with a d.c. signal from about 4:00 p.m. to 6:00 p.m. EST. . . . YTTVN has been heard on approximately 14,120 kc. d.c. note. . . . SU2A is on occasionally with his i.o.w. between 14,240 and 14,300 kc. . . . W5BNW worked FT4AG, Tunis, at 11:55 p.m. CST, July 18th. Note was d.c., frequency about 14,380 kc. . . . FT4AG is on about the same time every day.

28-mc. Activities

Interest continues high in "ten-meter" work, although conditions have been rather sketchy from mid-July. The fact is, however, that the band may open up anytime and bring on the excellent performance that took place during June and early July. The real 28-mc. men are sticking with it. Despite the fact that the band may open up for only very short periods some days, hardly a single day passes but what some communication is accomplished. And when a really good day comes along anything can happen.

Refer to page 52. August QST, for dope on the Lode, by the Lakewood (Ohio) Radio Club to the first radio amateur who Works All Continents on 28-mc. band after September 1, 1935. Oil up your gear and go after it.

W8RVI had a short QSO with VK2EP on July 10th at about 7:00 p.m. CST. W20KR has a weekly schedule with E18B. GSLA is anxious to make schedules on 28 mc. with any U. S. stations, W2FL, QSO G51A, a station which GSLA heard W1CCX on August lst between 1953 and 2030 GT. About August 20th G2TM will resume his schedules of automatic sending on 28 mc. He transmits from 1200 to 1300 GT and also from 1630 to 1730 GT, listening for replies after each of these periods. On June 18th FASBG heard W1AIV, W2CPA, WSMQO and W1DF. Those operators having a regular schedule for operation on "ten" are asked to send us their line-up. W5EHM is on 28,016 kc. daily at noon and in the evening from 6:00 to 7:30 p.m. CST. E19J, the only Swiss station on 28 mc., had worked 27 stations in ten countries up to the last report. W9RIF worked VK2EP several times in early July, VK2EP has a beam pointed in the direction of U.S.A. with 200 watts input, 'phone and c.w., on 28,010 kc. W9BGI has an automatic transmitter on 28 mc., which he runs daily between 8:30 and 9:30 p.m. CST. W5EHM heard T2RC on July 14th. W6FFQ on July 14th heard LUS3H and LUS9V. W4AJY worked VK2EP on July 13th and 14th. During the first two weeks of July W5WG heard 76 different stations on 28 mc. W5UGN reports hearing VK3EP, ZL2BN, ZL2GQ and W6VQ on July 13th. Among those working VK2EP are W6WQ, W9NY, W9FM, W4AJY, W9QBQ, W1AIV worked D4KJF on July 8th. The approximate frequencies of all wanted DX stations heard on 28 mc.: VK2EP 28,020 kc. LUI1EP 28,000, D4KJ 28,300, LUS9V 28,095, LUS3H 28,600, OA5J 28,600—28,100 kc. (self-excited).

Who will be the first "ten-meter" W.A.O.?

West Coast Hamfests

The Oakland Radio Club will be host to one of the greatest gatherings of amateurs ever to assemble under one roof at the first "ten-meter" W.A.O. called to order on Saturday evening, September 28th. The program includes the best food money can buy, several general FB time. One dollar covers everything. The meet­

September, 1935 49
The Marin Radio Amateurs will hold their second annual picnic and hamfest at McNears Beach, near San Rafael, Calif., on September 15th. All amateurs are invited. Full details may be obtained from W6SG, 79 Elinor Ave., Mill Valley, Calif.

QRR—New York Flood

Between the hours of 10:00 p.m., Sunday, July 7th, and 1:00 p.m., Monday, July 8th, 8.2 inches of rain fell in the Finger Lakes region of New York State. Loss of about 40 lives and property damage of over $5,000,000 was the grim cost of the inevitable floods.

Ithaca, N. Y., was right in the thick of the worst of the storm. WSBOA of that city lost no time in getting in its 1.75-mc. 'phone on the air, followed shortly by WSMBW on 3.9 me. WSBOA communicated with the local Red Cross Chapter and was very shortly busily engaged in handling messages for the flood-stricken (many homeless) people, who were anxious to relieve the anxiety of relatives. WSKXR, who was located in a lowland part of the city, was delayed in getting in his 1.75-mc. 'phone on the air by the high waters, which routed him from his home about 2:30 a.m. He helped materially when he finally was able to return to his shack. WSKXR heard WSCYQ calling the flood area with messages for Ithaca. Contact was established and the traffic promptly delivered. This traffic had come from Kentucky on c.w. to WSGQT, Penn Yan, who turned it over to WSCYQ, also in Penn Yan, for relay to Ithaca. WSKBW, Ithaca, cooperated as much as possible.

WSBLP of Geneva provided an excellent outlet for Ithaca traffic, handling quantities of important messages from WSBOA and relaying them over land wires. In addition, W5RL and W5MSZ of Buffalo, W8BII, Elmira, W8NYJ, Warsaw, WSCYQ, WSBLP, WSKXR, WSKBW and WSBOA formed a 1.75-mc. 'phone network and performed in veteran style. They hunted down missing persons and lost aeroplanes, forwarded descriptions of roads and bridges, and helped generally in the rescue work. Watkins, Glen, Elmira and Hornell had no telephone or telegraph communication; the network was on the job for forty-eight hours, when the lines were again established.

WSAAC gave valuable service at WSBOA and WSMBW in making personal contacts with message addressees. W8NXQ of Syracuse took traffic from Ithaca stations as did W8LIM, W8LDA, W8CQY, W8BII, W2IFY and W8AGU on 3.9 mc., and W8MXXQ and W8NVM on 1.75 mc. W8MJT worked with WSBOA in incoming traffic. Others cooperating included W3LT, W8LHC, W1QYA and W1BXX. W8EOL, one of Ithaca's amateurs, didn't have the chance to help out—the first floor of his home was completely inundated!

On the evening of July 8th, W2EGF, O.R.S. and A.A.R.S., worked W2BCX, also O.R.S. and A.A.R.S., and stated that he was in communication with W8BHK, O.R.S. at Bath, N. Y., which town was without lights, gas, or telephones. W8BHK was operating on battery power. This information was forwarded with help from W8GUC/WLTC to WLM, A.A.R.S. Washington control station, from where a special message (ZLVA) was sent to all Army Amateurs requesting that they keep the vicinity of W8BHK's and W2EGF's frequencies QRM-free. First Corps Area A.A.R.S. were standing by on the special 3497.5-kc. frequency to receive all assistance possible. W8BHK and W2EGF maintained regular hourly schedules, much traffic being relayed from W2EGF to W2BCX. Later, especially the following days, the 9th and 10th, W2BCX handled traffic direct with W8BHK. W8DSS, W2AIZ and W2DXO also helped out with traffic from W8BHK. By July 10th conditions were much better and relief communication was wound up that evening. W2BCX/WLM on July 8th was put on the air by W2FQ, who sent a QST to all amateurs asking them to keep the 3500-3600-ke. channel, where the emergency work was taking place, clear. A.A.R.S. W8BME and W8CSE cooperated in monitoring transmissions from W8BHK. W2EGF copied a press report from W8BHK for the Schenectady papers about 1000 words in length! Other stations cooperating and standing by in the emergency included W1BVR/WLG, W2BZZ/WLMG, W2GGE, W8BSP and W8AKB/WLQB.

It pays to be prepared! Little did the amateurs concerned in the New York State flood emergency work expect that they would be called upon to provide communication. It may be you next time!! Build that emergency gear now!!

Briefs

The motorboat regatta under the auspices of the Oakmont Boat Club and the Pittsburgh Sun-Telegraph at Oakmont, Pa., was the scene of some interesting 56-mc. work. The patrol boats, judges' stand and the pits were all equipped with 56-mc. transceivers and the races were reported via 56 mc. to the judges' stand. Members of the Amateur Transmitters Association of Western Pennsylvania cooperated with the Regatta officials in this effort to make the race more interesting to the spectators.

"Believe it or not," W5JTV can hear no first district stations at his address. But when he takes a receiver as close as four blocks away, the "one's" roll in FB!!

Did you see W5UE's QSL in the Universal News Reel showing the airplane endurance test at Meridian, Miss.??

W5Q1, Hazen, Ark., moved his rig from a tornado cellar to another location across town. When he started moving, a frog jumped out of his tool box. Midway between his new location a 12-inch lizard hopped out. As soon as he reached the new QRA and was setting his tool box down, a 6-foot rattlesnake came through another crack. That was too much! He called in W5F8 and the Chief of Police, armed to the teeth with high-powered rifles to make a thorough inspection. Nothing else was found; however, W5Q1 feels

TYPICAL VIEW, DESTRUCTION TO HIGHWAYS

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leery every time he puts on the headphones, expecting some beast to crawl out into his ear!

A schedule with VE8LN, Bowdoin College Ornithological Expedition at Kent's Island, Bay of Fundy, is reported by WJJL, West Acton, Mass. VE8LN is heard mostly on 3515 and 3860 kcs. using c.w. and 'phone.

While on a visit to A.R.R.L. HQ's and operating at W1MK, W2AYN received a message he himself had sent to MK several days earlier. Hi.

Amateurs Locate Stranded Yacht

At about 10:30 o'clock on the morning of July 5th, W4GQ heard an SOS on the 7-mc. amateur band, GM2AC promptly called the Navy headquarters where he knew they had been trying to reach the yacht by wireless for about 9:30 a.m. when he heard a p.d.c. signal on about 7150 kc. calling QO and signing VE3F1L. Expecting merely a QSO with Ontario, CM2AC answered. Communication established, imagine his surprise to copy "Mr Yacht Casarco 5 miles W of Cape Corinieres Have been waiting for coast guards for three days. All well on board but drinking water running low. If you have a fone will you call them and ask how soon we may expect them will QRX while you call." CM2AC promptly called the Navy headquarters where he knew they had been trying to reach the yacht by wireless for several days. Passing along all the information he had received and asking for a reply, he received the following, which he relayed to VE3FL: "Tell them the gun-boat Santa Clara will get after them forthwith." The woman, who had been reported ill, was now well again, the trouble being "too much sun." A real thrill for W4GQ and CM2AC, this incident is the kind that helps amateur radio maintain its high place in the public esteem! FB!

Upon receiving the certificate for Southern Minnesota in the 1934 Sweepsstakes Contest, W6DMA has won four major A.R.R.L. contests in a row in his Section. And it was done with not over 25 watts into the antenna from a self-excited rig. W6DMA won the 1933 Sweepsstakes, 1933 DX Contest, 1934 DX Contest and 1934 Sweepsstakes awards in the Southern Minnesota Section.

During the camp period of the HQ. Co., 3 Bn., 145th Infantry at Camp Perry, Ohio, WSLVV/8 handled traffic between Akron and the encampment there. Seven operators kept a 1.75-m. 'phone rig active. The final stage employed a 2112D and the lads stepped out in fine shape.

VE3LN of Melbourne, Australia, has been touring the States, visiting many hams en route. While in Washington he stopped in at W3ZD to attempt a QSO with home. Tuning over the 14-mc. band, a real thrill greeted VK3LN when he heard an R7 signal calling "VK3LN de VK3MR!" It was his buddy back home. QSO was established between W3ZD and VK3MR and more than an hour and a half of communication followed, an experience long to be remembered by VK3LN. While in N. Y. C., VK3LN maintained communication with VK3MR through W2GOX.

Milwaukee "Bootleg" Situation Under Control

By H. C. Kaetel*

IN EVERY major city of the United States the licensed amateur has come face to face with the peculiar species of individuals who think they do not need a license. It is not this writer's intention to go into the reasons why unlicensed stations should not be permitted to operate or to explain why the operation of "bootleg stations" is detrimental to amateur radio. The reasons are all too apparent. We amateurs in Milwaukee were faced with such a situation. During 1933 and 1934 not less than forty or fifty unlicensed transmitters using some fifty to sixty borrowed or "home-made" calls were in regular operation in Milwaukee in the five-meter band alone. Occasionally one of these bootleggers would get brave enough to move into one of the lower frequency bands. Call stealing was a common practice. Many times different groups in Milwaukee raised their voices in protest! Our good Inspector Hayes at Chicago could do little for us, his explanation in his letter to the author under date of March 6, 1935, reading in part:

"From an official standpoint, we must state that it is the duty of every citizen to report to the authorities any violation of the law. . . . It is impossible with limited personnel to observe all violations and we must rely to a great extent upon reports received from others. . . . It is, however, difficult to obtain authority for the expenditure of the necessary time and money.

"We have received rumors and reports of operation of unlicensed stations on the ultra-high frequencies from every large town in the district and a correction of this condition would be extremely difficult without the aid of the licensed amateurs."

The Kilocycle Club of Milwaukee determined to launch a campaign against the bootleggers. When the Board of Directors of the Kilocycle Club announced that it seriously and determinedly was going after the owners of illegally operated stations the results were surprising. Even stations of non-members were heard night after night warning bootleg stations to get off the air. Licensed stations were heard signing with bootleg stations to be free of criticism of working them. Station after station was dismantled. A few stragglers promptly received a visit from the Kilocycle Clubs Directors. The campaign was a success, Milwaukee was free of unlicensed amateur radio stations. The next thing was a means of keeping it that way.

Keeping the bootlegger off the air is easier than most readers might expect. Members working a station on the five-meter band for the first time invariably ask for the exact location of the new station. A visit to the address disclosed that the station was being operated illegally. If the address is given, in response to a direct request it is assumed that the station is being operated illegally. If the station proves to be a phony the members of the club observe its operations and combine information and clues. Sooner or later the operator of the unlicensed station slips up on his conversation and dishes out ample data leading to his identity! To date it has never been necessary to resort to the direction finder or field strength meter.

When Mr. Gallagher of the Chicago office of the Federal Communications Commission visited Milwaukee on the 22nd of June of this year, he promptly called on Mr. William Brossmann, W9EQP, at the latter's office and together the two made the rounds of a couple of dozen Milwaukee hams.

* W9SNK, Chairman Publicity Committee, The Kilocycle Club of Milwaukee.

September, 1935
shacks. At the end of the day and about fifty miles of travel they had uncovered no evidence of bootleg operation in the city and had received some dope regarding two 'suspicious stations in one suburban section. This condition is truly amazing and one is led to wonder how many other cities of 700,000 can report similar conditions.

The most outstanding piece of work in this field accomplished by the Kilicycle Club was the running down of the Milwaukee 20-meter bootlegger who used the call OK1AA in ARRL's contest this spring. This station was heard working stations in all districts and exchanged contest numbers with many. Was that chappie ever surprised when he tuned up with 'KIlicycle Club' on his dial? The case is now in the hands of the Commission.

When the Kilicycle Club Board of Directors hit any stubborn case where an operator will not listen to reason evidence is gathered together. There's one most excellent place to present it for action. That is the office of the local Federal District Attorney who is charged with law enforcement.

BRASS POUNDERS' LEAGUE  
(June 16th-July 15th)

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MORE-THAN-ONE-OPERATOR STATIONS

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<tr>
<td>W8HRL</td>
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These stations 'make' the B.P.L. with totals of 100 or over. Many 'rate' extra credit for one hundred or more deliveries. The following one-operator stations make the B.P.L. for delivering 100 or more messages: More than one. The number of deliveries is as follows: Delivery count:

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<th>Del.</th>
<th>Total</th>
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<td>W8GHA, 153</td>
<td>W7YTV, 106</td>
<td>W6SLX, 101</td>
<td></td>
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<tr>
<td>W7CQI, 184</td>
<td>W6KAI, 105</td>
<td>More-than-one</td>
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</tr>
<tr>
<td>W8CO, 122</td>
<td>K0AIAN, 102</td>
<td>W6HHR, 256</td>
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A.A.L.S. STATIONS

<table>
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<tr>
<th>Call</th>
<th>Org.</th>
<th>Del.</th>
<th>Total</th>
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<tbody>
<tr>
<td>WLMF (W8RYD)</td>
<td>614</td>
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MORE-TAN-ONE-OPERATOR STATIONS

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<tr>
<td>W6QN (K0DY)</td>
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<td>908</td>
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<tr>
<td>WLM (W3CLX)</td>
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<td>89</td>
<td></td>
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<tr>
<td>W4QA</td>
<td>644</td>
<td>644</td>
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A total of 900 or more, or 100 100 or more deliveries will put you in line for a place in the B.P.L.

O. B. S.

The following is a supplement to the list of A.A.R.L. Official Broadcasting Stations in October QST (page 49):

<table>
<thead>
<tr>
<th>Call</th>
<th>Org.</th>
<th>Del.</th>
<th>Total</th>
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<tr>
<td>W2AMB, W3QGU, W3DNU, W4CZA, W4DDF, W5EJM, W7AYM, W7BNX, W8CFU</td>
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National Highlights

THE most outstanding bit of communications work reported for this issue is the performance of amateurs in the New York State Flood in July. A story on their part in the emergency appears elsewhere in Operating News.

When this appears in print the summer season will be winding to a close, and amateurs should be thinking of radio more actively again. As is always the case during July and August, much time was spent in rebuilding and planning the new rigs for fall. Many operators went on "active duty" at National Guard camps. R. T. C. encampments, train cruising with the S.C.M. etc. Several instances of communication provided by amateurs between various N. G., Boy Scout, etc., camps and the homes of the campers have been reported. Much valuable assistance has been rendered in the past 56 mc. at boat races, regattas, and the like. Vacations have been more fun and activity in most amateur home stations are again being called up for action. Let's go!

W3GS, S.C.M. Easton, Pennsylvania, gave a fifteen-minute talk on amateur radio and the activities of the department of the N.R.L. over W3BWA on July 16th. The main purpose of the talk was to impress upon B.C.L.'s the importance of amateur radio by stressing emergency work, message handling, etc. Amateurs should embrace every opportunity to talk up amateur radio, talk over broadcast stations being one of the best means of spreading the gospel.

The Ham Fiesta at San Diego went over very well and everyone seemed to enjoy the fun. A few of the activities and the winners: "Tug o' War" (phone vs. cw) won by the phone men; 56-mc. hidden transmitter hunt, won by W6LRC. Ladies Audition Contest, won by the YF of W6LIP. QRM Copying Contest, won by W6BKZ. First prize for portable gear went to W6IMU. An interesting talk was made by the radio inspector, Mr. Linden. W6USA was visited by almost every one and a few of the lucky ones got to operate it. The gang is now looking forward to the Pacific Division Convention at Los Angeles, Aug. 31, Sept. 1st and 2nd.

K7FQ, Alaska S.C.M., has announced an S.C.M.-hour for contacts with Alaska stations only, to be held from 8:30 to 9:30 P.M. each Monday night, on the mc. band. K7TWF schedules KAI4RZ for dairy. The Brass pounder, edited by W7LD, Washington, D. C., contains articles in the Montana and Idaho sections. Plans are being considered to make this paper cover the entire Northwestern Division. A "spot frequency" net is being organized by the Montana S.C.M. W7ATAT. W7CYW schedules K6PII tri-weekly. During the first six months of 1935 W7AYO had over 2000 QSO's, nearly 500 of them over 6000 miles DX.

W8EUX had a 1.75-mc. "phone in operation at a high school exhibition in Dallas, Texas. The semi-annual hamfest of the Guadalupe Valley Radio Club was held on the Guadalupe River near Corpus, Texas, the night of July 13th with about 50 in attendance. W4ACB, Western Florida R. M., is conducting a Sectional QSO contest through the "Sunshine Review" section bulletin, W4KB, Valparaiso, Fla., is issuing a new sheet called the "Dope Bucket." September 1st will be Hamfest Day in Charleston, S. C., where North Carolina, South Carolina and Georgia hams will meet for a big time. W4BBV, Assistant S.C.M. for Georgia, has started the ball rolling for a State Net to begin about October 1st.

W1GK handled traffic for the A.E.F. Convention at Reckoland, Maine on 900 mc. W2GOX imites QST by radio on 14 mc. from VK3MR. W3DQB invites DX traffic; he is on the air daily from 6:00 to 7:00 a.m., 7:00 to 8:00 a.m., and 8:00 to 9:00 a.m., W3OEJ and W3BNF are lining up a contest for the Ronako Division, to start September 1st. W5HDD, West Virginia S.C.M., has retired after four years of service. W5KKG will carry on. The North Carolina "floating club" had a bang-up July meeting under the auspices of the Wilmington Club.

A hamfest at Pueblo, Colo., was enjoyed by 175 hams. Sixty persons attended the Utah Amateur Radio Club hamfest. The Framingham (Mass.) Radio Club on July 4th maintained a 56-mc. press network for athletic events at the Chamber of Commerce celebration and two-way aircraft to ground contact. W1FIF, W1FOZ and W1FOZ did the aircraft work while W1JAT and W1DDM covered the ground end. W1FIF desired message traffic on 3.5 mc., with W1FFO, W1GMD and W1DDM as relief operators. W1CO, W1BWC, W1FIY, W1JHE, W1JAAQ and W1DDM reported events to W1JAT, the net control. W1E took a message from K4DDE, "phoned it and delivered answer in 15 minutes!" The Nevada Amateur Radio Association held a picnic at Zephyr Cove, Lake Tahoe, on July 21st. W63GD has daily schedules with OMITB and W3KMO. W6QAO was winner of the Oakland Radio Club's 28-mc. contest. This club has now announced a new 28-mc. contest to run through September. W6AYV operated a portable at the San Francisco
STATION ACTIVITIES

CENTRAL DIVISION

ILLINOIS—SCM, Fred J. Hinds, W9WB—ERU is off the air due to bad 64A. TWWL is on with a 7.1-tube power. W9E is on 28 mc. Rig at SMD has more bugs than his dog "Spot." ITA worked three new countries. STG is touring Yellowstone Park. OKZ has YL-itis. CGV is on 7 mc. with the band. RVB is getting reads for Class "A." IEP visited DBO Starved Rock Hamfest.

Rigging for the Red River Valley Fair, September 10th.

Yellowstone Park. OKZ has YL-itis. CGV is on 7 mc. with the band. RVB is getting reads for Class "A." IEP visited DBO Starved Rock Hamfest.


INDIANA—SCM, Arthur L. Braun, W9TE-8FG delivers a six-pund-gold for TE, OEC spent month's vacation. UEU is a new O.B.S. FO has new hobby—rides with telescopic sight.


Michigan—SCM, Kenneth F. Conroy, WSDYH—

"Oqle County Radio Traffic Assn."


OHIO—SCM, Robert P. Irvine, WSCIO—AGL operated from Camp Perry during summer training of O.N.G. MQO is increasing power. LZK handled QRT to A.P. news from a SXN antenna. LZK says he is back on 8006 kc. He is now trying for DX on 7 mc. MXH wants O.R.S. NAL is now O.R.S. (Y.L.) ISK’s best DX last month—two K’s. HMII is tearing the old rig down and rebuilding. LVY finally worked Asia. VU1Q, June 14th, at 6:10 p.m. E.S.T. Buckeye Shriners R.R. Club is on line. KFPQ cancelled for the summer. MQC heard QRR from CZP July 8th. MXZ is now reporter from Celina. New jr. operator at BKE. RN is still on KFPN. BAH went on U.S.N.R. cruise with U.S.S. JRF. RQ is using RRC-20 to drive a 52 on 14 mc. JOU was visited by JTI and MMM. OCM wants information on A.R.R.S. EME is back on the air. FGC is back from vacation. MFV, new reporter from Vandala, expects to be on the air soon with a pair of Elmac 150-T’s in the final. LAY worked 9-J3 th. from Ft. Sheridan, busy farming. LSC is spending vacation at Kensington. Signal Corps. R.O.T.O. Camp. FKW, new reporter from Maumee. is at Ft. Sheridan, is illling Collins 4-A on 3550 kc. NVA will work portable from Vandalia, expects to be on the air soon with a pair of Eimac 150-T’s in the final. LAU has made W.A.O. and worked 51 countries in that time. OKH has been working in last three months on 14 mc.; results: 10 “J” QSO’s, 19 VK and KA, K6, PK, VS6, HRB is using 56-mc. transceiver in airplane. 

SOUTHERN MINNESOTA—SCM, Francis C. Kramer, W9DEI. DHE attended the Atlantic Division Convention while on his vacation. W9FQG has been off the air because of line filter, YLitis, and Ford-itis! AIR says five hours of commercial coping a day is bad for amateuring. BN continues to handle most of the section’s traffic. BTW cut his W.A.C. time to less than a day, and recently worked his 61st country. RHT has trouble trying to work 14mc. LVY is telephoning with call in O.M. KDI took his commercial job at last. KLN, new reporter from Maumee, is at Ft. Sheridan, Ill., with the Signal Corps. R.O.T.C. Camp, FKW, new reporter from Youngstown, wants O.R.S. MZD, new reporter from Newark, is using Collins 4-4 on 3566 kc. NVA will work portable for the summer at Lakeside. LIV is new reporter from Cleveland. APC sends his report in the form of a bulletin. KEV came home from a game of fold to find his antenna taken down and nicely coiled up and laying on his porch; it originally hung in a tree that was removed by the city. ‘Phone Report (by HIMS, Chief P.A.M.) BYF went on two weeks’ fishing trip to Glennie, Mich., and took 1.75-mc. ‘phone and 3.5-me. ‘phone rigs along. LIG is new O.P.S. at Cleveland. FJW is operating on 14-me. ‘phone. GDC is with C.C.C. Camp at Natural Bridge. Ky. FJC has new 5-fi. tower.

Traffic: WSC10 165 (WLHC 14) AGL, 161 MQO 77 LZK 35 (LCX 19) NAL 50 T11 IJFZ 10 ESK 9 HM1 7 LVY-LUM 6 FQ4 4 MQC-MXZ 3 AQ 2 BKE 1 WSUW (WLHI 110).

DAKOTA DIVISION

NORTH DAKOTA—SCM, Hartwell B. Burner, W9OEL. -JEJ high traffic man this month with total of 31 O.E. LSE’s already in the to-do list and has completely rebuilt Annual A.R.R.S.-A.R.R.L. picnic was held at Hope Community lake with 30 registered. HJC gave the gang dope on how to operate. HMH 7 LVV-KIM 5 KFQ 4 MjC-MZX 3 AQ 2.

Traffic: W90WU 1 W9CFU 3. FOQ 3.

SOUTHERN MINNESOTA—SCM, Phil D. Boardman, W9LEZ, WLUD—9ABE, 9CWG, 9HCH, 9HMM, 9LCX—RM’s, 9AED-PAM. Not much activity these days with that mercury bubbling out the top, and conditions very poor. When you read this report the worst will be over, so be as long as all get set for

The Kansas Section is saddened by the passing of Karl Keller, W8BDB, who was killed in a fall from the fifth floor of a Wichita building while a student during the World War; his ham radio experience dates back to spark days. W9BDB was one of Kansas’ most active and popular amateurs, well known as a Chief Radioman in the N.C.R. and a charter member of the Wichita Amateur Radio Club. His passing will be deeply felt.

A big winter season. Now is the time to send in that O.R.S. or O.P.S. application. LEZ received first DX QSL cards. NNM has grid modulated ‘phone working. AWH scheduled Boy Scout camp. NDM is putting the 212A into service. JXO handled Boy Scout camp traffic with a 12A in Hartley.

Traffic: W9LEZ 284 (WLUD 34) NNM 130 AWH 57 NDN 32 JXO 29 CWG 10.
NI is getting ready for camp to open the traffic season. The K.V.R.C. is working hard on the biggest and best State convention ever staged. Watch for dates and dope. FLQ is still in the throes of building and rebuilding. MUY worked on 7 me.


MISSOURI—Acting SCM, J. D. Mills, W9CJR—RYD leads the Section; he is building new shack, new receiver, and a new rig with 351A in final! NN! has new ERI station. His regular O.B.S. schedules. NNZ still has DX fever. AJL is having troubles "gator." KEF is on with new P.P. RK20 rig and says it's hot stuff. KCG, exponent of Texas power, used ham radio to help move the Moberly picnic. OLD is home to be on the map. KVB, on account of "Mr. December," is rebuilding ready for big fun. I<1EF is on 14 and 7 me. with push-pull '0A's. KEF has got back in the air. and is the only Boonville ham we know of. CEZ is working on the biggest and best State convention ever staged. A VC is planning to take Class "A" exam. BTJ got W.A.C. on 14 me., including six "J." SEV was W9PY, buying a new 96-me. transceiver. LVA is off the air to move QRA. AZL is trying out 56-me. Tri-tet. M.R. is building new shack, new receiver, and is rebuilding. MUY is now active. Big North-Missouri ham picnic was held at Moberly. July 4th, with DIC as the perfect host; good attendance from over most of State and very enjoyable time was had. DIC is attending the National Boy Scout Jamboree at Washington, D. C., and took along a 46-me. transceiver. DHZ is still at the old shanty. REE drove a lotta miles, detoured, rode the ferry and spent most of July 4th—at the Moberly picnic. Former S.C.M. C. R. Cannon, W9EG, resigned and CBR has been appointed. DQM is staying at his shack and is going to build a really big standard of handling Missouri's affairs, that has been set and kept by EYG. Sorry to lose EYG, and here's wishing him the best of luck. n'everything.


NEBRASKA—SCM, Samuel C. Wallace, W9FAM—RJU has new transmitter working on 1.75-me. 'phone and 35-me. e.w. DGL is making a little vacationing, going up to Seattle, Wash., and making a sort of circle, coming back via El Paso, Tex. KQX spent the Fourth with MGV in the hills north of Platte and played with 86 me. EHJ is rebuilding and ready for big fun. I<1EF is still working on crystals. DMY installed 50 Tri-tet and says it works very fine. DBR sends following reports: JEB has new home-made super receiver which is mighty fine. IEO has built up transmitter in the same shack that was used last year; 50, 96, 801 and '03A final. FOS is working a service job for both radios and electric refrigerators and is located at Bolivar, Kane. TNN's folks moved to Jetmore, July 13th with 33 FB p:oat and beef barbecue was served. A "Bull-Session" was enjoyed until the small hours.

Traffic: W9RJU 10 DGL 2.

WEST GULF DIVISION

NORTHERN TEXAS—SCM, Richard M. Cobb, W5Bll—DXY is in with new R.C.A. 838. CPB is working on 14 me. and will be on N.C.R. cruise Aug. 24th to Sept. 4th. COK will operate 96-me. 'phone in Chicago Aug. 15th to Sept. 15th. EZX was on 1.75-me. 'phone during exhibition at high school in Dallas. EUR and EJV visited with Guadalupe Club. PC threatens to be all over Texas with traffic schedules. The new transmitters on 7260 kc. wants schedules with 5th and 4th districts; operation is low. GONE BUT NOT FORGOTTEN—The Semi-Annual Hamfest of the Oklahoma Amateur Radio Club was held at Moberly, July 4th, with DIC as the perfect host; good attendance from over most of State and very enjoyable time was had.

Traffic: W5Bll DXY 18.

SOUTHERN TEXAS—SCM, Bradford A. Beard, W6ADZ—BEF carries five traffic schedules. DWN on 7290 kc. wants schedules with 5th and 4th districts; operation is DWN, DLE, DZK, EXZ. ETZ is in hospitaL and will be on soon with Collins 30FX. ENR took 59 Tri-tet portable on his vacation. EPE and EFF, brothers, are both using 1.75-me. and are home to be on the map. EVS is working DX on 14 me. CUJ worked 50 Europeans on Memorial Day, but EEO is going after radiotelephone first. BUB is interested in photography. AMJ is changing back to 7 me. AHW is back in town for short vacation from ship job. Houston Amateur Radio Club will have new portable 'phone and 14-me. 'phone. BTX is on 7 and 3.5 me. and active in the Storm Net. ENX is trying to pick up speed. L, R. Bowen, brother of KLE and EYA of Greenville, is about ready for membership in the G.A.R.C. BSH is coming on with a 50-watter. EOJ is contemplating on new rig. CPR is practicing on bus. DTB works hard for the Galveston Club. Gone but not forgotten—The Semi-Annual Hamfest of the Guadalupe Valley Radio Club was held on the Guadalupe Valley Railroad near Cuero, Texas, the first Sunday in September with about 60 members and approximately 15 visitors present. A very fine radio and food barbecue was served. A "Bull-Session" was enjoyed until the small hours of the morn.

Traffic: W6BEEF 38 DWN 35 A12 14 EKN 7 MN 5.
Briefs

At 5:30 p.m., April 14, 1935, W1AH answered a CQ from W2AIW. A check of logs revealed that they had QSO'd before on April 14, 1935, at 8:10 p.m., exactly ten years to the day and hour!
Register Transceivers When Sold?

Newport, Tenn.

Editor, QST:

It is . . . quite unfair for those amateurs, who have gone through the procedure of obtaining their “ticket” to have these violators [bootleggers] practically take the 56-mc. band from them. I know that the F.C.C. is doing all it can to catch and prosecute every unlicensed station, but without the complete cooperation of every amateur and the jobbers of 56-mc. equipment this will never be accomplished to any efficient degree.

I doubt if more than a small percent of these frequency usurpers have any knowledge whatever of the technical end of radio which would enable them to assemble their own 56-mc. transceivers, and with this idea in mind it looks as if the matter could be helped greatly by making it compulsory for every purchaser of this equipment to file with the particular jobber or radio dealer offering transceivers or any transmitting equipment, the call of the station and the license registration number, which would be furnished to the F.C.C. by these jobbers and dealers each week or not later than every two weeks. Other calls could be supplied by the would-be-violator, but not, the registration number. I am sure this method of handling transmitting equipment would certainly reduce the trouble we are now experiencing. It has been entirely too easy for just anyone to secure the fundamental components necessary for a transmitter during the past several years. I know that if enough effort is put forth this could be done by anyone who is determined to operate. Without possessing a license he can obtain the necessary equipment regardless of the restrictions, but this would necessitate the pulling of strings here and there, and the general run of these would-be-amateurs have neither the pull nor the initiative for such effort.

—John P. Stanbery, W4DPI

Use the Whole Band

34 Union St., Uniotown, Penna.

Editor, QST:

I notice that the A.R.R.L. is beginning to put on an intensive campaign to acquire more frequencies for amateur use at Cairo in 1938. Now this is an excellent plan, and I am very much in favor of it, but in the meantime why not use all the available frequencies?

It seems that some of the “brethren” think that the 7-mc. band is only 150 kc. wide! They park themselves in one end or the other of the band, and never even think of tuning down to the other end for a QSO. It is hard to blame them for this, for under present conditions it is almost unheard of for a station on 7005 to work another on 7295. But why not? After all the band is a good 300 kc. wide, so why not tune over the whole band after that lusty CQ? Of course it is wise to start at your own end, but don’t forget that there are fellows on the other. On 14 mc. the condition is even worse because of the ‘phones in the middle. We have tried it here, and we find that fellows can be worked across the ‘phones. So come on, OM’s, and let’s use all of the kilocycles we have!

—Lawrence Sheetz, W8MII

Dog-Pile

1634 Madison St., Denver, Colo.

Editor, QST:

Like a pebble in one’s shoe that the wearer aggravatingly puts up with for a certain length of time before removing, the following letter contains thoughts which have been rolling around in my mind for quite some time now, and which at last have been penned . . .

Have you ever as a youth been in a shouting contest with a group all yelling at the same time and someone at about fifty-foot distance trying to judge who has the mightiest pair of lungs? Have you ever played “dog-pile” and tried to be the last one on the heap; or have you ever enjoyed that twosome game with a baseball called “burn-out”?

If you have never engaged in any of these youthful antics, a fair substitute for them all can be experienced by trying to communicate at any time these days on any of the amateur radio bands while operating in the United States or near-by countries.

Feeling that the high-powered signal is the only one possible to push through the interference of many medium-powered signals, the fortunate few amateurs these past years have greatly increased the output of their transmitters. Unfortunately the amateur bands will accommodate only a limited number of kilowatt or near-kilowatt
signals, and seemingly that condition of complete accommoda-
tion was long ago reached; so that at the present time the
average chap with his medium-powered station must con-
tent himself with letting the big fellow enjoy the once
well-distributed hobby.

It seems unfortunate that the trend toward more selective
and sensitive receivers has not been more pronounced than
that toward more high-powered transmitters, both to keep
the expense of owning and operating an amateur station
more nearly within the reach of the average youth and also
to permit a greater number of interested young men to en-
joy this fascinating hobby of ours. . . .

This strange-looking picture can be changed into a much
more interesting one, I believe, if we all take part in a
so-called "super-receiver and lower-powered transmitter"
campaign, and thereby keep the hobby open for the greatest
amount of enjoyment for the greatest number. . . .

---Karl T. Dreher, W2IVW

Buggy Bugs

Editor, QST:

Would somebody please tell me why some people who
don't know any more about a bug than I do insist upon
having their call signs? . . .

Can CQ three times, sign three times or less. Repeat for
yourself.

---Andrew Arbuckle, W3LTB

No Codeless Exam

Editor, QST:

It seems to be the opinion of a few amateurs that the A.R.R.L. should take it upon itself to petition the F.C.C. to
remove the code requirement from the examination of those
persons desiring to operate in the U.H.F. bands—these
ultra-high-frequency fans who are too lazy to put forth a
little effort to learn enough code to pass the regular amateur
examination. You certainly can't call it anything but lazi-

don't know any more about a bug than I do insist upon

---Henry Ernst, Jr., W3FMA

Re QRZ

Editor, QST:

If one calls "CQ," and then listens for an answer, he is
henceforth the last thing to be heard. . . .

As said in QST in the past, QRZ should never be used in place of
CQ.

---Paul L. Stump, W3AXQ

Killing the Goose that Laid the Golden Egg

Editor, QST:

After reading articles pro and con concerning the activities of the A.R.R.L. with regards to past convention and
treaty meetings, particularly in connection with amateur
frequency allotments, I gather from what I read that if the
A.R.R.L. is permitted to continue in their present path
there will be no such thing as an amateur place in the
spectrum at all.

Now, if this is true why does the A.R.R.L. continue the chiseling away of ham frequencies? As I understand it, the
A.R.R.L.'s support depends on transmitting amateurs and
numerous S.W.L.'s, all deeply interested in short-wave com-

---Herbert Heath, W4UE

Editor, QST:

The usual c.w. contact these days does not con-

---Karl T. Dreher, W2IVW

Topics of Conversation

Editor, QST:

... What can we talk about to have a real interesting
contact? Here are a few things that really should be interest-
ting to talk about to the other fellow: Your age and occupa-
tion, married or single, and perhaps a mention of how
many kids you have if you're married. Hi! Then you can go
on and talk about some of your gals you had and a few
interesting notes on them.

... Where there's your other hobbies besides amateur radio.
Perhaps two fishermen can get together and fight out who
cached the biggest one. A couple of golfers can chat on
who's the best or two baseball bugs can say who was the
best player they ever saw.

For the more serious-minded fellow a chat on life itself
... What can we talk about to have a real interesting
contact? Here are a few things that really should be interest-
ting to talk about to the other fellow: Your age and occupa-
tion, married or single, and perhaps a mention of how
many kids you have if you're married. Hi! Then you can go
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many kids you have if you're married. Hi! Then you can go
on and talk about some of your gals you had and a few
interesting notes on them.
LAST MARCH we mentioned that much interest is being shown in I.F. transformers having variable coupling as a means of controlling selectivity. This idea is particularly interesting to us, because as far back as May 1933 we advertised variable coupling as a feature of our earliest model air-dielectric-tuned I.F. transformer. In this unit, the adjustment was made by a screw which moved the coils closer or farther apart.

This scheme was abandoned by us in later models, because we felt that it was not particularly desirable. Its only virtue is its ability to act as a selectivity control and this we feel can be better accomplished by other means. Its disadvantages are numerous, among them being the mechanical complication of changing coupling by a panel control, and the pronounced effect of the adjustment on gain and other circuit constants.

Variable selectivity presents a problem quite different in broadcast receivers than in communication receivers. In the former, the aim is "High Fidelity," which requires a sub-normal selectivity. In amateur receivers, the object is to eliminate interfering signals which necessitates abnormally high selectivity. Because of this difference, two entirely different types of control are desirable.

The most advanced thought on variable selectivity for broadcast receivers inclines toward some form of non-mechanical semi-automatic device. A number of schemes have been suggested for doing this, and it is probable that these will be incorporated in some of the newer receivers for the coming season. In one system, the coupling is controlled by the strength of the received signal, on the theory that strong local stations can override interference by mere volume, and consequently do not require complete elimination of unwanted signals by high selectivity. The controlling circuit is similar to a conventional AVC circuit, but is operated by the audio signal rather than the carrier. Of the many schemes suggested for obtaining the actual selectivity change without moving parts, only one will be mentioned; namely, connecting a variable load resistance across one of the I.F. transformers. This is quite practical if a specially designed I.F. transformer is used. Since the plate resistance of the 58 varies with the suppressor voltage applied, this tube may be used as the variable load resistor.

To come back to amateur receivers, however, the control should be in the direction of increased selectivity, not decreased. We think that the only practical answer to this is the Single Signal Filter, such as used in our communication receivers and discussed in detail on this page last March. In this filter, a knob on the front panel gives a variable admittance to the I.F. amplifier of from several kilocycles down to a few cycles.

We realize keenly that it is unwise to say that any development is valueless, and we do not wish to be dogmatic about it. However, we believe our comments above pretty well sum up the situation as matters stand. So for the present anyway, we will stick to fixed coupling. It seems the best way, particularly as it gives us the assurance that after they leave the factory, our I.F. units will stay at the optimum coupling value for best gain and selectivity.

JAMES MILLEN
Decibel Meter

To Increase Meter Range
—Use New Triplet Decibel Meter Kits!

These new Decibel Meter Kits increase range from up to 6 to up to 42 decibels. For 500 ohm input line. Furnished for either constant or non-constant impedance. The use of a decibel kit facilitates immediate adjustments and elimination of distortion.

No. 150 Decibel Meter Kit — Non-constant Impedance
Includes:
- Triplet 3” meter, 2-deck selector switch
- 9 wire wound multipliers with Bakelite mounting board, hook-up wire, blue prints and instructions
Complete — $21.67, Net to dealers.

No. 200 Decibel Meter Kit — Constant Impedance
Similar to No. 150 but with Triplet 3” Constant Impedance Decibel Meter.
Complete — $23.50 Net to dealers.

The above kits are also supplied with Triplet 2” Decibel Meters at $1.00 net each less than above prices.
Kits are easy to assemble — all parts marked to correspond with blue prints.

TRIPLET ELECTRICAL INSTRUMENT CO.
180 Main Street
Bluffton, Ohio, U. S. A.
Hark Ye, PHONE MEN!

THE NEW ALL-METAL TUBE

The new tubes—"sealed in steel"—invented and perfected by General Electric engineers—have many improved electrical characteristics. Here are a few of the highlights.

1. More effective shielding allows higher I.F. gain with stability.
2. Higher I.F. gain means—greater signal on diode, less harmonic distortion on high modulation—less audio gain required, quieter operation.

THE NEW GENERAL ELECTRIC RADIO WITH ALL METAL TUBES

MAIL COUPON FOR DETAILS

General Electric Company,
Bridgeport, Conn.
Attention: Sales Promotion Section R-159:
Please send me complete details regarding General Electric Radios with the All-metal Tubes.

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

The 1936 General Electric Radio with new all-metal tubes brings to amateur operators the latest advancement in radio science and engineering. Its fidelity and crisp clear-cut reproduction is far in advance of the field.

MODEL A-82 . . . An all-purpose receiver, scientifically designed for the many exacting demands of modern amateur stations. The following outstanding features will appeal to all hams.

- Air Trimmers—provide better calibration stability
- Sliding-rule Tuning Scale—easy to read as a ruler
- Improved A.V.C. due to higher I.F. gain.
- 5 Watts undistorted output delivered to 10 in. high-quality dynamic speaker.
- Frequency coverage 140-410 and 540-19,500 KC in 4 bands.
- CW oscillator may be added.

GENERAL ELECTRIC RADIO

MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

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but why put 'em that way? Why don't you put yours side by side in a nice QST binder. Then your QST file looks like what it really is — a library of the best radio amateur dope in the world. Twelve copies, and the yearly index go in each binder. Then your copies of QST are where you want them — when you want them. A sturdy binder finished in rich, wine colored, Du Pont Fabrikoid. Waterproof, oilproof, wearproof, troubleproof, 100 proof.

$1.50 each, postpaid

(One set of yearly labels (1919-1938) now provided with each binder)

American Radio Relay League
West Hartford, Connecticut

Q.C.A.R.C. operated VE3SG/VE3LI at Beaver Tourist Camp, West Hill, Ont., 12 miles east of Toronto. Operators VE3WK, VE3SG, VE3GR, VE3WT, VE3WU.

A 75 a.h. storage battery and a 200-volt Generator in series with an auto-vibrator type supply gave us 48 contacts and successful F.D. operation at Turkey Lake.—W.A.R.C., W9DKG.

Our 40-meter set was operated from a cabin at the western summit of the Mohawk Trail. Club members had a good time and wish it was scheduled bi-annually.—R.V.R.C., W1FTE-W1IUR.

M.A.R.C. was represented by VE2GB and VE2CO in the F.D., June 8th. A club picnic followed on June 9th.

Heavy rain made us change location plans at the last minute. Both enjoyed the contest very much and we also operated operation every 1 ½ hours. It showed us what could be done in case of emergency.—W8EZT-W3DZZ.

Cleared a road to a cabin at Windy Ghoul, N. H., on a rocky point overlooking Boscawen. Revamped our set, and got going in spite of rain. The marauding, W1CME made it a perp. Our was a hectic but triumphant expedition. Thanks to Mr. Blake and W1DMD for the loan of generators.—W1JOC.

49 QSOs from Scotland Hill, Spring Valley, N. Y., from W9LWY. We used two batteries and a six-volt rotary converter.—S.V.R.C., W2ENK.

Dial was alive with 5-meter answers all the time. It was fine idea. 39 stations, many 50 miles away and one 75 miles away were worked from Mt. Wilson with set permanently installed in car.—W6AM.

49 QSOs for 441 points on 56 mc. I had a neck-and-neck race with W1FGC/1; while our batteries were running low theirs were still plenty hot. Many points on less than 1 watt on 60 mc. Make it just before full moon next year so we have the light to work by—and a break from the weather man, please. Worked from Sweetman Mt. (1803 ft.) and Mt. Wachusett (2250 ft. elev.) with rig in Austin car. With hundreds of Qs heard we combed the bands for the reliable, parked on stations until they were clear, and got more QSOs than by calling CQ.—W1HDQ.

Our antenna was 8 ft. high at mast! Operated from set in car at park in city (3850 kc.) using dynamotor. 39 QSOs and enjoyed F.D. immensely, but the visitors were a problem. Suggest "CQ FD" call next year.—N2BNJ.

A grand time! Had 14 QSOs on 56 mc, in spite of the rain. Looking forward to next year.—W2DWW/2.

The antenna was only 6 ft. high. One operator kept busy wiping the antenna dry. Had 24 fine contacts. Will never miss another Field Day.—N9KIT.

Had a rescue party to look for one member who got lost in the woods. Field Day FB, why not have it oftener?—W5TPS.

VE3GI with VE3WB and VE3LK at Long Branch was housed in a summer cottage, antenna surrounded by trees, QRM from horseshoe pitching, we worked 29 stations. And enjoyed F.D. immensely, but the visitors were—C.C.A.R.A., W9EMN/W9KPS.

Casualties, broke a crystal, Location, cow pasture hill. Power, 5 dynamotor watts, QRM, cows and horses. Wx. FB, Success, 21 QSOs. Operators W9KWP and W9KJY.

Hand generator, five operators and a 5-meter rig in Green Hill Park, Worcester, put the Worcester Radio Ass'n in the running.—W1BKQ.

Starting from scratch a 7-mc. current-fed antenna was put up and working in less than a half hour.—VE3SG. 130 miles from club Headquarters, but our 1.5-kwa gas-driven generator had to be put aside in favor of regular mains, due to poor regulation and hash in the receiver.—W2AOL.

At 2 a.m. in a teeming rain a new antenna was put up, and the grind began in earnest. At the close a disheveled but happy crew had 94 contacts.—W6AMP.

Our first experience. 50 contacts, and next time will do better. Set up in open flat country, running antenna to 90 ft. silo, got 12 watts from dynamotor. Contest was thoroughly enjoyed.—C.C.A.R.A., W9EMN/W9KPS.

Score limited by conditions; all equipment battery-operated; an unforgettable experience. Used a 24-volt m.g. and station in a tent near Highland Lake, Winsted, Conn. Waiting now for next F.D.—H.C.A.R.A., W1DJC-W1APJ.

Twelve tents, power from two generators. Weather fair but cool (especially at 2 a.m.). All six oprs. 15 to 18 yrs. old. Many visitors. 50 QSO's. An enjoyable time and all eager for another F.D.—T.A.P.S.W.R.A., W8JTI-W3DZZ.

This has been our greatest effort in portable operation. Made 6 contacts on 56-mc., 3 on 7 mc. and 47 con-
NEW! MODERN! CERAMIC PARTS FOR • MODERN • TRANSMITTERS

BEGINNING with the original Stand-Off a decade ago, JOHNSON CERAMICS have been designed to do their particular job better than it has ever been done before. Likewise — each of these newest Johnson products will perform its appointed task better! See them at any Authorized Johnson Distributor — or write for Special Bulletin.

A new series of Thru-Panel Insulators, uniform in size with the new Metal-Base Stand-Offs, completes the range of models available from Johnson in this popular style. Especially useful for transmitter terminals. Available in plain and "Jack-Types," with white or brown glaze. Furnished complete with resilient gaskets, insuring freedom from breakage.

New Feeder Spreaders in 2", 4" and 6" lengths, accurately molded of high-quality low-absorption porcelain, will solve many transmitting and receiving antenna-system problems. Included is a new heavy-duty Commercial-Type Spreader.

New "Cruciform" shaped Strain Insulator, designed especially for high-frequency applications, has unusually low capacity, long leakage path and high mechanical strength — yet weighs less than one ounce!

These new Metal-Base Stand-Off Insulators (in foreground) eliminate breakage in mounting! Available in 1¾", 2½" and 4½" heights with plain or "Jack-Type" hardware. Included is a "Bee-Hive" with a unique oval metal-base requiring a minimum of mounting space. Available in white or brown glaze.

Commercial-Type Antenna Insulators, with special corrosion-resistant aluminum alloy end-fittings, are ideal where highest mechanical strength is important. Insulation is highest quality Wet-Process porcelain 1½" in diameter. Supplied in three lengths with leakage distances of 8", 12" and 18".

An improved "250-Watt" Socket Set with "Safety-Cup" plate terminal is the newest addition to the Johnson line of superior transmitting sockets. These sockets are standard equipment with well-known commercial transmitter manufacturers, yet cost surprisingly little!

A new high-quality commercial-type socket for the new RK-28 and RCA 803 Pentodes will be available shortly.

E • F • JOHNSON COMPANY MANUFACTURERS OF RADIO TRANSMITTING EQUIPMENT WASECA • MINNESOTA • U. S. A.

Say You Saw It in QST — It Identifies You and Helps QST
The New (SIXTH EDITION)
LICENSE MANUAL
WITH THE FOLLOWING CHANGES

★ Corrected text of the amateur regulations up to date, including amendments made June 18th at the request of the Board.

★ Corrected answers to all the representative examination questions relating to regulations where the same are changed by the amendments to regulations made June 18th.

★ Corrections in the text concerning permissible 'phone bands and portable privileges, as have been amended by these changes June 18th.

★ Additions to the text about licensing, to incorporate the existing arrangements in Alaska, Pueró Rico and Hawaii, the right to have code dictated or typewritten.

★ Several notable changes in the way of improved answers to sample questions in the Class-A 'phone examination, bringing them in line with the modern engineering concept of modulation.

★ Several other improved answers to typical questions appearing in the Class-B-C examinations.

It LEAVES THE JOB COMPLETELY UP TO DATE IN EVERY RESPECT. VALUABLE ALIKE TO THE BEGINNER AND THE ALREADY-LICENSED.

25 Cents Postpaid (No stamps, please)

The... AMERICAN RADIO RELAY LEAGUE West Hartford, Connecticut

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

64 C
DELCXE DIALS AND FLUTED KNOBS

These are the trimmings you have noticed of late on the finest equipment, now available at these prices. Dial plates made of circular finished solid nickel silver, not plated brass or aluminum. Fluted knobs are finest quality genuine bakelite.

<table>
<thead>
<tr>
<th>Size</th>
<th>Knob Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK4 (Large)</td>
<td>Medium 3&quot; Knob with skirt</td>
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</tr>
<tr>
<td>DK5 (Small)</td>
<td>Small Knob</td>
<td>$1.50</td>
</tr>
<tr>
<td>SKM (Medium)</td>
<td>Medium Knob</td>
<td>$2.75</td>
</tr>
<tr>
<td>SKM (Large)</td>
<td>Large Knob</td>
<td>$6.25</td>
</tr>
</tbody>
</table>

KEYING RELAY

will operate on one dry cell. Can be used with Single Pole Single Throw or Single Pole Double Throw. Sturdy construction, has 1/4" diameter Solid Silver Contacts. Compared favorably with expensive types. Special....$95

THE NEW BARR DB3 CLASS B MODULATED 5 METER TRANSCEIVER

We were surprised at the marvelous value offered in this transceiver, just as you will be when you own one of them.

PRICE $16.20 less tubes, batteries and accessories. Bulletin on request.

GROSS CRYSTAL CONTROL TRANSMITTER

GCW-25 Transmitter kit 25-30 watts. With one set of coils, $14.95

EIMAC UNSURPASSED TRANSMITTING TUBES!

Performance - Ruggedness
Power - Price
50-T Output 75 to 250 watts........$13.50
150-T Output 150 to 450 watts.....$24.50

CASED FILAMENT TRANSFORMERS FOR EIMAC TUBES

Cased 5 volts CT 12 Amps..............$2.95
Cased 5 volts CT 20 Amps.............$4.95

HEINTZ & KAUFMAN HK-354 GAMMATRON

150 WATT Plate Dissipation...........$24.50

WHILE THEY LAST ONLY FEW LEFT
Cased Filter Condensers
OIL IMMERSED silver cased filter condensers with stand off insulators.

<table>
<thead>
<tr>
<th>Condenser</th>
<th>DC Working Voltage</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 mfd.</td>
<td>1000</td>
<td>$1.95</td>
</tr>
<tr>
<td>4 mfd.</td>
<td>1000</td>
<td>$1.95</td>
</tr>
<tr>
<td>1 mfd.</td>
<td>1500</td>
<td>$1.95</td>
</tr>
<tr>
<td>1 mfd.</td>
<td>2500</td>
<td>$1.95</td>
</tr>
</tbody>
</table>

THE NEW PATTERSON PR16 RECEIVER

PR16C In Metal Cabinet complete with Tubes, Speaker and Crystal, $95.70
PR16 same as above without crystal, $89.70

NEW! HOYT BAKELITE CASE HOT WIRE ANTENNA METER

3/4" Across Flange, Mounts through 2 1/4" hole. Scale Length 18 3/4".
Ranges: 0/1.5; 0/3; 0/5 Amps...
$3.50

Natural Bakelite Grooved Plug-In Coil Forms

4 Prong..............................$5.50
6 Prong..............................$6.60

HEAVY DUTY ANTENNA KNIFE SWITCH

Single Pole, Double Throw 100 Ampere, 5 1/4" Break...
$1.45

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

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When it's tough sailing Skipper Serviceman, be nonchalant . . . steer by Centralab. For Centralab Controls are built to "take it" in all kinds of weather . . . under all sorts of adverse conditions. It's smooth sailing under sunny skies if you stock up with CENTRALAB Radiohms for each and every replacement job, which invariably work "better than ever before." Smooth, silent, safe, sure and certain . . . no wonder they are the choice of servicemen who "are in the know."

Write or see your jobber for the new, revised, accurate CENTRALAB VOLUME CONTROL GUIDE

Centralab
Division of
Globe-Union Mfg. Co.
Milwaukee, Wis.

plate and grid filter resistors are mounted on a strip of bakelite fastened to the screws which hold down the contact assemblies. A four-prong tube socket is mounted on the rear wall, to which the speaker connections are wired. The leads from the coil taps to the midget condensers are No. 18 push-back wire. C4 is soldered to the bottom stator lug on the oscillator section of the variable condenser.

LINE-UP AND OPERATION

For lining up the set a good modulated oscillator and output meter are desirable, but the station monitor and a 0-1 d.c. milliammeter will serve very well. The milliammeter is connected in the B+ lead to the second detector plate. This plate current is about 0.25 ma. under no signal conditions. The 2A7 works quite well as a second detector, although with the a.v.c. cut out it will overload on strong signals. But of course the volume is more than desired before the overloading takes place, and since a.v.c. is nearly always used for voice reception, this condition is not troublesome.

The i.f. circuits are tuned as in any other super. The coupling of T2 is set at maximum, the regeneration control at minimum, and the a.v.c. is cut out. After the i.f. circuits have been tuned, and while the oscillator is still coupled to the grid of the first detector, the plate coil of T2 is turned until the output suddenly drops. Just where it starts to drop is the desired coupling. This occurs at an angle of about 45 degrees in the writer's set. The tuning condensers may need a slight readjustment after this is done.

In tuning the r.f. circuits, inductance trimming is used to make all ranges track. One range is peaked by adjusting the trimmers on the large variable condenser. The midget condensers should be at minimum capacity and the large condenser tuned just slightly within the amateur band for the peaking process. Then, if the circuits do not track with the oscillator over the entire range, a different tracking condenser value is needed. Now go to another range and see if the same position of the trimmers peaks this range. If not, the end turns of the coils are pushed closer together or separated as may be required until all ranges track well. All the ranges are adjusted in the same way. Of course a small difference in the setting of the trimmers can be tolerated. If all ranges can be peaked with not more than one-eighth of a turn variation in the setting of the trimmer screws, the sensitivity will be excellent. It should be remembered that the oscillator coils are adjusted to tune just higher than the edge of the amateur band. A different lay-out or the use of different parts might require a slight change in the number of turns on the coils. Unless the signal oscillator used is well shielded, direct pick-up may make it hard to peak on the higher frequencies. In some cases background noise can be used to advantage in finding the peak, especially at the high-frequency ends of the ranges.

The overall gain of this receiver is more than can usually be used. All in all, its performance

Say You Saw It in QST — It Identifies You and Helps QST
ULTRA MIDGET CONDENSERS

Ultra High Frequency, Ultra Small Size, these new condensers are ideally suited for use in padding and neutralizing, and for tuning high frequency receivers. They are particularly suitable for Fixed-Tuned exciter stages of band-switching transmitters.

A balanced-stator model is also available, in which two stators act upon a single rotor. Connections are usually made to the two stators only, eliminating the rotor contact, shortening leads, and reducing minimum capacity. There are of course various other specialized uses to which this balanced unit may be put.

A small size of the new Ultra Midget Condensers simplifies efficient layout and effective shielding. They can be mounted inside small coil-shield cans. The shaft extension is long enough for a conventional knob or dial, but may be readily cut off at the groove provided for this purpose. (See arrow at left.) A hexagon head is provided so that adjustments can be made with a socket wrench when the shaft is not used.

The new condensers can be mounted either by the angle foot shown above, or by spacers and bolts direct to the panel, as illustrated below.

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Symbol</th>
<th>Net Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>UM-15</td>
<td>$ .75</td>
</tr>
<tr>
<td>35</td>
<td>UM-35</td>
<td>.90</td>
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<tr>
<td>50</td>
<td>UM-50</td>
<td>.96</td>
</tr>
<tr>
<td>75</td>
<td>UM-75</td>
<td>1.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Symbol</th>
<th>Net Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double-Spaced 25</td>
<td>UMA-25</td>
<td>$1.11</td>
</tr>
<tr>
<td>Balanced Stator, Single-Spaced 25</td>
<td>UMB-25</td>
<td>1.11</td>
</tr>
</tbody>
</table>

NATIONAL CO., INC. Malden, Mass.

Say You Saw It in QST — It Identifies You and Helps QST
MAKE SURE OF A CLEAR SIGNAL EQUIP WITH ASTATIC

To insure a clear signal in spite of ORM equip your transmitter now, with this remarkable modern microphone. The D-104 Astatic Crystal Microphone will give you long, faithful, dependable service too. Not only that but it's low in price and fully guaranteed. See your jobber today.

ASTATIC CRYSTAL MICROPHONES
ASTATIC MICROPHONE LABORATORY, INC.
YOUNGSTOWN, OHIO
"Pioneer Manufacturers of Quality Crystal Products"

WRITE AT ONCE FOR OUR
TIME PAYMENT PLAN
on the New BROWNING SET
DELAWARE RADIO SALES CO.
405 Delaware Avenue  Wilmington, Delaware

HAMS! IMMEDIATE DELIVERY ON
Amateur Communication Receivers
We are Headquarters for all nationally known lines. Everything for the H.A.M. Come in and "talk it over," with W8AQO (Bill Filler).
SUN RADIO CO., 297 Fulton St., New York, N.Y.

is highly satisfactory. It does not have a "five-foot" dial and may not equal some of the manufactured jobs, but it is believed that it compares very well with most of them.

DX Contest Results
(Continued from page 9)
where an award has not been made will notify us of three members who took part in the contest and reported, we will gladly award a certificate to the highest scorer promptly upon receipt of the information.

GENERAL ITEMS

777 and 852 were popular serial number choices. X1AY received 777 from thirty-nine stations, 852 from twenty-four. Q5BY worked 62 stations on the second day of the tests; his best total for one day in any contest. HC1FG’s contest log gets longer and longer; this year it arrived in one piece, 13 feet, 2 inches long! ZE1JB reports that Southern Rhodesian amateurs were prohibited from operating on 7-mc. at the time of the contest, a restriction which they hoped to soon have lifted. ZS2A observed that 90% of the stations calling him made their calls much too long. An encouraging highlight was the improvement in signals over previous years. Several foreign contestants remarked that about 95% of all W’s and VE’s were using crystal control. ZSFP lays claim to having the most outstanding signal heard—by the B.C.L. next door!

W8AYD’s first QSO. FM14AB, made him W.A.C. Many operators worked all continents during the contest. W18Z worked seven ZL’s and VE13 in one hour. An odd one: VE1DR heard OE1ER and HB9Q coming through on practically the same frequency. They were both sending their numbers to W stations at one and the same time; OE1ER sent 111444, HB9Q sent 444111. F1. Preamble to any contest all: "I would have done better if . . . . " VE3HQ’s biggest kick was raising PY1A to AW’s first QO of the contest. W9DQD derived his serial number from the calls of the first three J’s he ever worked; in 1934 he used the first three ZL’s, and in 1933 the first three VE’s. W18YI snagged Asia after trying for ten years; result—W.A.C. One afternoon at about 5:30 C.S.T, W9BQM heard all continents in two minutes without touching the dial; J2GZ, FS8C, ZD2C, LU2PC, QD9B, CM2AN. The Rettsmith and the Wouff Hong would be much too tame a punishment for the blackguards who bootlegged the calls of OK1AA, ZS2A and G5RB!

W9CPD worked K6KEF on 8.9 mc. ‘phone. ZL2BN (c.w.) made contacts with 14 mc. phones, W6Z2H and W2ZC. FS8C did the same with WB6LY and W2ZC. Greatest disappointment at W9MV was hooking K6KJM only to find he was operating portable in Connecticut. W9EFL QSO’d 60% of stations heard and 90% of countries heard. W8KL claims the title of the most persistent ham in the contest—he called 200 DX stations and had one QSO to show for it! A special award of QSL cards is being made to the W/VE highest scorer, W2SI, by W8DED. For transmitting W7MR used the 300-foot vertical antenna of broadcast station KOIN! W8FMU heard 47 countries in all. W8A0O worked VE30C, who was using the same serial number he was—737. W2AER had a two-way 14-mc. phone QSO with W6FF, who did much work on ‘phone.

ODE TO A LOW SCORE
Oh, I’d like to have broken the blasted necks
Of the W stations that CQ’d DX;
And I’ve placed on my list of Super-Pests
The VE stations that CQ’d Test.

Oh, I swore at those “died-in-the-wool” deceivers,
The foreign stations without receivers.
But, although I groaned and cussed and sighed
’Twas a grand contest, and I’m glad I tried.
—W6FF

VOAY’s contacts averaged one every six minutes—205 stations in 24 hours at the key. QMH, QML, etc., although not used as generally as they should have been, proved helpful to those using them. These valuable abbreviations speed things up considerably when widely used. KE4D
AMATEURS! Here's the receiver you've dreamed of owning — at a price that makes ownership possible! Its band spread is a sensation and a revelation. Its superior signal-to-noise ratio is an accomplishment of greatly advanced circuit design. Its many practical operating features contributed by many amateurs will thrill all "Hamdom."

Its low cost is due solely to the fact that the amateur is required to build part of this job himself — a simple task, for the TOBE TUNER comes completely wired and pre-aligned. Enthusiastic testimonials from critical amateurs concur in the opinion that here is a real communication job giving the finest tuning control obtainable — regardless of price — plus sensitivity, selectivity and low noise level!

TUNING RATE AND SPREAD

The table below gives an accurate analysis of the band spread of the TOBE Amateur Communication Receiver. To appreciate these extremely important features read May 1935 QST, pages 20-28.

<table>
<thead>
<tr>
<th>Band</th>
<th>Tuning Rate</th>
<th>Calibration Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>96.5Kc</td>
<td>9 Kc</td>
</tr>
<tr>
<td>80</td>
<td>30 Kc</td>
<td>3.4Kc</td>
</tr>
<tr>
<td>40</td>
<td>18 Kc</td>
<td>2.0Kc</td>
</tr>
<tr>
<td>20</td>
<td>17 Kc</td>
<td>3 Kc</td>
</tr>
</tbody>
</table>

THE DISTINCTIVE AMATEUR BAND DIAL

Lays out each of the four bands over a wide area and clearly shows C.W. and phone sections. The limits and sections of each band are indicated in Kc. The operator can tell at a glance the band he is listening on, type of reception, and whether he is going up or down in frequency. Polarindex lines permit logging of stations for reference.

NEW TOBE ACCESSORIES FOR THE AMATEUR!

Realizing the need of amateurs for the highest quality parts for set building at a price they can afford to pay, TOBE has focused its sixteen years of radio experience on this field with the result that a complete line of accessories similar to those illustrated is being developed.

A complete line including variable and fixed coupling air and mica tuned I.F. transformers; high, medium and standard "O" LITZ wound coils; beat frequency oscillators with air trimmers with adjustable beat note; new type air trimmers and padders for complete range of capacities.

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 previous records for fast QSO's when he raised a station, exchanged numbers and signed off, all within two minutes, forty seconds. A heavy a.c. power leak on the last day of the contest stirred plenty of excitement among the hams in W2GZV's town; the power company trouble-shooter was also a ham, so all was fixed in record time! In the case of unsatisfactory results at some stations, it was the "unfinished harmony," it was the "unfinished super!" Number heard most at W9FO—852; we wonder if all using that number used an 852 tube. Says W2BGE, "The competition is getting so keen nowadays that when you work a station you feel you have taken him away from about fifty other hams." W1DXL received the numbers 333333, 444444, 777777 and 888888—to enough to make a fellow dizzy. "Most lasting impression received during contest: That sickening feeling in the pit of your stomach when your best DX QSO comes back calling CQ again when you sign to him for the first time!"—W4WBRG. W18Z had a total of 63 countries! W3NW WAC'ed in 18 hours. W5HX used only a single 112A, 300 volts B batteries, for all his work. Of interest to all is the power used by W5SL, world-high scorer: 1 kw. on 7 and 14-mc., 250 watts on 3.5-mc. W9IU worked 18 Oceania stations in one evening, 15 in another and 14 another, The D.A.S.D., German amateur society, told its members to take part in the contest as much as possible. One member thought this was an "order," but he was sick during the tests so he took his log to his doctor and attested his sickness on it! D1B-U was the first DX QSO for more than 30 W's.  

Strays  

W3CWE wants to thank the ham who is bootleggin' his call for DX and out-of-the-way states, but wishes said ham would try just a bit harder for Asia and Africa so he can be WAC!  

W9TE says it's bad enough when the OW talks back, but when a Heising choke talks back, that's the last straw!

Our Cover Illustration  

(Continued from page 39)  

photograph of the gear in actual operation. Incidentally, the ultra-high frequency development work has resulted in definite achievement. In the past year more than a dozen different superheterodynes have been built. All of them served chiefly to impress us with the severe limitations of the conventional super for u.h.f. work. Recently, the problem has been attacked from a different angle and the latest experimental receivers, involving an entirely unconventional principle, have given us something to get excited about. After further proving of the new type of receiver, we plan to "shoot the works" in an early issue.

1935 Mid-American-Dakota Division Convention  

1935 Mid-American-Dakota Division Convention  

T HE 1924 Dakota Division Convention was hailed as one of the finest amateur conventions ever held, but when delegates to the Mid-American-Dakota Division Convention, held at Minneapolis May 3rd, 4th and 5th, pointed their automobiles homeward it was everywhere acknowledged that the 1935 convention was second to none in providing entertainment and features of interest to the attending amateurs.  

Registration began early Friday, May 3rd, when VE4GA from Regina signed up to take honors for coming the longest distance—almost
THE RME-9D Receiver was designed and built for amateurs. It had to be right to satisfy them. Naturally, every conceivable condition encountered in the daily contacts between stations was given careful consideration.

We do not care to broadcast in glowing terms what the RME-9D will do. You, as an owner, are privileged to draw your own conclusions. Remember, we guarantee that every receiver shipped must satisfy, and we have satisfied hundreds of amateurs.

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FLEXIBLE SHAFT COUPLING: This new and extremely useful gadget combines isolonite insulation with a short length of flexible shafting. It provides a driving means between offset shafts, or shafts at any angle up to 90 degrees. It virtually eliminates alignment problems. The shafting is of the highest quality (not speedometer cable), reducing backlash to an almost imperceptible amount. It is not recommended for high precision drives however. It is available with plain hubs without insulation, as well as with the isolonite insulation illustrated above. Hubs take 3/8 inch shaft.

Net Price, as illustrated $ .75
Net Price, plain hubs $ .36

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1500 miles, mostly over mud-filled roads. Trips to the Tribune building to view the A.P. Wirephoto apparatus and to the telephone company’s plant consumed most of the morning. In the afternoon the technical program got off to a flying start with a talk on transformers by Boyd Phelps, followed by A. R. Kahn on microphones and Frank Hajek on tubes. Evening found an open forum meeting in full swing with Director Carl Jabs presiding, with A.R.R.L. matters coming up for thorough discussion. A stag for the old-timers kept the plates hot until the early morning hours when the gang finally had to be shepherded out of the lobby of the West Hotel by the cleaners making their morning rounds!

Saturday morning Dr. H. E. Hardig of the University of Minnesota gave a mechanical demonstration of the operation of antennas and feeders which proved an eyecatcher to the gang. The afternoon program opened with Henry Argento on tubes, followed by George Grammer, continuing the subject of antennas, after which most of the fellows began to think they were going to have scalloped antenna leadin for the main banquet dish! At a noon session organized by Dr. Burton T. Simpson, WSCPC, fifty ‘phone men signed up for the Dakota Division Radiophone Association, electing W9JDO president. A showing of A.R.R.L. and Dakota Division hamfest movies finished off the afternoon.

At the banquet Friday night, Rex Munger, W9LIP, as toastmaster, and Ted Hediger, W9FK, as master of ceremonies, assisted by popular entertainers from the Twin City broadcasting stations, put on a rapidly-moving show which made three hours seem like as many minutes, giving the 500-odd hams, YL’s and XYL’s never a chance for a dull moment. Special prizes for the ladies were drawn after the entertainers were reluctantly allowed to go, followed by the big event—the drawing for the grand prize, a complete 100-watt c.w.-phone transmitter. The lucky winner, John Talen of Ogilvie, Minn., had just taken his exam during the convention—a swell send-off for a new ham!

An unusually large prize list ranging from crystals to superhet receivers kept the gang over for the drawing on Sunday morning. In the afternoon a golf tournament at the Westwood Hills Country Club, won by W9EAB, completed the three-day program. The 584 hams who registered at the convention went home with the firm conviction that the Twin Cities gang had put over a convention that couldn’t be beat. All credit to the hard-working committee, made up of leading members of the Minneapolis Radio Club and St. Paul Radio Club.

Technical Topics
(Continued from page 21)

zero at, say, 50 kc/s below the IF frequency to a positive value for higher frequencies; whilst the input reactance of the (other) second detector varies from zero at a point, say, 50 kc/s above the IF frequency to a negative value for lower frequencies.
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Although a conclusive judgment as to the ultimate utility of this latest Armstrong development in practical amateur work would be premature at this time, the evidence at hand (including the Major’s own comments to us) convinces us that, while it might some day find use in amateur 'phone on 56 me. and higher frequencies, it will not be practicable for the lower frequencies. On 160, 80 and 20 it seems quite clear that present systems of amplitude modulation, and derivatives thereof, will continue to hold sway. Of course QST will have the authoritative details in due time, following a promised practical demonstration by the Major himself and permission to release the information. In the meantime, advanced amateurs interested in studying the frequency-modulation background involved will find plenty to chew on in the following selected references:


A. Hund, High-Frequency Measurements (McGraw-Hill), Chap. XIV.

—J. J. L.

I.A.R.U. News

(Continued from page 46)

issues of QST. It is to the addresses following that cards intended for the countries shown are to be sent. Corrections, additions, or deletions to or from this list will be welcomed.

Algeria: See France.


Australia: W.I.A. Federal QSL Bureau, George W. Luxon, VK5RX. S Brook St., Mitcham, South Australia.

Austria: O.V.S.V., Willy Blaschek, Bahngasse 29, Klosterneuburg.

Azores: See Portugal.

Belgium: Reseau Beige, 312 Rue Royale, Brussels.

Brazil: L.A.B.R.E., Caixa Postal 26, Sao Paulo.


Canada: A.R.R.L., West Hartford, Conn., U. S. A.

Ceylon: G. H. Joliffe, VS7GJ, Frocester, Govinna; or A. M. Rahim, "Rillington," Weliswaste, Colombo.

Chile: Luis M. Desmaris, Casilla 781, Santiago de Chile.

China: I.A.R.A.C. Box 685, Shanghai.

Dominican Republic: Dr. Enrique de Marchena, Apartado Postal 912, Santo Domingo.

Czechoslovakia: C.A.V., Post Box 69, Praha 1.

Denmark: E.D.R., Post Box 79, Copenhagen K.


Germany: A.R.R.L., West Hartford, Conn., U. S. A.

Holland: C.W.R.O., West Amsterdam.

Ireland: A.R.A.R., 14, Lower Bridge Street, Dublin.

Italy: O.A.R.I., Torino.


Netherlands: C.W.R.O., West Amsterdam.

Norway: O.V.S.V., Post Box 96, Stavanger.

Portugal: See Portugal.

Rumania: See Portugal.


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The Open Forum was conducted by Director Kenneth T. Hill, assisted by F. E. Handy, Communications Manager, A.R.R.L. Roy C. Corde-
man, W3ZD of Washington, D. C., as radio aide to the Chief Signal Officer talked on A.A.R.S. matters.

The big event of any Hudson Division convention is the banquet and entertainment. The honors go to Jack Garrettson, W2AOM, for furnishing the entertainment and the food was most satisfactory.

The guest speakers at the banquet were: Col. Alvin C. Voris, U. S. Army; Lieut. E. S. Sarsfield, U. S. Navy; A. A. Hebert, treasurer, A.R.R.L.; F. E. Handy, A.R.R.L.; and the three former directors, Dr. L. J. Dunn, Dr. A. Lafayette Walsh and B. J. Fulld. Director Kenneth T. Hill acted as toastmaster.

After the banquet prizes were distributed, followed by dancing until morning.

—A. A. H.

A New Filter-Speaker
AMATEURS of some years' standing will remember the peaked audio filters which, before the era of single-signal reception, were widely used for the purpose of increasing selectivity in c.w. reception. A new loud-speaker using a mechanical resonator for the "peaking" effect, recently marketed under the name of the "El-Me-Ac Postselection Filter-Speaker," operates on much the same general principle. The El-Me-Ac unit is a loud-speaker which resonates sharply at a frequency of approximately 1000 cycles and can be coupled directly into the plate circuit of any receiving power tube, being especially effective when used in connection with pentode-type output tubes. The 1000-cycle resonator is a small cylinder which obtains its filter characteristics from the materials of which it is composed and the manufacturing treatment it undergoes. Because the filter is mechanical rather than electrical, the resonance curve is extremely sharp. It is actuated by being placed in the field of a high-inductance coil which is connected in the plate circuit of the receiver output tube.

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FOR the convenience of its members, the League maintains a QSL-card forwarding system which operates through volunteer "District QSL Managers" in each of the nine U. S. and five Canadian districts. In order to secure such foreign cards as may be received for you, send your district manager a standard No. 8 stamped envelope. If you have reason to expect a considerable number of cards, put on an extra stamp so that it has a total of six-cents postage. Your own name and address go in the customary place on the face, and your station call should be printed prominently in the upper-left-hand corner. When you receive cards, you should immediately furnish your QSL manager with another such envelope to replace the used one. List of managers follows:

W2—H. W. Yahnel, W2SN, Lake Ave., Hel me, N. J.
W3—R. E. Macomber, W3CZE, 418 10th St., N. W., Washington, D. C.
W4—B. W. Benning, W4CBY, 520 Whiteford Ave., Atlanta, Ga.
W6—C. E. Spitz, W6FZQ, Box 1804, Phoenix, Ariz.
W7—L. Q. Kelly, W7BPC, 4919 So. Prospect St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
W9—George Dammann, W9JO, 319 Sherman Ave., Evanston, III.
VE1—J. E. Roue, VE1FB, 84 Spring Garden Rd., Halifax, N. S.
VE2—W. H. Oke, VE2AH, 3184 Mountain Sights Ave., N. D. G., Montreal, P. Q.
VE3—Bert Knowles, VE3QB, Lanark, Ont.
VE4—Dr. J. J. Dobry, VE4DR, Killam, Alberta.
VE5—E. H. Cooper, VE5EC, 2024 Carnarvon St., Victoria, B. C.
K4—F. McCown, K4RJ, Family Court 7, San tarte, Puerto Rico.

82 Say You Saw It in QST — It Identifies You and Helps QST
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*660 1.50 *380-B 7.25 *865 8.45
*211 8.45 *388 11.75 866-A 1.95
*304-A 9.45 *461 2.45 872 11.75
*500 7.25 *465 11.25 872-A 13.25

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Type RAD with complete set of drilled and tapped mounting holes. ..... $5.45

Type RAU same size as RAD, less mounting holes .... $5.45

LEEDS 19" RACK PANELS crystalline finish on one side and dull black finish on the other. All panels are 1/4" thick.

<table>
<thead>
<tr>
<th>Aluminum</th>
<th>Steel</th>
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<tbody>
<tr>
<td>No. Width Weight</td>
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</tr>
<tr>
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<tr>
<td>PA2 3/4 3 &quot;</td>
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<td>PA3 5/8 3 &quot;</td>
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<td>PA4 7 4 &quot;</td>
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<td>PA5 8 1/4 5 &quot;</td>
<td>2.45</td>
</tr>
<tr>
<td>PA6 10 5/8 6 &quot;</td>
<td>2.55</td>
</tr>
<tr>
<td>PA7 12 3/4 7 &quot;</td>
<td>3.00</td>
</tr>
</tbody>
</table>

Jo Get Started in Amateur Radio obtain a copy of HOW TO BECOME A RADIO AMATEUR

(No. 8 in the A.A.R.L. series entitled The Radio Amateur's Library)

Completely done over in 1935 style, telling all about amateur radio and describing the latest equipment.

— push-pull crystal transmitter
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Many Amateur and Commercial ops., humiliated by their inability to "hit the ball," have come to CANDLER in confidence, and after a few weeks' personal coaching and specialized training have won the respect and admiration of all for the excellence of their work.

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Write for Bulletins on PEAK QS - 2½, 5 and 10 meter superhet receiver. PEAK M12 Aural Radiophone Monitor. PEAK P-11 Preselector.

EASTERN RADIO SPECIALTY CO.
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1845 Broadway Dept. B
New York, N. Y.

Midwest Division Convention

FRIDAY and Saturday, April 26th and 27th, was the time; the Hotel Savery III, the place; the event—the annual Midwest Division Convention. Hams to the number of almost 500 from all over the corn belt division swelled the attendance to make this one of the largest and most successful Midwest Division conventions ever held.

After an opening morning devoted to registration, getting acquainted, and license examinations for those who needed them, the convention proper got under way early Friday afternoon with Chairman Frank J. Sadiek of the Convention Committee bidding all hams welcome. The opening talk on a varied technical program was given by George Grammer, of A.R.R.L. Headquarters, who discussed antenna fundamentals; H. F. Gulliver followed with an exposition of a.c. operated amplifiers of the high-gain, high-fidelity type. After a brief recess the technical program was resumed by Kendall Clough, who described the use of the cathode-ray tube in analysing the performance of transmitters and amplifiers. Transformers, with particular reference to power-supply systems, was the subject covered by Boyd Phelps, who gave the closing talk on the first afternoon's program. Friday evening was given over to an A.R.R.L. business meeting, at which League affairs were thoroughly discussed, the meeting being capably handled by a committee headed by Guy Wilson, W9EL. As the mystic hour of midnight approached, timorous candidates were initiated into the mysteries of the Royal Order of the Wouff Hong, with the aid of a cast made up of members of the Des Moines Radio Amateurs Association.

Saturday morning saw a resumption of license examinations and meetings of various groups, including the Naval Reserve, conducted by Lt. Charles H. Morgan, the A.A.R.S., conducted by Director Kerr, and the organization of a Midwest Division Radiophone Association with the cooperation of W8FC. After lunch the technical meetings continued with George Grammer talking on Tri-Tets, then a discussion of the theory and application of the cathode-ray tube by B. C. Burden, with a demonstration of equipment and actual use of the tube which kept the interest of the gang at top pitch. Fred Schnell followed with a practical and entertaining talk on transmitter efficiency, and the program was closed by a discussion and demonstration of the velocity microphone by the RCA representative.

The banquet, held on Saturday evening, was under the toastmastership of Dr. G. W. Fox of Iowa State College. Features were a talk by Louis R. Huber on the amateur's place in the radio picture and short remarks by a number of other speakers. With the food safely put away came the big event—the drawing of prizes. A numerous and varied collection of prizes, with an HRO as the chief attraction, sent many hams home with just that extra bit of satisfaction which, added to that already generated by the

(Continued on page 00)}
Variable Condensers

FOR over 20 years General Radio has been engaged in the manufacture of high-grade laboratory-quality variable air condensers, thousands of which are being used by amateurs. The complete line of General Radio condensers includes everything between the 15 µµf midget and the laboratory standard with quartz insulation.

The Type 756-A Double Section condenser, illustrated at the right, was designed particularly for amateur frequency meters and for tuning units where a dual, adjustable band-spread capacitance is required.

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- "1936" Communication Receivers fully described and priced.
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Radio Accessories Company
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PARIS, FRANCE 
J. C. Balouzet, De Tigny, 6, Avenue Hoche

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ST. LOUIS, MO. 
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Lew Bonn Company
2484 University Avenue

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Electrical Supplies, Ltd.
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Radio Accessories Company

PARIS, FRANCE 
J. C. Balouzet, De Tigny, 6, Avenue Hoche

PEORIA, ILLINOIS 
Klaus Radio & Electric Company

ST. LOUIS, MO. 
Walter Ash Radio Company

ST. PAUL, MINN. 
Lew Bonn Company

WINNIPEG, CAN. 
Electrical Supplies, Ltd.

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RCA Victor Division of RCA Manufacturing Co., Inc.

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CHICAGO, ILL. 
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CHICAGO, ILL. 
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CLEVELAND, OHIO 
Northern Ohio Laboratories
2073 West 85 Street

CLEVELAND, OHIO 
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1301 Superior Avenue

DETROIT, MICHIGAN 
Radio Distributing Company
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DETROIT, MICH. 
Radio Specialties Co.
171 E. Jefferson Ave.

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FLINT, MICH. 
Shand Radio Specialties
903 W. Keeseley St.

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McGee at 23rd Street

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BUTLER, MO. 
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CHICAGO, ILL. 
Newark Electric Company
206 W. Madison Street

CHICAGO, ILL. 
Allied Radio Corporation
530 S. State Street

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CINCINNATI, OHIO 
Krauss Radio Stores, Inc.
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Northern Ohio Laboratories
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DETROIT, MICH. 
Radio Specialties Co.
171 E. Jefferson Ave.

FARGO, N. D. 
Dakota Electric Supply Company
123 Broadway

88 Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them.
Where to buy it

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

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
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<tbody>
<tr>
<td>GRAND RAPIDS, MICH.</td>
<td>235 Market Street, S. W. Radio Distributing Company</td>
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<tr>
<td>MADISON, WISC.</td>
<td>201 E. Washington Ave. Taylor Electric Co.</td>
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<tr>
<td>MILWAUKEE, WISC.</td>
<td>720 N. Jackson St. Taylor Electric Co.</td>
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<tr>
<td>PEORIA, ILL.</td>
<td>707 Main Street Klaus Radio &amp; Electric Company</td>
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<tr>
<td>ST. PAUL, MINN.</td>
<td>2484 University Ave. Lew Bonn Company</td>
</tr>
<tr>
<td>TOLEDO, OHIO</td>
<td>1014 Madison Avenue Aitken Radio Corp.</td>
</tr>
<tr>
<td>YOUNGSTOWN, OHIO</td>
<td>395 West Federal Street Ross Radio Company</td>
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CHICAGO, ILL. 926 W. Madison Street  
Newark Electric Company

CHICAGO, ILL. 520 S. State Street  
Midwest Radio Mart

CINCINNATI, OHIO 633 Walnut Street  
Steinberg's, Inc.

CLEVELAND, OHIO 610 Huron Road  
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DETROIT, MICH. 1336 E. Congress Street  
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See Page Four

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No high gain preamplification required. No background noise. No Power Supply. AND THE PRICE .......... $33

U. S. PATENTS PENDING

Send for Bulletin 3011

RADIO RECEPTOR CO., INC.
110 Seventh Ave., New York City

Midwest Division Convention
(Continued from page 84)

convention itself, made the 1935 Midwest Division Convention the kind that will live long in memory. The Des Moines Radio Amateurs Association and the Committee deserve congratulations for a well-handled and notably successful convention.

—G. G. W9DHP

Standard Frequency Transmission

<table>
<thead>
<tr>
<th>Date</th>
<th>Schedule A</th>
<th>Station</th>
<th>Date</th>
<th>Schedule B</th>
<th>Station</th>
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<tr>
<td>Sept. 4</td>
<td>BB W6XK</td>
<td>Oct. 4</td>
<td>BB W6XK</td>
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<td>Oct. 7</td>
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<td>Oct. 8</td>
<td>BB W6XK</td>
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STANDARD FREQUENCY SCHEDULES

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<tr>
<td>8:40</td>
<td>4000</td>
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</tr>
</tbody>
</table>

The time specified in the schedules is local standard time at the transmitting station. W9XAN uses 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 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.

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

Schedules for WWV

EACH Tuesday and Friday (except legal holidays), the National Bureau of Standards station WWV will transmit on three frequencies as follows: noon to 1:00 p.m., E.S.T., 15,000 kc.; 1:15 to 2:15 p.m., 10,000 kc.; 2:30 to 3:30 p.m., 5000 kc. These emissions are accurate to better than 1 part in five million at all times and are readily useful for calibrating amateur-band frequency meters by harmonics from an auxiliary 100-kc. oscillator, as described in previous QST articles (June and October, 1933; February, 1934).
HAM-ADS

1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimenters in their pursuit of the art.

2) No display of any character will be accepted, nor can any special typographical arrangement, such as all or part capitalized, be used.

3) Closing date for ads is 150 word, except as noted in paragraph (5) below.

4) Remittance in full must accompany copy. No cash or contract account or account commission will be allowed.

5) Closing date for Ham-Ads is the 25th of the second month preceding date of publication.

6) A special rate of 75¢ per word will apply to advertising which is purely commercial in nature and is placed and signed by a member of the American Radio Relay League. Thus, advertising of bona fide surplus equipment owned, and used, and for sale by an individual on a personal exchange of equipment or advertising for personal use, if it does not mention the American Radio Relay League takes the 75¢ rate. An attempt to deal in apparatus in quantity for profit, even if by an individual, is commercial, and takes the 15¢ rate. Provisions of paragraphs (1), (2), (3) and (4) apply to all advertising in this column regardless of which rate may apply.

Having made no investigation of the advertisers in the classified columns, the publishers of QST are unable to vouch for their integrity or for the grade or character of the products advertised.


TRANSFORMERS and low resistance chokes all new, unmounted. Magnavox Dynamic speaker. Bargain first $45.00 money order. F. B. McDonald, Jr., W4DMM, Waycross, Georgia.

DX and short wave fans "Toonrite" dial brings them in. No gimmick. "Toonrite," W2GSA, 2408 N. 42nd, N. Y.

SELL Gross Eagle 3, tubes, $10. W5ENU, Box 424, Hobbs, N. M.

SELL FI7TA, nearly new, tubes, power supply, 4 sets band spread coils. First rate receiver. Send offer. WSMKI, H. M. Lichte, Route No. 1, Lehighton, Pa.

HOLDERS—75¢, three $2. While they last. Crystals, Blanks, 50¢. Faberndio, Sandwich, Ill.

CALLBOOKS—new Fall 1935 Radio Amateur Call Book, handy book of late W and VE calls, many pages of new DX QRAs and important changes in prefixes, is yours for $1.25, or one year (four issues) for $4.00. (In foreign countries $1.50 and $4.25, postage included.) W9FQO, 610 S. Dearborn, Chicago.

QSLs. W2SN, Helmutta, N. J.

RECEIVERS—new and used sold and traded in, as Hammarlund, National, Postal, International, etc. Schwarz Radio Service, Dunmon, N. J.

CRYSTALS—"V" cut Zero Temperature Coefficient. Guaranteed drift less than Four Cycles °C. per million, 200% more output. Single Frequency Response. 160-800, within five kilocycles, $2.25. Beautiful Machined Holders, $1.00. Ham Crystals. 1104 Lincoln Place, Brooklyn, N. Y.

EMAC, Raytheon, Cardwell, Billey, RME9-D, Super Sky-rider, Sargent, Patterson, Trade in your receiver. Southern Radio Supply, 500 South, Little Rock, Ark. Att'n W8VK.

QSLs. Best looking, finest quality. Free samples. Maleco, 1601 Eastern Parkway, Brooklyn, N. Y.


CRYSTALS, guaranteed oscillators, Y cut 80-100 meter bands, $1. $50-500 kc. $2. Blanks, 60¢. Herbert Addington, 2232 Le Clair Ave., Chicago.


QSLs bound with your name in gold. Card brings details. W9CWM, Lincoln, Nebraska.

FOR sale: Complete 100M phone transmitter and FB7 receiver. Photo, description and price to prospective buyer. W9EYD, Ashland, Neb.


50¢ prepayment. "Toonrite," Babylon, N. Y.

QSLs. World's finest! Samples? (Stamp) W8DED, Holland, Mich.

LIFETIME microphones! Catalog free from W7EDQ.

QSLs. New stuff! Printer, Corwith, Iowa.

TRANSFORMERS and low resistance chokes all Hilite un-mounted at big savings. Also meters. Seed stamped envelope for lists. Leitch, Park Dr., W. Orange, N. J.

AC-DC SW3, bandspread 20, 40, 80, power pack, tube, $25. W6KGV.

QST, cards, two color, cartoons, message blanks, stationery, snapty service. Write for free samples to-day. W1BEB, 1691 Monticello Ave., Lowell, Mass.

SLIGHTLY used All-Star, Sr., receiver, beat oscillator, encide cabinet; complete, coils, tubes, power supply, cabinet mounted Magnavox dynamic speaker. Bargain first $45.00 money order. F. B. McDonald, Jr., W4DMM, Waycross, Georgia.

DX and short wave fans "Toonrite" dial brings them in. No gimmick. "Toonrite," W2GSA, 2408 N. 42nd, N. Y.

SWAP or sell: Complete Barr DB3 and/or 5"x7" Kodak for receiver or what have you. WIIJL.
SELL RCA receiver ACR-136, perfect condition, $50. Preston Drake, 43 John St., Middletown, N. Y.

QLs, 75¢ a 100, two colors, W9DGH.

SELL--rack and panel xmitter, 160-40-40, phone or c.w. 242A final, Class B modulated, complete with 3 power supplies, tubes and meters. Best offer. Also 851, 852, 511, meters, condensers, etc. Cheap. W1PZ, Joe Furrier, Lynnfield Center, Mass.

MISSOURI, Arkansas, Kansas, Oklahoma Ham--complete line amateur parts. O'Neill Tire & Battery Co., Joplin, Mo.

SELL or trade Supreme 333 deluxe analyzer, 85 tube tester. Want RCA carbon 03A. Ralph Senechal, Anamoose, N. Dak.


QLs, two color, 80 cents per hundred. F. Wood, Weyburn, Saskatchewan.

THREE 212Ds, $5. each; 552 new, $10; 550 used, $8; Weston RF 0-10, $5. Sypoq, 83 St. James, Buffalo, N. Y.

GUARANTEED crystals, 100-50, 1" square, within two kilocycles, $3.25. Less than 1", within 10 kilocycles, $1.50. Blanks, odds and ends, five for $1. William Threm, W8FN, 4021 Davis Ave., Cheviot, Ohio.

BUY your new receiver or trade in your old one for any make at Palmer's Trading Post, Route 1, Duluth, Minn. A.C. generators and everything in radio.

METERS—for your shack. Standard Supreme, Weston, Jewell, Triplott, etc. meters from 50¢ to $4.50. All perfect, new and used. Send for free surplus stock list of hundreds of other items. Supreme Instruments Corp., Greenwood, Miss.

FOR sale--QST magazines from May 1924 to present date, Highest offer takes lot of 135 copies. Rubin Cohn, 43 Main St., Middletown, Conn.

$1,000,000.00 appearance, performance. Relay racks, panels. QST specification power equipment. Edison Bb. Rectifier Engineering Service, 4837 Rockwood Rd., Cleveland, Ohio.


SELL used 852, $7. W8CCG.

AMATEUR WIRELESS KEY
For amateurs who want an inexpensive, high-grade wireless key, here is the proper instrument. It is equipped with a heavy, cast base, black finish, coin silver contacts, composition knob and nickel parts. The list price is only $1.50.

The SIGNAL line of telegraph instruments, wireless keys and wireless practice sets is complete. Send for literature.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan, U. S. A.

To OUR READERS who are not A.R.R.L. Members

Y ou 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

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

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

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

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<thead>
<tr>
<th>CHICAGO, ILLINOIS</th>
<th>KANSAS CITY, MISSOURI</th>
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<tbody>
<tr>
<td>Allied Radio Corporation</td>
<td>Burstein-Applebee Company</td>
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<tr>
<td>833 West Jackson Blvd.</td>
<td>1012-14 McGee Street</td>
</tr>
<tr>
<td>Complete standard lines always in stock — W9NRV — W9IBC — W9RZI</td>
<td>“Specialists” in supplies for the Amateur and Serviceman</td>
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<tr>
<td>Chicago Radio Apparatus Company</td>
<td>Radio Laboratories</td>
</tr>
<tr>
<td>415 South Dearborn Street (Est. 1921)</td>
<td>1515 Grand Avenue</td>
</tr>
<tr>
<td>W9RA and W9PSI — Amateurs since 1909</td>
<td>Amateur Headquarters — Complete Stock — Quality Parts</td>
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<tr>
<th>CHICAGO, ILLINOIS</th>
<th>LOS ANGELES, CALIFORNIA</th>
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<tr>
<td>Mid-West Radio Mart</td>
<td>Pacific Radio Exchange, Inc.</td>
</tr>
<tr>
<td>520 S. State Street</td>
<td>729-31 South Main Street</td>
</tr>
<tr>
<td>All standard lines carried in stock</td>
<td>Most completely diversified stock of amateur equipment in the West</td>
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<tr>
<th>CLEVELAND, OHIO</th>
<th>MILWAUKEE, WISCONSIN</th>
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<tbody>
<tr>
<td>Northern Ohio Laboratories</td>
<td>Radio Parts Company, Inc.</td>
</tr>
<tr>
<td>2073 West 85 Street</td>
<td>332 West State Street</td>
</tr>
<tr>
<td>Wholesale Dist. for National, Hammarlund, Thordarson, Cardwell</td>
<td>Complete stock nationally known products</td>
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<tr>
<th>DENVER, COLORADO</th>
<th>ST. PAUL, MINNESOTA</th>
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<tr>
<td>Inter-State Radio &amp; Supply Co.</td>
<td>Lew Bonn Company</td>
</tr>
<tr>
<td>1639 Tremont Place</td>
<td>2484 University Avenue</td>
</tr>
<tr>
<td>Amateur Radio Headquarters in the Rocky Mountain Region</td>
<td>Rex L. Munger, W9LIP, Sales Engineer</td>
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<tr>
<th>DETROIT, MICHIGAN</th>
<th>SAN FRANCISCO, CALIFORNIA</th>
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<tr>
<td>Radio Specialties Company</td>
<td>Offenbach Electric Company, Ltd.</td>
</tr>
<tr>
<td>171 E. Jefferson Avenue</td>
<td>1452 Market Street</td>
</tr>
<tr>
<td>Ham Supplies — National &amp; Hammarlund Sets and Parts</td>
<td>&quot;The House of a Million Radio Parts&quot;</td>
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<tr>
<th>DETROIT, MICHIGAN</th>
<th>SIOUX CITY, IOWA</th>
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<tr>
<td>Rissi Brothers</td>
<td>Warren Electric Co.</td>
</tr>
<tr>
<td>5027-31 Hamilton Ave. at Warren</td>
<td>Standard Lines and Discounts</td>
</tr>
<tr>
<td>W8KXX, Manager Amateur Department</td>
<td>T. J. Morris, W9SSN, Mgr. Parts Dept.</td>
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<tr>
<th>FRESNO, CALIFORNIA</th>
<th>TORONTO, CANADA</th>
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<tr>
<td>3265 E. Belmont Ave.</td>
<td>101 Queen Street, West</td>
</tr>
<tr>
<td>Wholesale: RCA-Thordarson-Bliley, All Standard Lines</td>
<td>Canada's foremost radio supply house</td>
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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.
Into the far reaches of the Arctic seas, for her ninth voyage, sails the Effie M. Morrissey, under the strong hand of famous Arctic explorer Captain Bob Bartlett. In her radio room you'll find that BURGESS Batteries have once again been chosen. Significant is the fact that BURGESS Batteries are the repeated choice of explorers who can't afford to take chances—who stake their very lives on keeping in touch with the world they have left behind. Maximum power and fine performance, long life and all-around dependability are the qualities explorers depend on in BURGESS Batteries. These, too, are the qualities that lead "hams" who know batteries to use only BURGESS. Look for the black and white stripes.

BURGESS BATTERY COMPANY, Freeport, Illinois.

Say You Saw It in QST — It Identifies You and Helps QST
Dependable Eveready Batteries furnish the push for New England's Highest Radio Station...

WIXR, at Mt. Washington Observatory, Gorham, N. H., has been pioneering ultra-high frequency research. Using frequencies in the region of 60 megacycles, they have communicated with a number of amateurs in that section. Eveready Batteries have played their usual dependable part in this work. "Mac" McKenzie, who has been operating WIXR, says:

"I powered our transmitting equipment with five parallel sets of five Eveready Layerbils in series. These batteries have been used almost exclusively for our plate current and are now, after about 325 hours of service at 150 mils to a short circuit, barely showing signs of wear. When I say they are showing signs of wear, I mean that on peaks of modulation, the oscillator plate current (modulator and oscillator use the same batteries) drops off a couple of milliamperes. They have given us remarkable service.

"All our various radio receivers, from the 133 megacycle to the 113 kilocycle, including a couple of broadcast receivers, are powered with Eveready Batteries."

NATIONAL CARBON COMPANY, INC. General Offices: New York, N.Y. Branches: Chicago, San Francisco Unit of Union Carbide and Carbon Corporation

EVEREADY BATTERIES
THEY LAST LONGER THEY'RE MORE DEPENDABLE
YOU COULD MEMORIZE THIS BANDSPREAD

Each band begins at 50 on the dial, exactly!

Each band ends at 450 on the dial, exactly!

- Each HRO receiver is adjusted and calibrated to the above charts by comparison with crystal oscillators. In fact, so accurate is the adjustment, and so small the temperature drift (less than 0.2% under the worst conditions, normally much better) that the HRO provides a reliable check on transmitter frequency.

- The same HRO coils can be switched to general coverage ranges, with each range including two amateur bands, one at 50, one at 450 on the dial.

NATIONAL COMPANY
The RCA-803 fills a gap which has long existed in the transmitting tube line—the need for a really powerful transmitting pentode. Incorporating an electrical and mechanical design which assures the utmost reliability, the RCA-803 is ideally suited for such applications as: a suppressor-modulated ’phone transmitter; multi-band transmitters where neutralization would be troublesome; transmitters where the number of tubes is to be kept at a minimum.

The RCA-803 is immediately available from your RCA de Forest Distributor. Write for technical information.

**CHECK THESE FEATURES**

- Dome Bulb
- Rugged Construction
- Precision Aligned Parts
- 125 Watts Plate Dissipation
- Carbon Plate
- 50 Watts Carrier Output (Suppressor Modulated)
- 200 Watts Output (Class C Telegraph)
- Ceramic Base
- Superior Insulation
- Thoriated-Tungsten Filament
- Easily Excited
- No Neutralization
- Amateur's Net Price, $38.50

**AMATEUR RADIO SECTION**

RCA RADIOTRON DIVISION

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