QST

Devoted entirely to amateur radio

In this Issue—
Using the New Beam Transmitting Tubes
The 30FXC transmitter can be supplied with the new 10X R-F Unit to amateurs who are particularly interested in the higher frequencies. The 10X R-F Unit requires the same panel space as the 10M unit ordinarily supplied but it employs a special tube and circuit arrangement adapted to the higher frequencies. The tubes are:

1. C100A Oscillator
2. 6L6 First Frequency Multiplier
3. 6L6 Second Frequency Multiplier
4. 2-6L6 Third Frequency Multiplier
5. 2-C800 or 2-C101 Power Amplifiers

The frequency range of the type 10X R-F Unit is 10 to 60 megacycles. The nominal plate input to the C800's in the final amplifier is 150 watts, giving an output of 100 watts at the lower radio frequencies and 60 to 75 watts at the highest radio frequency. The output circuit of the 10X R-F Unit is similar to that of the 10M and may be used with non-reactive high frequency lines, or it may be supplied with a matching network. Frequency change can be accomplished by means of plug-in coil assemblies. Both the grid circuit and the plate circuit of the final amplifier are tuned by front panel controls. All dials, including the oscillator and frequency multiplier stages are fitted with locks for fixing the position of the tuning condensers.
Band Spread Isn't All—
It's TRUE SELECTIVITY that Counts!

Of what use is Band Spread alone in a communications receiver when true selectivity is lacking? There's ELECTRICAL Band Spread in the Super Sky Rider instead of mechanical band spread. This, combined with the Super Sky Rider's fine selectivity, makes an ideal combination.

However the principal advantage of the Super Sky Rider is its TRUE SELECTIVITY, (Total Band Width 12 K C at 1000 times down as compared with 20 K C in many communications receivers. With Crystal Filter, selectivity is even finer*). Tuning is so sharp, that nearly 50% more clear channels are available with the Super Sky Rider.

It is this true selectivity, with its other great new features that make the Super Sky Rider outstanding among communications receivers. See it at your jobbers today or write for complete information.

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*11 Tubes, 10 of them metal.
40 M. C. to 535 K. C. in 5 bands.
328 Degrees main tuning dial.
Electro-mechanical band spread.
14 Watts undistorted output.

Direct calibration tuning — No charts or tables.
Field strength indicator.
Improved 10 meter performance.
Single signal crystal action.

Ceramic insulation.

*Measurements made at I. R. E. standard frequency, 1000 K.C.

The rich new solid walnut Super Sky Rider (Copper Lined) shown in the illustration above is now available at your jobbers.

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the hallicrafters inc.

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AMERICA'S LEADING MANUFACTURER OF COMMUNICATION RECEIVERS
TO EVERY AMATEUR—
WE RECOMMEND the NEW 1937
SUPER SKY RIDER
NOW AVAILABLE On Our TIME PAYMENT PLAN

BECAUSE we have operated the Super Sky Rider, because we have seen it
built — and because we are exclusively a receiver house and feel ourselves
competent to judge performance — we can enthusiastically recommend the
Super Sky Rider to every amateur as one of the finest communications receivers
obtainable.

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of our favorable time Payment Plan.

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THAT MAKE THE
SUPER SKY RIDER
THE OUTSTANDING
COMMUNICATIONS
RECEIVER OF THE YEAR

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• 40 M.C. to 535 K.C. in 5 bands.
• 338 Degrees main tuning dial.
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• Field strength indicator
• Improved 10 meter performance.
• 465 K.C. iron core I.F. for im­
proved selectivity.

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Gentlemen: Please send me complete details of the New 1937 Hallicrafters Line and the
Hinds & Edgarton Time Payment Plan.

NAME ________________________
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OPERATED BY W9APY AND W9WR

Say You Saw It in QST — It Identifies You and Helps QST
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Bowdoin-Kent's Island Expedition Reports:

"Aid Secured... Under Most Trying Conditions
-a Tribute to Burgess Portable Power"

"Expedition boat lost in dense fog—unable to reach base on Kent's Island"—so runs radiogram received from W. A. O. Gross (left), director of the Bowdoin-Kent's Island Expedition. But he continued

—"Aid was secured by communicating with five-meter transceiver which was operated for a very long time under most trying conditions—power source—Burgess Batteries—this incident constitutes a real tribute to your product."


BURGESS BATTERY COMPANY
Freeport, Illinois
# Ultra High Frequency Tubes — Medium Power

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# Ultra High Frequency Tubes — High Power

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— and be sure of

"More Watts per Dollar"

**TAYLOR Carbon Anodes**

Taylor Carbon Anodes can be run at red heat without injury to filament emission but Taylor Carbon Anodes will not show any color when run at the rated plate dissipation.

All leading radio parts distributors recommend Taylor Tubes.

Get your copy of the New Taylor Tubes Combined Catalog and Handbook No. RM from your favorite distributor or write to us...FREE.


Say You Saw It in QST — It Identifies You and Helps QST
HAMMARLUND proudly presents a new, complete series of "MC" variable condensers with exclusive features that set a new and dominant standard for condenser design.

Single and split-stator types use cadmium plated, soldered brass plates and Isolantite insulation to assure lowest losses and highest efficiency under all conditions of temperature and humidity. Strictly noise-free operation, even at the ultra-high frequencies, is insured with a new split type rear bearing plus a new noiseless, silver plated Beryllium wiping contact.

Available in 27 different sizes — single and split-stator models — 20 to 325 mmf. — midline or semicircular plates — single hole panel and base mounting. Illustrated above, are the "MC" single type with midline plates, and the "MCD-MX" split-stator type with double-spaced midline plates.

A special leaflet completely describing these new "MC" condensers has just been prepared and will be sent to you, free of charge. Just mail the coupon below.

HAMMARLUND MANUFACTURING CO., INC.
424-438 W. 33rd St., New York City

☐ Check here for new "MC" leaflet.
☐ Check here for new Hammarlund "37" Catalog.

Name ........................................ 
Address ........................................ 

Hammarrlund's 25th Year

Say You Saw It in QST — It Identifies You and Helps QST
Section Communications Managers of the A.R.R.L. Communications Department

All appointments in the League's field organization are made by the proper S.C.M., elected by members in each Section, or other appointments he can tell you about them, too.

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* Officially appointed to act until the membership of the Section chooses the permanent S.C.M. by nomination and election.
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.

Hiram Percy Maxim, Founder

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State College, Pa.

Vice-President ...... GEORGE W. BAILEY, W1KH
Weston, Mass.

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West Hartford, Connecticut

Treasurer .......... ARTHUR A. HEBERT, W1ES
West Hartford, Connecticut

Communications Mgr. . F. EDWARD HANDY, W1BDI
West Hartford, Connecticut

General Counsel ...... PAUL M. SEGAL
1010 Shoreham Building, Washington, D. C.

Address all general correspondence to the executive headquarters at West Hartford, Connecticut
WITH this issue QST comes of age. Twenty-one years ago this month, in December of 1915, the early members of the American Radio Relay League received their first copy, a little blue-covered magazine of twenty-two pages. Our League itself is older, having been formed in the spring of 1914. The rapid growth of the relay idea soon made it imperative to have some means of regular contact between the members. Dedicated to this need, the first issue of QST was subtitled the December Radio Relay Bulletin. Our League of those days having almost no finances of its own, the magazine appeared as the private venture of Clarence D. Tuska and the late Hiram Percy Maxim, our secretary-editor and president of that time. Announcing now the attainment of our majority, we are proud to say that QST is the oldest radio magazine in this country and, as far as we are aware, the oldest in the whole world.

Our earliest years were hectic but immensely interesting. The avidity with which American amateur radio received a magazine of its own was inspiring. The office of our youthful editor, a college student, was in the attic of his home, the work done after class hours. The printing was done by the father of another local amateur. The finances were elementary: the month’s receipts had been so much, the membership list had now grown to so many, how many pages would this much money print? Thus QST straightway attained respectable proportions and was firmly ensconsed as the amateur’s own magazine. When an issue came off the press, the early officers of the League and the members of their family would devote an evening to wrapping the issue, a jub which was regularly done on a table in Mr. Maxim’s library. The copies were then put in a mail bag, tossed into Mr. Maxim’s car, and driven to the post office. What a far cry from today, when a considerable staff works the month long on the job and when machinery spins for days to grind out tons and tons of copy for readers everywhere!

The owner of a complete set of QST’s may well be proud of them. Filling nearly five feet of bookshelf, they truly constitute the five-foot shelf of amateur radio knowledge. They are a history of our entire movement, a record of its traditions, a textbook of its technical practices. So great is the amateur appreciation of QST that the early files have attained a considerable money value. Our Circulation Department has long had no copies prior to 1925 and we do not deal in the older copies, but we notice a brisk trade in them in “Ham-Ads.” Our first issue is now a collector’s piece and seems to command a price of about $15.00, the whole of Volume I at least $30.00, the pre-war issues generally several dollars apiece, the earlier post-war issues at least a dollar apiece, while a complete file is easily worth around $200.00. Of course this is just a sidelight but one that we think our readers may find interesting.

Since the war, QST has been owned by the League itself, that is to say, by the members of the League. A place where they may foregather for the discussion of triumphs and problems alike, it has been built largely by their own contributions. Certainly it may be said that it has been built altogether by that splendid spirit which is amateur radio’s. Since 1925 it has also been the official organ of the International Amateur Radio Union. Today it is read by nearly every amateur in America, by innumerable foreign hams, and copies find their way to almost every civilized spot on the globe. It will be found in every laboratory worthy of the name, including many a one of a foreign government.

When amateurs first began to work internationally, there were many persons who believed that this relationship would lend great impetus to the movement for an international auxiliary or synthetic language which could be readily mastered by peoples of every tongue. We ourselves thought so in those early days and devoted much study to the question. The project failed completely, for a rather astounding reason, and we don’t know but that it then and there sounded the death knell of the auxiliary language movement. The explanation now sounds simple: As amateurs sprang into existence in other countries, following the early transatlantic successes, they found it imperative to read QST as a guide to successful practice. As a result of this need to read and understand QST, countless thousands of foreign amateurs have acquired a satisfactory working knowledge of English. It is indeed called “QST English.” Thus English has become indisputably the language of international amateur radio. We have ourselves met and conversed in English with scores of foreign amateurs who as...
sort that their knowledge of the language came solely from the study of QST! (What a responsibility, considering the way we hams are tempted to mutilate our mother tongue!) We have perhaps talked too much about ourselves but it is supposed to be our privilege on this birthday. Because of the unique nature of QST as a medium through which amateurs everywhere may cooperate, QST has been happily privileged to contribute substantially to the advance of our art. Carrying the torch in many an uphill struggle, endeavoring always to conduct ourselves in terms of the greatest good to the biggest number, we have participated in many profound changes in amateur radio. We renew our pledge to strive ever onward to even greater things, and with your continued help we’ll do it! K. B. W.

Columbia Announces Annual Award to be Given America’s Outstanding Amateur Radio Operator

WILLIAM S. PALEY, president of the Columbia Broadcasting System, has announced the offer of a permanent award to be presented annually to that individual who, through amateur radio, in the opinion of an impartial Board of Awards, has contributed most usefully to the American people, either in research, technical development or operating achievement.

Mr. Paley has designated the American Radio Relay League as the permanent custodians of the award. Upon it will be engraved each year the name of the winner of the award. A smaller replica will be presented to the individual selected as the winner by an impartial board of experienced authorities on amateur radio activities.

Five noted men have been selected to serve on this Board of Award, it was announced by Mr. Paley on October 17th. The members of the board are Rear Admiral Cary T. Grayson, chairman of the American Red Cross; C. P. Edwards, director of radio for the Canadian Department of Marine; Anning S. Prall, chairman of the Federal Communications Commission; J. H. Dellinger, chief of the radio section of the United States Department of Commerce’s National Bureau of Standards, and A. E. Kennelly, professor emeritus of electrical engineering at Harvard University.

All members of the board are experienced authorities on amateur radio activities and their recommendations will be followed by Columbia in presenting the annual award of merit to the nation’s most outstanding amateur operator.

This action was taken because Mr. Paley felt that the useful service which amateur operators had rendered to stricken communities during the flood disasters in the early part of 1936 was only a single example of the very great contribution they have made to radio communication as it exists today. For the purposes of the award only persons living in the United States and Canada will be considered eligible. Such an arrangement will make possible a thorough and fair survey of accomplishment without regard to national boundaries but within a single geographical unit.

When Mr. Paley announced the original plan for the award he expressed the hope that members of the board would not look upon their duties as being in the nature of selecting the winner in a contest, but would endeavor to recognize outstanding work and experimentation done by amateurs and acknowledge meritorious service to the American people and to the advancement of radio communication.

“In the development of major industries, as in the growth of sports,” he said, “the amateur precedes the professional; and we in commercial broadcasting owe a debt of gratitude to those thousands of experimenting enthusiasts who first broke the ground in the limitless field that is radio to-day. The great progress that the amateurs have made in the past 20 years has been an inspiration to us in our particular sphere of endeavor. In establishing this annual award, I wish it to be an acknowledgment of the valuable contribution which amateur radio operators in the United States and Canada have made to radio science and communication, as well as to the public service which they have rendered in times of emergency.”

Mr. E. K. Cohan, Director of Engineering of the Columbia Broadcasting System, a member of the American Radio Relay League since its earliest days, made the announcement of the award, on behalf of Mr. Paley, at the Chicago Convention of the A.R.R.L. before thousands of amateurs assembled from all parts of the United States and Canada.

The exact nature of the award itself is at present in process of determination. Seven young sculptors of distinctive merit have been selected to submit their concepts and interpretations of a design for the trophy. Each is giving very considerable thought to the design in an effort to develop something distinctly in the spirit of amateur radio communication.

Inasmuch as it will take several months to collect and examine the data and recommendations on which the award will be based, it is not anticipated that the selection of the winner will be made prior to March 15th.
An Inexpensive Five-Band Low-Power Transmitter

A 20-Watt Output Rig Suitable for C.W. or Plate-Modulated 'Phone

By George Grammer,* W1DF

SELECTING a design for a low-power transmitter capable of operating both c.w. and 'phone on all regular communication bands is not altogether easy. When it becomes necessary to balance cost of tubes, apparatus, and power supply against simplicity, ease of operation and power output (especially modulated power output), some careful figuring is required in order to reach a satisfactory conclusion.

Probably the great majority of low-power transmitters average a power input of about thirty watts. At this power level a very effective transmitter could be built up using a small transmitting pentode as the output tube—but a 500-volt plate supply would be required, and there would also be the necessity for special arrangements should plate modulation be used. Furthermore, it is doubtful if any appreciable saving in apparatus would result, since to cover a number of bands with one crystal practically the same number of tuned circuits is required regardless of the tube line-up.

In planning the transmitter to be described, therefore, it seemed to us that the most economical way to get effective performance, both c.w. and plate-modulated 'phone, on all five bands was to use inexpensive receiving tubes, provide as many stages as might be necessary to give adequate excitation for the final amplifier on all bands, and use straightforward, time-tried circuits. Although there are four stages in all, the transmitter is fundamentally simple both in design and operation, and its performance has justified the reasoning behind it.

As we have intimated, the necessity for 'phone operation was a consideration in the design of the set. The description of the modulator, however, will be left for a later issue, the present article being confined to the transmitter itself, an antenna coupler, and the power supply.

THE TRANSMITTER CIRCUIT

The circuit diagram is given in Fig. 1. The crystal oscillator tube is a 41, used in the standard pentode circuit. The output of this tube may be fed either to a 41 doubler connected as a high-µ triode, or to a 41 neutralized amplifier-doubler also used as a triode, but with the screen tied to the plate. The doubler stage is used only when it becomes necessary to operate the final amplifier on a frequency four times that of the crystal. The final stage uses two 42's in push-pull, used as triodes with screens and plates tied together.

Considering now some of the individual features of the practical circuit diagram, it will be observed that parallel feed is used on all three driving stages. This was done because, since it was deemed desirable to build the whole transmitter on a metal sheet to obviate grounding difficulties and unwanted interstage couplings, it permitted mounting most of the tuning condensers directly on the metal base and eliminated the need for the insulation which series feed would have required. Parallel feed has the incidental advantage that there is no danger of accidental

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*A Assistant Technical Editor.
A PLAN VIEW OF THE TRANSMITTER WITH THE 1.75-MC. COILS IN PLACE

The location of the various components is discussed in the text.
tube socket. The doubler cut-out switch is next in line, to the right of the doubler tube and $L_4$. Next, to the front, is the driver neutralizing condenser, $C_{15}$, with the driver tube directly behind it. To the right of the driver tube is its plate coil, $L_3$; in front of $L_3$ is the driver plate tank condenser, $C_9$. These are followed by the two tubes of the final amplifier, then the final plate tank condenser, $C_{14}$, and last, the plate tank coil $L_4$.

Inspection of the photograph will show the placement of the few remaining parts above the baseboard. The plate blocking condensers, $C_5$, $C_7$, and $C_{12}$, for the oscillator, doubler and driver tubes respectively, are mounted by their wire leads close to the plate prongs on the tube sockets. The doubler and driver grid condensers, $C_3$ and $C_5$, are likewise close to the proper socket prongs and to the movable arms of the switch to which they are connected. The grid leaks, $R_3$ and $R_4$, are mounted close to the condensers. The final amplifier cathode by-pass condenser, $C_{14}$, is between the two tube sockets. The oscillator feedback condenser, marked $C$ in the diagram and shown dotted between oscillator plate and grid, is of very small capacity and is made by bringing a short length of No. 14 tinned wire near the lead between the oscillator tube grid prong and the crystal socket. It can be seen in the top view photograph. A connection is brought from the stator plates of $C_1$ to an unused prong on the crystal socket, and the wire "condenser" is soldered to the same prong. Separation between the two wires is about 1/16 inch, and the wire connected to the plate circuit is about 1 1/8 inches long. This condenser may not be needed, although the grid-plate capacity is so low in the 41 that it may be difficult to get a low-frequency crystal, especially one ground for 1.75 mc., to oscillate without it.

All above-board wiring is of No. 14 tinned copper wire. Grounds are made directly to the metal sheet by the shortest possible connections. The switch, $S_w$, is a standard product which comes furnished with a fibre cross piece. This has been removed and replaced by one homemade from bakelite in the interests of better insulation for the r.f. which the switch must carry.

Terminal strips for the various connections are mounted along the rear edge of the baseboard. The plate milliammeter, mounted on the small bakelite panel fastened to the baseboard with angle brackets, is at the rear center, with the plate jacks on either side. The latter are mounted underneath the board, and project into holes through the base so that the meter plug goes in vertically. There is thus no danger of shock from touching the jacks.

The arrangement of parts underneath the baseboard is shown in another photograph. By-pass condensers and r.f. chokes are mounted as closely as possible to the above-board circuits to which

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they belong, and r.f. ground leads are short. Since all of the components on top of the board are fastened to the base by means of machine screws running through the board rather than by wood screws, plenty of ground connections are available. To mount the plate-current jacks, holes are drilled in the flat metal parts and the jacks fastened down by short wood-screws.

The neutralizing condensers for the final stage are mounted underneath the board as shown. Connections to these condensers are made as symmetrical as possible. None of the leads or metal parts of the condensers touch the wood; the condensers are mounted by means of wood screws running through the holes in the Isolantite end plates, and are held above the board by short tubular spacers. The condenser shafts project through holes in the baseboard so they can readily be adjusted from above by means of a screwdriver.

Chokes, condensers and resistors are as a general rule mounted on small bakelite lug strips except for those connections which go direct to ground. To avoid leakage, no r.f. leads are allowed to touch the wooden base, all holes through which such leads are run being drilled large enough to allow plenty of clearance. The plate feed connection for the final stage is made through a jack-top porcelain feed-through insulator.

Referring once more to the top of the baseboard, it will be noted that $C_3$, the driver tank condenser, is mounted on porcelain standoffs (the particular ones used are National Type GS-1 with the metal parts removed). This is necessary to insulate $C_3$ from the metal base, since both sides of the condenser are at high r.f. potential because of the neutralizing circuit.

**THE ANTENNA COUPLER**

A satisfactory system of antenna coupling for any transmitter, whether low- or high-power, always is a problem, especially when it is not known in advance what type of antenna is going to be used. The coupler illustrated in the photograph is a compromise outfit, particularly adaptable to use with antenna systems involving a ground connection or tuned feeders. It is essentially simple, consisting of a pickup coil, a pair of tuning condensers, and a switch for connecting the condensers either in series or parallel with the coil and feeders. Provision also is made for the insertion of loading inductance, should it be needed, by means of the four-prong socket on the coupler baseboard. The circuit diagram is given in Fig. 2.

The arrangement is such as to permit variable inductive coupling between pickup coil and final-amplifier tank coil. The coupler baseboard measures 9 inches wide by 8½ inches deep; the runners underneath are 1¾ inches high so that the left-hand edge of the baseboard can slide over the transmitter baseboard without touching it. The left-hand runner is 1½ inches from the edge of the baseboard. The pickup coil, $L_1$ in Fig. 2, is mounted on a 1¾- by 2½-inch platform of bakelite which projects off the edge of the board and is in turn mounted on a wooden riser which brings the axis of the pickup coil to the same height as the axis of the final tank coil in the transmitter.

Coupling between the two coils can readily be varied by moving the antenna-coupling unit about so that the spacing between the two coils can be changed. The general view of the set shows moderately-close coupling between the two coils.

Should link coupling be preferred to inductive coupling, the pickup coil may be omitted from the antenna coupler, the antenna coil and its link being wound on a four-prong form and plugged into the socket on the base. Identical links would then be used at both transmitter and coupler end. Some amateurs may prefer this method to the inductive coupling shown, especially if it is desirable to locate the antenna coupler some distance from the transmitter.

The fibre strip on the series-parallel switch should be replaced by a bakelite strip, just as was done with the switch in the transmitter.

The two tuning condensers are mounted on a half-inch wide bakelite strip 7 inches long, which in turn is mounted somewhat above the wood. This avoids any possible leakage through the wood, a precaution which is not hard to take.

**POWER SUPPLY**

The power supply needs little comment, since it is quite conventional in design. Inexpensive receiving-type components are used throughout.

The particular transformer specified has just about the right power capacity and voltage output to run the whole rig without difficulty, being loaded to about rated capacity when all four stages are working. Using either an 83 or 83-V rectifier, the output voltage is approximately 380 under full load. No bleeder is used, the chief reason for its omission being to avoid overloading the transformer. A light bleeder of about 50,000 ohms might be used to discharge the condensers when the transmitter is out of operation, if desired, although normally the condensers will discharge through the tubes in the transmitter when the primary power is shut off.
To avoid the expense of a separate filament transformer, the filament winding on the power transformer is used to supply the heaters of the tubes in the transmitter. During stand-by periods between transmissions, therefore, the power supply must be left "on" in order to keep the tube heaters up to temperature. The simplest switching method is to open and close the negative connection between the power supply and transmitter, a system which, while perfectly satisfactory from an operating standpoint, places quite a strain on the filter condensers during stand-by periods when the power supply is delivering no current. Electrolytic condensers with ordinary surge ratings will not stand up under this treatment; special condensers with high surge ratings must be used. The particular condensers specified have been found to be satisfactory in this service. We do not recommend the paper replacements for an 8-µfd. electrolytic because, although they are satisfactory from the voltage standpoint, a paper replacement for an 8-µfd. electrolytic has considerably lower capacity and the filtering is inadequate.

**OPERATION**

Considerable flexibility is possible in the method of operating the transmitter to get output on various bands. Recommended combinations are given in the table below:

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<tbody>
<tr>
<td>1.75</td>
<td>Cut out</td>
<td>3.5</td>
<td>7.0</td>
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<tr>
<td>1.75</td>
<td>3.5</td>
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<td>1.75</td>
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<td>3.5</td>
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<td>3.5</td>
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<td>7.0</td>
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<td>28</td>
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</table>

From this table it can be seen that the "doubler" may be used either as a doubler or quadrupler, and the "driver" as either a straight amplifier or doubler. For working on the band next above that in which the crystal frequency lies, it is recommended that the driver be used as a doubler rather than to use the regular doubler and feed the driver as a straight amplifier; the excitation to the final stage is about the same with either method and cutting out the doubler is simpler from the operating standpoint.

With quadrupling in the second stage, quite good output can be obtained from the final stage at eight times the crystal frequency. The excitation for the final is lower, of course, than with successive doubling in each stage, and this procedure is therefore recommended for c.w. work only, not for 'phone. However, it offers a ready means for working four bands with one crystal. If the builder is the holder of a Class-B license, opera-

**COMPLETE SET OF COILS FOR ALL FIVE BANDS**

Note the flexible center-taps on the final-amplifier tank coils in the foreground. The G. R. plugs on these leads are inserted in a jack-top feed-through insulator on the baseboard.

<table>
<thead>
<tr>
<th>COIL DATA</th>
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<tbody>
<tr>
<td><strong>Freq. Me.</strong></td>
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<tr>
<td>------------</td>
</tr>
<tr>
<td>L1</td>
</tr>
<tr>
<td>L2</td>
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<tr>
<td>L3</td>
</tr>
<tr>
<td>L4</td>
</tr>
<tr>
<td>L5</td>
</tr>
</tbody>
</table>

**NOTE.—**Taps are counted from lower (ground) end of coil. Higher taps on L1 go to grid of driver through Sw; lower taps to grid of doubler, also through Sw. L1, L2 and L4 are wound on Hammarlund bakelite plug-in forms; four prong. L4 for 1.75 Me. is wound on bakelite tubing; for 3.5, 7, and 14 Me., the coils are Barker and Williamson Nos. 80A, 40A and 20A respectively, with taps soldered to center turn. L4 for 28 Me. has turns cemented to celluloid strips. Turns on all coils should be spaced evenly to fill the length specified above.

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TUNING ADJUSTMENTS

Tuning is not a complicated process, although it should be carried out with care. Connect the power supply and key, and connect jumpers across the external bias and modulation terminals. If a second d.c. milliammeter of about 0–50 or 0–100 range is available, it may be connected to the bias terminals to measure grid current in the final stage. Useful accessories for tuning are a small neon bulb, a thin stick whittled at the end to serve as a screwdriver for adjusting the neutralizing condensers (the use of such a tool rather than a regular screwdriver avoids unwanted capacity effects), and a phone plug which is left open.

The first step is to get the oscillator working. With the crystal and the proper oscillator plate coil in their sockets, open the doubler switch, Sw, and insert the meter plug in the oscillator plate-current jack. Put the dummy plug in the driver plate-current jack; this will open the driver plate circuit and prevent the tube’s drawing excessive plate current during the adjusting process. The key should be open to perform the same job for the final stage. Now turn C₁ down slowly from maximum capacity until the oscillator plate current dips from its non-oscillating value of about 50 milliamperes to about 10 or 15 milliamperes, indicating oscillation.

Assuming that the driver tube is to be operated on the same frequency as the oscillator, insert the proper coil in its place circuit and, without changing any of the plugs, close Sw in the rear position (in the photograph, upper position in Fig. 1). Closing the switch probably will cause the oscillator to stop, so C₁ must be retuned to make it start again; the proper condenser setting will be found at a lower value of capacity. Touch the neon bulb to the grid of the driver and adjust C₁ for maximum glow. The driver is now ready for neutralizing.

To neutralize the driver, touch the neon bulb to one side of C₂ and rotate C₃ slowly until the bulb glows. Tune for maximum glow, then adjust the neutralizing condenser, C₁₅, to cause a reduction in glow. With each adjustment of C₁₅, readjust C₃ to maximum glow, which indicates that the tank circuit is in resonance with the crystal frequency. It probably also will be necessary to re-adjust C₁ slightly to keep the oscillator at maximum output, since changing C₃ and C₁₅ will change the oscillator tuning slightly. Continue the process until a setting of C₁₅ is found at which it is impossible to get the neon bulb to glow for any setting of C₃. This point of neutralization is quite sharp, and moving C₁₅ slightly in either direction will cause the glow to reappear. Once the correct setting of C₁₅ is found, it need not be changed for various bands provided the driver plate coils are wound carefully with uniform spacing between turns, and providing the taps on the coils are on the center turn.

Once the driver is neutralized, the meter plug may be transferred from the oscillator to the driver jack. Rotate C₃ until the driver plate current drops to its lowest value, which indicates resonance. This minimum plate current at resonance should be about 10 to 15 milliamperes with the key open; with the key closed it should rise to about 30 ma.; the exact value will depend upon the band on which the transmitter is operating. There should be a substantial neon glow at the grids of both final-amplifier tubes.

To use the driver as a doubler, insert the proper plate coil in the socket and tune C₃ as before, leaving the neutralizing condenser untouched. The plate-current dip should be about as with straight amplification. In both cases, the plate-current with C₃ set off resonance should be in the neighborhood of 70 or 80 ma.

**FIG. 3—POWER SUPPLY DIAGRAM**

- **T**—Power Transformer, 375 v. each side center-tap, with 6.3-volt and 5-volt windings. (Thordarson T-7062).
- **L**—Filter choke, 8.75 henrys at 150 ma. (Thordarson T-1700).
- **C₁, C₃**—8-µfd. high-surge electrolytic condensers (Malory UR-187).
A Versatile Crystal-Controlled U.H.F. Transmitter

A Compact 100-Watt Design for 14-, 28-, and 56-Mc. Operation with Automatic Control Including VODAS for 'Phone

By Walter H. Grosselfinger,* W2ATQ, and Thomas Prosser**

The progress of amateur communication on the ultra-high frequencies has been aided greatly during the past few years through the development of more efficient circuit components. The radio transmitter described here makes use of two of these by incorporating vacuum tubes designed expressly for ultra-high-frequency operation.

The WE306A vacuum tube is a pentode of the filamentary type having low internal capacities and a center-tapped filament which adds to the efficiency by effectively reducing the inductances in the filament circuit. The WE305A, a four-element screen-grid tube, provides an efficient amplification medium on the three bands for which the transmitter was designed. The final amplifier operates at an efficiency of 55-75% depending upon the frequency band used. Normal input to the final amplifier is 160 watts.

Stability of the carrier is maintained to better than 0.04% of the specified frequency regardless of temperature, humidity or modulation, by the use of a low-coefficient quartz plate ground to seven megacycles. One quartz plate is satisfactory for the three frequency bands on which the transmitter operates. Plug-in coils were used where mechanical design did not interfere with the efficiency of the circuit arrangement.

An outstanding feature of the unit is its simplicity of operation with the “Voice Operated Delayed Amplification System” (VODAS). The “VODAS” is an adaptation of the system used in commercial telephone circuits and defined “Voice Operated Device Anti-Sing.”1 This system is inferior to commercial types but is satisfactory for amateur service. The entire radio transmitter is placed in an operating condition by pressing one of the control buttons located either at the remote position on the speech amplifier or on the rectifier unit. The key switch provides for the selection of either of three types of operation, “VODAS-CW-Manual.” In either operating position, circuit and relay adjustments are so arranged that relays operate to ground the antenna and open the plate supply voltage on the receiver before the radio-frequency carrier is applied to the antenna; it is not necessary in the “VODAS” position to make any manual circuit changes while operating the communications system. As an added protection to the receiver, a neon tube is placed between the grid of the first tube and ground. In the “CW” position, the telegraph key operates the necessary relays and performs the same function. For the “Manual” position the key on the speech amplifier is moved to “Manual” to apply the carrier and place the receiver in a non-operative condition. Keying at 30 w.p.m. with break-in is accomplished. Return to the “CW” position operates the receiver and shuts off the transmitter carrier; that is, if the telegraph key is not operated. The entire transmitting system is shut off by C-bias failure or pushing either of two stop buttons, one located on the transmitter and the other on the speech amplifier.

The stability of the transmitted carrier justifies the use of the new commercial u.h.f. radio receivers which are certainly far too selective to receive the present frequency-modulated radio transmitters on the 56-megacycle amateur band.

* 2473 Elm Place, N. Y. C.
** 542 Eastern Parkway, Brooklyn, N. Y.

1 “Sing” is expounded as audio feedback.

FIG. 1—THE COMPLETE TRANSMITTER (AT THE LEFT) IN ITS HOME LOCATION AT STATION W2ATQ

The speech amplifier unit, with the superhet receiver at its right, is on the operating table.

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The audio frequency characteristic of the entire transmitting system is uniform to within 2 db over the 50- to 11,000-cycle range. The acoustic fidelity was not measured. The distortion factor measured at 400 cycles with a General Radio distortion factor meter is 4% at 85% modulation.

We consider this unit "portable" only because we have been using it for such work. It weighs 400 pounds complete. However, it was simple to "break down" the units and transport them. The transmitter has traveled both in automobiles and boats with equally successful results. Thus far it has seen little amateur service, having been used mainly in field strength measurements in the vicinity of 56 megacycles. The photo of Fig. 2 was taken on portable location at Manorville, Long Island, New York, where most of the tests were conducted. A double-voltage generator (900 volts d.c.-110 volts a.c.) was driven by the auto engine and connected to it by a single-plate disc clutch. The clutch arrangement allowed the car to be used without running the generator. Since about 4 horsepower are required to drive the generator, a disconnecting provision is quite an asset.

THE RADIO-FREQUENCY UNIT

The chassis model of the radio-frequency unit, for which the circuit is given in Figs. 4 and 5, was constructed entirely of cardboard prior to a satisfactory solution of apparatus placement and shielding problems encountered. Drawings for the metal model were then made and the transmitter became an actuality. The material for the chassis and shielding is \( \frac{1}{16} \) -inch soft aluminum which can be bent in either direction without fear of cracking. All drillings were made before assembly and a \( \frac{3}{8} \) -inch lip was bent on each piece of shielding wherever it butted against another piece. All component parts of the shielding were fastened with 6-32 binder-head brass machine screws, nuts and shake-proof lock washers. They were cadmium plated to maintain uniformity of appearance and to prevent corrosion. The chassis proper consists of thirteen individual pieces. Those adjacent to the WE305A tubes were given a high polish to aid in heat deflection. (See Fig. 3.) Much concern will probably be given to the compactness of the radio-frequency unit. It could probably be spread out to cover half of a relay rack, but this is neither necessary nor desirable. "Hot" leads are kept as short as possible and proper shielding improves the efficiency of the transmitter. (See Figs. 6 and 7.) No trouble was experienced as the result of heat in the modulator unit. However, in the radio-frequency section it was found desirable to use forced draft ventilation on the WE305A vacuum tubes when the transmitter is operated in a constant-carrier position. This was accomplished by the installation of a small blower placed in the r.f. unit under the 3rd amplifier tank circuit. Large Fahnestock clips connect to the studs at the top of the WE305A tubes to aid heat radiation. The transmitter has been in continuous operation for a twelve-hour period during which time field strength measurements were made at 100% modulation at the portable location in Manorville, Long Island, New York. The tuning was periodically checked.
and found stable at all times without readjustment.

The frame of the r.f. unit serves two purposes. It forms a sturdy mounting for the transmitter and with its cover completes the shielding of the radio-frequency unit. It is constructed of \( \frac{3}{8} \)-inch by \( \frac{3}{16} \)-inch extruded aluminum angle, fastened at the corners with gusset plates and \( \frac{5}{32} \)-inch diameter were punched in the covers to provide ventilation for the vacuum tubes and the resistances mounted in the voltage-divider compartment. This method of ventilation was preferred to screening because greater mechanical protection is afforded. Ventilating facilities were carefully planned, as the covers form a very vital part of the shielding system, particularly in

\[ \text{FIG. 4—CIRCUIT OF THE OSCILLATOR AND TWO DOUBLER STAGES OF THE R.F. UNIT} \]

\[ \begin{align*}
L_{1aT} & \text{ to } L_{1T}, \text{ inc.} \rightarrow \text{See coil table.} \\
L_{1T} & \text{ to } L_{2T}, \text{ inc.} \rightarrow \text{R.f. choke coils (Ohms-}
\
C_{1T} & \text{ to } C_{2T}, \text{ inc.} \rightarrow -0.002-
\
C_{2T} & \text{ to } C_{3T}, \text{ inc.} \rightarrow -0.001-
\
C_{3T} & \text{ to } C_{4T}, \text{ inc.} \rightarrow -0.002-
\
C_{4T} & \text{ to } C_{5T}, \text{ inc.} \rightarrow -0.002-
\
C_{5T} & \text{ to } C_{6T}, \text{ inc.} \rightarrow -0.002-
\
C_{6T} & \text{ to } C_{7T}, \text{ inc.} \rightarrow -0.002-
\
C_{7T} & \text{ to } C_{8T}, \text{ inc.} \rightarrow -0.002-
\
C_{8T} & \text{ to } C_{9T}, \text{ inc.} \rightarrow -0.002-
\
C_{9T} & \text{ to } C_{10T}, \text{ inc.} \rightarrow -0.002-
\
C_{10T} & \text{ to } C_{11T}, \text{ inc.} \rightarrow -0.002-
\
C_{11T} & \text{ to } C_{12T}, \text{ inc.} \rightarrow -0.002-
\
C_{12T} & \text{ to } C_{13T}, \text{ inc.} \rightarrow -0.002-
\end{align*} \]

\( \frac{1}{4} \)-inch aluminum rivets. It would be advantageous to substitute structural aluminum \( \frac{1}{8} \)-inch thick because of the tendency of the lighter extruded stock to warp when riveted. Two pieces of angle iron fastened at right angles on a bench will facilitate in maintaining squareness when drilling and assembling the frame. The gusset plates were made from \( \frac{3}{16} \)-inch half-hard aluminum sheet.

The covers for the frame were made of \( \frac{3}{16} \)-inch half-hard aluminum sheet. Perforations of

\[ \text{FIG. 5—THE PUSH-PULL FINAL AMPLIFIER CIRCUIT CONSTANTS ARE GIVEN UNDER FIG. 4} \]
final amplifier where a slight unbalance may cause erratic operation and consequently shorter tube life with a resultant loss in efficiency. A small trap door is provided for the meter-jack mounting plate. This door allows access for the measurement of the oscillator grid current, the second amplifier grid current, the third amplifier (buffer) grid current and p.a. grid current. Filament voltage is also checked at this opening, as is the antenna current, the plate current of the first harmonic amplifier, second harmonic amplifier, third amplifier and power amplifier.

Measurement of the grid current of either of the final amplifier tubes is possible through a toggle switch mounted at the rear of the chassis. A 3/16-inch aluminum crinkled finished mat covers the 1/2-inch aluminum panel. The entire unit is fastened to the frame by four thumbscrews shown mounted on the front panel. Small photosketched plates identify each control adjustment. A photostat copy is provided on the front panel describing the adjustment and voltage—current constants for the 56-28- and 14-Mc. bands.

The absence of dials or hand wheels may not appeal to some amateurs. However, screwed adjustments are a distinct advantage in portable work and less likely to disturbance by other than the operator. The front view of the unit (Fig 1) exposes the tuning and coupling controls. Beginning at the lower left and proceeding in a clockwise direction, these are the harmonic-amplifier tuning, first harmonic amplifier, second harmonic amplifier, power amplifier grid coupling, third amplifier plate tuning and power amplifier grid tuning controls. The power amplifier plate tuning control is reached through a similar opening at the rear of the transmitter. The antenna coupling is pre-set, whereas the link coupling is adjustable at the 3rd amplifier tank. The chart located under the controls designates the setting for the three frequency bands mentioned.

The oscillator-harmonic tuning unit, L1, plugs in just below the quartz plate mounted next to the oscillator tube, Fig. 6. From left to right in this view are harmonic tuning condenser, the first harmonic amplifier tank coil, L2 (not inserted), and switch Sw1T. On the upper shelf, left to right, are the quartz plate, WE306A oscillator, WE306A first harmonic amplifier and first harmonic amplifier plate tuning. The output of the first harmonic amplifier is directed through Sw1T to either the second harmonic amplifier grid, or the third amplifier, depending upon the frequency to be transmitted. As yet no suitable 14-Mc. quartz plate has been found to act as a satisfactory substitute for the 7-Mc. quartz plate in the frequency multiplication system here used. Although it is possible to quadruple to 56 Mc. in the second WE306A, higher efficiency is realized by doubling and using an additional WE306A as a doubler to 56 megacycles. The WE306A which operates on 56 megacycles is mounted in an inverted position underneath the second harmonic amplifier tank coil.

An interesting feature of this tuned circuit is the absence of a tank condenser and is illustrated in Fig. 8. As will be noted from the illustration, tuning is accomplished through a screw arrangement which compresses or expands the coil. The transmitter when used on 14 and 28 megacycles does not utilize this stage; consequently, it was not necessary to arrange the tank coil for removal. In addition to the switch (Sw1T) mentioned, Sw2T is required to connect the grid...
of the third amplifier to either the plate tank of the first or second harmonic amplifiers. The third amplifier (buffer) provides excitation for the two WE305A tubes, through link coupling, in a push-pull circuit operating with an efficiency of 55% at 60 megacycles.

Sw2T performs three operations; it connects the bleeder resistor across the B-supply when the second harmonic amplifier is not used, and selects the excitation from either the first or the second amplifier. The insertion of a bleeder resistor is of importance in maintaining constant the "B-C" supply load.

To prevent flashover of the power amplifier tuning condenser the antenna circuit is loaded by a 60-watt lamp during preliminary tuning adjustments; and QRM is eliminated. The shielding on one side of the power amplifier serves two purposes; on 14 Mc. this shield acts as one side of a condenser formed by two polished, rounded-edge aluminum plates placed 3/4-inch from the shielding. They may be seen in Fig. 6.

Connection to the two plates is made through link switches which add 25 µfd. to each of the power-amplifier tank condensers. These capacitances are indicated as C42T in Fig. 5.

FIG. 7—TOP VIEW OF THE R.F. UNIT AND ITS CASE

THE MODULATOR UNIT—"VODAS" OPERATION

Containing the Class "A" prime modulator consisting of two WE276A vacuum tubes, this

COIL DATA FOR R.F. UNIT
(7-Mc. Band Crystal)

<table>
<thead>
<tr>
<th>Output freq.</th>
<th>LoT</th>
<th>LoT</th>
<th>LaT</th>
<th>LaT</th>
<th>LaT</th>
<th>LaT</th>
<th>LaT</th>
<th>LaT</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 Mc.</td>
<td>¾&quot; d.</td>
<td>¾&quot; d.</td>
<td>¾&quot; d.</td>
<td>¾&quot; d.</td>
<td>1&quot; d.</td>
<td>1&quot; d.</td>
<td>1&quot; d.</td>
<td>1½&quot;-1½&quot; pancake</td>
</tr>
<tr>
<td>28 Mc.</td>
<td>Same as above</td>
<td>Same as above</td>
<td>¾&quot; d.</td>
<td>Not used</td>
<td>1&quot; d.</td>
<td>1½&quot;-1½&quot; pancake</td>
<td>1&quot; d.</td>
<td>1&quot; d.</td>
</tr>
<tr>
<td>14 Mc.</td>
<td>Same as above</td>
<td>Same as above</td>
<td>1&quot; d.</td>
<td>Not used</td>
<td>1&quot; d.</td>
<td>1½&quot;-1½&quot; pancake</td>
<td>1&quot; d.</td>
<td>1&quot; d.</td>
</tr>
</tbody>
</table>

* Wound on R39 rod with groove machined to retain wire.
unit, shown in Fig. 9, also houses the B-C supplies and the VODAS circuit. In the operative position, the relay $S_1M$ grounds the point “X” on the combination B-C power supply. By so doing, the three WE306A vacuum tubes in the transmitter are supplied with higher B voltage and normal C bias. At the same time the bleeder current plus the operating position for 1,200 milliseconds before releasing. It is admitted that this system is not very practical when the signal is received by a super-regenerative receiver such as is used by most amateurs on the five-meter band, but only because of the high inherent hiss level in the radio receiver. When the signal is intercepted by a superheterodyne receiver, such high noise output is absent.

Because of its weight, the modulator unit is built into a welded steel frame, cadmium dip finished to prevent corrosion. The side panels consist of 16-gauge sheet steel, black crinkle finished on the exterior and aluminum finished on the inside.

The front panel is removable to allow for adjustment of the C-bias voltages. Two jacks are arranged in the side of the unit for measuring the plate current of each WE276A vacuum tube. Relay $S_1M$ included in this unit prevents the application of plate voltage to any of the vacuum tubes in the r.f. unit when the B-C power supply is inoperative. Relay $S_2M$ in the speech amplifier unit is interconnected with $S_1M$ to provide additional protection. This is necessary because the two WE276A tubes receive their bias voltage from the speech amplifier supply and an oversight by the operator in turning on the speech amplifier would result in damage to the two WE276A tubes.

The weight of the modulator unit complete is approximately 60 pounds. All cables terminate in the back of this unit; that is, those from the rectifier, r.f. unit and speech amplifier. Connections are made quite simple by the use of Jones plugs, which are suitable for handling the voltages used. A resistance is wired in series with the filament of the WE276A tubes to compensate for the slightly higher filament voltages, made necessary by the voltage drop in the wiring and plug con-
connections between the modulator and the r.f. unit. The modulators easily modulate the two WE305A push-pull final amplifier tubes 100%.

THE MAIN POWER SUPPLY

The main power supply for the transmitter was given careful consideration before construction as a great deal of equipment had to be placed into a very small space. As illustrated in Fig. 11, the entire unit is unusually small when one considers the number of components contained therein. The frame is made of one-inch angle iron welded in the corners and cadmium plated to resist corrosion. Where necessary, steel strips are spot welded to the frame to hold the various relays, Rectox rectifier and the two carbon-pile variable resistors necessary to control the filament and plate voltages of the transmitter.

Again Jones plugs are used to connect to the other units. A 110-volt socket is provided as the inlet for the 60-cycle supply. A 12-volt 250-watt filament transformer supplies the filaments of all the vacuum tubes in the radio-frequency unit; a 300-volt transformer supplies the necessary voltage to the WE249B hot-cathode mercury-vapor rectifiers operating full-wave and feeding the 30-henry 500-ma. choke coil and 4µfd filter circuit. A glance at the rectifier circuit shows the bleeder resistor connected before the choke coil. This is a distinct advantage, because the choke coil is subjected to less load and therefore is not likely to become saturated. In this case the choke coil is rated well within its current carrying capacity and it was really unnecessary to connect the bleeder resistance in this manner except to retain good design practice. Within this unit is also the rectifier filament transformer and the 24-volt Rectox unit which supplies the relays mounted in the various units. Two pilot lights indicate the condition of the power system; one lights with the filaments of the vacuum tubes and the other when the plate voltage is turned on.

A 46 tube functions as the time delay device in conjunction with a small relay. Circuit conditions are such that the following sequence takes place when depressing the start button: Relay $S_1P$ is energized, holds itself in position and applies 110 volts to the filament transformer; the 46 tube lights at the same time as the other tubes in the transmitter, since it is supplied by the same source of voltage. In series with the filament is a rheostat known as the time-delay speed control, so
named because it regulates the speed at which the filament of the 46 tube lights. This can be controlled over a 0-15 second period and has proven most satisfactory. When the 46 tube has attained an operating condition, the 110-volt rectified a.c. flows through the relay S2P which operates the plate supply relay S2P. As S2P assumes its full travel, it breaks the filament circuit of the 46 tube, replacing it to a cold condition (ready for the next delay action), "makes" a holding contact and applies the 110 volts to the plate transformer primary. Depressing the stop button breaks the relay circuits and replaces the trans-
mitter to a ready-to-operate condition. It should be mentioned that this sequence is not attainable if the safety relays connected in series with the stop switch are not in the operate position. Explanation of their function is given in the individual units in which they are located. There is one obvious weakness in the power supply; the carbon-pile resistors vary considerably with temperature. However, in order to conserve space their use was required.

As in the modulator unit, the exterior is black crinkle finished with aluminumspray interior. The perforated screen on the tube side of the rectifier facilitates their

FIG. 11—THE MAIN POWER SUPPLY UNIT

FIG. 12—CIRCUIT OF THE SPEECH AMPLIFIER UNIT

QST for
placement. Four steel bolts threaded into the four corners of the frame are adjustable for levelling purposes.

SPEECH AMPLIFIER

Mechanically the speech amplifier, shown on the operating table in Fig. 1, consists essentially of three parts; the chassis, panel and box. The chassis proper is constructed of \( \frac{3}{32} \)-inch soft aluminum bent to form a "dishpan," the corners of which are welded. Because of the size of the stock used, it was necessary to use soft aluminum. After all punchings and cutouts were completed, the chassis was sand-blasted. Later it was heat treated to increase its rigidity, necessary because of the weight of the components. The box and panel were constructed of 14-gauge sheet steel. The panel and rear of box are of similar construction, being bent to form shallow pans \( \frac{3}{8} \)-inch deep, the corners of which are welded. The back was spot welded to the box proper which is made of one piece bent to form a rectangle, welded at the junction of the two ends. Reinforcing ribs were welded on the inside of both top and bottom of the box. The front panel is connected by two \( \frac{3}{32} \)-inch formed brackets. The front panel is covered by a mat on which all the designations are engraved. Aluminum was used for the chassis, since it was decided that stray fields would be held to a minimum.

All of the mechanical design follows good standard practice. Protective finishes have been applied in accordance with the specific requirements of the various components. The outside of all of the units was given a black crinkle finish baked on. The entire finishing job was done at one time to assure uniformity of appearance. All screws, nuts and washers used are brass, cadmium plated, as is the steel framework.

ANTENNA SYSTEM

Some very efficient and yet simple coupling arrangements have been devised for use with the various antennas constructed. Concentric lines were chosen for transmission in all cases because their losses are extremely low, about 2 db per 1000 feet. Since the impedance of a concentric line constructed of \( \frac{3}{8} \)-inch de-oxidized refrigerator tubing and No. 14 gauge wire is about 70 ohms, it is obvious that it would be desirable to connect this at the center of a half-wave antenna. The coupling unit used in the tests on Long Island was constructed in the field with the aid of a plumber's soldering copper and material available in any auto supply store. This antenna system is illustrated in Fig. 12. The antenna was constructed of \( \frac{3}{8} \)-inch hard brass tubing into which was telescoped a \( \frac{1}{4} \)-inch tube arranged so that it could be tuned and adjusted to the proper frequency and then clamped into place by a setscrew. A yard-arm 10 feet long was installed on the mast supporting the antenna and found to be the most satisfactory solution for the erection of a vertical system.

Fig. 13 shows the antenna mounted on the bumper of the automobile. It has given very satisfactory mechanical and electrical performance regardless of the fact that the car was driven at close to maximum speed at various times. The sketch of Fig. 14 shows the simple constructional details. The antenna consists of a steel fishing pole \( \frac{3}{4} \)-wave long mounted in a "bee hive" insulator supported on a 2-foot section of \( \frac{3}{8} \)-inch brass tubing and is fed by a concentric line. The antenna is made in three sections for simple removal when not in use.

Adjustment of the antenna was accomplished with the aid of a field-strength meter completely shielded and connected to the end of the transmission line. A piece of wire was substituted for the steel fishing rod and was cut down until maxi-
mum strength was indicated on the rectifier-microammeter used as the indicating device. This was later replaced with the fishing rod cut to length.

from its socket to prevent application of the high voltage to the buffer and power amplifier tubes. The speech amplifier is turned on by turning the "VODAS" sensitivity knob, located at the right side, so that the relay S1P is energized to allow operation of the control circuits associated with the radio transmitter. Depressing the start button on the speech amplifier or transmitter unit operates the relay S1P, thereby lighting the filaments of all the vacuum tubes and applying B-voltage and C-bias for the oscillator and harmonic amplifier stages. Moving the key to the "Manual" position removes the high bias from the oscillator and harmonic amplifier vacuum tubes and places them in operative condition. The grid milliammeter plug is inserted in the oscillator grid circuit jack and the oscillator tank condenser located in the bottom of the oscillator coil is adjusted for maximum current. The grid meter plug is then inserted in the first harmonic amplifier grid circuit jack and the oscillator tank harmonic circuit is tuned for maximum grid current. It is advisable to recheck the oscillator tank condenser before proceeding with further adjustments. Insert the grid meter into the second harmonic amplifier grid circuit jack and tune the plate tank circuit of the first harmonic amplifier for maximum grid current indication. The grid meter is now inserted in the grid circuit jack of the third amplifier or buffer circuit, again tuning for maximum grid current by adjustment of the second harmonic amplifier tank circuit. Plate voltage may now be applied to the buffer and power amplifier stage. The same grid meter used for previous adjustment is inserted in the power amplifier grid circuit and the plate tank of the third amplifier is tuned for maximum indication.

If the link tuned circuit is badly out of adjustment, it may be necessary to use the plate milliammeter for resonance indication in this circuit. In most cases this was found necessary upon the installation of a new set of coils whose characteristics were not known. It should be remembered that as soon as grid current flows in the power

A more practical arrangement for permanent installation in a congested section of New York City was considered desirable. This is shown in Fig. 15. It consists of a 3/4-wave section of brass pipe with a 1/4-wave matching section mounted 10 inches to one side and fed by a concentric transmission line. Since the end of the antenna is grounded, it also affords additional protection against electrical storms.

TUNING PROCEDURE

The 56-Mc. coils are inserted as indicated in the table and the 46 time delay tube is removed

<table>
<thead>
<tr>
<th>Steel Fishing Rod 4' long</th>
<th>30 Caliber Cartridge Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Bee Hive&quot; Insulator</td>
<td>6&quot; Standoff Insulator</td>
</tr>
<tr>
<td>clamp over bumper</td>
<td>Concentric Transmission Line</td>
</tr>
<tr>
<td>Ant. Support</td>
<td>Insulator</td>
</tr>
</tbody>
</table>

AUTO ANTENNA

PERMANENT ANTENNA

FIG. 15—CONSTRUCTIONAL DETAILS OF THE CAR ANTENNA
FIG. 16—CONSTRUCTIONAL DETAILS OF THE PERMANENT ANTENNA FOR FIXED LOCATION

It uses a quarter-wave matching section with concentric transmission line feed.


QST for
What the League Is Doing

League Activities, Washington Notes, Board Actions—For Your Information

Elections

What promise to be the “largest” elections in A.R.R.L. history are being held this month, when eight divisions are choosing directors and alternates. At this writing it seems that there is to be a contest in practically every division and we expect that something like 11,000 ballots will be mailed out from League headquarters. The Committee of Tellers, and its staff will have a very busy day cut out for it on December 21st, when the ballots are opened and counted. There will be a special broadcast of election dope from W11NP that evening.

Code Exams

Not only must the applicant for an amateur license copy correctly for at least one minute at thirteen words per minute; he must also demonstrate his ability to send without error at that speed. In some of the examining offices the testing of sending speed is a new thing. Every amateur going up for examination should be prepared for it. We mentioned in QST a few months back that a candidate would be accorded up to three opportunities to transmit without error at thirteen w.p.m. This does not mean that three separate tests are given the applicant, with an announcement by the Inspector that the candidate has failed Trial No. 1 and will now commence Trial No. 2. It is all done in one effort. The candidate starts, sending from copy, and the Inspector holds a stop-watch on him. If he proceeds without error, he is stopped after a minute and told that he has passed. If he makes an error, the Inspector resets the stop-watch to zero, saying nothing but commencing the count again. In the event of another error he does the same thing. If, unfortunately, left an ugly crease down the front cover and frequently made it difficult to straighten out the magazine. We have always been disappointed at the unfavorable comparison in appearance of members’ copies and newsstand copies. We have frequently tried flat mailing, but it has never before seemed secure. Now after considerable experimenting and the acquisition of some special machinery, we believe we have it licked. If it doesn’t work out, of course we’ll go back to folding, but we hope that we can now deliver your copies in better condition. Our circulation manager would be interested in knowing your reactions to the new method and particularly to have reports of any unfavorable results that are noticed from the change.

Mailing

QST Flat QST comes to you this month mailed flat without a fold, realizing a dream of years. For a long time back, the magazine has been folded vertically when wrapped for mailing. It made a secure package that carried QST safely to the most remote corners of the world but, unfortunately, left an ugly crease down the front cover and frequently made it difficult to straighten out the magazine. We have always been disappointed at the unfavorable comparison in appearance of members’ copies and newsstand copies. We have frequently tried flat mailing, but it has never before seemed secure. Now after considerable experimenting and the acquisition of some special machinery, we believe we have it licked. If it doesn’t work out, of course we’ll go back to folding, but we hope that we can now deliver your copies in better condition. Our circulation manager would be interested in knowing your reactions to the new method and particularly to have reports of any unfavorable results that are noticed from the change.

Collected Rotteness

How would you fellows like to see all of the “Rotten” stories of the Old Man gathered into a book something like De Soto’s history and selling for about a buck? Since the passing of Mr. Maxim we have received many suggestions from old-timers that this be done. We have just been reading over the stories. We find them immensely interesting and amusing, but we are of course examining them from the background of amateur experience through the days in which the stories were written. Good old T.O.M. and the Wouff Hong! Boy, what a story! But what we do not know is whether the amateurs who did not live through those days would be interested in owning such a book. Of course we think the thing is practically priceless, but then we’re prejudiced and we simply do not know. The editor would consider it a great favor if members who feel an interest in the subject, one way or the other, would be so kind as to drop him a postcard with some expres-

(Continued on page 70)
Operating Notes on the Transmitting-Type Beam Power Tube
An Experimental Exciter-Low-Power Transmitter Using the 807

CHARACTERISTICS and ratings of the new 807, transmitting counterpart of the 6L6, are given elsewhere in this issue. The tube offers the advantages of 25-watt output at a plate supply voltage not exceeding 400 volts, and the ability to operate efficiently with very low driving power—two features which do not need further comment. When early models of the tube were received, the chief point of interest was whether or not the grid-plate capacity was low enough to enable operating the tube without neutralization, its rated value of 0.2 µfd. seemingly being about on the border line. To settle the question, we built up the little rig shown in the photographs, giving the tube the advantage of all the shielding that would be necessary with other types of tubes.

Previous experience with the small transmitting pentodes had indicated that one of the chief causes of self-oscillation was capacity coupling between the input circuit and the plate of the tube—often overlooked in comparison to the more obvious possibility of magnetic coupling between the input and output circuits external to the tube. To prevent the possibility of either type of coupling, therefore, a metal chassis was used as a base for the unit, and the coil connected to the grid circuit of the 807 was shielded. The tuning condenser for this coil was mounted below deck to prevent any stray coupling to the output circuit from this source. The plate tank circuit for the 807 was mounted on top of the chassis and was therefore completely isolated from the input circuit. As a means of preventing coupling between the plate tuned circuit and the grid wire running down through the tube a shield, high enough to reach the bottom of the plate, was placed about the lower portion of the tube as indicated in the photograph. With this setup it seemed fairly certain that any feedback would have to be through the tube itself.

Careful tests show that with shielding of this nature the tube has no tendency to oscillate at frequencies up to and including the 7-Mc. band; it functions as a true screen-grid amplifier. On 14 Mc. it will self-oscillate after a fashion, but usually with negligible power output. When separately excited, however, it settles down nicely and behaves like any normal amplifier, showing no tendency to go off on its own—this, too, when driven by the fourth harmonic of a Tri-tet oscillator operating at a very low power level. On the whole, therefore, we have found no occasion for attempting to neutralize the tube, which is fortunate, because it is always a rather messy job to neutralize a tube with such low grid-plate capacity.
when operating straight through. For doubling, somewhat higher bias is desirable than for straight amplification, although the value seems to be rather non-critical in either case. A 50,000-ohm grid leak is about right for doubling, 20,000 for Ca-100-µµfd. variable (Cardwell MR-IOSBS). C10-SO•µµfd. mica.

straight amplification; the straight-through output is cut only very slightly with a 50,000-ohm leak, however, so that the higher value might just as well be used for both purposes. With this leak resistance, a grid current of about 2 milliamperes gives optimum operation.

In the circuit shown in Fig. 1, the driving tube is an S9 Tri-tet, operated at 250 volts. Even with this low voltage on the plate of the oscillator, no difficulty at all was experienced in getting the rated tube output of 25 watts from the S07 on either 3.5, 7 or 14 Mc., using a 3.5-Mc. crystal in all cases. With the oscillator plate circuit, L4C2, tuned to the fourth harmonic of a 3.5-Mc. crystal and the 807 doubling to 28 Mc., the output was somewhat more than ten watts with a plate input of about 30 watts. With a 7-Mc. crystal, doubling in the oscillator plate and doubling again in the 807 stage, the output was better than 15 watts on 28 Mc., with the same input. The latter performance could be duplicated with a 3.5-Mc. crystal by using higher voltage on the oscillator. The tube shows better doubling efficiency when going from 7 to 14 Mc., as would be expected, the actual output being approximately 20 watts with an input in the neighborhood of 35 watts.

In all cases the tube was operated at or below the normal ratings, since the low-voltage possibilities are most appealing. Although the maximum plate voltage rating is set at 400, it is quite possible that no damage would be done by going a bit higher—say to 500—provided the screen voltage is kept down to the rated figure of 250. It should be pointed out, however, that the insulation in the tube is not designed to hold very much more than the rated voltages.

THE PRACTICAL TRANSMITTER

As we already have said, the unit shown in the photographs was constructed primarily to get some practical information on operating the tube, but when we got through we found we had a very acceptable low-power transmitter, capable of working nicely on four bands with a single crystal. With an inexpensive power supply (such as the one described in connection with the low-power transmitter elsewhere in this issue) for c.w. work, it is equivalent to the ordinary rig using a type 10 at five or six hundred volts, requires fewer stages for the same output on as many bands from the same crystal, and requires no neutralizing. Complete break-in is possible, since the oscillator and amplifier are keyed simultaneously. The all-metal construction may be a drawback in some cases, but the shielding indicated is not only desirable but necessary. However, regular breadboard construction on thin sheet metal would serve the same purpose.

The metal chassis (Bud) measures 7 by 13 by 2 inches. On the top, at the front, are the oscillator cathode coil L4, oscillator plate coil L5 in its shield (Hammarlund Type CS-3), the 807, and the plate tank condenser C4. Along the rear are the crystal socket, 89 oscillator tube, and the plate (Continued on page 70)
A Moving-Coil Tuning System for the High-Frequency Receiver

A New Approach to the Coil Changing Problem in Multi-Band Sets

By James Millen,* WIHRX

So many of the important advances in radio design have been initially accompanied by great disadvantages, that at times it has seemed that progress has been backwards. Thus pentode tubes and Class-B amplifiers made possible great economies in material, but at first appeared to threaten such a loss of audio quality that pessimists freely predicted that the industry was going to the bow-wows. It didn’t, of course. Almost immediate technical improvement so reduced inherent defects that pentode and Class-B amplifiers are at least comparable in audio quality to the time-tried Class-A triode systems at the present time.

Amateur radio is in the throes of just such a change at the present time. For many years plug-in coils have served us faithfully. Slow but continual improvement has brought their design to a degree of electrical perfection which other means of coil changing has not equalled. They allow close grouping of coil, condenser, and tube, with efficient shielding wherever needed. They permit coils and shields of generous proportions to be used. Contacts of rugged design and positive action are taken for granted with well engineered coils. Likewise, there is no excuse for not guiding coils into position and holding them there with sufficient precision to insure exact duplication of calibration.

With the advent of “all-wave” receivers, intended for the casual broadcast listener, some sort of coil switching became necessary. Obviously, the set had to be self-contained; and also obviously, it had to have emphasis placed on convenience. On the other hand, the general public was not familiar with high-frequency communication receivers, and so was not unduly critical of the over-all performance. If they could get G5SW or 2RO now and then, everything was OK. Judged by amateur standards, some of those early receivers were pretty terrible performers.

For all their shortcomings, they were compact and they were convenient. Consequently, the question was soon raised whether these advantages could not be incorporated in an amateur receiver without sacrificing performance in any way. The answer was, probably yes; “probably”, because the proof of the pudding is in the eating, and so far as we know no commercially available receiver with knob-controlled range changing equals in all respects the performance of the best plug-in coil receivers now in use. We say “yes”, because the solutions to the problems involved are in sight.

By its very nature, the coil switch has inherent disadvantages, and these can best be discussed by taking a specific example. Six years ago a high-frequency converter equipped with a coil switch was designed. This switch was considered to be of very advanced design at that time, and in fact compares favorably with most now in use. There were a number of things wrong with it, however, and a discussion of its failings will throw light on the whole problem. To check off the points in its favor, the shielding between stages was excellent, the switching mechanism rugged and dependable, dielectric losses were low, coils and trimming condensers were mounted close to the switch contacts, making leads as short as possible, coils were not unduly crowded and accessibility of all

* Middleton, Mass.
parts was adequate. Against it may be cited the fact that idle coils were not isolated, calibration was not permanent, and the design was not flexible. To explain these points a little, the fact that idle coils are not isolated is objectionable because absorption losses are present.

As originally designed, the converter had a pronounced dead-spot whenever it was tuned near the natural frequency of one of the idle coils, even though the positions of the coils were chosen for minimum coupling. This very common defect of coil switches was largely eliminated in the case of the converter by having additional switch arms short-circuit the offending coils.

Calibration was uncertain because slight changes in the position of the switch arms caused appreciable variation in the distributed inductance and capacity of the tuned circuits. As a result, the converter actually could be tuned through a limited range by slight movement of the range-changing knob! This defect could be eliminated, of course, by providing a positive locking device for the switch arms. It could have been done six years ago, but in those days nobody cared very much. Many modern broadcast sets still have the same defect, and apparently for the same reason—but the b.c.i. does not care.

The third defect was lack of flexibility. By this we mean that the arrangement cannot be readily adapted for use in up-to-date receivers. A high-performance receiver, such as the HRO for instance, may require four coils for each range, "airtight" shielding, air dielectric trimming condensers, and short h.f. leads, to mention only a few of the more obvious necessities. These features could not be built into a switching system such as that described without running into a lot of trouble. The most promising arrangement of this type seems to be a layout similar to the "mousetrap" type attenuators used in standard signal generators. This attack on the problem seems to hold some promise, but there are many

(Continued on page 74)
An All-Band 'Phone Transmitter Using Beam Power Tubes

By G. Mathis,* W3BES, and J. B. Carter**

The beam power tubes, although not very old, have become very popular among the amateur fraternity. Previous articles in QST have shown their adaptability to amateur use in both audio and r.f. circuits. This article describes a complete all-band 'phone transmitter using the new tubes in both modulator and r.f. sections.

Previous experience with the metal 6L6 has not always been satisfactory, but no difficulties were encountered with the glass prototype. In addition to the use of the 6L6G, two of the new RK-39 beam power type tubes are utilized in the r.f. power amplifier, where they are vastly superior to the receiving-type beam tubes. The tentative ratings of this tube were considerably exceeded without the plates showing any trace of color; furthermore, arcing between tube elements was entirely lacking even when potentials of 1000 volts were applied momentarily to the plate. This than usual, thereby assuring a high degree of frequency stability. Only when using the fourth harmonic of the oscillator was it found necessary to increase the oscillator plate voltage to approximately 400 volts.

The output of the buffer stage is inductively coupled to the grid of the Class-C RK39's. When used on 1.75 Mc, a small air condenser is inserted in the form of this coil, without which the size of the combined buffer plate and amplifier grid coil would be all out of proportion. The grid coil of this final stage is similar to the old TNT circuit and is wound according to the same rules. For economy, a single condenser is used in the plate circuit of the final stage. This necessitates insulating the tank condenser from the grounded chassis. A split-stator condenser with grounded rotor might be used to better advantage because of the cross neutralization. This will simplify neutralizing for all frequencies once the neutralizing adjustments have been correctly made on one frequency.

Since this transmitter is primarily for 'phone use, cathode biasing is used on the buffer and amplifier stage. This type of bias was found to be entirely satisfactory and economical as well as foolproof. Inasmuch as the radio-frequency section of this transmitter proved to be relatively free from trouble and presented no problems, the following hints and precautions should be carefully observed.

The Tri-tet cathode coil should have as few turns as possible, as has been repeatedly mentioned in these columns. Of prime importance is the necessity of disconnecting the screen voltage of the beam tubes whenever the plate potential is off. This condition is likely to exist when neutralizing. This difficulty may be easily overcome by inserting a double-pole switch in the screen and plate leads to these tubes.

No specifications for coil data are included because they do not differ from similar transmitters that have been described in these pages.

** Kenyon Transformer Co., Inc., New York, N. Y.


QST for
The modulator system of this amplifier provides a gain of 120 db and a power output as great as 90 watts. This output exceeds the manufacturer's rating but no appreciable amount of distortion was noticeable. The construction of this unit makes provision for either a crystal or high-impedance velocity microphone, or a single- or double-button carbon microphone. For crystal microphone or high-impedance velocity type, input is directly coupled to the grid of the first 6C5 which is resistance-coupled to the second 6C5. The input transformer for use with a carbon microphone goes to the grid of the second 6C5. The volume control is at the grid of this tube which is resistance-coupled to the third 6C5 voltage amplifier. This tube is transformer-coupled to the 6N7 operated in push-pull.

The transformer used is of the driver type for reasons which will be seen later.

The 6N7 stage employs a novel method of obtaining good driver performance with a small tube. In order to reduce the effective plate resistance and obtain good audio regulation at the grids of the 6L6's, inverse feedback is used from the plates to the grids of the 6N7.

The high-gain audio unit uses a pair of 6L6G tubes in the push-pull class-AB modulator with an inverse feedback circuit in the 6N7 driver stage to improve driver voltage regulation.

The 6L6G modulator tubes are transformer-coupled to the Class-C load with a transformer having three different secondary impedances available to match various loads. Exceptionally good regulation is afforded for the critical screens of this stage with a 6N7 tube. The novel application of this tube provides a practical solution in an economical manner. The amount of feed-back necessary to effect good regulation in the driver system is not extremely critical. It may be varied from 8 to 16% depending somewhat on the other constants of the circuit. The reason for using the driver transformer for this stage is to provide good regulation at the grids of the 6N7, when the grids are driven slightly positive. With these two precautions in the driver stage—namely, the use of a driver transformer and inverse feed-back—power sufficient to drive the 6L6G tubes to 160% of the maximum power output may be obtained.

The 6L6G modulator tubes are transformer-coupled to the Class-C load with a transformer having three different secondary impedances available to match various loads. Exceptionally good regulation is afforded for the critical screens of this stage with a 6N7 tube. The novel application of this tube provides a practical solution in an economical manner. The
usual method of stabilizing the voltages for the screens is to use a bleeder carrying heavy current. This is expensive and not as efficient as the aforementioned system. An entirely separate rectifier system is used for the bias of the Class-AB audio stage which is also one of the contributing features that permit such large outputs. This rectifying bias system consists of a combination plate and filament transformer and one choke. The regulation obtained at maximum grid current surges is approximately only 1%.

The power supply for the audio and r.f. end is obtained from a new type of transformer. This transformer has three different secondary windings. One winding is used for the audio unit and the other two windings are connected in parallel for the r.f. section. A single 83 tube is used for the audio and two similar tubes for the rest of the transmitter. This supplies 400 volts for the modulator and 600 volts for the r.f. section. Voltage adjustments may be obtained by means of three taps on the primary of this transformer. Each tap provides a change in voltage of 12%. The inclusion of this type transformer is highly desirable, since the drain afforded by the Class-C stage in 'phone operation helps stabilize.
Rebuilding a Commercial-Type Condenser Microphone for Practical Ham Use

By Robert S. Coe,* W1CBG

If you are one of those individuals who like to spend a lot of time on the audio end of your 'phone rig, the following may be of interest; namely, rebuilding one of the professional types of condenser microphones of the era of 1930, so as to eliminate the necessity for batteries and to increase the output to a more practical level for ham use.

The microphone and pre-amplifier unit in this case is one of the well-known RCA types (Model AA-4088), which as originally designed uses Type 864 d.c. tubes with a six-volt filament battery, and gives an output (with three stages) of about -35 db, a level quite low for ham use where the builder wishes a minimum of apparatus and a maximum of quality and results. Of course the first thing to do is to get the mike. This may be done by getting in touch with a broadcast station that is installing later type studio equipment. The microphone and pre-amplifier unit here was purchased for about fifteen dollars, a good value.

The frequency characteristic is approximately flat over the audio range necessary for good quality, and while perhaps A-6 > C+9, it is undoubtedly superior to that of many microphones in use today.

The pre-amplifier in its original form, as already mentioned, is quite low in output to be really practical for ham use, since -35 db across the load into which this unit is intended to work (250 ohms) represents a voltage swing of only about 0.02 volt. This is quite readily overcome by a little simple rebuilding, after which the level of the pre-amplifier output is brought up to about -10 db, an increase of around 25 db over the output of the original arrangement. The output impedance of the new arrangement is also of a much higher value; in fact, high enough to feed directly into the grid of the first stage of the speech amplifier. The voltage swing represented by an output level of -10 db at this higher impedance is of the order of 2 volts on normal talking in a quiet conversational tone of voice. (Not shouting like a circus barker.) This level was checked on a voltmeter designed for the purpose.

The tubes used in the new arrangement are 6C5's (metal) with their heaters operated directly on a.c. The plate supply can be obtained from a tap off the speech amplifier power supply, with the addition of a little more filtering. The additional filter can consist of two small filter chokes, an 8-µfd. filter condenser, and the correct dropping resistor to give the required voltage. (180 volts at 2.5 ma.) The chokes and resistor can be quite small with the low current drain of only 2.5 ma. (With some tubes it might go as high as 3.5 ma.)

An unusual thing was discovered while eliminating hum from the heater circuits of the 6C5's; namely, that the heaters would work equally as well on 2.5 volts as with their normal rating of 6.3 volts, insofar as this particular circuit was concerned, the only difference being that they took longer to warm up. With 6 volts a.c. there was a slight trace of hum which disappeared entirely when the heater voltage was dropped down.
to 2.5 volts. This is probably explained by the fact that the lower voltage caused a smaller disturbing field around the heaters and their wiring, and thereby induced less unwanted voltages in other parts of the circuit.

The actual operations of changing over this pre-amplifier are simple and inexpensive. After removing the amplifier proper (contained in a small black case) from the cast metal mike chassis lined with sponge rubber, it is necessary to remove the subbase mounted a half-inch or so below the regular base of the black amplifier case. (Do not attempt to remove the regular base attached to the black case. This is not necessary and may cause you trouble.) The next question is to take apart the sockets and completely remove them from the chassis, and then to enlarge their mounting holes until the new octal sockets can be substituted. The ones used here are of the variety that mount with a clamping ring, although in this particular case the ring cannot be used and each socket is fastened in place with small flat-head machine screws passed through small holes drilled in the rims. The wiring of the original and rebuilt unit is shown in the diagrams. The output transformer inside the sealed case is not used, and the extra plate resistor and coupling condenser for the last stage (for high-impedance output) are anchored on the base, by means of their No. 14 wire leads, adjacent to the socket wiring. It may be necessary when replacing the protective sub-base to place two or three washers on top of the spacers already provided, to allow extra room for the output coupling devices. An additional clearance of about 3/16-inch was necessary here. The remaining resistors and coupling condensers are left "as is." The filament dropping resistors, the filament winding and the resistor associated with the old filament circuit, are not used, the original filament circuit being eliminated when the sockets are removed. Grid bias is obtained from two small "penlite" type batteries strapped to the front of the amplifier case adjacent to the terminal studs to which they are connected, on the front side of the base. The reason for batteries in preference to some form of dropping resistor is to eliminate the possibility of instability and regeneration.

In order to balance out the hum it is necessary to provide a 20-ohm center-tapped resistor across the 2.5-volt heater supply, the center tap going to ground. One of the screwdriver-adjustable variety was used, allowing easy adjustment to get complete elimination of the hum. It is important that the 2.5-volt a.c. supply to the heaters in the pre-amplifier should be entirely independent from any other circuits (must feed mike amplifier heaters only) for complete hum elimination.
It is desirable to make a new cable, consisting of three separately shielded pairs, braided or otherwise fastened together. Such an arrangement will prevent possible intercoupling between circuits and at the same time will prevent r.f. pickup in the audio system when the mike is used in the vicinity of the transmitter. One pair would carry the output, one the plate supply, and one the a.c. heater supply. It is advisable to incorporate the

(Continued on page 79)

Miniature Cathode-Ray Tube Announced

Type 913, with Metal Construction, Soon Available

TECHNICAL data on the little metal-tube brother of the 906, some months in the works, has at last been released by RCA, and we may expect that the tubes themselves will be available in the very near future. This new small-size cathode ray tube, to be known as the type 913, is in a metal envelope like that used for the 6L6, except for the glass viewing screen at the end. It has the standard octal base. The screen diameter is approximately one inch. The 913 has the same element arrangement as the 906, and therefore will do all that the larger tube will do, although on a smaller scale.

The 913 is a high-vacuum tube of the electro-static-deflection type, capable of operating at low voltages. A brilliant image can be obtained with an anode voltage as low as 250 volts. Characteristics and ratings are as follows:

Heater voltage .......................... 6.3 volts
Heater current .................................. 0.6 amp.
Inter electrode capacitances:
Control electrode to all others ... 10.5 µfd.
Deflecting plate D1 to plate D2 ... 3.6 µfd.
Deflecting plate D3 to plate D4 ... 4.3 µfd.
Anode No. 2 voltage .................. 500 volts max.
Anode No. 1 voltage .............. 125 volts max.
Grid voltage ........................... Never positive
Grid voltage for current cut-off* ...... −90 volts app.
Peak voltage between Anode No. 2 and any deflecting plate ............. 250 volts max.
Fluorescent-screen input power per sq. cm. ........ 5 mw. max.
Typical operation:
Anode No. 2 voltage ............... 250 500 volts
Anode No. 1 voltage (app.) ......... 50 100 volts
Grid voltage adjusted to give suitable spot
Deflection sensitivity:
Plates D1 and D2 .......................... 0.15 0.07 mm/v. d.c.
Plates D3 and D4 ...................... 0.21 0.10 mm/v. d.c.

The 913 has an 8-pin octal base, with pin connections as follows:

Pin No. 1—Anode No. 2, deflecting plates D2 and D4, and shell

* With approximately 100 volts (to focus) on Anode No. 1.

Pin No. 2—Heater and cathode
Pin No. 3—Anode No. 1
Pin No. 4—Deflecting plate D1
Pin No. 5—Grid
Pin No. 6—Deflecting plate D3
Pin No. 7—Heater
Pin No. 8—Tied inside tube to Pin No. 1

Numbering is according to the RMA standard method, given in the Handbook.

A typical circuit diagram for use with the tube is given in Fig. 1. With this tube, as with other cathode-ray tubes, normal operation is with Anode No. 2 (and therefore the positive terminal of the high-voltage supply) grounded. This places the heater and cathode at power-supply voltage above ground, and in cases where a small broadcast-type power supply transformer is used, care should be taken to see that the heater winding is well insulated. At the voltages used on 913, probably any of the small transformers can meet this requirement without difficulty. Whenever possible, it is desirable to operate the tube with the shell grounded so that danger of accidental shock can be avoided. However, if the tube is incorporated in a receiver and works from the regular power pack, grounding of the shell will not be possible and it becomes necessary to make an insulating mounting for the tube. A length of bakelite tubing completely enclosing the tube is recommended in such case. When operating with the shell "hot," the insulating condensers C3 and C4 are necessary; they may be omitted, however, when the tube is operated with a separate power supply which permits grounding the shell.

With this little tube, a really inexpensive cathode-ray oscilloscope for the amateur is in sight. We understand the price on the 913 is to be less than five dollars, which would bring the cost of a homemade job with all features an amateur needs down below the $10 mark.—G. G.
A. R. R. L. Copying Bee—December 11th

A MEDALLION award by the League will be presented to the winner or to as many as submit perfect copies! Like the previous Bees this will give hams a chance to try copying some unusual word combinations, figure groups, and simple punctuation. There may be trick words, or misspelled words, sent in no particular sequence. It's an excellent opportunity to check up on our personal operating ability. Are we as good at the basic business of knowing our code stuff as we think we are? A new feature that will be of genuine interest to every participant: The League will return all papers (except winners) with a copy of the transmitted texts to each participant with a confidential rating. This report on standings will be made as soon as feasible after the closing date for mailing of copies. Transmissions will all be between 50 and 100 words in length. The sending will be by tape at about 25 words per minute. It will be a test to copy what you hear.

The following stations, all using "automatic" equipment, have been selected in the different time zones, and each will transmit different text. Care will be taken to make all messages equally difficult by different words, word order, errors, etc. It will be worse than useless to try to correct or compare messages. However, we urge everybody that knows the code at all to take part. Send in whatever you get, however little that may be. Check on your own proficiency and have some good fun at the same time.

In addition to the confidential rating you will receive you have a chance to win, and all participants will be mentioned in the report in QST. The schedule of transmissions for Friday night, December 11th:

<table>
<thead>
<tr>
<th>Station</th>
<th>Frequency</th>
<th>E.S.T.</th>
<th>C.S.T.</th>
<th>M.S.T.</th>
<th>P.S.T.</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1INF (W. Hartford)</td>
<td>3825/7150 kcs.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
<td>7:15 P.M.</td>
<td>6:15 P.M.</td>
</tr>
<tr>
<td>W2AYN (New York)</td>
<td>7290 kcs.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
<td>7:15 P.M.</td>
<td>6:15 P.M.</td>
</tr>
<tr>
<td>W9UZ (Chicago)</td>
<td>7003 kcs.</td>
<td>10:15 P.M.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
<td>7:15 P.M.</td>
</tr>
<tr>
<td>W9BAZ (Louisville)</td>
<td>3810 kcs.</td>
<td>10:15 P.M.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
<td>7:15 P.M.</td>
</tr>
<tr>
<td>W6CIS (San Francisco)</td>
<td>3504 kcs.</td>
<td>11:15 P.M.</td>
<td>10:15 P.M.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
</tr>
<tr>
<td>W6AM (Long Beach)</td>
<td>7250 kcs.</td>
<td>11:15 P.M.</td>
<td>10:15 P.M.</td>
<td>9:15 P.M.</td>
<td>8:15 P.M.</td>
</tr>
</tbody>
</table>

The rules for taking part in the copying bee:

1. Any amateur operator, not having access to the tape or transmission copies, and copying wholly by ear, is eligible.
2. Mark one copy as your "best"; only this one copy shall count, but report all the above stations that you can hear to us. Keep copies other than your "best" to check yourself when we mail out the official texts to you.
3. Print your name, call signal, and address plainly on each entry.
4. Send in original copies. Re-copying messages invariably introduces errors and detracts from credits.
5. Copies must be mailed bearing a postmark in the year 1936 to be counted. Mail at once or within five days to make sure.
6. Every contestant must certify he has not been employed as a commercial or government radio, Morse or cable operator in the last year. This is strictly an amateur contest. The following exceptions, however, shall be eligible: (a) Holders of commercial licenses without experience under same. (b) Such holders ('phone licensees or technical attendants) whose duties have not been telegraph operating within one year.

The transmitting stations will each send V's and identify themselves for ten minutes before scheduled times above. All amateurs are requested to note the frequencies listed and try to cooperate by keeping silence on these channels during copying bee transmissions, which start at the time indicated. Here's luck in the copying bee, and remember, write down just what you hear. If the transmission or what you can get is fragmentary, send it in just the same, so you receive credit, and we can send you the official texts for your examination.

—F. E. H.
Circuit Design of a Modern Amateur U.H.F. Superheterodyne

By Karl Miles*

I N DESIGNING a superheterodyne receiver for use in the ultra-high-frequency bands, there were certain fundamental points that had to be considered.

1. Image rejection.
2. Ability to receive self-excited 'phone transmitters, even those of the transceiver type.
3. The suppression of automobile ignition and similar types of noises.
4. The use of conventional tubes for length of life.
5. Stability and ease of operation.

When all these points were considered it was seen that a cheap receiver could not be built to do the job. So, in order to design a receiver from a practical point of view, more than just the ultra-high-frequency spectrum had to be included. Frequencies up to about 5 Mc. enter into the picture of a commercially practical ultra-high frequency receiver. In this range we must consider selectivity to a much greater extent than is usable, for instance, on the five-meter amateur band, where transceivers and "wobulation" are the rule rather than the exception.

THE I.F. SYSTEM

Starting back to the first of the list as given, we find, from former experience, that when using a stage of r.f. on the 14-Mc. band satisfactory image rejection is achieved with an i.f. frequency in the neighborhood of 465 kc. Therefore, in order to attain approximately equal image rejection on the 15-Mc. band, where transceivers and "wobulation" are the rule rather than the exception.

Tests were made on the Q of different coils, both air- and iron-core, and on different shapes of coils. It was found that the coil having the highest Q was one wound with 10-44 Litz, 1 3/4 of an inch wide, on a Polyiron core.

After the design of the coil was decided upon work was begun on the losses in i.f. trimmers. It was found that there was a marked difference in the total efficiency of the circuit with compression-type trimmers when different makes, different kinds of the same make and even different trimmers of the same kind and make, were used. Apparently compression mica trimmers which ran satisfactory at 465 kc. would not prove satisfactory on the line at 1,600 kc. Air trimmers were investigated and were found to have less losses, as would be expected.

From commercial practice in the design of i.f. units, considering stability of setting and capacity, Sickles dual air trimmers with each section consisting of a fixed air minimum and a small air variable and having the two sections electrically shielded from each other, proved the most satisfactory. Since the circuits are less selective at 1,600 kc. than at 465 kc., it proved advantageous to go to two stages of i.f. in order to accomplish selectivity in the neighborhood of that which is arrived at with one stage of iron-core i.f. at 465 kc.

Now, having achieved selectivity which is

* The Hallicrafters, Inc., 3017 Indiana Ave., Chicago, Ill.
satisfactory for the reception of stable transmitters, we must do something to allow the reception of the boys who have "wobulation." After numerous measurements of frequency shift from modulation on 50-Mc. transmitter were made, it was discovered that any transmitter which deserved the name of even "fair" stayed within a 100-ke. band. Work was then begun on our 1,600-ke. i.f. system to develop a method whereby the noise of the selectivity curve at 2 times down could be broadened out to approximately this width. Different methods of expansion were tried. The continuously variable expansion type was found to have an advantage in that intermediate degrees of expansion could be accomplished. However, the movement of leads in this type, when the coils were moved, had the effect of upsetting the tuning because of capacity and inductive changes. This effect is much more noticeable at 1,600 kc. than it is at 465. The resistance expansion type was tried and gave a very nice noise, but the losses introduced by the resistance were too great since the sensitivity of the total system changed about 500 to 1.

Another method of expanding the i.f. selectivity is by means of a third coil in the i.f. transformer unit, wound very close to the primary and arranged with a switch so that it can be cut in and out of the secondary circuit. When it is in the circuit the percentage of coupling between primary and secondary is very high and over-coupling results, broadening the i.f. without materially affecting the gain. When this coil is cut out of the circuit by use of the switch, normal selectivity at just less than optimum coupling is achieved. By varying the number of turns and the percentage of coupling of this third coil in respect to the primary, different degrees of overcoupling or expansion are achieved.

When the next door neighbor comes on with his transmitter the selectivity can be improved to allow working close to his frequency with the sacrifice of some degree of understandability of the other fellow. In order to take advantage of this feature, expansion of the i.f. selectivity is made in three stages: "sharp," for the reception of stable oscillators, with very good selectivity; "medium," which gives understandable signals from self-excited jobs and still gives a fair degree of selectivity; and "broad," which gives very understandable signals from frequency modulated transmitters. This last is very useful when looking for that elusive answer to your CQ in that the set is broad enough to make this a "stand by" position. The band thus can be covered more quickly without skipping over some station that is calling you.

No modern high-quality communication receiver is built without a crystal filter. In normal work we find, particularly in the ham bands, that the stations are so close together that separation without single-signal selectivity is practically impossible. In the crystal circuit, we have gone to the method where the center tap of the input circuit is taken from the coil and the output of the crystal filter is fed into a transformer, the primary of which is designed to match the crystal impedance. The secondary is tuned, with a step-up ratio.

IGNITION NOISE SILENCING

One of the other considerations in the design of an ultra-high frequency receiver is the suppression of interference of the nature of auto-

(Continued on page 80)
The ordinary amateur who is fortunate enough to have both summer and winter locations usually has his main transmitter at the winter place and uses a portable in the summer, especially if the summer place is a farm without electric power. Not so WlHRX; here the customary procedure is reversed. The power-less summer location boasts a one-kilowatt 'phone transmitter, while the winter-time QRA gets the benefit only of a low-power rig!

WlHRX is owned by James Millen, well known to the fraternity as the author of several QST articles and of those little talks which appear in each issue somewhere about page 57. The winter location of the station is in Malden, Mass.; in summer the scene is moved to a farm near Middleton, Mass., some twenty miles north of Malden. The "farm" is really one in name only, since no attempt is made to cultivate the soil of the hills which roll about the landscape. During the past few years much time and effort have been expended in remodelling the Colonial farmhouse and in installing equipment which will bring to the site all the conveniences of the city—but without benefit of the power line some distance away. Gasoline is the answer.

A fair-sized bungalow, some hundred yards from the house, combines the functions of radio station, recreation room, and guest house. One of the photographs shows the setting, another shows part of the interior of the main room. The location, despite the fact that it is high and decidedly clear, has not proved itself to be particularly "hot" for getting out, but compensation is to be found in the pleasant surroundings which make it just about an ideal spot for operating. Besides, there is lots of room to put up antennas which will overcome the effects of the rocky New England soil, which presumably is at fault.

Getting down to equipment, the transmitter is divided into two sections, one a complete low-power transmitter, the other a high-power amplifier and modulator. The low-power outfit occupies the left-hand relay rack of the pair at the right in the photograph. The output stage uses a pair of RK-20's in push-pull, driven by a fixed-tune exciter similar to the one described in November, 1935, QST. A variable air-gap crystal holder is used in this unit to provide frequency variation over the 20-meter 'phone band, in which most of the operation is carried on. Below the r.f. units in the rack is a Collins 7-C speech amplifier, used either to modulate the suppressors of the RK-20's or to drive the Class-AB modulator for the high-power stage when the latter is in use. Power supplies for the r.f. section also are contained in this rack.

The right-hand rack of the pair contains the

**WlHRX, WITH ITS DISTINCTIVE ANTENNA ARRAYS, MAKES AN ATTRACTIVE PICTURE**

When radio palls in the summer time a swimming pool, just out of the photograph to the left, offers a welcome change from QRM.

HRO receiver, oscilloscope, loud-speaker, and a panel for spare coil boxes. A shelf suspended from

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the rack below the receiver serves as an operating table. Below the table there are open shelves for holding miscellaneous apparatus.

The high-power amplifier and modulator are mounted on the rack in the left-hand corner in the station photograph. A rear view of this assembly is given in another photograph. The Class-C amplifier, at the top, is link-coupled to the low-power transmitter; a pair of W.E. 251-A tubes is used in push-pull in this stage. The modulators are 851's, operated Class-AB. With this tube line-up there is plenty of reserve power-handling capacity all along the line; nothing needs to be worked hard even when running a full kilowatt input.

Of particular interest about this installation is the method of obtaining power to run the transmitter. Power supply equipment for the low-power set, and also for lighting the filaments of the tubes in the high-power end, is designed for operating from 110 volts, 60 cycles. A gasoline-driven 110-volt generator, housed in a fireproof cubicle some distance from the station, takes care of this load and in addition handles the lights for both station and house. To get rid of ignition noise, the line from the generator to the station is run in lead-covered cable, buried a few inches in the earth. A bank of storage batteries, totalling about 32 volts, is kept charged by being connected across the generator

Plate supply for the high-power unit is taken from a separate machine, consisting of a 3000-volt d.c. generator (salvaged from a nearby broadcast station when the latter changed over to rectifying equipment) directly coupled to an old four-cylinder Chevrolet motor. The generator and its driving engine are mounted on an iron-girder framework and housed in a weather-proof box just outside the operating room. The machine is shown in one of the photographs. Controls for the starter, throttle and spark are brought in to the operating position. This supply is operated only during transmission, since it makes considerable noise, both electrical and audible. The throttle gives the operator easy control of the plate voltage; one simply "steps on it" for more voltage!

A separate radiator is being installed inside the operating room to be connected to the motor during cold weather so that the heat developed will be put to good use. The receiver is operated entirely from batteries, using 6-volt tubes, with a regular storage battery for the filaments and heavy-duty "B's" for the plates.

Ultra-high frequency equipment is installed at the end of the operating room. The five-meter rig is one which has given good service for several years, using a push-pull oscillator with a pair of 800's, modulated by Class-B RK-18's. Reception is handled by either an SRR or One-Ten receiver. On five meters, excellent contacts have been made many times with West Hartford, a distance of about 120 miles.
The view of the outside of the station gives a glimpse of the two transmitting antennas. The structure at the left of the picture is the five-meter directive array, consisting of four half-wave vertical radiators spaced a half-wave apart, with four parasitically-excited reflectors. This is the rig whose photograph has appeared in recent editions of the Handbook. The 20-meter antenna is a simpler array of the same general type, using two vertical antennas spaced a half wave apart, with reflectors a quarter-wave behind. The excited antennas are fed at the center through Q bars, with a non-resonant transmitting line connecting to the transmitter.

The tower which holds the 20-meter antenna is a self-supporting wooden affair 34 feet high, with a 4 by 4 mounted in the center at the top. The essential constructional details are given in the drawing. The platform at the top is readily reached by means of ladders. The antennas and reflectors hang from four bamboo poles of the proper length to give the desired spacing between elements; these poles are fastened to the 4 by 4 near the platform and are guyed to the top as shown in the photograph. Weighted ropes at the bottoms of the wires keep them vertical. Installation of this simple directive system has notably improved the performance of the station, since results were not at all satisfactory with a simple antenna of the single-wire type.

In the winter time, when snow and ice make the farm practically inaccessible, the low-power transmitter and the receiving rack are set up among the citified comforts of Malden. Using a 20-meter Johnson Q mounted vertically on an unguyed 2 by 4 set in concrete with a 2 by 2 extension at the top to keep the lower end of the antenna off the ground, the set gets out quite well on 20-meter 'phone, even though the power output is only about 40 watts with suppressor modulation.

Flash!

Just before going to press, we received a letter from Neil Werner, W9AJA, telling of a QSO with a station signing "EA4AP." The operator at EA4AP said the station was being run on American property by Associated Press men in Madrid. During the 25 minute QSO Werner was told that the original EA4AP was dead, but it was believed that EA4AO had escaped to France. Conditions in Madrid were serious; the shortage of food and war material was becoming apparent, and numerous air raids were occurring each day.

Believed to be authentic, the signal of EA4AP was T6 at 14,305 kc.
A Cathode Ray Oscilloscope Switching Circuit

By C. T. Read, W9AA

The switching arrangement shown in Fig. 1 has been in use by the writer for several weeks and has proved very satisfactory. It is used here in connection with a National HRO receiver and CRO oscilloscope but could be adapted to any type superheterodyne receiver and oscilloscope.

The diagram is self-explanatory. The switch used is an ordinary 4-pole double-throw ant-capacity switch with one pole idle. In the transmitting position the oscilloscope is connected for trapezoid or rectangular patterns, depending on whether the audio input or an a.c. sweep is used on the horizontal plates. The tuned tank circuit should be resonant with the transmitter frequency and the r.f. input adjusted by means of the tap to give proper vertical deflection. Never adjust the size of the pattern by detuning the tank, as it will give a distorted picture.

In the receiving position it is connected according to the directions issued by the National Company. A small jack-top feed-through insulator can be put through the back of the receiver and the 0.5 µfd condenser mounted between it and the plate of the last i.f. tube. With the G.R. plug removed from the jack the operation of the receiver is not affected in any way. When the wire leading to the switch and oscilloscope is plugged in, it is necessary to retune the last intermediate stage because the capacity of the wire to ground detunes it. When using the switch to change from the receiver to the transmitter, however, no retuning is necessary since the capacity is in the wire, not in the oscilloscope.

In checking the modulation of a received signal no sweep circuit is used, the 20,000-ohm resistor putting the horizontal and vertical plates out of phase and producing an oval pattern on the screen. An unmodulated carrier will describe a thin line oval in shape. As modulation is increased the thickness of the line increases until at 100% the oval becomes a solid pattern. Over-modulation produces a bright spot in the center of the oval. This check of course is only accurate on comparatively strong signals free from QRM, as interference and fading will show over-modulation when none exists. However, an accurate check usually can be secured on any signal over R6 by waiting for a quiet moment.

The receiving position can be used to check hum level on unmodulated carriers and key clicks on c.w. transmitters by using a 60-cycle sweep on the horizontal plates. With this arrangement a perfect signal produces a rectangular pattern on the screen. Any a.c. component in the signal will produce curves in the top and bottom of the rectangle, making a concave or convex figure and sometimes a figure 8 at the top and bottom.

Keying patterns may be observed with the 60-cycle sweep by watching the screen intently while a series of dots or high-speed keying is being transmitted. Proper keying will show long V shaped lines running from the middle to the top and bottom of the rectangle. As the keying becomes more abrupt the slope of these lines becomes steeper. With bad clicks the lines become practically vertical and transient surges may be seen above and below the main pattern.

An hour’s observation on any of our amateur bands will convince anyone that we need a good housecleaning. A large number of our ‘phone stations are still overmodulating, and the percentage of a.c. hum and key clicks in some so-called T9 signals is truly amazing.

A Voltage Quadrupling Circuit

The circuit of Fig. 2, contributed by Frank Dickey, of San Antonio, Texas, is an arrangement using four rectifiers and four filter con-
densers to get quadruple d.c. voltage from a low-voltage a.c. source. It is an extension of the voltage-doubling principle already familiar to amateurs.

The fundamental schematic is shown in the upper diagram, while a practical circuit using a pair of 25Z5 rectifiers is given in the lower drawing. Four 8-µfd. electrolytic filter condensers are used for building up the voltage. Additional filter could, of course, be incorporated in the circuit by adding a choke and putting an additional condenser section across the output. A test of this circuit showed a no-load d.c. voltage of 600; at a 40-ma. drain the terminal voltage was approximately 500 volts.

A Different Keying Monitor Arrangement

Fig. 3 is a diagram of another of the seemingly endless suggestions for monitor keying. The particular advantage of this system is that absolutely no connection need be made to the receiver, and that no retuning of any monitor is necessary when the transmitter frequency is changed. The idea was prompted by the fact that the keying relay had an extra, unused set of contacts, although of course it might be possible to hook the setup directly in with the key carrying the oscillator plate current, without use of a relay.

The monitoring device is a small oscillator tuned to 454 kc., (the i.f. frequency of the receiver) and loosely coupled to one of the i.f. stages by a wire wrapped around the coil of the monitor oscillator and then brought in the back of the receiver to within a few inches of the grid lead to one of the i.f. tubes. This seems to provide adequate pickup for a good signal in the speaker or 'phones, but will not cause any interference in nearby receivers of the same i.f. frequency, because when the pickup wire is removed the oscillator is no longer audible in the receiver.

The oscillator was easily constructed in a few minutes using a 27 tube, with an old tapped r.f. coil from a b.c. set. This was padded up to the i.f. frequency with a fixed 0.0005-µfd. condenser, and tuned with a 0.0005 variable which easily hits the i.f. range at about half capacity or so. The circuit is the simple series-fed Hartley, and the voltage was most easily obtained here from the suppressor grid of the .59 Tri-tet. It could just as easily be obtained in numberless other ways, since the drain is only a few ma. Pitch is easily adjusted to suit the operator, and since the oscillator is very high-C no drift has been experienced, even in several hours' operation.

As our receiver is not blocked except when very close to the crystal frequency, the receiver is left as is when sending. However, the r.f. gain control can be turned down to shut out other signals or prevent blocking.

Thomas Friedman, W8FPL

Negative Bias from the Plate Power Pack

Most schemes for obtaining bias without a separate supply, achieve their object by sacrificing plate voltage—as in the case of cathode bias, tapping up on the bleeder, etc.—or else involve grounding the positive of one of the low-voltage supplies, thus making a clean cut tie-in of

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the various negatives impossible and necessitating the exercise of care in grounding and shielding.

The method diagrammed in Fig. 4 involves none of the difficulties mentioned above since practically a separate bias supply is made available without the need for a separate transformer. The additional parts can, as usual, be found in the average junk box, and what isn't there can be purchased for a few cents from the local dealer.

The equipment pressed into service at the writer's station comprises an 82, a midget b.c.l. choke, a questionable electrolytic 8-µfd. condenser, and an old tapped b.c.l. voltage divider of about 10,000 ohms. With 350 volts a.c. input the unit delivers 270 volts of negative bias, more than ample for a pair of 10's. One of the taps is utilized to advantage and the resulting 150 volts soars about 20% with grid current flowing.

The particular transformer in the rig which is picked to do the work should be one which provides sufficient secondary voltage (center to either end) to give more than the bias desired for the stage in question. To provide bias for a pair of tens or 802's the crystal supply transformer should fill the bill nicely.

There are, of course, limitations in its application as with all economy schemes. The chief concern in this case appears to be the possibility of overload because of the added bleeder drain through one side of the transformer. This, however, would be true only if we were trying to use a very low resistance bleeder in the interest of good bias regulation. When grid current flows, however, it tends to cancel the heavy bleeder current. In short, if you must use this stunt to bias a pair of 150T's to Class C, use a high resistance bleeder and a couple of 45's as bias voltage regulators as described in QST some time ago.

Additional stages may be biased from the same supply providing that the total grid current through the bleeder is not so high as to result in excessive soaring. An 802 and a pair of tens can be supplied with ease. Adequate r.f. filtering must, of course, be provided.

---R. Bassett, W2EAR

This method is used in some receiver and speech-amplifier applications (see Lund and Howe, "Considerations in Speech-Amplifier Design", January, 1936, QST), and has at various times been suggested in these pages for transmitting. The utility of the method deserves that it again be brought to the attention of those who do not have the equipment or space for a separate bias supply.—Ed.

![Diagram](image)

**FIG. 4—PLATE AND BIAS SUPPLY FROM ONE TRANSFORMER**

I.—12-30 henry midget choke
C.—4-8 sfd, filter condenser of suitable voltage rating
R.—Tapped bleeder, 10,000 ohms or more
V.—Rectifier tube with inverse peak rating suitable transformer voltage

GETS a nice letter from a scholarly gentleman in England who says I am coming in swell over there on 20 meter fone from W4SM, which is my other call, and that I am QSA 5 and R 9 with all kinds of modulation and thanks for the entertainin' talk I made on the Spanish revolution and how's tricks in America by now. Hah! In fact hah, hah. I betchoo that burns up old Buck Taylor, and Doc, and Pat, and Martin, and Tony, and George, and Aubrey and Jimmy Long and all them big fone nabobs. They hafta spend years sequenterin' nickels away from the OW, and smokin' rat tail stogies, and skimpin' along and doin' without the life givin' vitamins contained in hooch to git together enough scads to buy a modulator, and then when they git it they gotta bust a vest button to get across the Ohio river. Whereas, W4SM, which never had a modulator and ain't even had a xmitter for two years can get nice dx easy as pie. Cw efficiency, I calls it.

---W4IR of the "Dixie Squinch Owl."

**THE 1936 VK/ZL DX CONTEST—FIRST SCORES**

UNUSUALLY good conditions during the first three week-ends in October resulted in a great deal of activity in the VK/ZL DX Contest, sponsored by the Wireless Institute of Australia. On the east coast, VK and ZL stations could be contacted during almost all of each 26-hour period. The 28-mc. band was good for several hours each week-end, giving many of the ten-meter gang a chance to run up good scores, since ten was the only band on which repeat contacts were allowed. Although the signals on 7 mc. had

(Continued on page 88)
CALLS HEARD

WSFAR, John J. Michaels, North Wales, Penna.
(28-Mc. Band)
September 17th-20th
F2MUD, Ron Cox, South Winds, Conn.
(28-Mc. Band)

GTDD, J. R. Tuck, 26 South Ave., Stote Park, Coventry, Eng.
(14-Mc. Band)
July-October

Robert Muguet, 58 rue de Verdun, Meudon, S. & O., France
(14-Mc. Band)
September

Containing

W9SOL, Julius Wengler, South Heights, Penna.
August 19th-27th

Call letters in bold face type indicate 'phone

G9YL, Miss B. Dunn, Felton, Northumberland, England
(28-Mc Band)

2-tube receiver

W9LHF-Liscum Dew, 524 Riverside Drive, New York, N. Y.
(7-Mc. Band)

Call letters in bold face type indicate 'phone

New York, N. Y.

(14-Mc. Band)

October 2d

W2BND, Ben Braunstein, Aboard S.S. Washing-
Colombia:

On October 29th amateur radio achieved another great victory. The scene of that victory was the Republic of Colombia; the combatants, the Liga Colombiana de Radio Aficionados and certain elements in the government opposing the granting of licenses to radio amateurs. The L.C.R.A. won. In a “surprise finish,” near the end of the session, following a period when it looked as though all were lost, the Senate of Colombia on the night of the 29th rushed through legislation recognizing the rights of amateur radio in that country.

The story behind that victory is long, the struggle bitter. For many years Colombia has enjoyed the distinction of being one of the only two nations on earth actively hostile to amateur radio, the other being Italy. In both countries, this attitude flowed from specific personal animosities. In Colombia the all-powerful Ministry of Correos, possessor under the Colombian fiscal law of a complete monopoly over all forms of radio communication, for years refused to recognize the right of private participation in any radio activity of any kind. All services—broadcasting, as well as amateur—suffered equally under the situation. Yet, despite a maximum of intra-governmental pressure the Minister of Telegraphs remained adamant. All attempts to secure a relaxation of the monopolistic point of view ran up against a stone wall.

It became increasingly clear that legislative redress was the only solution. With the aid of the President a bill was drafted providing for the creation of a national radio-communications commission, consisting of a chairman appointed by the President and representatives of the Ministry of Telegraphs, War and Education, as well as one representative each of commercial broadcasting, commercial radiotelegraph and radiotelephone, and of amateur radio. It was a good bill, and it early won the approval of a majority of the Congressmen. But powerful opposition still prevailed.

Most damaging was the attitude of the press. Fearing competition on the part of commercial broadcast stations, provided for in the bill, newspapers fought the act bitterly. Inasmuch as until recently the Congress had been shackled by press control, this was a decided handicap. Another powerful group of opponents were the foreign commercial communications companies, with which the Colombian government monopoly did business on the basis of special privilege contracts—Marconi, Telefunken, etc. This group was particularly opposed to amateur radio, an attitude they also display—although less successfully—in their own countries.

To all this opposition must be added a general
ignorance on the part of government officials concerning radio problems in detail. An example of this is the confusion that sprang up concerning the broad definition of radio communication, as covering all forms of radio activity. The Minister of Telegraphs was very nearly successful in forcing upon a helpfully-disposed but bewildered Senate an interpretation of provisions of the Madrid treaty and the Colombian fiscal law which regarded all types of radio communications, including broadcasting and amateur, as identical with revenue-producing two-way telegraph or telephone work.

There is no need to elaborate further on the maze of opposition that existed. Suffice it to say that, step by step, with commendable perception of the problems involved and their solutions, in a campaign characterized by unusual energy and the competent application of political and legal strategies, the officers of the L.C.R.A. won the fight. Particular credit goes to Dr. Ferdinand Carrizoza, past president, and Rafael Tamayo, existing president, and, most of all, to Italo Amore, indefatigable competent honorary secretary of the L.C.R.A. To them and to their associates, heartiest congratulations. Through them, amateur radio today celebrates its latest triumph—a new recognition, another stepping-stone to the pinnacle of international prestige.

—C. B. D.

Spain:

Despite attempts to secure information through European amateurs and American newspaper correspondents in Spain, authentic information concerning the situation of Spanish amateurs is lacking up to the time of going to press. Rumors are rife. From a German amateur comes a report, unconfirmed by other sources, that EA4AO, ex-EAR96, preeminent Spanish DX amateur, has been executed by Madrid loyalists. A further rumor is that all the U.R.E. official organization has been similarly dealt with. Throughout Europe ring charges and countercharges of non-neutral amateur activities are rife. A Barcelona amateur accuses other Spanish stations of Soviet propaganda activities. In Portugal an official decree has closed down all amateur stations, on a neutrality-preserving basis. Strife rings the change, and amateur radio dances to the tune . . .

Applicants:

Recently-received applications for membership in the I.A.R.U. are from the Liga de Amadores Brasileiros de Radio Emissao (Brazil) and the Newfoundland Amateur Radio Association.

The I.A.B.R.E. is well established in Brazil: calls and licenses are granted by the government through the society.

Newfoundland had no radio society until the formation of the N.A.R.A., but a keen personnel is rapidly rounding the organization into form. All communications should be addressed to the Secretary: Eric S. Holden, P. O. Box 650, St. John's, Newfoundland.

Applications for membership are presented to the Union in the semi-annual Calendars, and the result of the voting is known after a five-month voting period.

Argentina:

Amateur radio goes none too well in Argentina at the present time. From LU3JC we learn that some difficulty is being experienced with license renewals. Applications for renewal are received, a written examination given, but no license is forthcoming. Many calls have already been removed from the lists.

LU7AZ, via W4EG, tells of the Argentine system of identifying calls and districts. The first letter following the number in the call is the key to the district, e.g., "A," "B," and "C" show the station to be in the city of Buenos Aires, "D" and "F" the Province of Buenos Aires, etc.

Here and There:

Germany: From the D.A.S.D., W. Slawyk, D4BUF, writes: "The DASD-DJDC proved a surprising success. There were nearly 800 stations participating, among which were about 300 'W' stations. We wish to thank all American amateurs for the support they gave our first contest" . . . . . . The headquarters society was privileged to entertain Wolf E. Franzok, D4GZF, Clemens Panet of the German Broadcast system, and Hubert Underberg, second operator at D4ZOI, during October . . . . . . New Zealand: The 85- to 105-meter band formerly allotted to the Radio Emergency Corps has been curtailed to assignments of 2870-2930 kc. and 3350-3400 kc. because of increased domestic commercial need, according to L. G. Petrie, N.Z.A.R.T. General Secretary . . . . . . Denmark: Former E.D.R. Secretary Ahrent Flensborg, OZ1D, succeeds James Steffensen, OZ2Q, as president of the Danish Society. Steffensen has been particularly active in I.A.R.U. affairs, presenting many worthwhile ideas for the advancement of the Union.

(Continued on page 94)
Ten Meters: The 28-Mc. band is giving a generally fine performance to judge from recent DX reports. Our only plea with respect to it now is that hams use the whole 28-to 30-Mc. band! While the interference does not yet reach the levels noted on low-frequency bands, there are some complaints noted. Our suggestion is that stations working c.w. DX the world over use the 29-to 30-Mc. part of the band more—then QRM-free work will be possible for telegraph operators (29-30 Mc.) and 'phone (28-29 Mc.) with fewer complaints from either. It appears as quite natural that this band should exhibit a few "growing pains" until the degree of occupancy by 'phone reaches proportions that give this the self-exclusiveness common to 'phone allocations elsewhere.

'Phone Message Handling' Phone operators as a rule have never "gone for" message handling in a big way, perhaps because rag chewing is the major 'phone objective. In A.R.R.L. transcons of years gone by c.w. telegraphers led in accuracy, while 'phone showed superiority with respect to speed in some of the tests. Results depended on the degree of practice and skill in operating, on organized system in tackling the relaying problem, and on location of most stations participating in relays in groups close to one frequency, or one part of the band, for most favorable work. Brass-pounders of course get lots of practice in handling traffic with system and dispatch; they get their fun that way. Voice stations in the past have been handicapped by having operators whose experience in handling record communications has in some cases been allowed to lapse so full inherent "speed" possibilities could not be realized. But of late, while 'phone operators have not by any means reported traffic in volume, there have been signs of many individual instances of useful 'phone message handling. It will never be our policy to take the part of a reformer, to encourage traffic groups to work DX, or DX groups to work 'phone, 'phone groups to change their basic interest to traffic, or any other combination. A.R.R.L. Communications Department policy is to assist all amateur groups and interests along the line of natural interest. Along that line, A.R.R.L. OPS will be trying out a new form, a special tool to help improve experimental adjustments and operating policies, about the time this appears in print.

We started to call attention to the fact that more instances of exchange of record communications are taking place by 'phone than in past years. This is undoubtedly for the best. We invite all stations to report this work so they (and ham radio) may be credited. We want to call the attention of all 'phone operators to the correct technique for highest accuracy, use of repeats and word lists, and system, such as exemplified in operations in airways, police and telephone systems where voice operating standards are high. See page 360 of the new A.R.R.L. Handbook or pages 319-320 of the '36 edition for good procedure and word lists—and be sure to use a complete message form if and when you handle traffic. It goes NR-CALL-CK-PLACE-TIME-DATE-ADR-TEXT-SIG. More 'phone nets and activities are desired. See the 'Phone Activities Manager in your A.R.R.L. Section; give him suggestions for what you want to see for activities, period to get together on the air etc. Tell him you are ready. Ask your SCM or Hq. to line you up with your PAM if you don't know who he is.

Be ready for Public Service and Emergencies: General attention to development of operating ability to make our work more effective in all communicating branches of amateur radio is continuously necessary—and special attention to the handling of record communications makes for superlative operators with high general proficiency. Nets, trunk lines, and schedules cover the country, both c.w. and 'phone, and automatically maintain amateur radio's readiness for any sort of emergency that may strike any part of the nation, at the same time operating proficiency is held at the peak through regular systematic work. League members have reason to be proud of the organized operating system that this year bids fair to outperform all previous attempts. The whole system is of course the sum of the parts, individual hams, members of nets, trunks, ORS, OPS, RMs, PAMs, SCMs, etc., each one with a fine individual responsibility to make every sked click not only take pride in their work, but deserve the thanks of all our fraternity for carrying forward the "public service" tradition of amateur radio, to higher levels in individual and group readiness to serve.

In the emergencies of last season certain inadequacies in the operating abilities of new men belonging to both c.w. and 'phone ranks were
made apparent. We have a substantial annual turnover in ham ranks... and without self-interest and training in systematic lines of work the booster for either mode of communication cannot find himself either accurate or speedy in handling telephone or radio circuits. In an emergency such men haven't "what it takes" to take over an important radio circuit with any volume of communications. They may make good messengers or supplementary aids, but the vital radio links take skilled operators, else the penalty of garbles and delays, inadequate station records etc. It is not to argue the relative merits of c.w. and 'phone that we write. That each has its important place has been demonstrated. This is just to suggest that in getting our fun out of the game, all of us, whether able to go in for hamming in a big way or not, and whatever our pet branch of the hobby, ought to make a station practice of handling a few good messages—enough to know correct form, and be able to write down a communication properly and accurately—else where do we all stand when opportunities to do this in a big way for ham radio occur? It is unfair to yourself to be able to help only as a messenger or aide to a station in emergency, and unfair to others to pull down an otherwise splendid average performance by unduly slow and inaccurate operation with chances of illegible results. More and more, however, operators tried of so-called rubber-stamp "73-cul" QSOs are turning to organized phases of amateur work that combine operating fun, more QSOs in limited operating time, strong personal friendships, with constructive building of personal communicating abilities.

-F. E. H.

Briefs

The South Hills Brass Pounders & Modulators third annual hamfest was held in Pittsburgh, Pa., Sunday August 2d. It was slated to open at noon, but long before that time out-of-town visitors started to arrive. W8IJZ of Manchester, Ohio, being the first at 8:30 A.M. They kept coming until the registration cards showed a total of 787 paid admissions! This was one of the largest ham gatherings ever held in the Pittsburgh area. There were many present who did not register, among them being wives and children, so the full attendance is estimated as being over greater than 787. The numerous prizes distributed had a cash value of nearly $1500. It is hardly necessary to say that everyone enjoyed the affair!

Life Saved by Amateur Radio

The alertness of Elmer Asselin, and S.W.L., who is a shut-in, residing at 4330 Ithaca St., Strathcona, was responsible for the saving of a human life, Gerard Fournier. 35-year-old lumberjack, was found from the backwoods to rest comfortably in a Montreal hospital after a tree fell on him, breaking his back. On the evening of October 3d, Elmer Asselin, who passes away the long hours, during which he of necessity must remain in bed, by listening to amateurs, heard VE2GB, Berthierville, Que., calling "CQ Montreal Emergency" on 'phone. Asselin immediately had his father telephone to VE2HT, O.P.S., who lost no time in diving into his shack and throwing the receiver and transmitter on the air. He heard VE2HL of Quebec City calling "CQ Montreal." Contact was made and it was learned that Fournier, the injured man, was at the shack of Dr. Rivard. VE2BH, at Clova. Contact was established with the doctor and, at his request, authorization was obtained to transport Fournier to Montreal by plane. The plane left Clova at 7:15 A.M., while Dr. Rivard was again QSO VE2HT. At the hospital officials stated that the prompt action in bringing the injured man to Montreal was responsible for saving his life. Congratulations to all who had a part in this work.

Hams Afloat

W8FFK is now operating on the Steamer Ashabula, WDBG, running between Ashabula, Ohio and Port Burwell, Ontario. W8EJY left the S.S. Grand Island, KFNA, for college; the new operator on that ship is W8CGH. Ex-W8OT is with the Coast Guard at Buffalo, "Oil" W1CJD, served as operator on a two weeks' run of the S.S. Appa, KDAK. W8CQI when last heard from was operating aboard the Tug Sulphide, KENQ, which is in the pulpwood trade on the Great Lakes; rig consists of a 3½-kw. spark with conventional detector and two-step receiver. W8CEU is on the Great Lakes operating KFPM, the John W. Boardman. VE2BP keys the 14½-kw. rotary gap on the S.S. Ford Siranthuma, GMSK. W1JL was last reported as pounding brass on the S.S. City of St. Louis, WFCP. Equipment is a Marconi P-4 2-kw. spark and an RCA ET-800 tube job. The latter has an output of 50 watts and uses four '10's in self-excited p.p. circuit. An old-timer, Thos. W. Braidwood, S8U of pre-war days, 3BA after the war, is now in the merchant marine, is returning to the air as W3GLH. Commercial operating has kept him two from ham radio for the past seventeen years, during which he has been on 4 freighters, 7 tankers, 7 passenger ships and 2 yachts—five years on the latter. His latest ship is the S.S. Vosius, KUTS.

Pikes Peak Celebration

Due to the opening of the Pikes Peak highway, Colorado Springs staged a mammoth celebration during which the Pikes Peak Amateur Radio Association took part by covering most of the events by 56 mc. On June 27th the modern version of the Pony Express left Cheyenne headed for Colorado Springs, and the car accompanying the pony express rider was equipped with a 3.5-7 mc. c.w. rig as well as a generemotor powered 56-mc. transmitter and receiver. The a.c. generator which operated the c.w. equipment went haywire, putting the whole burden of communication on the 56-mc. equipment. W9YAE on top of Pikes Peak contacted W9IDL, who was operating the mobile equipment about 40 miles north of Colorado Springs and maintained contact until the express reached Colorado Springs. W9YAE relayed the information on the location of the riders to W9NRZ, who was operating the 56-mc. station in the Chamber of Commerce building in Colorado Springs. The 56-mc. equipment in the car and on the Peak was designed and built by W9IDL. Practically every member of the P.P.A.R.A. assisted in putting over the job of furnishing communication for the Pony Express. Denver hams assisted by securing information on the location of the riders between Cheyenne and Denver and relaying it on to W9YAE on the Peak. W9FWU at Arvada also rendered valuable assistance. On June 28th, 56 mc. also played an important part by covering the foot race up Pikes Peak. This the gang also covered in grand shape.

KAIAN, Official Observer, had the Chinese Vice Consul in Manila out to his station and showed him how the Chinese commercials were using our amateur bands, especially 7 mc. The Vice Consul was much interested and stated that he was sending a cablegram to his home government requesting that the interfering stations be ordered off the amateur bands. Re QRM: In addition to the Chinese commercials we are still having trouble from some radiotelephone stations in the Dutch possessions to the south of us, but so far I have not been able to determine the calls.

-KA1GR, SCM, P. I.
An interesting radiophone test has been made on 14 mc. between VK2ABD (Sydney, Australia) and my station, W6LLQ (Pacific Palisades, Calif.). After contacting a great number of Australian radiophones during the past six months, I selected VK2ABD for a test on extremely low power as the signal from his station is one of the best under normal circumstances. At 11:30 p.m. EST on August 11th, VK2ABD reduced his normal power of 30 watts to .54 watts being 135 volts at 4 m.a. The quality was still excellent, and on normal power was 59 plus; on .54 watts the signal dropped to a varying strength of 85 to 88, but perfectly readable at all times. The test was made in the presence of two witnesses at my station and in the presence of VK2XS at the VE end. I think this is an outstanding record of some sort.

—Henry M. Harris, W6LLQ.

The Rag Chewers’ Club

The Rag Chewers’ Club made its initial bow in June, 1925. Designed to encourage more friendly contacts and to discourage the “Hello-Good-bye” type of QSO, it has done much to bond together those operators interested in honest-to-goodness rag chewing over the air. Membership is still open and a supply of clasp membership certificates are on hand for those who qualify. Follow the rules here outlined and make your station eligible to sign “RCC.” Present club members are urged to sign “RCC” after each call so that those wishing to join may identify you and take steps to get “initiated.”

How to get in:
1. “Chew the rag” with a member of the club for at least a solid half-hour. This doesn’t mean a half-hour of conversation or message handling.
2. Report the conversation by card to the Rag Chewers’ Club, A.R.R.L., West Hartford, Conn., and ask the member station you talked to to do the same. When both reports are received you will be sent a membership certificate entitling you to all the privileges of a Rag Chewer.

How to stay in:
1. Be a conversationalist on the air instead of one of these tongue-tied infants who don’t know any words except “cugn” or “cul,” or “QU” or “nil.” Talk to the fellows you work and get to know them.
2. Operate your station in accordance with the radio laws and A.R.R.L. practice.
3. Observe rules of courtesy on the air.
4. Sign “RCC” after each call so that others may know you can talk as well as call.

How to get out:
1. Call a fellow and then say something like, “W7 nil hr Om cul 78 . . . .”
2. Call anybody if you are so dumb that you can’t make some conversation.

3. Fail to QSP promptly a single message—either by radio or by mail.
4. Call more than five times without signing, or call lengthy QCs without listening for answers.

South African DX Contest

The S.A.R.R.L. is staging a world-wide DX Contest in January, 1936. Serial numbers with RST report followed by three self-assigned figures are to be used by each operator. The contest will start Saturday, January 2d, at 0400 GMT, running through Sunday, January 3d to 2200 GMT, and will be resumed on the following three week-ends at the same time. African stations include the following: ZE1 to 6; ZT1 to 6; ZU1 to 6; CR7, CR8, VQ2, VQ3, VQ5, ZE1, FB9, ON4 and FR8, a total of 27 African zones. Two points will be counted for exchange of numbers between stations, four points for 28-mc. exchanges. U.S.A., Australia, Canada, and New Zealand will be divided into their districts. A multiplier will be used. DX stations will multiply points earned in contacts by number of African zones worked. African stations will multiply points by countries and by the divisions mentioned. A handsome trophy to the world’s highest scorer and a certificate to winners in each country or subdivision.

The above information was received from ZU6E by W6KBD, as well as pertinent details coming from ZU6P via W4AUU.

A.R.R.L. Elections Via W11NF

As soon as the results are known in the elections for A.R.R.L. Director and Alternate they will be transmitted to the entire O.B.S. system (see page 118, Oct. QST) for radio transmission during the following several days.

In addition, the information will be addressed directly to members by W11NF on the following expansion of the daily 8:30-10:30 P.M. EST O.B.S. transmissions:

Monday, December 21st—simultaneous tape transmissions on 3975, 7190 and 14,300 kc.
7:30 P.M. EST 20 wpm
8:30 P.M. EST 20 wpm
9:30 P.M. EST 20 wpm
10:30 P.M. EST 15 wpm
11:30 P.M. EST 20 wpm

Tuesday, December 22nd—simultaneous tape transmissions on 3975, 7190 and 14,300 kc.
8:30 P.M. EST 15 wpm
9:30 P.M. EST 20 wpm
10:30 P.M. EST 25 wpm

W9NTP was declared the winner in the A.R.R.L. 1936 DX Contest for the Los Angeles Division on the strength of his 57,222 points. His nearest competitor was operator H. Y. Sasaki at W6CXW with 45,305.

W9NTP writes an amateur radio column for his local paper and is interested in exchanging clippings with other amateur radio column writers. His address: Wm. E. Brentlinger, 1025 South 11 Street, Terre Haute, Ind.
How's DX?

How's your DX? Did you ever hear anyone say it was good? No; at least not until that elusive station had faded out, or the other fellow had worked him first. At that, it's perhaps a justifiable attitude, since DX is one of the most highly specialized forms of communication in amateur radio. And the prize usually goes to the fellow with the patience to sit down and comb the band, edging up to high-powered locals in the search for a weak signal that means the umpty-umpth country in the ninth continent. Then you switch the antennas around until you find which one he peaks on, and you give him a blast, key arcing and transformers groaning. . . .

Where:

How many times have you worked a rare one, only to find that you had no way of confirming the QSO, since the QRA was not known? Never? Then you are lucky. Take the case of Charles Koppe, W8CHO, for example. He worked VR2NB on the 4th of October (14,350 kc. RAC) at 10 A.M. E.S.T. VR2NB, according to the international prefixes, should be in the Fiji Islands, but he gave his QRA as "Sandakan," which is in British North Borneo (VS4). The answer, of course, is that VR2NB is now VS4CS . . . . FMSF, worked by W9RBI on October 13th at 12:30 P.M. (14,200 kc., very a.c. phone), is not so bad, probably a brandnew station. VR2NB was his "B4UP". W9RBI is W0 over there . . . . But the lad who is in a quandary, an old, deserted country in the ninth continent. Then you switch the antennas around until you find which one he peaks on, and you give him a blast, key arcing and transformers groaning. . . .

John M. Davidson, ZElJR, whose 14-MC.

"Phone signal has been coming through regularly the past few months"

A real old-timer, he signed FO1SR in 1919, made his c.w. WAC in 1926, and his "phone WAC in 1935.

however, is ZS8A, s6 almost any morning but tough to raise . . . . A few for the East coast gang: KA1BH, on "phone, comes in from 7-8 A.M. E.S.T. at 14,320 kc. VR2AU, on 14,300 kc., T9, 12 noon; PK6AK, on 14,200 kc., T9, 11 A.M.; V31AA, on 14,050 kc., T9, 2 P.M. . . . John Crawford, W9YPG of Indianapolis, has been keeping his 10's warm. In the region between 14,200 and 14,300 kc. he found 22OC, 2JLL, 2JLI, 2JNB, 2JEQ, 2JFT, 2JGR, and 2JCC. Other stations worked include KAIAP, SU1SG, 1Z2AB, ES5C, ZP2AC, and VR5VC.

Whos:

From W6AC and W6MCQ in San Francisco we learn that Van, ZU7J, is seriously ill at a hospital in Cape Town, having a lung collapsed. He is anxious to get back on the air with his new SOT transmitter, and says to look for him on the old frequencies with more sock shortly. We all wish you a speedy recovery, Van . . . . Fellowes like George Heideman, W7AXX, deserve a hand. How many would have the fortitude to crank a Ford engine every time they called or worked someone? Yet George does just that since, with no a.c. available, a Ford engine-driven generator is the only way he can get power for his 10's. It prevents his working break-in or coming back fast but—DX: WAC and 35 countries; cost: about 20 cents per morning. And now no cracks about, "OK, let George do it!" . . . . From W3ZPO we learn that US3A in Morocco needs QSO's with Vermont and Kentucky for his W.A.S. Look around 14,420 kc. for a T9 signal . . . . Not for W.A.S., but because he is ex-WDZ1L. OA4AB is looking for contacts with stations in Utah and South Dakota. Look for him on 14,064 kc. in the evening and early morning. Full QRA is: D. P. Wilkes, care Cerro de Paso Copper Corp., Oroya, Peru . . . . The VK/ZL contest brought forth some commendable performances. Jerry Mathis, W3BES, worked 47 VK/ZL stations in 7 hours on October 4th; Clark Redlin, W1SZ, worked 61 over a 24-hour period on October 21th . . . . Dick Sears, WB1LR, sends a note of encouragement to the low-power 'phone merchants. During September, Dick had 39 contacts with 'phone, nearly all of them good rag-chews. The power used was 80 watts to pull-push 10's. Outstanding signals reported are VK2IQ, VK2ACO, VI2A2, VK3Z2, VK7JB, and VK3MR. Mornings up to 8 A.M. E.S.T. is the time . . . .

The first HBE (R.S.G.B.'s "Heard British Empire" award)
QST

By Harold J. Burchfield, W6JTV

A HARASSED Red Cross official sitting at his desk, candle light showing the scars lines on his face, a dead telephone beside him. Outside the flood waters rising by the hour. Already cut off from his outside ties by the rising waters which had inundated the roads, stopped the trains, up-rooted the telegraph poles, fed the city into total darkness. The howling wind, driving the heavy rain against the glass. Truly in a position not to be envied. With the knowledge that many were homeless, sick, hungry, wet and shivering with cold, the hospitals without light and in-erected for the homeless, kitchens had been established to feed the workers and the destitute, some ‘phone service had been restored, but still the tireless amateur was at his post, calling for a doctor to help some person too up to it. That “Service” as applied to the ama­teur rests on two essentials. From amateur radio proficient operators are available in time of national emergency such as dawn approaches a plane’s motor is heard overhead, circles a few times, and drops several parachute loads to the earth below. Antitoxins, bandages, surgical instruments, food. Those cannot be lowered by parachute for the roads are all under water, as are the fields, and there is no place for him to land. Soon another plane shows in the distance, then two more. Their loads soon dropped, they return to their base of supplies for more.

In the meantime others in the city have been busy, five-meter rigs have been set up at strategic points, and these are quickly utilized to take the place of the out-of-commission telephone system. Even with the efficiency of the modern telephone repairmen, they can work so fast and so faster. In the meantime communication in and about the stranded community was of the utmost importance. Organizing and directing search parties to go through the wrecked homes, looking for those who may have been pinned under falling debris, bringing a lost child back to the arms of its hysterical mother, calling for a doctor to help some person too injured to be moved without medical aid, giving the repair crews assistance in ordering and obtaining emergency ma­terial for repairs to the AC mains, and to the illuminating gas pipe lines. By evening things were well under control, feeders had been attached to another source of electricity, and a limited amount of power was available. The telegraph had been re­established and the city was slowly coming to life. A more and more messages asking for aid of all kinds, medical supplies, food, tents for the homeless, messages to loved ones outside the stricken area. Contact is quickly made with another ama­teur some hundreds of miles away, a good operator, one who can get in touch with the State Capitol. Within a few hours as dawn approaches a plane’s motor is heard overhead, circles a few times, and drops several parachute loads to the earth below. Antitoxins, bandages, surgical instruments, food. Those cannot be lowered by parachute for the roads are all under water, as are the fields, and there is no place for him to land. Soon another plane shows in the distance, then two more. Their loads soon dropped, they return to their base of supplies for more.

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PAØ DX Contest

The N.V.R. announces a PAØ DX Contest to be held on the following week-ends: Dec. 12/13; 19/20, 1936; 26/27; and Jan. 2/3, 1937, from each Saturday at 1940 GT until Sunday at 2040 GT.

Each PAØ station will give a code group which must be confirmed via QSL card. Only one contact with each PAØ will be permitted during each week-end, unless the contact takes place on another band. The station in each country that contacts the greatest number of PAØ's will be awarded a certificate.

Code Practice Schedules

Additional code practice volunteers: W9JYO, Lima, Ohio, transmits code lessons each Tuesday and Friday from 5:00 to 6:00 P.M. EST on 1933 kc. W8PBP, Pontiac, Mich., transmits on Wednesdays and Fridays, 7:00 to 7:30 P.M. EST on 1765.5 kc. Starting December 15th and continuing until February 1, W8PBP/W8UA, Olathe, Kansas, will transmit code practice daily from 7:00 p.m. to 8:30 p.m. on 1933 kc. This station will be remembered for an excellent series of code lessons a few seasons ago. We welcome these new Code Practice Stations and wish them every success.

The first year Engineering Class of Columbia University comprises 14 men. Of them, 5 are hams: W1FTA, W2DJQ, W2GUL, W3GVL, W7BSL.

BRASS POUNDERS’ LEAGUE

(September 16th-October 15th)

Code Practice Schedules

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 122): W3EOE, W4QOV, W4EVE, W6EAG, W7CH, W7FL, W7CFV, W9ZJ, W9UF, W9BLL, W9F7G.

O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 122): W3EOE, W4QOV, W4EVE, W6EAG, W7CH, W7FL, W7CFV, W9ZJ, W9UF, W9BLL, W9F7G.

W7KY, W. D. Allingham, is trustee for club station W7KY. A case of reversed identity. Hi
A.R.R.L. A-1 Operator Club

THE A.R.R.L. A-1 Operator Club was organized in May, 1933, to promote and encourage a high caliber of operating among amateurs. Membership has increased constantly until it now totals 695 of amateur radio's best operators.

Nomination by two operators who already "belong" is necessary before an operator is nominated to membership. A complete and up-to-date list of A-1 Operator Club members is given here—nomination by any two of these operators will make you eligible for membership.

It is not sufficient to be merely a "speed king" to rate membership among the "A-1 Operators"—you must be an "all-round good operator" with consideration given to general keying, voice technique, procedure, copying ability, judgment and courtesy. The Club is open to all active radio amateurs, both phone and cw, in any country of the world. Operating qualifications alone are considered without regard to membership in A.R.R.L., or any other society.

Members of the A-1 Operator Club are forever on watch for candidates for membership. Make your operating the kind that will bring you to the attention of the membership! Nominations are made carefully, members being warned against permitting personal friendships and the like to carry any weight in making selections.

It is hoped that eventually the A-1 Operator Club will number in its ranks every amateur operator who lives up to a high standard of operating technique. Only if you do that, bearing in mind the several points considered, can you hope to join the ranks. Watch your operating at all times! Supplementary to the membership roster appear in QST from time to time as new members are admitted.

A-1 OPERATOR CLUB ROSTER

C.W.: WlABC AFB AGA AJB ALM AMG ANC APR ARB ATR ATJ ABA BB BD BEF BEU BIH BLM BMP BLO BNC BUX BVY BVZ Bly Bma Bne Cen CQF CQG CQG CRP CTF CTI DAY DDB DFS DJF DKK DKB DOW DUB EBM EBT EFA EFE EQE EUG EEU FEO FRO GCF GGM GIK JPL KJL HK LK M (Ha) OR QS SB SS TS UE UB VE VS W8 WZ ZQ, ZVR.

Phone: W8AQM AGJ AKC CQW S8BYM DNO JN TP W8AER AYX HUY CNY DP DK DX DK HX KJ W8AOG BCJ WCW ONE CKT XU W8AJ AOM APN CFC DLD FE FED KK LJF RO WDJ CJX CPR DRR VEDJ EVLJ.

Foreign: 6A4R EJ2S BEO 2MA 2ZQ 3ZY 3QG 3XG NYX 3YD T1U W8FA NEN CBB CQJ CIJ DLD DZU OQ (RL) W8ADP DUC DVC GAL GR3 GXL HJY HXO KFC QD W8AMX BRU BSV CQX TS W8JL CIO CNZ DPZ DZY ESU ESY FUV FVM GUN HGU HLO KDB LKH LPH MDL MEB MDF.

Phone: W8XW W8BBD UN W8ARE VESV DX

FOREIGN

CQWA CP4AAA EA6AIV E855G F8SAB F8EEX SGK SQS SWB Q4PL 2ZY 3ZY SBY S6W S6V 6SP LZY 6WY 6QX 6VX 6U6 6RHQ 6J2G O4AM E1AAN L4UB6E6E IEF1 6H3NBM 04AK 204NAU 4AC P6AEF PKSST FYIAW 2BX SMGSA SPIDE SUICH I6SGQ9QD I6EOSQ 3ML2W 1AP5W VQ4HR ERZEEA 1AM 1AY ZEHJZ Z1AAO Z3BH 2A

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OBERVERS' HONOR ROLL

Cairo Commercial Occupancy Survey For October 1936


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QST for
**ELECTION NOTICES**

To all A.R.R.L. Members residing in the Sections listed below:

The closing date for receipt of nominating petitions for Section Manager, the name of the present incumbent, and results of any previous election for the Section Manager position is December 15, 1936. Nominating petitions have been received from A.R.R.L. members residing in the following Sections. The closing date for receipt of nominating petitions is the closing date specified above, for the active season on 3.5 me., and separate 250-watt on 14 me. CW gets FB results from his 166. JG is QRL with the battery rig. HX has been bitten again by the blizzards. HT, GB, HL and BW did a fine piece of emergency work. Report with your station. Any T.L. or net traffic schedule with W1IQR. JK received cards from both AW and DQ.

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<th>Section</th>
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**ELECTION RESULTS**

Valid petitions nominating a single candidate as Section Manager were filed in a number of Sections, as provided in our Constitution and By-Laws. The term of office is about to be held in each of these Sections in accordance with the provisions of By-Laws 4, 6, 8, and 9. The elections for the active season on 3.5 me., and separate 250-watt on 14 me. CW gets FB results from his 166. JG is QRL with the battery rig. HX has been bitten again by the blizzards. HT, GB, HL and BW did a fine piece of emergency work. Report with your station. Any T.L. or net traffic schedule with W1IQR. JK received cards from both AW and DQ.

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Mr. Weems' term of office began October 1, 1936. Mr. Ferrill, W9LBT, and Mr. A. B. Saxon, VE3SG, were nominated. Mr. Weems received 29 votes and Mr. Ferrill received 16 votes. Mr. Weems' term of office began October 1, 1936. The closing date for receipt of nominating petitions for Section Manager is December 15, 1936. Nominating petitions have been received from A.R.R.L. members residing in the following Sections. The closing date for receipt of nominating petitions is the closing date specified above, for the active season on 3.5 me., and separate 250-watt on 14 me. CW gets FB results from his 166. JG is QRL with the battery rig. HX has been bitten again by the blizzards. HT, GB, HL and BW did a fine piece of emergency work. Report with your station. Any T.L. or net traffic schedule with W1IQR. JK received cards from both AW and DQ.

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storm. The gang wishes to express its deepest sympathy to
lots of DX on 14 mc. HQ has a new transmitter. OD is on
JP on the passing of his mother. JJ now on 14 mc. has a new
spirit River when all wires were down on account of snow.

ALBERTA—CM, Alfred D. Kettenbach, VE4LX-EO
building. DC is getting a pair of 35T's. LQ and QX are
58

112 mc. HV is still keeping schedules on 1.75 mc. nightly.
FZ has built a new rack. JK is contemplating purchase of
a new receiver. HG is grid modulating an '03a on 3.5 mc. ID
spent part of his vacation attending the Convention at
Scheneectady and won a 211 tube. IP is rebuilding with
6L6. BR is still building. For a battery-operated rig using
four 30's as the final, AG is using 'phone on 1.75 mc.
age-most to IN on winning that scholarship. FB, ED, JJ
has finished his new receiver, crystal filter and everything. BE
and BG are keeping schedules with VY7NA. EE has been
published with both antennas. GB is on code and AM on
one night and paid the S.C.M. a visit in company with 2BB;
the gathering consisted of GGQQ, VE2HIP, BB, LJ, LV and
EE. BO has a 6.16 kicking the pants off a' 46. HL EW has
received his new rack, an FB job. JR is using the Comach
Antenna Coupler. CA is using a Taylor 755 as buffer-doubler
and doing a fine job on 28 mc. AH is building to a pair of
35T's. IP has purchased a Johnson "Q" for 14 mc. EP and
GE have both been transferred out of the Province; we'll be
hearer you, fellows. BE was guest speaker at a recent
meeting of the M.A.R.C. Quite a few of the boys turned out
to hear the lecture on Television by Dr. Zwoykin, KM,
LJ, JD and 1N have applied for O.R.S. Your S.C.M. was
highest Canadian scorer in recent International DX tests.
DM is using a single wire-fed antenna now, but DQ doesn't
think much of the idea. It would be interesting to know how
many countries the DX men have visited; send in your
reports and let us compare notes.

Traffic: VE2IH 31 EC 17 HT 57 BU 69 AB 11 GO 33
JX 207 BB 197 JJ 8 DR 105 DG 278 LC 12 EE 14.

PRAIRIE DIVISION

MANITOBA—SCM, A. J. R. Simpson, VE4BG—The
outstanding event of the last month was the amateur
booth at the radio show held at Winnipeg. The M.W.E.A.
put on a fine exhibit and provided the main interest for
the crowds that attended the show. VG keeps active on 7
and 14 mc. and has a weekly schedule with MH at Biegar, Sask.
SS announces the arrival of a new junior V.L. operator also
is busy rebuilding the rig into a rack and panel arrangement
and at present is heard with a T55 final. ED is putting out
a strong signal on 14 mc. with a 211 final and works Europe
on 7 mc. VE3S consistently. AG has converted a 600 into a
smaller rack and panel job and it looks very FB. QB
is back on the air with a low-power rig until he can get some
high power lined up once more. JT still keeps well up in
front with the DX. EK is back on the air with a battery-operated
phone. GL is moving to new QTH and is planning a new
skyhook to put out his signs from a pair of T155's. GQ
is busy rebuilding with a pair of T35's in the final. IP is about
to move to new QTH and is planning a DX rig. IM is moving to
new QTH and is planning new DX rig. ED has a new
Johnson Q antenna and finds it to be FB; he also is acquiring a new
Hallucrafter a.s. crystal receiver. LH is busy putting out a very FB
phone signal on 14 mc. MW has that receiver built and is now trying to get his rig
working properly on 14 mc. VM has finished rebuilding his trans­
mittance but is shortly going to be married, so will not be heard
for some time yet. NI keeps 14 and 28 mc. hot with his very
FB phone and is working his share of the DX. NM keeps
consistently. AG has finished rebuilding the outfit
and VK's consistently. AG has finished rebuilding the outfit
and VK's consistently. AG has finished rebuilding the outfit.


Traffic: VE3S 56 HT 35 HH 69 AB 11 GO 33


Traffic: VE3S 56 HT 35 HH 69 AB 11 GO 33


On Planned Use

10 Maple Pl., Irvington, N. J.

Editor, QST:

I read with interest your October editorial on the planned use of our bands employing engineering principles. Your exposition of the problem was very complete, in my opinion. However, I violently disagree with the idea of an essay contest in order to collect opinions. We suffer from too many opinions and too few facts. You may get opinions, to be sure, from such a contest, chiefly I believe from non-engineering sources. When we are ill we call a doctor, not a blacksmith. It seems to me that engineers should be consulted on a problem that is strictly an engineering one. An impartial unbiased allocation of 'phone and c.w. within our band limits can only be accomplished by such means.

The first thing that an engineer requires before attacking a technical problem is the collection of as many facts as possible pertaining to it. I would like to point out that no data of real value is available at the present time. If we have a collection of facts concerning the habits of the amateur as regards hours and frequencies and several other factors, then and only then can we start to improve things, working on a tangible base instead of guesses or opinions.

The League's withdrawal of the request to increase the size of the 75-meter sub-band is a case in point. The reasons given are all right as far as they go. Here again we have an opinion developed by the Board that the band should be widened backed up by extremely sketchy facts, to say the least.

If we continue in the belief that no changes should be made unless unanimous amateur opinion is necessary we might as well consider the bands permanently frozen in their present state. There will always be objections to any change regardless of great benefits to the majority. However, I feel that most amateurs are fair-minded and if they are shown the actual facts in any given situation they will stand back of any action the Board of Directors may take.

I would like to point out that the seven members of the F.C.C. are not necessarily engineers. In this respect they are similar to our own Board. However, the similarity ends immediately on technical problems because the F.C.C. maintains a competent engineering staff whose opinion is carefully weighed on engineering matters. I believe I am correct in stating that the Board in all its history has made no effort to secure opinions from the dozens of competent engineers who are also active amateurs. Even if they had the engineers' opinions would be of little value because of the lack of facts on which to work.

The League's business has of course been conducted in excellent fashion as evidenced by its continued growth and world-wide prestige. In this respect my hat is off to the Board of Directors for their display of foresight and good business judgment. Business ability is not a gauge of engineering ability, however, and successful operation of the League business does not qualify the Board members as engineers. The results prove this to be true. Apparatus development in the hands of the Headquarters staff has advanced amazingly. Our frequencies in the hands of the Board are a Topsy-like growth that engenders an increasing dissatisfaction which is on the increase.

No criticism is of value without constructive suggestions. If our technical progress insofar as apparatus is concerned kept pace with our progress in frequency allocation we would still be using rotary gaps and one-tube receivers. We don't have to stew in our own juice in the present manner if engineering horse sense is applied to our greatest problem in place of an "it can't be helped" attitude.

Let us have a complete accurate survey of all of our bands as a starter. Let this material be placed in the hands of engineers. I suggest that one 'phone and one c.w. man be appointed by each divisional director. Let these men thresh out the problem and let their conclusions then be presented to the Board of Directors for action. Let the survey results and the Board's decisions be published in QST. I am sure that every fair-minded amateur will get on the band wagon instead of rocking the boat and improved conditions together with a greatly improved esprit de corps will result.

--D. A. Griffin, W2AOE

1253 Washington Ave., Wisconsin Rapids, Wis.

Editor, QST:

... The editorial in October QST ... is certainly a thought in the right direction. When we start dividing up the bands, why not go all the way? Several changes won't cause any louder squawk than one change in the present
regulations. We are all agreed that conditions on our bands are bad, and we want something done about it. Let's do those things that best satisfy the majority, because you can't please 'em all any way. Why not make all rigs crystal controlled after a certain date? (It worked out fairly well when p.d.c. became a requirement.) If c.w. is good for the broadsides band it's good for us. Until we get those additional frequencies we are after, let's widen the output of our bands and make use of those frequencies that are now blotted out with broad, rough, wobbly signals. The cost of c.w. is about the same as the antiquated p.p. 10's, and most hams end up with a crystal rig anyway. Reduce the QRM and the kw. boys will be more willing to reduce power, thereby further reducing the QRM. While I am strictly c.w., I realize what the 'phone men are up against, and if we clean up our c.w. bands we will have more frequencies, and I think the 'phones are entitled to some of them, but this cleaning-up business goes for the 'phone bands also. Let's...quit laying a book on the key for 15 minutes while we tangle the rig, especially at night.

Then why not kill this Class C license except for shut-ins? The present Class C boys will make the grade so it won't work a hardship on our brother hams, but it will stop some of the new ones from learning the code on the air.

The editorial by K. B. W. in October QST struck me as being the sanest and surest method of alleviating some of the QRM....

---Francis M. Becker, W3GJP

---Absecon, N. J.

Editor, QST:
The editorial by K. B. W. in October QST struck me as being the sanest and surest method of alleviating some of the QRM. . . .

---Eugene "Red" Stiles, W4LBB


Editor, QST:
This fact should cause more thought about your October editorial. On the morning of October 13, 1936, about 7:38 A.M., I contacted WIGAN. We had a QSO for ten minutes when I had to leave my house. I was using an input of less than .75 watts on 'phone.

I contacted WIERG, E. Douglas, this noontime and WDWP, New Milford, Conn., also Q5 BS.

It seems that in the absence of QRM results are satisfactory. The antenna, by the way, was very poor. It was a Zepp of incorrect length. The feeders were almost touching the ground. What waste of power is going on!

---Edward Kawatsuki, W1HISK

---Rocky Mount, N. C.

"Harmonic Couplers"

Editor, QST:
...I note with interest an epistle by a Kansas ham who advises against the use of importance matching networks in antenna coupling circuits, with the reason that such coupling circuits as ordinarily used in amateur transmitters will increase harmonic radiation.

It is funny the number of gadgets the average ham will read about and immediately build, thinking he will have something superior to time-proven circuits. But the fact remains that in this case someone has been grossly misinformed, as the only practical value of an antenna-coupling unit is to reduce harmonic output; the matching network being nothing more than a low-pass filter.

We all agree that it isn't so nice to get in bad with the F.C.C., but I believe if Mr. Kansas will see that his antenna unit is working properly, he will have less, and not more, harmonic radiation.

---Paul Dillon, W5GN-WEBB

Editor, QST:—The significant phrase in the above letter is "working properly." Correctly adjusted so that it constitutes a pure resistance load at fundamental resonance, the pi-section filter displays capacitive (short-circuiting) reactance to harmonics. If mistuned on the inductive side of resonance, however, inductive reactance is offered harmonics, and they are frequently transmitted with equal or greater efficiency than the fundamental. Regrettably, this condition of mistuning is not invariably apparent, and is quite frequently regarded as the normal mode of operation. Therein lies the danger of low-pass antenna-coupling filters.

---Damariscotta, Maine

Editor, QST:
The more we observe the average present-day ham the more we are tempted to recount some of the old time experiences in order to enlighten some of the "brethren."

Our text-to-day is that you can't just sit on the band wagon and ride continuing without wearing out the guy that's doing the pushing, and while we're on this subject it's a

---Continued on page 68---

Bread on the Waters

Damariscotta, Maine

Editor, QST:
The editorial carried in the October issue of QST gives the amateur much food for thought. Planned use of our amateur frequencies is indeed a problem of vital concern to all, and intelligent study should be invited and encouraged in order that some sort of a plan most beneficial to the veteran as well as the novice, to high-powered stations and low, could be worked out.

That some such plan is needed is evidenced by the ever increasing number of stations appearing each month. [Editor's Note.—Many new stations, yes, but the 40% annual turnover must also be remembered.] We also know that this number will continue to increase as time goes on, and unless something is done within the next year or two, chaos will surely reign supreme in the few frequencies allocated for amateur operations.

Two of the suggestions mentioned in the editorial in my opinion are very noteworthy, and I am in favor of the adoption of both. If a station is a station should be required to have some arrangement for reduction of power when full power is not necessary to carry on successful communication; and
To MANY, the particular joy of amateur radio is sending a readable signal over as great a distance as possible. The obvious way to do this is to increase the power of the transmitter. This method works very nicely up to a certain point, — that point being when the legal limit of 1 KW is reached. There are rumors that the method is used even beyond that point, for now and then one hears of the “California Kilowatt,” a unit that is measured by the operator’s conscience instead of a wattmeter.

In any case, there is really no need to resort to such devices. In this country at least, the legal limit is on the input, not the output, so that any increase in last stage efficiency results in a perfectly permissible gain in output power. Doubtless the law was written the way it was to encourage higher efficiency.

The subject is quite timely, for the recent development of new triodes designed to work into high impedance load circuits permits a much higher plate efficiency than possible with older arrangements. Output is materially increased. To be sure, more driving power is required to get maximum output with high impedance loads. But what of it? If plenty of signal, — all the law allows, — is what you are after then excitation is a minor problem. The legal watts are the ones that are precious.

However there is another even more effective way to increase the signal. That is to use some sort of directional antenna. Personally we never cease to be astonished at the results obtained by their use. Recently we had very disappointing results with our transmitter connected to a conventional antenna. Disappointing is hardly the word to use, for the only result of a day of calling CQ was one contact. W1SZ and W1DF who later spent an unfruitful evening laboring over the rig evidently considered this contact a major miracle, for they promptly sent us a special richly-engraved WOS* Certificate. After that experience we decided that the location must be poor, and set out to build a 1 KW affair using the high efficiency triodes mentioned above. We also built a directional 4-element vertical array. The antenna was finished before the transmitter, so we connected up a little 15 watt exciter to try it out, and pulled in R-9 reports from the Middle West. Maybe our location is poor, but the array certainly does push the signal out. And it certainly does pull signals in, too. We have proved, to our own satisfaction at least, that a good array is 10 db better than a flat top for reception.

Incidentally, vertical arrays of the type shown in the drawing have much to recommend them. Directional antennae such as the W.E. “Diamond Array” give splendid results but they are so big that the amateur is somewhat at a disadvantage in trying to use them. The system shown above is mounted on an umbrella-like frame of bamboo, and is light and compact enough to be rotated easily on a pivot. The tower shown above is somewhat pretentious, but probably the peak of the barn roof would do just as well as a place to mount the array.

When orienting a directional antenna, do not take bearings from a flat map. Use a globe, and stretch a thread around it from the location of your station to the point you want to reach. Great circle paths are deceptive. For instance, here in New England the beam must be aimed North of West to put the signal in Australia. You can win a bet on that one any day, and it is easy money.

* WOS — Worked One Station

JAMES MILLEN
Bread on the Water

(Continued from page 60)

good plan to remember that, as a rule, "You can't get out any more than you put in," and it's a mighty good idea to get behind organized authority like A.R.R.L. and pull together like we did in the old days.

In the back yard of 69 High St., Portland, Maine, there was a regular ham radio station owned by Everett "Nemo" Spencer Rogers. The station was in operation years before licenses were issued. Some of the gang who grew up in radio there were "Nemo" (now W1GE); Conrad T. Beerda1y, who was known as "Hunker" and who is now an engineer at R.C.A.; Howards Wash., "Bonehead," whose cartoons have appeared in QST; and yours truly.

It will interest you fellows to know that in those days we joined right in the regular commercial business. We would contact European steamers coming into port and report their positions and docking time to Western Union who would forward same to the company's offices and the whole business accepted as official—but of course without pay to us.

This story concerns the time that William Howard Taft was president of the United States. It seems that for some reason or other he was riding around on the Mayflower and decided to make a visit to Portland, Maine. As they were proceeding up the coast we contacted them and later heard an official message routed through old WBF, addressed to Senator Hale at Portland. Briefly, the message requested the senator to meet the President at the dock in the morning at a rather early hour. We knew the senator was at his summer home at Falmouth Foreside and we reasoned that, by the time the message was transferred over the wires and reached Portland and the messenger had tried to deliver it at his city residence, it would be some time before the important information reached him.

In a garage directly back of the shack was an "old faithful" Cadillac. This car had a serial number less than 100. It was one of those old buggies where you walked up a ladder in the back and cranked on the side. It had a handle to steer with and it was a regular volcano when it got going. Begoggled and determined, with the message in one hand, part of the gang started out in the chilly night air to deliver the message at once.

The trip of several miles was uneventful but upon arrival everyone in the house had retired and we stirred up quite a commotion before the object of our visit was comprehended. The senator appeared in time and the import of the situation slowly but surely dawned upon him. It meant a heap of work for him in calling all the dignitaries together and needless to say there was not much sleep in that household the remainder of the night.

When he realized the service that had been so cheerfully given to assist him he was overcome with gratitude and he thanked the gang over and over. He said, "Boys I don't know how to thank you, but if the time ever comes when I can return the favor do not hesitate to call on me."

Many years passed, and in 1921 we hams were having a devil of a time with legislation intended to cut us down. Yours truly at the time was A.D.M. of New England. A.R.R.L. was pulling like heck to hold what we had, but all of us were concerned. As I meditated the possibility of any little bit I could do to help that old incident came to mind. I immediately wrote a letter to Senator Hale, who was chairman of the Committee on Naval Affairs which at that time held our destiny in its hand. I appealed to him urgently, telling him I was one of the gang that helped him out when President Taft came to Portland so many years ago and asked him if he remembered.

"Boy, oh boy! The letter I received in reply I shall never forget. It was very cordial—but I only saw three precious words: "Yes, I remember." All at once the Senate Committee on Naval Affairs came out with a vengeance for the ham and we saved the day.

I do not for one instant believe that the fate of the legislation was determined solely by my letter but I do believe the "broadsheet upon the water" so long ago did return.

In my humble mind there seems to be an outstanding moral to this story. It prompts me to suggest that we focus our minds and apparatus on service to the people and communities where we live. Cut out all this eternal arguing and pull together as a solid gang back of A.R.R.L. Then the future—the bands and the privileges—will take care of themselves.

--- H. W. Casher, W11BE
Recently I made an extensive trip around the country, during which time I discussed with many amateurs their receiver problems.

The enthusiastic interest in a special band spread receiver the laboratory designed for me some time ago, leads me to believe that such a receiver would be welcomed by many amateurs.

Therefore, we have made a limited number of these special receivers which are now available through your regular National dealers.

The price* is unusually low, because the standard NC-100 tools as well as the standard HRO laboratory test equipment are used for the production and testing of these strictly amateur receivers, the only new tooling being the blanking die for the “trick” condenser plates necessary for Straight Frequency Line tuning over the calibrated band spread ranges.

James T. Miller

**FEATURES:**

**FIVE BAND SPREAD RANGES**

- 1.7 to 2.0 megacycles
- 3.5 to 4.0 megacycles
- 7.0 to 7.3 megacycles
- 14.0 to 14.4 megacycles
- 28.0 to 30.0 megacycles

**AUTOMATIC PLUG-IN COILS**

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**AMPLIFIED, DELAYED A.V.C.**

**POWER OUTPUT 10 WATTS**

**C.W. OSCILLATOR**

**CRYSTAL FILTER†**

**BUILT-IN POWER SUPPLY**

**12 TUBES**

*Retail price, complete with tubes, crystal filter,† 10” dynamic speaker chassis, etc., $125.00

†U. S. Patent No. 2,054,757

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Centralab comes to the rescue with its New SELECTOR SWITCH

When you fall asleep, dead to the world from fatigue, trying to dope out how in blazes you're going to get all those dizzy connections right on that new analyzer ... take it easy ... CENTRALAB'S new SELECTOR SWITCH KIT, with thousands of combinations will ALWAYS solve your problem. See your jobber today.

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**Centralab**

**Signing**

Editor, *QST*:
Although I am a new ham I have been noticing the great waste of time in QSO's due to signing each time the parties switch from one to the other.

... When break-in is used, you can discuss each item and get rid of it and as soon as any part of the QSO is lost or not understood you can break-in and get it straightened out. All this will reduce the time of QSO's for the matter transmitted.

Everybody does not have a receiver which will permit break-in nor as we see it this necessary.

I see no reason why in ordinary communication we cannot use the same system. For example, suppose after establishing contact with a station I ask a question and sign "K." He can come right back and answer and in turn say his word or two and sign "K." The only time when we have to sign the calls is at the end of the transmission.

Rule 384 states that the only time you have to sign is at the end of each transmission. The only ambiguity lies in the definition of the word "transmission." Rule 386, in regard to logging, indicates clearly enough that "transmission" means the QSO in its entirety.

... With 'phone and with c.w. break-in it is permissible to refrain from this constant signing, and logically there is no reason why an ordinary c.w. should be burdened with signing a dozen times or so in a single QSO.

Fred Sutter

**Editor's Note.** In following this suggestion, note should be taken of the additional requirement that stations sign at least once every 15 minutes. In other words, sign at the end of each QSO or at least every 15 minutes, omitting calling at the beginning and end of each "come-back."

---

**Going to Europe?**

John Bright St., Birmingham, 1, England

Editor, *QST*:
Whilst in the States, I found a tremendous number of hams and their wives who wished to visit Europe, particularly England, and 1 suggested to one or two of them that it need not be anything like as expensive as most of them had thought, particularly if a large group could come over together. All of those to whom 1 spoke received the idea favorably, and in contacts over the air 1 am getting a tremendous number of inquiries as to whether anything has been done about this.

This visit would not only cement the already growing friendship between British and American amateurs but would provide facilities for many who could not otherwise afford the journey. In addition to this, it would be excellent publicity in Europe, making the European countries much more radio conscious than they are at the present time.

A lot of the organization would have to be done at the American end but in order that I may have further data to enable me to get in touch with the shipping companies and obtain the lowest possible rate, 1 would like to know who is interested in the proposition, the number who would like to come and the most suitable date for them to make the trip. It is suggested that the length of time to be spent in this country should be of the order of 7 to 10 days....

I would also like a volunteer at the American end to look after the arrangements over there, if the scheme goes through.

---

**W. H. D. Nightingale, G6NI**

**Strays**

W2DTE's contribution in connection with the restoration of cheap milliammeters (p. 37, September *QST*) brings to mind a method I have used successfully for a long time. When the meter magnet becomes demagnetized by reason of overload, remove the magnet from the meter and rub it vigorously for a few seconds on a small horseshoe magnet—the 10-cent store variety—with the
ask any amateur!

It's what you find under the cover that counts. The critical attention to detailed construction ... the employment of component parts of highest grade and quality ... the rigid laboratory checkup on every receiver ... above all, the guaranteed satisfaction to the owner ... makes the RME-69 Single Signal Super the logical choice.

Write for Bulletin 69

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Dykanol, Mica, Paper, Wet and Dry Electrolytic

An Inexpensive Five-Band Low-Power Transmitter

(Continued from page 16)

To adjust the doubler, again insert the dummy jack in the driver jack and set the oscillator going as before. Then insert the meter plug in the doubler jack and, with the proper plate coil at \( L_2 \), rotate \( C_2 \) until the plate current dips, indicating resonance at the harmonic. The doubler cannot be operated on the same frequency as the oscillator, since it is not neutralized. The plate-current dip should be from about 40 ma. to 20 ma. (with the driver tube in its socket), when the doubler is tuned to twice the crystal frequency. When quadrupling, the dip will be quite small, but the neon bulb should glow when touched to the grid of the driver. Make certain when quadrupling that \( C_2 \) is tuned to the fourth and not the third harmonic; usually both will be found on the same coil. The fourth is of course the one at the lower-capacity setting of \( C_2 \). The driver tube is tuned in the same way when operating from the doubler as when being excited directly by the oscillator.

To adjust the final stage, get the oscillator and open end of the meter magnet facing the open end of the horse-shoe magnet. This is quick and convenient.

—W5ELC
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THAT'S WHAT THESE BOYS OF W4AZK SAY ABOUT THE AMPEREX HF100

Read the rest of this unsolicited letter...

(Note: 300 watts of output can be obtained with 2 watts of driving power.)

"... Below are some of the reports received and stations worked in one evening from eleven o'clock PM to six o'clock AM and in a location very unsatisfactory for DX. The figure after the call letter indicates the signal strength as reported to us by that station. An input of 300 watts was used at 14160 kc.

\[
\begin{array}{ll}
\text{WEIS} & \text{VE4CW-8} \\
\text{VE1BR} & \text{F611-9} \\
\text{W4FDO} & \text{T1BDG-7} \\
\text{W7AOT} & \text{GAMV-7} \\
\text{G6AQ} & \text{VPSR-8} \\
\text{F2CO} & \text{VE2BG-9} \\
\text{G6AH} & \text{T12CR-7} \\
\text{VK5L} & \text{T15J-8} \\
\end{array}
\]

This was two weeks ago and we are having the same consistent reports coming in. We cannot say too much for the HF100 as we believe it to be a tube that cannot be beat.

Very truly yours,

David S. Traer
W4AZK

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Filament ...................... Voltage 10 Volts
Amplification Factor .................. 10
Grid to Plate Transconductance @ 100 ma. 4500
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Plate to Filament ............. 1.4 uuf.

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driver into operation, and insert the proper plate coil at L4. Leave the key open. Touch the neon bulb to the connection at one end of L4 and rotate C4 until the glow appears, indicating resonance. The neutralizing condensers, C16 and C17, should both be set at minimum capacity. Now increase the capacity of both neutralizing condensers in equal steps, a little at a time, readjusting both C4 and C5 as each change is made, just as was done in the case of neutralizing the driver tube. The procedure is the same, except that in this case two neutralizing condensers instead of one have to be moved. When the correct settings are found, the neon bulb will not glow when C4 is swung through resonance. The neutralizing condensers should be set at approximately equal capacity; if, on completing the job, it is found that one is at high capacity and the other at low, the whole procedure should be gone through again until the amplifier is neutralized with equal capacity settings of C16 and C17. The bottom-view photograph of the transmitter indicates approximately correct settings for neutralization.

After the final stage is neutralized, the meter plug may be inserted in the amplifier plate jack and the key closed. Rotate C4 to find resonance, again indicated by minimum plate current. With the amplifier plate circuit off resonance, the plate current will be considerably over 100 milliamperes and the meter will go off scale; at resonance the plate current should drop to 10 ma. or less on all bands except 28 me. where it may be slightly higher.

When the adjustments described above have been carried out, the transmitter is ready to go on the air.

ANTENNA TUNING

Since the process of transferring r.f. power from the transmitter to the antenna depends so much upon the type of antenna used, it is not possible to give definite instructions as to tuning. The reader is referred to the antenna chapter of the Radio Amateur's Handbook for detailed information on antennas and tuning systems. We can, however, describe the general method of using the coupler.

With the transmitter tuned up and the key closed, and with the feeders connected to the antenna coupler, move the coupler pickup coil into the vicinity of the amplifier tank coil and try various settings of the antenna tuning condensers to obtain a rise in amplifier plate current. With tuned feeders, it will not ordinarily be necessary to use the loading coil (L2 in Fig. 2), hence the socket can be shorted by plugging a piece of heavy wire in the prongs, or by having available a blank coil form or old tube base with a jumper soldered in the prongs.

It is best to start with loose coupling, causing only a small rise in amplifier plate current. Tune the antenna circuit to exact resonance, and then increase the coupling until the amplifier draws a current of about 80 or 85 milliamperes. Avoid using such close coupling that there is considerable reaction between the antenna and amplifier tuning adjustments. The loading coil may be necessary in some cases where parallel tuning is
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- Crystal mike input
- Gain and tone controls
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used on the lower-frequency bands, depending upon the feeder length.

With everything working properly, the power output of the amplifier will be in the vicinity of 20 watts or slightly more with a plate current of 80 milliamperes. This is about as much plate current as should be drawn with tubes of this type, especially if 'phone is to be used.

What the League Is Doing
(Continued from page 87)

tion of their feelings in the matter. He would be as interested to hear from those who affirmatively feel that it would not be a good idea as from those who favor it. If it can be indicated that the League press will recover its costs in publishing the book, the job will probably be done.

Canada Prepares

Canadian General Manager Alex Reid this autumn made an excellent presentation on behalf of Canadian amateurs before the committees of the Dominion government preparing for Cairo. The petition recited the work of amateur radio and its benefits to the Dominion and requested the expansion of the 7-mc. and 3.5-mc. bands to 7000-7500 kc. and 3500-4500 kc., respectively. The amateur proposals have been taken under consideration by a committee on frequency allocations, whose report has not yet been announced.

Operating Notes on the Transmitting-Type
Beam Power Tube
(Continued from page 26)

tank coil, L4. Below the chassis and directly below their respective coils are the oscillator cathode tuning condenser C3 and plate condenser C5. These are midget condensers of the type which are insulated from the chassis; essential in this case. C3 is mounted on small feed-through insulators to insulate it from the chassis.

The below-chassis view shows the arrangement of the remaining parts in the circuit diagram. R.F. wiring is of No. 14 tin­ned wire; ordinary push-back wire is used for the power leads. The power supply voltages are carried into the unit by means of a cable. The jacks at the rear (bottom in the photograph) are for measuring grid and plate currents in the 807 stage; these currents were of particular interest to us, but it might be as well to provide a third jack for oscillator plate current. The double binding-post assembly is for the connections to the key. Grounds in all cases are made directly to the chassis with short leads. Needless to say, the plate-current jack must be insulated from the chassis. To provide a suitable amount of capacity for the oscillator cathode circuit, C1 is shunted by C8, a fixed mica condenser.
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Air-tuned Aladdin
Polyiron Transformers
In This Circuit

That was the turning point! Only those of us who have actually experienced the effectiveness of these 'I-f's' can realize the complete satisfaction derived in picking up and separating the signals when they are coming in. The technical data sheet 536 is obtainable upon forwarding your QSL card which includes performance curves, circuit diagrams, etc.

### Selectivity at 465 kc

<table>
<thead>
<tr>
<th>Type</th>
<th>Directivity (measured between 6Y7 and 606 tubes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type G101A</td>
<td>465 kc Converter</td>
</tr>
<tr>
<td>Type G201M</td>
<td>465 kc Diode</td>
</tr>
<tr>
<td>Type G101c</td>
<td>465 kc Crystal Input</td>
</tr>
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Cathode keying is used on both tubes. The cathode of the 807 is bypassed to ground through $C_{11}$ in the case of the oscillator, the lower end of the cathode tank circuit is similarly bypassed through $C_{13}$. The r.f. choke in the keying lead from $C_{13}$ is simply a precaution to prevent the key from trying to become part of the oscillator circuit. This system has been found to work very satisfactorily, giving clean keying with no tendency to chirp when $C_{1}$ is set correctly. For eliminating key clicks, it might be preferable to use fixed bias on the amplifier, to cut off the plate current without excitation, and key only the oscillator.

A voltage divider, consisting of $R_{3}$, $R_{4}$, $R_{5}$, and $R_{6}$ in series, supplies the proper voltages to the tube elements when a 400-volt plate supply is used. With the resistor values given, the measured voltages under operating conditions were as follows: oscillator plate and amplifier screen, 250 volts; oscillator screen, 100 volts, oscillator suppressor, 50 volts.

Tuning on any band is relatively simple. Adjustment of the Tri-tet oscillator has been covered many times in QST and the Handbook, and the usual method should be followed. If an 80-meter crystal is used and the plate circuit, $L_{2}C_{2}$, is tuned to the fourth harmonic, care must be used to pick the right harmonic, since both the third and fourth can be hit on the same coil. With the constants given, grid current to the 807 should be about 2 ma. on the second harmonic and in the vicinity of 1 ma. on the fourth. The 807 plate current should dip to a very low value (10 ma. or less) when $C_{3}L_{3}$ is tuned to resonance. Loading the plate circuit to make the tube take about 90 milliamperes should give the rated tube output of 25 watts.

It so happens that with $C_{3}$ and $L_{3}$ as specified, any two adjacent bands can be covered without changing coils, the lower-frequency of the two being found near maximum capacity on $C_{3}$ and the higher-frequency near minimum capacity. If the 807 is used as a doubler on the higher-frequency band, shifting from one band to the other is simply a question of readjusting $C_{3}$, no coil changing being necessary.

All in all, the 807 looks to be a good tube for the low-power transmitter or for exciters. We could wish that a little more internal shielding was incorporated in the structure to eliminate the tendency toward oscillation on 14 Mc. although, as already pointed out, this tendency has no real disadvantages in practical operation. It has been said that tubes of this type, because of their extremely high power sensitivity, are prone to parasitic oscillations, particularly of the type involving the screen circuit. In the rig shown, no tendency of this sort developed. Should parasites be present, however, the recommended cure is to insert a non-inductive resistor of about 100 ohms in series with the screen right at the tube socket and on the screen side of the bypass condenser. This will have no measurable effect on the normal plate output.
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Moving-Coil Tuning System for the High-Frequency Receiver

(Continued from page 31)

difficulties to be ironed out, of which high manufacturing cost is the most obvious but not the most vexing.

In the meantime, there is another straightforward attack. Suppose we make a cast aluminum box, divided by partitions into as many shielded compartments as necessary. Into each compartment put one h.f. coil, together with its air dielectric condenser. This accomplishes at one stroke the air-tight shielding between ranges and between used coils and idle coils. It provides room for efficient coils and low-loss condensers. The next problem is short leads. Easy. Move the coils, shield and all, until the desired set is brought close to the tuning condenser. And lastly, for permanence of calibration, provide an accurate mechanical track for the coils to slide on, and a positive detent to lock them into position on the track.

This brings us back right where we started, of course. We are using plug-in coils after all, and the coil switch is still an unsolved problem. But we have the convenience we were after, since a knob on the front panel of the receiver makes instant coil shifts. And we have a self-contained, compact unit.

Let's see what this looks like in an actual receiver. Two views of the under side of the receiver show the arrangement. The coil shifting mechanism is clearly shown in both views. One side of the coil shield slides on a steel rod finished to close dimensions. The other edge of the assembly is supported by a track machined in the shield itself. A rack and pinion provide a means of moving the coils by a knob on the front of the set. Trimmers are reached through small holes in the shield.

There are several details that the illustration does not show. Metal rubbing against metal causes objectionable noise in high-gain high-frequency receivers. The insulated bearings in tuning condensers point the way to the solution; the coil shield likewise runs on insulated bearings. Suddenly breaking the h.f. circuits causes crashes in the loudspeaker. Experiment proved that removing the screen voltage from the r.f. tubes would make the set "dead", and that it would die quietly. Accordingly, small switches shut off the screen voltage while coils are being shifted. Accurate positioning of coils after range changes is accomplished by the design of the contacts themselves, which are of the double side-wipe type with four-point contact. Since there are fifteen of them, their combined wrap-around effect locks the coils into exact position with unmistakable finality.

As it stands, the moving-coil mechanism gives a pretty good answer to the problem of coil changing. It retains plug-in coils with all their usual virtues, and adds compactness. But only the future can tell whether it is the final answer.

The tuning system, while all-important, is not
The type UM Ultra Midget Condenser is designed for use in ultra high frequency receivers, transmitters or exciters where a small efficient padding or tuning condenser is needed. Its wide acceptance for such use is founded on its small size for mounting in shield cans, on its shaft extensions on each end of the rotor for convenient ganging, and on its universal type of mounting. These features when used in conjunction with our flexible couplings (a few from our complete line are illustrated below) make a unit that is easily adaptable to unusual layouts. At the right in the illustration above, is one model of the UM condenser (a balanced stator model is also available). At the left are two of the many convenient methods of mounting and ganging. Other features include a staked and soldered construction which, together with the "self locking" rotor design, makes the UM condenser virtually proof to vibration. Prices are extremely low, ranging from $.75 (net) for the 15 mmf size to $1.14 (net) for the 100 mmf size.

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Phone Transmitter Using Beam Power Tubes

(Continued from page 52)

the voltages through a constant current drain. Furthermore, with one unit layout is simplified and mechanical difficulties are avoided.

Great care has been exercised in the construction of this circuit to make it economical and easy to assemble with a minimum of kinks to iron out. No special precautions are necessary in constructing the r.f. section.

In the modulation section all stages are isolated by de-coupling resistors and by-pass condensers. Because of the high gain it is advisable to shield completely all leads over one-inch long. The shields of these leads should be connected together and grounded to a common point. Care should also be taken to mount the input transformer at a distance of five or six inches from the driver and output transformer.

Some of the difficulties previously encountered with 6L6G tubes may be eliminated if the foregoing precautions are observed. In Class-AB use, because of the great power output and amplification of these tubes, it is imperative that no high-frequency surges be impressed on the grids. If this happens are-over inside the tubes or at the socket may result. Until everything is properly working it is advisable to shunt a 0.01-µfd. condenser between each grid and ground to bypass these surges. If a microphone is connected or disconnected to the input of the amplifier, the gain control must be turned down; otherwise, the surge may cause damage to the tubes.

Beam power tubes should never be operated in any position except vertical. The beam effect of all of the receiver. The schematic circuit of the NC-100 receiver in which the moving-coil system is used is shown in Fig. 1. In this diagram only one of the tuning-coil range units is shown, for the sake of simplicity in illustrating the circuit principles. In addition to the r.f. pre-selector, first detector and high-frequency oscillator, the circuit comprises two high-gain i.f. stages using air-core transformers, a triode (cathode-drop biased) second detector, pentode amplified a.c.e. using plate rectification, separate c.w. beat oscillator, and two audio stages, the second of which is of the high-output push-pull pentode type. There is also a cathode-ray tuning indicator (6E5) controlled from the a.c.e. circuit. A heavy-duty power supply is built in the same chassis and there is a separate speaker unit.

A crystal filter unit with controllable bandwidth and rejection is optional in place of the first i.f. transformer, between the first detector and first i.f. amplifier. Its circuit is given in the lower left-hand corner of the diagram. With this additional feature the wide range of selectivity from that required for good quality broadcast reception to that necessary for pulling signals out of the QRM on the amateur bands is made available.

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60 watts output with 60% plate efficiencies when quadrupling
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Rebuilding a Commercial-Type Condenser Microphone

(Continued from page 87)

grounded sides of both the output and the plate supply as part of their respective pairs inside the shields, rather than to depend entirely upon the shields for this function. The three shielded coverings should be well bonded electrically at several places along the cable length and the bond at the mike end should be strapped to the chassis. This will automatically be done where the regular cable anchor included as part of the mike chassis is clamped directly onto the shields. A ground from the pre-amplifier should be strapped to the mike chassis and the opposite end of the cable shields should be strapped to the speech amplifier chassis and ground. An early ground may or may not be necessary, depending upon location and arrangement of the speech amplifier.

There seem to be a great many ham 'phones on the air to-day that have good carriers and are not over-modulated but which have poor audio quality. Some don't seem to have any highs over a thousand cycles, which of course makes them hard to understand. They sound as though there were large barrels placed in front of the mikes and as if the operators were speaking their pieces from the opposite ends of the barrels. Then, too, there is the ham who sounds as though he had placed an audio filter in his speech amplifier and was cutting off everything except perhaps a thousand cycles.

78

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Circuit Design of Modern U.H.F. Superhet

(Continued from page 40)

It would seem that if a ham is going to spend enough to bother with 'phone, he would be better off with perhaps less power and a better sounding rig, which would mean spending a little more for the pickup and audio equipment than for the r.f. end of the rig. The average c.w. ham has come to the point to-day where he believes in quality of signal first, with quantity second, and there should be the same motive with regard to 'phone, even though it's only a three-watt rig on five meters.

mobile ignition and other discharges of similar type which are prevalent in the communication-frequency bands. Looking over the problem from this angle, receivers were built up similar to the S.I.G. described by Ross Hull in *QST*¹ that is, a superheterodyne with super-regenerative second detector. This type of detector discriminates against ignition interference. The set worked fine on 'phone signals, but when a beat oscillator was added results were far from satisfactory on c.w. telegraph signals. Another drawback was that it entailed a sacrifice of selectivity in the second detector circuit, this circuit being very broad. Still another drawback, in the multi-range receiver, was the presence of harmonics of the quench oscillator.

Then different types of noise reducing circuits were tried. Some of the audio limiting devices proved fairly satisfactory, while others that had been described were complete flops. The main trouble with audio limiting devices is, as J. J. Lamb has pointed out in *QST*,² that the second detector and audio circuits receive shock excitation which causes undesirable secondary effects.

About this time, *QST* released the information on the noise silencer which works in the i.f. system.² Having been at Hartford while some of Jim Lamb's work was under way, the writer had seen and heard the results obtained. This system was given a trial and proved successful. The 1,600-kc. i.f. offered advantages in this system over those obtained at 465 kc. One of the requirements is a short time constant of the diode resistor and capacity. At 1,600 kc. only about one-fourth of the diode load capacity is required for equivalent r.f. filtering, which allowed us to make our time constant about 4 times as fast, thus stepping up the action of the silencer and making it more effective than the 462-kc. type.

Numerous transformers feeding from the 6J7 noise amplifier to the diode rectifier were tried and measurements were made of the efficiency of the circuits in relation to the over-all set operation. It was found that the full-wave diode transformer for the noise silencer should have gain in excess of that used to feed the diode second detector. In practice, the noise-silencer

---

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by A.R.R.L.

On a choice of tubes for the input circuits, the acorn types 954 and 955 looked very good because of low internal capacities and short leads, which make for gain on the ultra-high frequencies. Some 50 of these tubes were run through tests and their characteristics taken. Then the tubes were put on a live test rack. At the end of 100 hours their characteristics were again taken and about 60% of them were found to have changed appreciably from original measurements. The G6, which had originally varied about 40% from rating, was now varying as much as 90%. Four of the tubes had burned out. At the end of another 100 hours, measurements were taken on the remaining 46 tubes and it was found that only three of the tubes had characteristics near normal and 18 more had burned out. This proved to our laboratory force that for a commercial communication receiver these tubes were not as yet developed to a satisfactory point.

While it was possible to get r.f. gains of 4 to 6 in the 56-Mc. band, it was also possible with 6K7's, by keeping their leads short, to get gains of from 2 to 3, and with the 78 to get gains of from 1½ to 2. This made only a difference of 6 db in the total gain of the set. Another thing that was in the favor of the metal tubes over the acorn or 78 tubes was that the 6L7 allowed coupling the signal-frequency oscillator to the first detector without the trouble involving interlocking which is very prevalent at ultra-high frequencies. From the foregoing, it will be seen that metal tubes deserved choice over the acorn tube for a practical communication receiver.

After having decided on what tubes to use in the r.f. and first-detector stages, the next problem was the design of an efficient tuned circuit for the ultra-high frequency band, and of the coupling from the antenna to this circuit and from the plate of the r.f. tube to the grid of the 6L7. Checking over previous work on the ultra-high frequencies, it was found that coils of rather large diameter and heavy wire had been used, but that in most cases these had been used where only one tuned circuit was employed and where no consideration of other circuits was involved. Measurements were taken of some of these coils and the Q ran from 250 to 350. In fact, one coil which looked very good, being made of tubing, was measured and surprisingly its Q was not as good as that of coils made of solid wire of a smaller diameter. This led to further investigation of different size coils and sizes of wire, and it was
The New 1937 Edition of the RADIO AMATEUR'S HANDBOOK

FOR four months our technical and editorial groups worked on the revision and elaboration of the Radio Amateur's Handbook for its 1937 edition. Many important technical developments during the past year and sweeping changes in operating technique and methods have called for enlargement of the book and rewriting of almost all chapters. Some idea of the extent of the revision may be had from the fact that two hundred new illustrations are included, most of them being prepared especially for this new edition. Special attention has been given to the new developments in noise silencers for short-wave receivers and to the new technical trends in circuit design. A wealth of new material is added to wide fields of transmitter planning, construction and adjustment. The capabilities of the new tubes are exploited to the full in the transmitter designs presented. Extended space is also given to the ever-important subject of antennas, the new ideas in coupling methods being treated in particular detail. The ultra-high frequencies come in for a big share of the space also, new and advanced equipment being detailed to illustrate the newer trends in this rapidly-growing field. As in previous editions full attention has been given to charts and tables of general information for the radio enthusiast; the vacuum tube tables, for example, occupying seventeen pages and being, without doubt, the most complete and detailed tube list ever published.

The basic purpose of the Handbook is to present a complete treatment of every phase of modern amateur radio from elementary theory through advanced practical application, with emphasis always on ideas and methods that have shown their worth in the field. This new edition, we firmly believe, will fulfill this purpose more effectively than any of its predecessors.

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discovered that the $Q$ of a coil wound with two turns of No. 13 tinned copper wire and having $\frac{5}{8}$-inch inside diameter, with spacing of $\frac{3}{4}$ inch between turns, gave us a $Q$ of over 450. The work done along this line showed that for maximum efficiency, even at the ultra-high frequencies, a coil should have about the same length as its diameter. 

A coil of about these "square" proportions worked in very nicely in the general layout of the receiver. Because it was small it had small external fields, and being wound with a wire which can be handled much easier than tubing, it proved a more practical coil from the commercial point of view. In the design of those coils we have gone to No. 14 tinned copper because of slightly greater ease in handling and availability.

In the matter of coupling the antenna to the r.f. stage, the general practice has been to use capacity coupling. Measurements were taken comparing capacity coupling and inductive coupling, and in contradiction to former practice, inductive coupling was found to give better gains. (This was later checked and verified by an independent laboratory.) The same was found true on the r.f. stage. The primary winding was four turns of No. 28 d.c.c. wire in each instance. The whole coil was wound on the small form and dipped in "Q-Max-3" to prevent corrosion and moisture absorption.

The oscillator was of the heater type with the grid of the oscillator directly connected to grid No. 3 of the 6L7. With this type of oscillator it was found that, on the ultra-high frequency band over which it tuned, the output was approximately constant even when no special precaution was taken to load the circuit critically. One reason for this may be that as the frequency decreases the load upon the oscillator is lessened, the input impedance of the 6L7 becoming higher as the frequency is decreased. In tracking the ultra-high frequency band, advantage was taken of the small (0.002-µfd.) a.v.c. by-pass condensers on the r.f. and antenna stages. The oscillator was made to track on the low-frequency side of the signal frequency, where it is in phase with the incoming signal on the mixer grid and not out of phase as is ordinarily the case on the high-frequency side. This leads to greater sensitivity as the result of slight regeneration rather than degeneration, as so often is the case in ultra-high frequency receivers.

It was found that in switching from band to band, appreciable losses were incurred in the first laboratory models of the set. Checking through to find out where these losses were, it was found that they occurred in two places: In the leads from the variable condenser to the switch and from the switch to the coil, and in the bakelite sections of the switch. This matter was taken up with the switch manufacturer and isolantite sections were supplied. The tuning system was then worked out so that the contact arm of the switch was connected directly to the stator of the variable condenser and the lugs on the coil forms were soldered directly to the contact lugs on the switch. Thus extra leads in this part of the circuit
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![Image](https://via.placeholder.com/150)

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<thead>
<tr>
<th>Cap.</th>
<th>Voltage</th>
<th>Size</th>
<th>Weight</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mfd.</td>
<td>2000 V. DC</td>
<td>5 x 3 1/2 x 1 1/4</td>
<td>1 1/4 lbs.</td>
<td>$1.25</td>
</tr>
<tr>
<td>2 mfd.</td>
<td>2000 V. DC</td>
<td>5 x 3 1/2 x 1 3/4</td>
<td>2 lbs.</td>
<td>$1.55</td>
</tr>
<tr>
<td>5 mfd.</td>
<td>2000 V. DC</td>
<td>3 1/2 x 2 3/4 x 5/8</td>
<td>4 lbs.</td>
<td>$2.75</td>
</tr>
<tr>
<td>15 mfd.</td>
<td>2000 V. DC</td>
<td>3 1/2 x 2 3/4 x 11/2</td>
<td>6 lbs.</td>
<td>$5.25</td>
</tr>
<tr>
<td>(including 2 1/2&quot; bakelite standoffs)</td>
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</tr>
<tr>
<td>1 mfd.</td>
<td>1000 V. DC</td>
<td>5 x 3 1/2 x 1 1/4</td>
<td>1 1/4 lbs.</td>
<td>$1.25</td>
</tr>
<tr>
<td>2 mfd.</td>
<td>1000 V. DC</td>
<td>5 x 3 1/2 x 1 3/4</td>
<td>2 lbs.</td>
<td>$1.55</td>
</tr>
<tr>
<td>5 mfd.</td>
<td>1000 V. DC</td>
<td>3 1/2 x 2 3/4 x 5/8</td>
<td>4 lbs.</td>
<td>$2.75</td>
</tr>
<tr>
<td>20 mfd.</td>
<td>1000 V. DC</td>
<td>3 1/2 x 2 3/4 x 11/2</td>
<td>6 lbs.</td>
<td>$5.25</td>
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were eliminated. These two changes made a marked improvement in the gain of the r.f. and antenna stages at ultra-high frequencies.

It will be seen in the circuit diagram of the set (Fig. 1) that the variable tuning condenser is only across a portion of each secondary, while the grid circuit of tube is across the full secondary. It was found that a better match of the input impedance of the tube can be arrived at by this method and that higher gains accordingly are secured. On the band which covers from 38 to 19 Mc. the tap is made at about ¾ of the total inductance, while on the band which covers from 21 to 10 Mc. it is made at about ½ of the total inductance.

The antenna primaries are of the low-impedance type and both leads of the primary are brought to binding posts for doublet antenna connection. An extra binding post connected to the chassis is provided so that when a single-wire lead-in is used, one side of the primary may be connected to the chassis, while the other side of the primary is connected to the antenna. Field tests have shown that with some antennas and at some locations stronger signals are received by connecting one post to the chassis, while at other times better results have been obtained by leaving this post disconnected from the chassis and connecting this terminal to a good ground. It has even proved advantageous when using large antennas to connect a small variable condenser (100 µµfd.) in series to ground, and at other times to connect it in parallel with the other primary terminal and to tune the input circuit.

Another innovation is a control on the i.f. beat oscillator for varying its strength. When beat oscillator voltage is made approximately the same strength as the incoming signal, the signal-to-interference ratio may be improved. Also, when receiving weak signals, the "hiss" resulting from noise components beating with the oscillator voltage in the second detector can be reduced to a point where it cannot be heard; but if the beat oscillator was left at this strength, even a medium-strength signal might block the beat oscillator. So by varying the strength of the beat oscillator, more favorable combinations can be obtained.

The audio system is conventional. The output tube, a 6F6, is connected to an output transformer which is arranged for either a 5,000-ohm speaker or to feed into a 500-ohm line. No plate current flows through the circuit so that magnetic, permanent-magnet dynamic, or electrodynamic speakers may be used.

VK-ZL Contest

(Continued from page 48)

fair strength, the ease with which stations were contacted on the two higher-frequency bands, coupled with the fact that no multiplier was allowed for multi-band operation, confined most of the activity to the 14- and 28-mc. bands.

Directive antennas were the order of the day. W3EVFT used 3 half-waves in phase on 28 mc.
Be Santa Claus to Your Friends
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QST can help you with your Christmas list. Each year an increasing number of individuals finds it to be the ideal gift. A subscription present is unique, too. It serves as a monthly reminder of your thoughtfulness. A yearly subscription, including League membership, costs only $2.50, little enough for the ones you have in mind. And — we'll send an appropriate gift-card conveying your Christmas Greetings at the proper time.

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unequaled R.F. Choke, enables us to pass on
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price. This National type R-100 Choke, ideal
for high frequency transmitters and receivers,
is now available at a new net price — $.36
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MALDEN, MASS.

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V You need a binder for your
1936 QST's --- and another
for 1937.

Xmas suggestion — give a
membership-subscription or a
new Handbook.

DECEMBER, 1936

and 2 half-waves in phase on 14 mc., W6FZL
used a properly-oriented long wire (500'), W6HX
had a pair of stacked doublets, and W9TB,
W1TW, W1SZ, and W1JPE were using unter-
minated rhombic antennas. W2DTB used the
tests as a proving-ground for his antennas, trying
out different combinations each week-end.
VK3EG had two "V" beams, 10 wavelengths
on a side on 14 mc., operating simultaneously,
although their fire was directed on two courses 30
degrees apart. Although power was not over-
looked as a means to a good score, antennas were
given more consideration than ever before.
A few exceptionally well-operated VK/ZZ stations
using break-in cut the contact-time down to
a minute or so, permitting a large number of
contacts-per-hour in some cases. Outstanding at
W5BES were VK3EG, ZL4AO, VK3MR,
VK3GQ, VK2HF, VK6SA, VK2AE, VK2DA,
and VK3CP. But the general opinion of the op-
erators in the United States is that the majority
of the VK/ZZ stations called "Test" and "CQ"
for much longer periods than was necessary. In
one morning W5BES worked 47 stations; W9TB worked 56 the first week-end; W5SI
worked 50 during one 7-hour period, and W1SZ
worked 67 during his first week-end. W1SZ
would probably have been the highest in his dis-
trict if he had operated more than just the last
two week-ends of the contest.
A word about the probable winner, VK3EG.
He had 750 contacts, 180 of them with Europe,
and he totalled 75 countries. All European coun-
tries except Spain and Bulgaria were contacted
during the contest! VK3EG was high man in the event
last year, and won this year's B.E.R.U. contest.
A scarcity of VK6, VK7, and ZL4, coupled
with the complete absence of VK8 and VK9
stations, served to limit some of the scores of
stations in this country. The Australian 'phone
stations, who have been coming through well
lately, either went to c.w. for the contest or
didn't enter, since 'phone operation during the
contest brought no worth-while returns.
Although we were unable to obtain complete
returns on the contest, the following list will serve
to indicate some of the high-scoring stations op-
erating during the contest. The Australian scores
are via VK3OC-W1SZ.

<table>
<thead>
<tr>
<th>Station</th>
<th>Contacts</th>
<th>Points</th>
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<tbody>
<tr>
<td>W1FH</td>
<td>85</td>
<td>5420</td>
</tr>
<tr>
<td>W1JPE</td>
<td>104</td>
<td>6050</td>
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<td>W1SZ</td>
<td>97</td>
<td>5700</td>
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<tr>
<td>W1TW</td>
<td>56</td>
<td>3800</td>
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<td>W2DTB</td>
<td>85</td>
<td>5340</td>
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<td>W3BES</td>
<td>133</td>
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<td>W3EVT</td>
<td>146</td>
<td>7230</td>
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<tr>
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<td>W6FZL</td>
<td>193</td>
<td>8430</td>
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<tr>
<td>W7BT</td>
<td>90</td>
<td>6180</td>
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<tr>
<td>W8ZY</td>
<td>117</td>
<td>6800 (approx.)</td>
</tr>
<tr>
<td>W9IJ</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>W9TB</td>
<td>212</td>
<td>8440</td>
</tr>
</tbody>
</table>

88
Troubles CAN BE OVERCOME IN 1936 with OST binders priced at $1.50 postpaid (Not available outside of the United States and Possessions) (One set of yearly labels (1921-1940) provided with each binder) American Radio Relay League West Hartford, Connecticut

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<table>
<thead>
<tr>
<th>Station</th>
<th>Countries</th>
<th>Points</th>
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<tr>
<td>VK2AE</td>
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<td>VK2LZ</td>
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<td>115,000</td>
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<tr>
<td>VK3EG</td>
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<tr>
<td>VK3MR</td>
<td>45</td>
<td>110,000</td>
</tr>
<tr>
<td>VK4BB</td>
<td>54</td>
<td>127,000</td>
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<tr>
<td>VK4YL</td>
<td>48</td>
<td>105,000</td>
</tr>
<tr>
<td>VK5FM</td>
<td></td>
<td>160,000</td>
</tr>
<tr>
<td>ZLIDV</td>
<td></td>
<td>150,000</td>
</tr>
</tbody>
</table>

Complete returns will be given as soon as they are received from the W.I.A.

—B. G.

**Calls Heard**

(Continued from page 47)

<table>
<thead>
<tr>
<th>Station</th>
<th>Countries</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>ZLIDV</td>
<td></td>
<td>150,000</td>
</tr>
</tbody>
</table>

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—B. G.
New BLILEY CRYSTAL UNITS, OVENS, HOLDERS

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Model 70S (at left), "Communications-Type" Crystal Microphone. The best known speech microphone — an original Shure development — widely used in commercial and amateur stations. Complete with integral desk mount and 7 ft. of cable. List Price .................. $25

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The "T" type illustrated is the TJ-200-UD, one of a series of standard units in this class.

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1. Now you can conveniently, safely reduce the power in tubes while tuning, Panel-Pathed!
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- 1750, 3500 and 7000 kc. bands — $3.00 each. Add $1.00 to above price if plug-in, dust-proof holder is desired. (Holder as illustrated to fit G.R. jacks or round holder to plug into a tube socket can be furnished)

- G.R. Jacks to plug illustrated holder into — $1.50 pair.

Low frequency drift crystals (Type L2C) having a drift of less than 5 cycles per million per degree C. are supplied at the following prices: 1750 and 3500 kc. bands — $3.50 each; 7000 kc. band — $4.00 each. Holder $1.00.

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5 minutes. It is somewhat similar to the hiss of a receiver going into oscillation. He likens it to the effect produced by charged rain or snow falling on the antenna, except that it is not so staccato. He sets forth the theory that it might be produced by a shower of charged particles, possibly from the sun, since he has noticed it only during the day. Comment on this phenomenon is invited.

Strays

Note from W3MG re panels: "In a recent transmitter I used 3/16-inch Celotex Tempered, which is practically the same as Masonite. A good grade of Jade Green Enamel was used, giving three coats and rubbing the gloss of each coat with pumice on a damp cloth. After the final rubbing down the panels were waxed and rubbed well. The final finish is a velvety finish of medium shade, very durable and easily cleaned.

"If there are any razzberries on the green, just try it once with black meters, dials and knobs and see if the XYL won't let you put the rig in the parlor! A medium shade of gray would also look well; or if you insist on black, the same finish will look like bakelite."

W9LQE wishes he could collect a tax for every unnecessary use of "there" by so many of the 'phone fraternity. How about a levy on "and-uh," too?

New Amateur Tubes

Types 154, 807, RK-39, and 808

TUBE manufacturers have been busy with development work during recent months, the result being a number of new types which have recognizable advantages for amateur work. Recent additions to the many varieties now available include high-frequency tetrode triodes of medium power capabilities, and some transmitting versions of the 6L6.

HK-154

The Type 154, made by Heintz and Kaufman, falls in the 50-watt plate dissipation class, and is particularly adapted to working with optimum efficiency at moderate plate voltages. It is a medium-mu, tetalum-plate tube with fairly low interelectrode capacitances. A single tube is rated to deliver 200 watts at 1500 volts, the maximum rating, as a Class-C amplifier, and a pair of them in Class-B can give an audio output of 250 watts at the same voltage. Preliminary ratings and characteristics are as follows:

- Filament voltage: 6.7 volts
- Filament current: 6.5 amp.
- Plate dissipation: 1500 watts.
- Max. plate voltage: 1500 volts
- Max. plate current: 175 ma.
- Max. grid current: 30 ma.
- Plate resistance: 1750 ohms
- Amplification factor: 6.7
- Interelectrode capacitances:
  - Grid-to-plate: 5.9 µfd.
  - Grid-to-filament: 4.3 µfd.
  - Plate-to-filament: 1.1 µfd.

(Continued on page 100)
ALADDIN TUBES

May have had his Lamp — but did it light up in so many places?

Will light the way for better and more numerous QSO's. Compare the rating and plate dissipation of the various Taylor Tubes and you will be convinced of their superior output. They are Guaranteed to "take it." Exceptionally easy to drive.

If you have not received a copy of the latest TAYLOR 31 PAGE CATALOGUE, come or write for one. Full of real information.

**Complete Stock of Famous Taylor Tubes Always on Hand**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type T-55</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fil. Volt., volts</td>
<td>756</td>
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<tr>
<td>Fil. Cur., amps</td>
<td>200</td>
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<tr>
<td>Class &quot;C&quot; Osc. and Power Amp.</td>
<td>822</td>
<td>18.50</td>
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<tr>
<td>Max. Op. Plate Cur., ma.</td>
<td>872</td>
<td>12.00</td>
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<tr>
<td>Max. Plate Dissipation, watts</td>
<td>814</td>
<td>18.50</td>
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<tr>
<td>Max. Plate Dissipation Grid, ma.</td>
<td>110 V.D.</td>
<td>21.50</td>
</tr>
<tr>
<td>TRU-SOUND RACK CHASSIS 15 to 100 M ohms</td>
<td>117 V.D.</td>
<td>17.50</td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td><strong>$19.50</strong></td>
</tr>
</tbody>
</table>

**Taylor Custom-built Tubes**

MAY HAVE HAD HIS LAMP — BUT DID IT LIGHT UP IN SO MANY PLACES?

**Complete Stock of Famous Taylor Tubes Always on Hand**

**Items of Interest**

- **Pyranol Condensers**: 2 MFD.—2000 Volts $2.90
- **Rack Chassis**: $1.05
- **Wing Brackets**: $0.60
- **Rack Panels**: $0.50
- **Circle Cutting (Small)**: $1.25
- **Circle Cutting (Large)**: $1.95
- **Hallcrafters**: $1.25
- **National HRO $167.70**

**Radio Shack**

46 Brattle St.
Boston, Mass.

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

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**Rack Chassis**

<table>
<thead>
<tr>
<th>Model</th>
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</tr>
<tr>
<td>3000</td>
<td>$9.85</td>
</tr>
</tbody>
</table>

**International Plate Transformers**

- **Model 2000**: 1000 and 750 volts each side of C.T. 300 Mills $5.95
- **Model 3000**: 1500, 1000 and 750 volts each side of C.T. 300 Mills $5.95

**International Chokes**

- **Smoothings**: Swing-Around Cased
- **Cardwell**: $1.50
- **Mycalex Insulation**: $15.00

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---

BOSTON, MASS.
Leesburg; he expects to have 1-kw. c.w. and 14-kw. 'phone on 1.75 me. soon. FXL keeps schedules with 14-watt input and an SDR receiver. FPL is on 28-mc. 'phone with 200 watts input. EXW, FQO, EJ5, CGB, UVA, QK, EVV, PKR, 2KHD, 2IP and JSM are at the U. of Va.; FDR is in the Signal Corps, but he says he will report to the S. C. will receive "QRX" each month.

Traffic: W6CFL 157 AKN 50 CQW 47 CHE 39 FJ 38 FKD 18 AJI-CSY 6 MQ 3 FIT 2 AJI-BSH-BWA-EXI-

WEST VIRGINIA—SCM, Dr. Wm. H. Riheldaffer, W8KKG—The Grafton High School Radio Club voted in 12 new members. Its station, CFD, is on daily. MJS has a nice new panel for his new Jr. operator, NTY is working 14 mc. QIS is on 7 mc. with a static of 47. DIZ is still rebuilding. MIT lost his skywire by lightning. FT is 1.75-mc. 'phone light when home over the week-ends. ONP has a low-power race and panel. KFW applies for A.A.R.S. KDI is working new DX in 14 mc. CXR is working most of the DX heard in Wheeling. CWY is new W.A.C.; AZD doesn’t count countries until contact is verified (which is a good idea); he leads the W. Va. Traffic gang in the number of schedules maintained with a pair of Grammats at 4000 volts. JWL has new QTH and 5 acres for skyscapes. MIZD has new 61.0—10 pair LT’s job.

Traffic: 14 LFX. 3 211 UVU 20 NU OAF 1 OEF 3 3FR 21 KXQ 5 FYX 4 KIU 12 3 AKQ 20 KEG 47 J RL.

ATLANTIC DIVISION

EASTERN PENNSYLVANIA—SCM, James M. Brinting, W3E2—R.M.’s: 3AKB, 3AQN, 3EOP, 3ASW. The question is frequently raised about the number of schedules an O.R.S. is required to keep. Four. S.C. is more interested in the quality and quantity of traffic handled than in the number of schedules maintained. For those of the traffic gang who find spare time at a premium, we advise taking part in the “Penna. Traffic Band” system. Ask the S.C. for details. Remember, this band is open to ALL.

Traffic stations regardless of your affiliations. 3EW worked 6NU with a P.P. ‘phone crystal oscillator on 3.5 me. 3GMK has installed 50-mc. equip for local relaying. 3DI increased power to 56 watts output and is experimenting with a radio receiver. 3EU is planned with a pair of new members. 3GM has been having some nice ragchews on 7 mc. 3AMR is on the air. 3GDI increased his 56 mc. rig and can’t get it back together again. 3EYO is back on his old rig. A.E.C. club station, 3DGF, is working plenty on 7 mc. 3FBJ says the bands are beginning to sound good again. 3AMR is increased power on 14 mc. 3GO has been keeping schedules with a pair of 6A6’s job.

News: 1.75-mc. reports (which is a good idea); he leads the W. Va. Traffic gang in the number of schedules maintained with a pair of Grammats at 4000 volts. JWL has new QTH and 5 acres for skyscapes. MIZD has new 61.0—10 pair LT’s job.

Traffic: 14 LFX. 3 211 UVU 20 NU OAF 1 OEF 3 3FR 21 KXQ 5 FYX 4 KIU 12 3 AKQ 20 KEG 47 J RL.

ATLANTIC DIVISION

EASTERN PENNSYLVANIA—SCM, James M. Brinting, W3E2—R.M.’s: 3AKB, 3AQN, 3EOP, 3ASW. The question is frequently raised about the number of schedules an O.R.S. is required to keep. Four. S.C. is more interested in the quality and quantity of traffic handled than in the number of schedules maintained. For those of the traffic gang who find spare time at a premium, we advise taking part in the “Penna. Traffic Band” system. Ask the S.C. for details. Remember, this band is open to ALL.
EWW 16 GMK 15 GDI-GHP 12 CEQ 9 ADE 5 FBJ-EOZ 4 AQN 5 CQS 2. W8DG8 81 FLA 65 (WLQG 45) UV 55 EKG 42 MRQ 14 EX 9.

MARYLAND-DELAWARE-DISTRICT OF COLUMBIA—SCM, Edgar L. Hudson, W3BAA—R.M.'s: 3CQS, 3CXL, 3EOU, Chief R.M.: 3BWT, P.A.M.: 3SW. It is with great regret that we report that the death, on Sept. 7th, of Chief D.M. W. G. Hudson, W8DRE, was announced. We shall greatly miss his daily cheery greetings over the air. He passed on after a three months' illness due to a heart attack, at the age of 63. Entering amateur radio as early as 1921, he kept his curiosity and enthusiasm as the art developed, from spark coil to the latest ultra-modern rig. He was interested in all the phases of amateur radio and his transmitters have been designed for traffic, DX and phone. He was successful at all of these. Traffic, however, was his hobby. He was a perfect example of what an amateur should be like. He used to tell his CQ at one time the leading one in Washington, D. C. His other hobbies included gasoline-powered water craft and automobiles. He is survived by his widow and two daughters. The friends and associates of W8DRE are invited to attend the funeral at his residence on Tuesday, Oct. 11th at 10 a.m. Our sympathy is extended to the family in the hour of their bereavement. Let us who remain continue to carry the banner of Ham Radio in as noble a spirit as did our old friend "HF" of the past. In New York, W203, a former member of WLM staff, was recently transferred to Angley Field, Virginia, being replaced by Richard Bradley (5VZ). CIZ and CQS attended the A.A.R.S. Convention at Fort Howard, Md. DNL and 5VZ worked during the recent hurricane. FCQ has just completed W.A. and will start work on Oct. 16th with a very capable crew of G's transferred to this Section from San Diego, Cali. Welcome, OM. GQT operates O.R.S. from Ferris Industrial School near Wilmington, Del. BAK has a fine trip to the West Coast, by auto, and covered 7000 miles without a puncture. FFQ has gone back to college. BWT was off the air on two weeks' vacation. FPQ has Class "A" ticket. EZN is rebuilding. GFF has new 25-watt rig, and made 57 contacts in 2½ days. CDQ visited Bermuda on her vacation, and reports fine time. AOE will be back on the air again in about a month; he has just graduated from the U. of Md. Glad to welcome you back again, Bob. GAD operated port-in-a-box on last 8. Traffic: WS6CIZ 426 CXL 213 (WLM 1203) BWT 287 CQS 23 EZN 16 FFQ 10 EPD 4 FQB 3 G2K 2. (Aug.—Sept.) WS6FFQ 176 BWT 96 CXL 126 (WLM 1413) CIZ 113 BKZ 4 G2K 3 EPD 5 (Aug.—Sept.) G2K 2. SOUTHERN NEW JERSEY—SCM, C. D. Reardon, W3ZX—The South Jersey Spot Net is now functioning and smoothly, and indications are that the amount of traffic handled will be even greater than last winter. The Section will lose FOS, who is moving to Philadelphia. FML is building a new 6L6 crystal rig. EFM is a busy man during the summer and is just leaving for his vacation. DNU is new alternate for AFV in T.L. "B" and will have break-in going soon. IDA is busy handling schedules and lots of traffic. EEK is spending most time on 14 mc. c.w. HIR is active on 3.5, 7 and 14 mc. and reports GNM new ham in Trenton. ZI made 34 contacts in last RM Party and had a very good time. BEJ is just moving to Newark and will be busy with traffic when he gets his rig into good working order. DNN wants to know what happened to 3610 kc. LGD got his rig back again and is getting a rig on the air. GAI works Washington, D. C., on 3.5 me. with 4 watts, and has just finished the Third Corps A.A.R.S. Convention at Baltimore on October 10th—11th.

Traffic: WSOFO 418 (WLQG 8) KWA 310 KUN 236 MOT 105 ADY 104 KBM 101 PTW/F2G 55 QAN 44 KBN 38 (WLQM 9) PFX 31 IUY-KOB 23 NDE 14 CMP 10 MIW 7 FIP 5 AXD-OSI 6 CUG-CJF-MWV 2 UK 9. WESTERN NEW YORK Section—A. O. Smith, WD8SS—R.M.'s: 57JT, 8BJO, 8AQH, P.A.M.: 9SCU. The Western N. Y. Section QSO Party will be held on Sat., Dec. 26th, starting at 6 p.m. E.S.T. and ending at midnight, Sun., Dec. 27th. All stations, 'phone or c.w., in this section are invited to participate whether holding A.R.R.L. appointment or not. Let's see who can make the most contacts. Send your score to the S.C.M. not later than Jan. 15th. CJB is busy with W6's on 7 me. MWV brought the bug again and is getting a rig on the air. DGL is working the bug again and is getting a rig on the air. DGL is working in Texas. O.H. is getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interested in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interest in A.A.R.S. and O.R.S. respectively. KAA is doing a good job on the air. O.Q. is interested in getting interest in A.A.R.S. and O.R.S. respectively.

The traffic season started Oct. 1st with a big increase in activity. The following stations are given special credit for taking part in the Nutmeg Net: AFB, AFQ, AJO, BJS, CTT, CJD, DOW, FNM, GFM, GME, GTX, GYV, HSX, (Continued on page 106)
New Amateur Tubes

(Continued from page 96)

The following power outputs are obtainable in different classes of service:

<table>
<thead>
<tr>
<th>Power (V Watts)</th>
<th>Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>600</td>
<td>15.5</td>
</tr>
<tr>
<td>750</td>
<td>15.5</td>
</tr>
<tr>
<td>1000</td>
<td>25.0</td>
</tr>
<tr>
<td>1500</td>
<td>25.0</td>
</tr>
</tbody>
</table>

Required driving is power approximately as follows: Class-B audio, 10 watts; Class-B r.f., 5 watts; Class-C r.f., 10–15 watts.

The 154 has a standard four-prong base and a tubular hard glass bulb. Plate and grid terminals are brought out on opposite sides of the bulb, making these connections highly convenient for short leads to grid and plate tank circuits.

RCA-807

The 807 is a glorified 6L6, rearranged to make it especially suitable for transmitting. To this end, the tube is enclosed in a glass bulb, has a ceramic base, and has the plate connection out the top. Some additional shielding has been incorporated in the element structure so that the tube compares with the 807 in grid-plate capacity, although because of its high power sensitivity, it may have a tendency to self-oscillate in amplifier circuits at high frequencies (14 me. and up) or in layouts where the input and output circuits are not carefully isolated. Preliminary ratings and operating data are as follows (all ratings are maximum):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage</td>
<td>6.3 volts</td>
</tr>
<tr>
<td>Heater current</td>
<td>0.9 amp.</td>
</tr>
<tr>
<td>Interplate capacitances</td>
<td></td>
</tr>
<tr>
<td>Grid-to-plate (with shield)</td>
<td>0.2 µfd.</td>
</tr>
<tr>
<td>Grid input</td>
<td>11.6 µfd.</td>
</tr>
<tr>
<td>Output</td>
<td>6.6 µfd.</td>
</tr>
<tr>
<td>As Class-B R.F. Amplifier:</td>
<td></td>
</tr>
<tr>
<td>Plate voltage</td>
<td>500 volts</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>400 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>165 ma.</td>
</tr>
<tr>
<td>Plate input</td>
<td>300 ma.</td>
</tr>
<tr>
<td>Plate dissipation</td>
<td>21 watts</td>
</tr>
<tr>
<td>Screen dissipation</td>
<td>2 watts</td>
</tr>
<tr>
<td>Plate-modulated R.F. Amplifier:</td>
<td></td>
</tr>
<tr>
<td>Plate voltage</td>
<td>600 volts</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>250 volts</td>
</tr>
<tr>
<td>Grid voltage</td>
<td>1400 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>250 ma.</td>
</tr>
<tr>
<td>Grid current</td>
<td>5 ma.</td>
</tr>
<tr>
<td>Plate input</td>
<td>325 ma.</td>
</tr>
<tr>
<td>Plate dissipation</td>
<td>14 watts</td>
</tr>
<tr>
<td>Screen dissipation</td>
<td>2 watts</td>
</tr>
<tr>
<td>Class-C Amplifier or Oscillator (unmodulated):</td>
<td></td>
</tr>
<tr>
<td>Plate voltage</td>
<td>400 volts</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Grid voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Plate current</td>
<td>300 ma.</td>
</tr>
<tr>
<td>Grid current</td>
<td>5 ma.</td>
</tr>
<tr>
<td>Plate input</td>
<td>40 watts</td>
</tr>
<tr>
<td>Plate dissipation</td>
<td>21 watts</td>
</tr>
<tr>
<td>Screen dissipation</td>
<td>3.5 watts</td>
</tr>
</tbody>
</table>

Typical operating conditions for 807 as an oscillator or keyed amplifier are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate voltage</td>
<td>300 volts</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>400 volts</td>
</tr>
<tr>
<td>Plate input</td>
<td>2250 ma.</td>
</tr>
</tbody>
</table>
80-T TRANSMITTER
1500 TO 30,000 KILOCYCLES

ONLY 3 TUNED CIRCUITS
ANTENNA MATCHING CIRCUIT
EXCITATION CONTROL
PHONE — CW SWITCH
4 FULL SCALE METERS
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3 TYPES OF KEYING AVAILABLE
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125 WATTS INPUT

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Thor 6L6 Inputs ........................ 2.21
Thor 6L6 Modu. Outputs 60 w. 5.88
Thor 6L6 P.A. Line V.C. Output 3.53
RCA 6L6 Tubes ......................... 1.18
Thor 6L6 Power Tr ........................ 5.30
RCA 807 Tubes ......................... 3.90

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Hallicrafter
ACR-175
RME-69
Hammarlund

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The 807 has a 5-prong base, with connections corresponding to those of the 27 or 66 with the screen replacing the plate. The tube may be used at maximum ratings at frequencies as high as 60 megacycles.

RAYTHEON RK-39

The Raytheon low-power beam tube carries the designation RK-39. Although resembling the 807 in appearance and bazing arrangement, the physical structure is somewhat different so that the two tubes are not identical. Because of the internal construction, the tube is rated for plate voltages as high as 750; the grid-plate capacity is such, however, that the tube must be neutralized when used as a straight amplifier. Ratings and characteristics are as follows:

Heater voltage ................................ 6.3 volts
Heater current ................................ 0.9 amp.
Max. plate voltage ........................... 750 volts
Max. plate current ........................... 90 ma.
Max. screen voltage .......................... 250 volts
Max. screen current .......................... 10 ma.
Max. plate dissipation ........................ 20 watts
Max. screen dissipation ........................ 3 watts

Interelectrode capacitances:
Grid-plate ................................... 1.0 µfd.
Input ......................................... 1.0 µfd.
Output ....................................... 7.5 µfd.

Typical operating conditions for various types of service are given below:

Tetrode crystal oscillator:
Plate voltage ................................ 500 750 volts
Plate current ................................ 60 70 ma.
Screen voltage ................................ 250 250 volts
Screen current ................................ 6 7 ma.
R.F. crystal current ........................... 20 20 ma.
Plate dissipation ............................. 14 20 watts
Power output .................................. 16 20 watts

Frequency doubler:
Plate voltage ................................ 500 750 volts
Plate current ................................ 35 45 ma.
Screen voltage ................................ 270 250 volts
Screen current ................................ 12 7 ma.
Grid voltage (battery) ......................... 140 130 volts
Grid current ................................ 2 3 ma.
Plate dissipation ............................. 7 14 watts
Power output .................................. 11 20 watts

Class-C Amplifier:
Plate voltage ................................ 500 750 volts
Plate current ................................ 60 80 ma.
Screen voltage ................................ 200 250 volts
Screen current ................................ 12 10 ma.
Grid bias ..................................... 40 60 volts
Grid current ................................ 4 4 ma.
Driving power ................................ 0.2 0.5 watts
Plate dissipation ............................. 7 20 watts
Power output .................................. 23 40 watts

If screen voltage is obtained from a dropping resistor, a minimum value of 50,000 ohms is recommended. When the RK-39 is used as a crystal oscillator the grid-leak resistor should not be more than 10,000 ohms for realization of full output; the use of a 400-ohm cathode resistor also is recommended.
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Type VM2A mounted crystal frequency drift less than 4 cycles supplied within 1 Kc of specified frequency in the 1.7, 3.5, 7 mc bands $4.50, each.
Type VC2 unmounted 1 inch square crystal supplied in the 1.7, 3.5, 7 mc bands within 5 Kc of specified frequency $2.25
Type VC2 in the 1.7, 3.5, 7 mc bands only supplied within 20 Kc of specified frequency $1.50

The 808 is a low-capacity high-mu triode in the 50-watt plate-dissipation category, designed for both r.f. and Class-B audio applications. Grid and plate connections are brought out through the bulb, the former at the top and the latter at the side. It has a tantalum plate and a spherical bulb.

Typical operating conditions are as follows:

Class-B audio (two tubes):
Plate voltage .................. 1250 1500 volts
Grid voltage .................. - 15 - 25 volts
Peak r.f. grid voltage ....... 120 110 volts
Zero-sig. plate current ....... 40 30 ma.
Max-sig. plate current ....... 250 190 ma.
Load resistance (per tube) .. 8175 4575 ohms
Max-sig. driving power ...... 10 8.8 watts
Max-sig. output power ...... 22 18 watts

Class-B r.f. amplifier:
Plate voltage .................. 1250 1600 volts
Grid voltage .................. - 50 - 35 volts
Peak r.f. grid voltage ....... 65 50 volts
Plate current .................. 45 40 ma.
Grid current (approx.) ....... 1 1 ma.
Driving power (approx.) ..... 5 2 watts
Power output (approx.) ...... 10 1 watts

Class-C plate-modulated amplifier:
Plate voltage .................. 1100 1250 volts
Grid voltage .................. - 210 - 225 volts
Peak r.f. grid voltage ....... 300 300 volts
Plate current .................. 120 100 ma.
Grid current (approx.) ....... 35 35 ma.
Grid resistor ................. 6800 7000 ohms
Driving power (approx.) ..... 11.5 10.5 watts
Power output (approx.) ...... 22 10 watts

Class-C telegraphy:
Plate voltage .................. 1250 1500 volts
Grid voltage .................. - 150 - 200 volts
Peak r.f. grid voltage ....... 300 350 volts
Plate current .................. 135 120 ma.
Grid current (approx.) ....... 30 30 ma.
Driving power (approx.) ..... 8 9.5 watts
Power output (approx.) ...... 120 140 watts

The 808 has a four-prong standard base, with filament pins connected as usual. The tube carries full ratings up to 30 Mc. At 60 Mc., plate voltage and plate input should be reduced to 75% of the normal maxima; at 130 Mc., to 50%.

With these new tubes added to the assortment already made available in the past year, the low- and medium-power fellow certainly has no reason to complain of lack of tube types. Rather it is the other way 'round! It is of interest to note that the trend now seems to be away from the graphite plate and back to the bright ones—the latter having the advantage, which we have stressed occasionally, that improper operating conditions are evident immediately by a flare-up of the plate.

—G. G.
... Then Read This!

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for Director. JNU Parkway Radio Association have started their meetings for

...Atenas, KDAK, AMZ and AVI visited CBA, C.A.R.C.'s Bulletin will be sent to all amateurs in Connecticut for two issues. All O.R.S. appointees are requested to review the established qualifications for O.R.S. as set forth in "Operating an Amateur Radio Station" or the Handbook. Appointments are made to active, traffic-handling stations in recognition of their ability and interest in traffic work, and may be suspended or revoked for failure to live up to the qualifications referred to above.

...The WlAKS 482 has been doing a little more "Section Spirit." Join the

...Use "Section Spirit." Join the

...WlAKS 482 has been doing a little more "Section Spirit." Join the

...Traffic: WINFP 309 A4D 246 UE 232 DMP 183 GKM 98 CTS 83 AF 77 GMS 54 GXT 39 JMY 27 INP 10 JXP 4

...Traffic: WINFP 309 A4D 246 UE 232 DMP 183 GKM 98 CTS 83 AF 77 GMS 54 GXT 39 JMY 27 INP 10 JXP 4

...WlAKS 482 has been doing a little more "Section Spirit." Join the

...Maine's Chief R.M. and is

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...Maine Parkway Radio Association have started their meetings for the month (B.P.L.) and reports the Army Net going in great style; just look at the traffic totals.

...Traffic: WINFP 309 A4D 246 UE 232 DMP 183 GKM 98 CTS 83 AF 77 GMS 54 GXT 39 JMY 27 INP 10 JXP 4

...Maine's Chief R.M. and is

...UNITED STATES—SCM, Albert N. Giddia, WINCO-BTG is

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with the boys as he passed thru. The boys at AQ are getting in their winter wood and standing by for a cold winter. FUB is working on P.A. system using 6/5's. The P.A. held its annual Halloween'Party, and all the goblins were there. JRY has a new superhet of which he is real proud. Code classes have started at the P.A. again on Monday evenings at 7:30 p.m. Anyone interested is welcome to attend.


VERMONT—SCM, Alvin H. Battison, WIGNF—R.M.'s: JFSF, IEZ. P.A.M.'s: 1AVF, 1DQK. FSV is high traffic man; he has a fine line of schedules. OA9 now has a Go-devil bug. GAN and IRO are on 3.5- and 14-mc. 'phone. IRO and AJJ attended the Schenectady Hamfest; both won prizes. ATF plans to be on for the Vt. traffic hour. EZ altered drive got 30 hams signed up. ILN is off 56 me. for good after a short illness. He was one of the pioneering amateurs classes have started at the P.R.A. again on Monday evenings in their winter wood and standing by for his 28-mc. WAO; he reports VK's easy to work. CUN is back in Newport. BJP has been promoted to Superintendent of Distribution of his power company; he needs Asia for 28-mc. WAC; worked MXQG, VQA8 and three J's on 14 mc.; needs two states for W.A.S. and sends two sheets of O.O. work. DQK is on 7 mc.; his XYL is now licensed as KEP. JZF has new NC100 ordered. AHN reports a visit with JMEQ. GJW attended the State Teachers Convention.

IJD still has his nose in the grass. He is working on a better linear. He was one of the pioneering amateurs and will ever be remembered for his large efforts, yet modest nature, and for his radiant personality. His frequency will ever seen a dead spot on our dial—a tender rememberance.

Traffic: W1FSY 324 GFN 96 EZ 60 GAE 38 ATV 11 AHN 6.

HUDSON DIVISION

EASTERN NEW YORK—SCM, Robert E. Haught, W2LU—EGF changed QTH to 23 Catherine St. HCY is using 03A final, 20/70 kw. JMB is using 2F3. BLU is getting out on 14 mc. AXZ reports HON OB schedule, 7 to 8:30 a.m. CC had several visits from VK3AL, also VK2SHM, 3AL's son-in-law; G8G is visited also. BJR reports activities of M.M.A.R.C. JAW, A.A.R.S., applies for O.O.S. IKV is on 3940 kc. 'phone; he won QA4A at Hudson Division Convention. HUM is in Florida for next six months. HCM tried 'phone, but c.w. looks better. FQG sends 73 to gang and for Mt. Vernon boys, JQX and JOY are on 56 mc. with new 80-watt 6L6 M.O.P.A.'s. VJ reports for following: IXK and GXE returned to schedules. CHK ent time


NORTHERN NEW JERSEY—SCM, Charles J. Hamner, W2FOP—HIZY made the B.P.L. this month. IOZ is new member of the N.N.J. GSP Club. GVZ finished 1-kw. rig for 7 mc., his third High-power rig in operation. ICM is now living in Newark. HNY won 211 at Hudson Division Convention. JFP reports for details. HGO is building a new O.R.S. in Ocean County. HCO is back on the air after being off the air for some time. HCO is looking for some good traffic men to fill out our Section. JFT is working on 14 mc. and hopes to get W.A.S. HJX is working on 56 exciter. JMB gave up cascade modulation—result, big improvement in signal. HIA's brother has 7-mc. rig in the same room; their antenna layout would make A.T. and T. jealous. FOI is new secretary of O.T.C.R.A., taking the place of HTX, who is away at college. JTF has new job, in a new car. HJK is making an around in new cars. CAT is looking for a good baker. RCX believes in matrimony after being stuck to his power supply and not being able to get away; lucky his XYL pulled the plug. HLY is still looking for some good traffic men to fill out our Section.

Traffic: W2BCX 436 (WLN 656) HZY 524 GGE 386

GOW 320 HOZ 218 GVZ 216 ICW 178 HNP 114 FOP 109 HXX 105 GAS 63 HQL 58 HBIQ 50 BZ 35 ICJ 30 IQM 27 CJK 24 IIQ 5.

102 Central Ave., Massapequa, L. I. New O.B.S.; BDN, DQW. KJ can be heard on Trunk Line "C" daily on 3965 ke. at 7 a.m. PF is studying for promotion to major in Signal Reserve and can be heard on Madison. O.S.S. sked, schedules. CHX is new job as studio engineer at WNEW. LG has the urge to go back to sea operating, but at the present time is trying to make crystals oscillate. 0. O. GDF finds plenty of harmonics on the Columbia grid to keep him busy checking. JFP is studying for a Class "A" ticket. FF wants a QSO with a Delaware station on 3550 ke. ELK sent a message to Hollywood, Calif., via SWQ and got an answer in five minutes. HSY handled a call in on the Vt. traffic to set up a QSL. CGI reports for the first time after being inactive for five years. JNJ wants to get back on 7 mc. after being on 56 mc. all summer. GVX finally made his W.A.C. cert. and reports that the Columbia AM on 28 mc. was heard in Java. JGR reports for C.C.N.Y. Radio Club on 7 and 14 mc. JGR reports for C.C.N.Y. Radio Club on 7 and 14 mc. JGR reports for O.B.S. appl. HBO reports that the Tu-Boro Radio Club is building 200-watt rig. BGO is rebuilding his complete outfit. APV is working on vertical antennas with reflector rotatable. JCD gets better results with a center-fed antenna than the end-fed Zepp. JAE's 14-mc. harmonic was heard in Java, so now he is on 14 mc. HEO's reflectors went west. HLI is going on 1.75-mc. 'phone. EQY is at his new QTH: 110-38 130th Street, South Ozone Park, Isl. blew his only 211D. GUL can't get his distributor to work on 14 mc. JVX's feeders blow down. BMG is working with Mr. Gainer. GQG is new member. JBR can be heard on 7012 kc. with 500 w., 5000 w. input. JHT has 616G's working on 7145 kc. JGC is building rack and panel job. HWS is working school station JFP, CXF worked 50 V's on 14 mc. 'phone during month. JMB is limited to one hour a day on the air for a day or two. He is building a new rig; DQO is following the L.I. Net. EXR hears plenty of Canadians. JTB is on 56 mc. using TNT P.P. '18; it leads in traffic. L.I. Net. operates on 3700 kc.; DBQ for details. HGO is having trouble with 2450 kc. Final. Regular operating frequencies: EYS 3612; HJB 3614; HRA 7101; HML14, 348. N.C.R. members on 3570 kc.: A.D.W., FLD, GES, AOV, AJM, HDP, AA, CIT, ENS, BKE, BFA. IOP is anxious to have out-of-town hams visit him at 277 West Ave., N.Y.C., telephone SU-7-2928.

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A.R.R.L. QSL Bureau

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 call station should be printed prominently in the upper left-hand corner.

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W3--R. E. Macomber, W3CZE, 418 10th St., N. W., Washington, D. C.
W4--B. W. Benning, W4CBY, 320 Whiteford Ave., Atlanta, Ga.
W5--E. H. Treadaway, W5DNR, 2749 Myrtle St., New Orleans, La.
W6--D. C. Mast, W6KHV, 423 East E Street, Ontario, Calif.
W7--Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8--F. W. Allen, W6GER, 324 Richmond Ave., Dayton, Ohio.
W9--George Dammann, W9JO, 319 Sherman Ave., Evanston, Ill.
VE1--J. E. Roe, VE1FB, S4 Spring Garden Rd., Halifax, N. S.
VE2--W. H. Oke, VE2AIH, 5184 Mountain Sights Ave., N. D. G., Montreal, P. Q.
VE3--Bert Knowles, VE3QB, Nanaim, Ont.
VE4--Dr. J. J. Dobby, VE4DR, Killam, Alberta.
VE5--E. H. Cooper, VE5EC, 2024 Carnarvon St., Victoria, B. C.
K4--F. McCown, K4RJ, Family Court 7, San­tucie, Puerto Rico.
K6--James F. Pa, K6LBH, 1416 D Lunalilo St., Honolulu, T. H.
K7--Frank P. Barnes, K7DVF, Box 297, Wrangell, Alaska.
KA--George L. Rickard, KA1GF, P. O. Box 849, Manila, P. I.

Circulation Statement

PUBLISHER'S STATEMENT OF CIRCULATION AS GIVEN TO STANDARD RATE AND DATA SERVICE
This is to certify that the average circulation per issue of QST for the six months period January 1st to and including June 30, 1936, was as follows:
Copies sold ........................................... 42,872
Copies distributed free .......................... 406
Total ...................................................... 43,278

K. B. Warger, Business Manager
D. H. Houghton, Circulation Manager
Subscribed to and sworn before me on this 31st day of August, 1936
Alice V. Scanlan, Notary Public

108 Say You Saw It in QST — It Identifies You and Helps QST
Plug-in Base and Shield, Type PB-10 (either 5 or 6 prong). Net price, $.45
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Type FXTB (either 5 or 6 prong). Net price, 2.94
Midget Coll Forms (R-39).
Type XR-2 (15/16" dia. x 1¼" long). Net price, .21
Type XR-3 (9/16" dia. x 1¼" long). Net price, .18
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With this new plug-in base, it is extremely easy to build high performance gear — whether it be for experimental receivers, bread board layouts, monitors, exciters or what have you.

The low-loss R-39 base, with prongs moulded in to fit standard sockets, has mounting holes for our type UM Air Dielectric Condensers and our R-39 coil forms. The illustration shows the effective assembly that is possible with these units. This PB-10 base fits our Fixed Tuned Exciter Tanks, thus making them available for plug-in mounting. Attachment to the shield can is easily made by four screws.

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Latest development in oscilloscopes — uses new Modulated Neon Beam principle — opens new fields in audio measurement. Checks modulation, locates distortion. Excellent for amplifier, microphone and speaker response. Used in wave form study or as a super-sensitive salvanometer and vacuum tube voltmeter. The unit as illustrated measures 6½" wide, 10" deep and 13" high. Beautiful etched chrome finish on panel. Durable and fully guaranteed.

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Schedules for WWV

EACH Tuesday, Wednesday 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. On each Tuesday and Friday the emissions are continuous unmodulated waves (cw) and on each Wednesday they are modulated by an audio frequency. The audio frequency is in general 1000 cycles per second.

Strays

In connection with the voice-controlled relay described in November QST, W2AKH writes that some trouble with oscillation of the 885 without voice input was experienced when the 50,000-ohm cathode resistor specified in the article was used. Changing to 100,000 ohms cured it and the unit then worked as described.

W9OKZ reports that there is now a third VS2: Mr. Beebee, VS2AJ. Which certainly proves that VS2’s are consistent! (October QST, p. 78.)
TRIMM phones. Reliable service. Thousands of operators using TRIMM phones are assured of the most complete and quality of parts. RCA tubes, Cornell-Dubilier condensers, UTC choke and transformer in the kit.

WHAT YOU GET: Coil form, wire, directions for winding and starting secondary and link for 40, 80, 160 meters. Power transformer, 400-0-450 v. a.c., 50-watt primary. B supply choke, 10 henries at 400 ma. 2.1 millihenry r.f. choke. 100 mmfd. tuning condenser, lanthanum insulated. 1400 v. R.D. Three 31 mmfd. paper condensers, 600 w.r. 8, 500 dry electrolytic 400 v. w.g. Voltage divider: 5,000-ohm 10-watt; 50,000-ohm, 3-watt. 10,000-ohm, 1-watt. 400-ohm, 10-watt. Drilled, punched, finished chassis 7 x 14 x 3 inches. Valpey crystal (specify band) VM2. Four sockets (two for tubes, one for crystal, one for coil), (0-100 etched metal dial plate with pointer knob. Line cord and toggle switch. Two standoff insulators for link output. Copper tubing, wire, directions for winding and SO-watt primary. UTC 30-henry, 125 ma. Line cord. UTC output transformer, primary 6,000 ohms p. to p.; secondary tapped 25 mfd. 35-v., C-D dry electrolytic. Two separate 8 mfd. 400 v. C-D dry electrolytics. Two 1 mmfd. C-D 400-v. paper clipping condensers. 1 mmfd. C-U 400-v. tone control condenser. 25,000-ohm tone control rheostat, 50,000-ohm, 1-watt potentiometer volume control, 10,000-ohm, 1-watt. Two 50,000-ohm, 1-watt. Three 50,000-ohm, 1-watt. 125-ohm, 10-watt. Puncheted and finished chassis, 3 x 15 x 2.5 inches. Five sockets for tubes, one socket for tuner output (tuner plug and connector not supplied). A terminal strain line cord, plug and toggle switch; two knobs: screws, nuts, bolts, wire, 6-0.6 and 81 tubes (one each). Diagram and instructions. Order Model Twin X Kit, shipping weight 10 lbs.

$15

THE Model A Twin Kit contains parts for building an audio amplifier of 15 watts output at 2 per cent, total harmonic distortion of speaker driven with its 5Z3 power supply, for modulating a medium-powered voice transmitter, with 100 IAB gain, and high impedance input, this circuit may be used also for public address, phonograph pickup, or for supplying audio power amplification for a tuner. Our circuit is a phase inverter balanced against degeneration and phase distortion. A 6J7 input feeds a 6C5 inverter-driver. Output consists of 6J6 fundamental. V.h.f. and tone control.

WHAT YOU GET: UTC Power transformer, 400-0-400 a.c., 50-watt primary. UTC 807-A choke. UTC output transformer, primary 6,000 ohms p. to p.; secondary tapped for 4.5, 1, 5, 8 and 15 ohms for voice coils. Chrome shield, 18 mfd. 35-v., C-D dry electrolytic. Two separate 8 mfd. 400 v. C-D dry electrolytics. Two 1 mmfd. C-D 400-v. paper clipping condensers. 1 mmfd. C-U 400-v. tone control condenser. 25,000-ohm tone control rheostat, 50,000-ohm, 1-watt potentiometer volume control, 10,000-ohm, 1-watt. Two 50,000-ohm, 1-watt. Three 50,000-ohm, 1-watt. 125-ohm, 10-watt. Puncheted and finished chassis, 3 x 15 x 2.5 inches. Five sockets for tubes, one socket for tuner output (tuner plug and connector not supplied); A-terminal strain line cord, plug and toggle switch; two knobs: screws, nuts, bolts; RCA tubes, one 6J7, one 6G5, one 5Z2, two 6L6. Diagram and instructions. Order Model Twin T Kit (shipping wt. 13 lbs.)...

$17.00
A Versatile U.H.F. Transmitter

(Continued from page 90)

amplifier vacuum tubes, they will be excited sufficiently also to draw plate current. The plate meter should be removed from the third amplifier plate jack and inserted in the power amplifier plate jack and the plate tank circuit of the final amplifier should be brought to resonance to prevent damage to the two WE305A tubes. It is advisable at this time to readjust all circuits in the entire unit as previously described. The 60-watt bulb acting as a dummy load for the transmitter should be at full brilliancy with these preliminary adjustments. More accurate adjustments will improve this to some extent.

Throwing the toggle switch in the grid circuit of the final amplifier in either direction measures the grid current of either of the WE305A vacuum tubes in the final amplifier. The tuning coils should be compressed or expanded as necessary to provide equal grid current in either circuit. Once equalized, such readjustment is unnecessary. It is preferable to obtain this condition with neither plate nor screen voltage on the push-pull final amplifier stage, since a non-resonant condition in plate of the final amplifier may bring about unequal grid current. After equal grid currents are established, similar adjustments should be made to the plate tank coils in the final amplifier by checking to see whether the grid currents have been unbalanced. It is not necessary that this procedure be very accurate. Experience has shown that more than a 10% discrepancy seldom occurs. In passing it may be well to mention that the push-pull inductances, both in the grid and plate circuits, are spaced equally distant from the shielding at both ends and the transmitter is inserted in the cabinet with but one side removed to allow access to the coils during adjustment, thus retaining a balanced condition.

The authors wish to express their appreciation for the excellent cooperation offered by the Wilder Manufacturing Company of Brooklyn, New York, and for their aid in solving the mechanical problems and the actual metal work involved.

The Delta Division Convention

BRIGHT and early Saturday morning, September 5th, several members of the Monroe Amateur Radio Club were on hand at the Virginia Hotel to greet the arriving Delta Division amateurs. The ladies were sent off to the theatre at about 1:30 P.M. to enjoy the film "Anthony Adverse," while the rest of the gang gathered on the roof for greetings by the Commissioner of Public Utilities, Hon. W. D. H. Rodriguez, representing the mayor of the city. Informality was the rule of the day, especially after Com. Rodriguez compared the influx of "hams" to the shipping of...
Two Hundred Meters and Down

The Story of Amateur Radio

By CLINTON B. DESOTO

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No. 9 in the series entitled The Radio Amateur's Library

The AMERICAN RADIO RELAY LEAGUE
West Hartford Connecticut

"hams in barrels" to refugees in the city during the 1927 flood. Unfortunately, Senator Noe was out of the city as well as Mr. Williamson, who had been scheduled to address the assembly.

Vacation time and sundry other things conspired to deprive us of the majority of the scheduled events and speakers. Nevertheless, the program went off very well. Mr. E. Ray Arledge, Delta Division director, addressed the assembly, giving much valuable and interesting information to the hams.

It was decided to dispense entirely with that part of the program scheduled for 5:00 P.M. on Saturday, and much to our surprise all the boys were on hand on the roof to enjoy the dance recital prepared for the ladies. The entire group of assembled hams melted away shortly after the dance program, with the invitation to reassemble on the roof at 7:00 P.M. for refreshments and dancing, the scheduled barbecue having been postponed until the same time the following day.

This particular meeting was the grandest "get-together" of congenial folk I have ever seen. Music was provided and everyone danced, talked, "refreshed themselves," etc., until one of the local hams invited the whole gang out to his home to finish the evening surrounded by an astounding assortment of ham paraphernalia.

Promptly at noon all gathered on the roof again to partake of the banquet—and what I mean, it was some banquet! It was an absolute shame for all the Delta hams not present to miss those delicious thick, tender steaks we had. Naturally, very little was said or done for some time with the exception of seeing that all food in sight vanished as quickly and satisfyingly as possible. Pat Lynch, W5EGK, toastmaster for the occasion, introduced Mr. Arledge who presented a very interesting talk.

Then the matter of distribution of prizes got under way. It was halted at about two o'clock to view another dance program presented by the same school. After this several contests were held, as called for in the program, and the remainder of the prizes were distributed by the drawing of numbers.

At 6:30 P.M., Sunday, the delegation met at the southern entrance to the hotel where a bus donated by the city waited to take everyone out to the mayor's country home for the barbecue, the last scheduled event of the convention. The boat ride had been omitted because Senator Noe was absent from the city. Well, you wouldn't have thought it possible for that gang to eat so much barbecue after all that banquet! A few had to leave a little early in order to catch their train home, but there was a good crowd still there when the bus finally started them back toward the hotel. A few of the bravest continued the celebration even after that. Then came the final parting with many regrets for the necessity of departure and expressions of good will and wishes for future meetings.

—Jewel L. Caraway, W5PJW
(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 section of this column be used for advertising, such as all or part capital letters be used which would tend to make one advertisement stand out from others.

(3) The Ham-Ad rate is 15¢ per word, except as noted in paragraphs (1), (2) and (4).

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QSL—$650 per 100 and up. Samples for stamp, W2AEX.


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SELL $7.50 postpaid. Buescher 6-flat saxophone—sell $55, or trade for W2GWS, 88-34 200th St., Queens Village, N. Y.

FIFTY cents for a radio magazine! Yes, and worth it. The special annual (January) 200-page number of Radio out in December is included. In addition, door prizes are awarded, $5.00, large bottle 50¢. Electro-Chemical Laboratories, 1781 Riverside Drive, N. Y. C. 

SALE, speakers, microphones, amplifiers, test equipment, tubes, horns, units, and lots of other surplus supplies that are useful to hams. Write frequently, W2APZ.

SELLING all equipment—two stations—write W2AER.

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QSL—$1. two color, $1. W5LQM, 1040 Kelton Ave., Columbus, Ohio.

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Qsl's, w8ihn, helmetta, N. J.

Write for trade-in price on your old receiver. We buy all. Walter ashe radio co., st. louis, Mo.

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Sell—Complete ten tube receiver, 130 watt phone emitter, $6. Standard parts. Write, W1ezf, 318 E. sinto, Sparks, W. A.

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Qsl's, free samples. Frinter, corvath, Iowa.


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Variax Transformers

A wonderful line voltage control, that is smaller, more convenient to use and furnishes high current over a narrow voltage range.

**Type 70-B** — 115 v. at 2 amps, $10

**Type 80-B** — 115 v. at 7.5 amps, $15

Write for Bulletin 07-Q for complete data

Here are two handy G.R. forms for that multiband transmitter.

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Set of 4 matched Sylvania metal tubes, $2.73

Complete 11 watt unit, tubes, Wright DeCosters No. 990 speaker, Bell projector, crystal microphone. .......... $22.95

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for sizes, complete descriptions and prices, see our advertisement in Nov. issue

We Are Headquarters for the Following

Hammarlund — Melzer — Alladin — Triplet — United Transformer — Cornell-Dubilier

Say You Saw It in QST — It Identifies You and Helps QST
VARIMATCH transformers are used in the UTC 6LC Universal Beam Power Amplifier

VARIMATCH transformers are used in the UTC 6LC Universal Beam Power Amplifier

PAK amplifier kits feature: Power output 35 watts self bias, 55 watts fixed bias; gain 118 DB, immediate changeover to 95 DB; separate power supply and audio decks; stabilized feedback; mobile operation with geanmotor—30 watts output provision for electron mixer or low impedance input if desired.

- **PAK-1** Self bias amplifier kit, 35 watt operation. Output transformer impedances 500, 200, 16, 8, 5, 3, 1.5 ohms. Includes all accessories such as resistors, condensers, sockets, calibration plates, chassis, dust covers, hardware except tubes. All fully mounted. Net to hams...$45.00

- **PAK-1X** Same as PAK-1, but with Varimatch modulation output transformer. Impedances available are: 220, 408, 1180, 2350, 2400, 3000, 4670, 4750, 5560, 7000, 9150, 9470 ohms. Net to hams...$48.00

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**UTC Varipower autoformers perform 3 functions**

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<table>
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<th>Description</th>
<th>Output Rating</th>
<th>Net to Hams</th>
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<tr>
<td>VA-1</td>
<td>150 watt output rating</td>
<td>Net to hams</td>
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<tr>
<td>VA-2</td>
<td>250 watt output rating</td>
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<td>VA-3</td>
<td>500 watt output rating</td>
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<tr>
<td>VA-4</td>
<td>1000 watt output rating</td>
<td>Net to hams</td>
<td>$9.00</td>
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<tr>
<td>VA-5</td>
<td>2000 watt output rating</td>
<td>Net to hams</td>
<td>$12.00</td>
</tr>
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</table>

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A Ten-Meter Converter (Grammer). .

A Versatile U.H.F. Transmitter (Grossfinger and Prosser) .

Adapting the Pattern PR-10 for 10-Meters (Exp. Section) .

Adapting the QST Three-Tube Transmitter to Ten Meters (Exp. Section) .

Antenna Coupling to the 56-Mc. Receiver (Exp. Section) .

An Unconventional Receiver for the Ultra-High Frequencies .

Car Antenna Kinks (Exp. Section) .

Remote Tuning of U.H.F. Receivers (Rife) .

Revised Transceiver Circuit (Exp. Section) .

Regerative Doubler (Exp. Section) .

More Locked Oscillator Circuits (Exp. Section) .

Some Trick Crystal Circuits (Brown) .

A 6A7 Transmitter (Exp. Section) .

55, May

60, Feb.

50, May

11, June

14, Aug.

37, Dec.

96, Dec.

31, Feb.

29, Mar.

60, July

64, Apr.

53, May

28, Dec.

29, Mar.

53, Oct.

28, Aug.

30, Sept.

55, May

60, Feb.

50, May

ULTRA-HIGH FREQUENCIES—APPARATUS

100-Watt 55-Mc. Crystal-Control Output With Only Four Stages (Goodman) .

23-Mc. Converter with Tuned R.F. Receivers (Exp. Section) .

5-Meter Crystal Control With Push-Pull 800 Output (Reinartz) .

56-Mc. Crystal Control With Resonant-Line Coupling (Sanders) .

A 28-Mc. Rotary Beam (Breuer) .

A 5- and 10-Meter Converter (Long) .

WHAT THE LEAGUE IS DOING

20, Jan.

24, Feb.

25, Mar.

33, Apr.

25, May

27, June

19, July

21, Aug.

26, Sept.

30, Oct.

27, Nov.

27, Dec.

Minutes of 1936 Board of Directors Meeting .

Phone Frequencies .

The June Hearing .

The Ultra-High Frequencies and the June F.C.C. Hearing .

WITH THE AFFILIATED CLUBS

28, Jan.

54, Apr.

QST for December, 1936, EASTERN Edition

RUMFORD PRESS
CONCORD, N. H.
IN REPLY to professional demand, a Combination Panel consisting of a spare-coil cabinet, matched speaker and power supply is now offered as an auxiliary to the HRO Receiver. Making a compact well-appointed receiver with its speaker properly segregated to prevent annoying mechanical feed-back. Your choice of finish, either rich grey or black leatherette. Retail prices are: HRO receiver, relay rack type, with coils covering 1.7 to 30 megacycles — $179.70; Combination Panel type SPC — $52.50; Table-model Relay Rack type MRR — $13.50.
This outstanding new transmitting tube provides not one but a host of features never before incorporated in one tube type. Study these features carefully to assure yourself that this is the type to use in your new transmitter.

1. **TANTALUM PLATE**—Gives high plate dissipation and assures freedom from gas.

2. **LEADS**—Plate at top, grid at side, provide maximum insulation, maximum convenience of circuit arrangement, and low inter-electrode capacitances.

3. **BULB STYLE**—Gives maximum heat dissipating area and cooler bulb for equivalent size tube. Large spacing between plate and bulb reduces possibility of gas evolution from bulb.

4. **ELECTRODE SUPPORTS**—Constructed with minimum of insulating materials.

5. **LARGE PLATE CAP**—Provides low contact resistance and greater strength.

6. **HIGH PERVEANCE**—Perveance is a fundamental tube constant inversely proportional to tube impedance. A high-perveance tube is, therefore, a low-impedance tube. A high-perveance tube can be operated at reasonable plate voltages with high plate efficiencies, thus avoiding the necessity for costly high-voltage power supplies.

7. **HIGH-MU GRID**—Requires less bias—is economical and convenient. Low cut-off voltage means low plate current at zero bias; thus, the tube is protected should excitation fail with grid-leak bias.

8. **HEAVY DUTY FILAMENT**—7.5 volt, 4 am Filament provides large reserve emission for heavy-duty operation.

9. **CONSERVATIVE RATINGS**—Class C telephone service: 50 watts plate dissipation; 1500 plate volts, 200 watts input power—RCA's conservative ratings assure long, economical, and satisfactory tube operation.