QST

devoted entirely to amateur radio

march, 1938
25 cents

In this issue—
- Simplified Superhet
- New Ideas in Exciter Design
- More on Television
A Hound’s Tooth . . .

is not as clean as the design of the 30J r-f section. Every piece of metal and ceramic bespeaks simplicity and performance.

COLLINS RADIO COMPANY
CEDAR RAPIDS, IOWA   NEW YORK, N. Y: 11 WEST 42 STREET
THE INFINITE IMAGE REJECTOR * is just one of the features of the NEW SKY CHALLENGER II that makes it unique among communications receivers. Where ordinary amateur receivers are designed to reduce image ratio to the minimum level, the Hallicrafters have gone a step further, and provided the means to effectively eliminate image interference. Any amateur can appreciate the value of this new Hallicrafters circuit, especially when working the 10 and 20 meter bands. Combined with the 1,000° Spiral Band Spread, its razor-sharp selectivity, and rigid, smooth-operating, mechanical superiority, this feature accounts for the instantaneous popularity and acceptance of the New Sky Challenger II by the amateur radio world. See it at your dealers or write for complete information.

* Patents applied for

- 9 Tubes
- Infinite Image Rejector
- 1,000° Spiral Band Spread
- 38 MC to 540 KG (7.9 to 545 Meters)
- Rarefied Main Tuning Dial
- “S” Meter Terminals
- Iron Core IF’s

All Hallicrafters Receivers available on Liberal Time Payments

"WORLD'S LARGEST BUILDERS OF AMATEUR COMMUNICATIONS RECEIVERS"

Say You Saw It in QST — It Identifies You and Helps QST
Ever since the announcement of the 1938 Super Skyrider, this receiver has had the enthusiastic support of the Hallicrafters dealers. During the short period that it has been available, our dealers have sold more Super Skyriders than any other Hallicrafters receiver and we believe more than any other communications receiver built. This has been extremely gratifying, for we appreciate the unique position of the dealers in amateur supplies and the invaluable service they are performing for amateur radio.

Most dealers are experienced amateurs themselves, and their advice and counsel on technical subjects and equipment is eagerly sought. They act as a clearing house for information on new developments and in general do everything in their power to further the cause of the radio amateur.

Because we value the amateur supply dealers' judgment so highly we are happy to receive their support of the 1938 Super Skyrider and accept it as the highest form of approval. Ask your dealer about the Super Skyrider and the Hallicrafters Time Payment Plan.
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TWO NEW WONDER TUBES

TZ-40

A high Mu zero bias Triode offering wide possibilities in Class B Audio operation and as a high power doubler and buffer. 175 watts of Class B Audio output with 3 watts drive! As an exciter it will drive efficiently an amplifier stage to 700-800 watts input. Complete technical bulletin for the asking—at your Distributor or write us.

TZ-40

GENERAL CHARACTERISTICS

<table>
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<tr>
<th>Characteristic</th>
<th>Value</th>
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<tbody>
<tr>
<td>Filament</td>
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<tr>
<td>Filament current</td>
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<td>Amp. factor</td>
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<td>Plate to Grid cap</td>
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CLASS B AUDIO OPERATION

(Values for 2 tubes)

<table>
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<tr>
<th>Characteristic</th>
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<tr>
<td>Plate Volts</td>
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<tr>
<td>Bias</td>
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<tr>
<td>Peak A.F. Grid to Grid voltage</td>
<td>220</td>
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<td>Zero signal DC plate current</td>
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<td>Max. Sig. plate current</td>
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<td>Plate to plate load</td>
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<td>Av. Driving Power</td>
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<td>Power output</td>
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CLASS C OPERATION

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<tr>
<td>Plate current</td>
<td>115 MA</td>
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<tr>
<td>Grid volts</td>
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<td>Grid current, Max.</td>
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<tr>
<td>Driving power, Max.</td>
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OVERALL DIMENSIONS

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<tr>
<td>Max. length</td>
<td>6½</td>
</tr>
<tr>
<td>Max. diam.</td>
<td>2</td>
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Comparison Sells Taylor Tubes

Taylor HEAVY CUSTOM BUILT DUTY Tubes

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

T-40 T-40

A pair of WONDER TUBES—setting an entirely new standard of value. Experienced Radio Distributors, Tube Builders and Engineers, marvel at Taylor's aggressiveness and ability to continually produce better transmitting tubes at “More Watts Per Dollar” values. You, the amateurs of the world will wonder at the more efficient results of these truly amazing WONDER TUBES. Read the characteristics and remember that the rugged carbon anodes used in these and other Taylor tubes operate at red heat without injury to filament emission. The T-40 and TZ-40 operate efficiently in all transmission services on all amateur frequencies. These new WONDER TUBES are destined to be the outstanding sales champs of 1938. See them before you buy—comparison sells Taylor Tubes.

T-40

A general purpose Triode with characteristics that make possible super-efficient performance in all Class C services on all Amateur Frequencies. Extremely easy to drive—the ratings given here are maximum requirements for high level modulated amplifiers. For CW or buffer operation the drive required is 50% less. Ask your distributor or write us for complete technical bulletins.

T-40

GENERAL CHARACTERISTICS

<table>
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CLASS C OPERATION

(1.7 MC. to 60 MC.)

<table>
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<tr>
<td>Driving power, Max.</td>
<td>10 watts</td>
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Recommended by Leading Parts Distributors

"More Watts Per Dollar"

TAYLOR TUBES, INC., 2341 WABANSIA AVE., CHICAGO, ILLINOIS

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 listed below. Mail your QST (on the 16th of each month) or covering your radio activities for the previous 30 days. Tell him or other appointments he can tell you about them, too.

### ATLANTIC DIVISION
- **Eastern Pennsylvania**: W3QP John Buck Morgan
- **Maryland-Delaware-District of Columbia**: W1BAK
- **Southern New Jersey**: W3BEI
- **Western New York**: W2CNS
- **Western Pennsylvania**: W5FO

### CENTRAL DIVISION
- **Illinois**: W9KJ
- **Indiana**: W9RG
- **Kentucky**: W9ARU
- **Mississippi**: W9PR
- **Ohio**: W8AQ
- **Wisconsin**: W9UFT

### DAKOTA DIVISION
- **North Dakota**: W9RZA
- **South Dakota**: W9RSB
- **Northern Minnesota**: W9IZZ
- **Southern Minnesota**: W9DCM

### DELTA DIVISION
- **Louisiana**: W5ABJ
- **Mississippi**: W9GHP
- **Mississippi**: W5DEP

### HUDDSON DIVISION
- **Northern New Jersey**: W2LU
- **New York, N. Y., & Long Island**: W2GNM

### MIDWEST DIVISION
- **Iowa**: W9EZE
- **Kansas**: W9PB
- **Missouri**: W9YD
- **Nebraska**: W9FAM

### NEW ENGLAND DIVISION
- **Connecticut**: W1CTT
- **Maine**: W1PFB
- **Eastern Massachusetts**: W11WC
- **New Hampshire**: W1BPT
- **Rhode Island**: W1HRF
- **Vermont**: W1GNF

### NORTHEASTERN DIVISION
- **Alaska**: K7ENA
- **New Hampshire**: W2PROT
- **New York**: W7QRE
- **Oregon**: W8PXT
- **Washington**: W7WY

### PACIFIC DIVISION
- **California**: W6OQF
- **Nevada**: W6HIC
- **Oregon**: W9BC
- **Washington**: W8HD

### ROCKY MOUNTAIN DIVISION
- **Colorado**: W9EA
- **Utah-Wyoming**: W7AOH

### SOUTHEASTERN DIVISION
- **Alabama**: W4DSG
- **Eastern Florida**: W1DVO
- **Florida**: W4BJS

### WEST GULF DIVISION
- **Louisiana**: W5DXA
- **Texas**: W5CEN
- **Texas**: W5BH0
- **New Mexico**: W5C5G

### MARITIME DIVISION
- **Florida**: VE1DQ
- **Ontario**: VE3SG
- **Quebec**: VE2EE
- **Alberta**: VE4BG

### VARIOUS DIVISIONS
- **Ohio**: W9FAX
- **Minnesota**: VE4EL

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*Official appointments to act until the membership of the Section choose permanent S.C.M.'s by nomination and election.*
LET us consider the material that enters into the building of good transformers and associated products. We will first consider insulation of the various kinds, such as paper, cloth, varnish, compound and bushings, as well as solder which has an important bearing on their effectiveness.

Paper, the first to be considered, must not be confused with ordinary paper, but must be of special electrical grade, free from all metallic specks and acid or alkaline reaction. When a new supply is received, all this type of material is tested in a commercial laboratory to be sure that it has a neutral reaction.

Varnish beside being neutral must be able to withstand heat, and its solvent must not attack the enamel on the wire or oxidize at any of the soldered joints. In fact the varnish must penetrate to all points and deposit a film over paper and all insulating material so as to keep moisture out after the impregnating process as well as to insulate the coil electrically.

Compound must have all of the preceding characteristics and in addition must be so made that it will not oxidize under the presence of ozone, or in itself absorb moisture. Furthermore this compound must be of such a type that the heat developed by the transformer will be equally transferred to all parts of the metal container. If this were not so the outside of the container would be cool and the coil very hot and would burn out from lack of heat transfer.

Bushings offer a wide choice, from the low voltage type, made of composition, to the Ceramics of the dry process type and glazed, to the better grade of the wet process type of which some are glazed and some plain. This latter type for high voltage and non-moisture absorbing qualities are the best.

Solder is another factor in the ability of a transformer to stand up. In no case should acid soldering paste, compounds or acid core solder be used on electrical joints inside or outside. Only the best grade of rosin core solder should be used.

Furthermore, the operator's hands or fingers should not come in contact with any soldered joints for the acid present on the skin is often enough to start corrosion. Gummed stickers should never be moistened in the mouth for saliva very often contains sufficient acid to do irreparable damage to the coil.

In the above discussion the major precautions necessary to protect transformers from their natural enemies, acid and moisture, are pointed out.

F. P. Kenyon
The American Radio Relay League

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West Gulf Division
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c/o Humble Pipe Line, Talco, Texas

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 fraternality 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 requisite. Correspondence should be addressed to the Secretary.

HIRAM PERCY MAXIM, FIRST PRESIDENT

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State College, Pa.

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

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West Hartford, Connecticut

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West Hartford, Connecticut

General Counsel........PAUL M. SEGAL
1026 Woodward Building, Washington, D. C.

Address all general correspondence to the administrative headquarters at West Hartford, Connecticut.
THE critical season when most communications emergencies occur is again upon us. Floods, hurricanes, sleet storms—the threat of broken wires and consequent intelligence gaps in the last months of winter imposes heavy responsibility on amateur radio.

Amateurs have provided emergency communications at such times for nearly two decades. Until recent years, theirs have been largely performances of individual heroism—deeds of valor performed single-handed or by comparatively small groups. It is only in the past two or three years that the concept of amateur radio, as an entity, taking over the bulk of emergency communications activities whenever existing services are overloaded or disrupted, has achieved form. Now that concept is coming to be accepted, not only among amateurs but by other radio services and government and relief agencies as well.

It should perhaps be stated, parenthetically, that in speaking thus of “amateur radio” we are using the broadest definition. Amateurs have many affiliations; much “amateur” emergency activity is nominally directed by such authorities as the Signal Corps, Naval Reserve, National Guard, even the Coast Guard and Army Engineers, as well as municipal and semi-private agencies. But in a realistic sense these groups are all affiliates of amateur radio; they are dependent upon amateurs for operating personnel; and to a major extent they utilize amateur frequencies and operate under amateur status. Their sole connecting link is amateur radio. The amateur is the yeast that leavens the whole batch of bread; without him the individual groups could not exist.

The keynote of all our emergency communications system is, therefore, the amateur. The responsibility is likewise his. This responsibility makes imperative the exercise of forethought and preparedness. Occasionally one hears optimistic assertions on the part of private or governmental agencies that professional emergency communications corps are being or will be organized, to avoid the haphazardness of amateur methods. A little simple arithmetic will show the impracticability of any such ambitious plan; the facilities simply aren’t available. To establish a system of minimal utility several thousand units would be required. More or less regular drills would be essential to provide the consistent practice essential for proficiency. The cost would be staggering. Apart from that, the wastage in radio channels would be prohibitive.

But the fact that such plans are even broached indicates a lack in the amateur system, however. Further evidence of such a lack is the implied desire on the part of certain agencies following the Ohio River flood last year to take over the administration of amateur facilities in future emergencies.

And there lies the key to the lack. It is one of administration—organization. Our facilities have been more than adequate; we have thousands of skilled operators, we have permanent stations located in nearly every community, and we have many hundreds of units of portable self-powered equipment developed in recent years as a result of A.R.R.L.’s Emergency Corps and Field Day campaigns. Beyond that, we have amateur and amateur-affiliated networks covering the entire country.

All that has been lacking has been centralized organization—coordination. In past emergencies such centralized, coordinated control has evolved spontaneously in some regions; in others, inefficiency, duplication of effort, and confusion and delay have prevailed. In the future we cannot depend on accident. We must have efficiency and reliability and complete coverage from the very start. We must prepare adequately, not only with personnel and equipment, but with organization.

For the past seven months A.R.R.L. has been working on this problem. For the most part it has been a process of working out details in the broad general plan, expanding the program of the A.E.C. of the past several years, providing a skeleton framework of organization to serve as a rallying point for mobilization in time of emergency need. Recommendations to the F.C.C. to aid the amateur service in its organized capacity to serve the public were made by the Board last May. About December 15th the nucleus of the plan—the appointment of Emergency Coordinators in all communities of sufficient size—was gotten under way; by the end of January some sixty coordinators had already been appointed.

The details of this plan have already been circulated through Communications Department bulletins, and will be the subject of a detailed article in the next issue of QST. Every amateur should examine this article with care, for it is of great importance to the future of amateur radio.

—C.B.D.
Canada—U. S. A. Contact Contest

April 14th, 15th, 16th, 17th and 18th

WHAT a glorious weekend of operating that will be, 102 hours for renewing old friendships. Records of previous years should be topped this year. Last year VE3GT won a lovely trophy fourteen inches tall, which was donated by Canadian Marconi Co. This year, The Canadian General Electric Co. is donating a cup to go to the highest scoring Canadian station. Other Canadian manufacturers are donating prizes in equipment to go to the next three or four highest stations. Canadian General Manager Alex Reid, VE2BE, has heartily endorsed this year's contest, which is being sponsored by the Section Communications Manager of Ontario, Fred H. B. Saxon, VE3SG. Logs should be mailed to him at 302 Lee Ave., Toronto, Ontario, not later than midnight April 30, 1938.

THE CONTEST RULES

Dates: Starts—Thursday, April 14th, 6 P.M. local time. Ends—Monday, April 18th, midnight, local time.
Duration: 102 hours.
Frequency: Any or all amateur bands may be used.
Object: Each VE will work as many W stations as possible in as many United States A.R.R.L. sections (see list page 6, QST) as possible. Each W will work as many VE stations in as many VE sections as possible.
Scoring: The same log form as used for last year's contest will be used. Message preambles will be exchanged. Each preamble sent will count one point and each one received will count one point. It is not necessary for preambles to be exchanged BOTH ways before a contact may count, but one must be sent or received before credit is claimed. All preambles must be handled under approved A.R.R.L. procedure. Mark each new section as it is worked. The "check" portion of the preamble will be the RST report of the station worked. Sample preamble: NR 1 VE3GT CK 579 Toronto, Ont. 6:02P Apr. 14. W Stations multiply number of points by the number of VE sections worked and multiply the final score by nine, there being nine times as many U.S.A. sections. VE stations multiply the number of points by the number of U.S.A. A.R.R.L. sections worked.

POWER AND OPERATOR HANDICAP

Each station having less than 100 watts input to the final stage shall multiply the score by 1½.

Where more than one operator normally operates a station the total score of the station shall be accepted, providing a certificate is attached to the log giving the names and call signs of the operators making the score.

PRIZES

A.R.R.L. Certificates of Merit will be awarded to the leader in each of the 70 A.R.R.L. sections in the U.S.A. (and possessions) and Canada. Suitable prizes for a limited number of Canadian leaders will be available. The Canadian General Electric Co. are donating the main prize this year, a cup, which will be known as The C. G. E. Trophy. The sponsor will not be in the running for a prize, but will be on the air to give points to aid W stations in obtaining a higher score.

OPERATOR'S CERTIFICATE

The following certificate is requested on each log submitted:

"I hereby state that in this contest I have not operated my transmitter outside any of the frequency bands specified on my station license, and also that the score and points set forth in the above summary are correct and true."

In checking the logs of last year's contest it was noticed that every A.R.R.L. section had active participants, yet there were six sections from which no logs were received. This year the sponsor would like to be able to issue certificates of merit to each of the 70 sections. W6ITH led the U. S. contingent last year with 101 contacts, 93 of which were made on 'phone, all seven Canadian sections being worked. This was splendid work, but, never being satisfied, we are looking forward to some one bettering it this year.

QST for
BACK in 1936, just before spring started thinning the ranks of the brethren, while slaving away trying to absorb a little book knowledge I read an article written by Captain Irving Johnson recounting some of the experiences he had had with a crew of young fellows on his schooner circumnavigating the globe two years before. The idea of his cruise had been to take boys, mostly of college age, on what amounted to a “share-the-cost” basis, and sail around the world. These fellows also served as the crew.

Having a bit more than the usual touch of adventurous spirit in his blood, Irving Johnson took his ship into many of the out of the way places seldom visited in recent years. Among other things he did on that first cruise was to discover five new islands in the Pacific and chart them, to weather an Indian Ocean cyclone, and to discover a major waterfall in British Guiana over five-and-a-half times as high as Niagara. However, from my point of view, one serious error had been made—they carried no radio. In fact, several times during the cruise folks at home began to worry over them when the Yankee was unable to follow the schedule that had been laid out before leaving America.

Captain Johnson’s closing words were: “I hope to leave Gloucester (Mass.) again with another group of boys November 1st, 1936, for a similar cruise.” I inquired for further details. The idea sounded good to me as I had become rather fed up with classes and the like.

After due preliminary negotiations, during which I looked over the boat and was looked over, I finally signed on for the coming world cruise. As a ship the Yankee was a 92-foot, two masted schooner, built some forty years ago by the Dutch Government for pilot service on the North Sea. The old pilot service orders were to stay out until no other vessel could. By that time the pilot ship could not risk coming in close to shore, so she was literally built for all kinds of weather. In those days she had no power and had to rely on her sailing ability alone. To-day she is as sound as the day she was commissioned though time has seen a few minor changes. Below, she has been refitted to make living conditions more comfortable on long cruises in the tropics. A 35-h.p. semi-Diesel motor makes for easier maneuvering at docks and through narrow passes. Another addition to the ship’s original gear is the radio antenna, which runs from the lead-in bowl in the deck near the base of the mainmast to the main spreader. The antenna is a vertical 55-foot Marconi.

I had been told before signing that if I finally went on the trip, the “Skipper,” as I soon came to call Captain Johnson, would see that there was radio equipment on board. Some personal friends of his had been trying to sell him the idea that high-frequency radio on a small boat was very practical, but Captain Thompkins of the Wander Bird, KMUP, whom the Skipper knew well, had not had much success with his attempt. We ended up with a compromise between what I wished to have and the Skipper’s idea of cost. This amounted to an old m.o.p.a. designed for service ten years ago on 100-meter c.w., which I rebuilt to work on the high-frequency ship bands. With an 801 driving p.p. 801’s I was supposed to get an output of about 75 watts. The receiver was a Sargent model 12 which I chose because Walter Evans of Westinghouse Radio Division warned me from his experiences that moisture troubles would be very bad. The makers advertised the model 12 as having been made primarily for shipboard use. Now, I wish that I had bought two receivers—keeping one in the oven drying out while using the other.

Previous to sailing I had decided that here was a good chance to see what amateur radio could do when it came to rendering daily long-haul traffic contacts without the aid of high power and...
directional antennas at both ends. I made arrangements with several stations in various parts of the world for schedules and spread the word in general that while legally WCFT was a ship station licensed for communication with amateurs, actually she was an amateur station operated by an amateur and would be in communication with amateurs. Unfortunately, even after making some trips to Washington to see the F.C.C. people personally, I was unable to get permission to operate in the amateur bands. The best they could do for me was to indorse the licenses in the same way as for Byrd—permitting amateur contacts under the call WCFT but requiring us to operate on regular ship frequencies. Therefore, many stations who would have liked to have carried schedules were unable to, because their receivers were made to tune the amateur bands only.

When we sailed on November 1, 1936, I had skeds with the following: W8PH, W1ZB, W8BQP, W8IUE, G6NJ, K5AI and VP5JB. In addition I was to work VS1AA and ZS2X when I got within range of them. Unfortunately, difficulties with the installation required that I carry a skeleton schedule with W1ZB only.

Right here Carl Madsen, W1ZB, should come in for his bow. He heard of the Yankee’s cruise shortly before we sailed and wrote offering his services, as he felt that, aside from having a good station with a modest DX record, he was in a position to give WCFT quick service to our home office which was in Springfield, Mass. He came down to Gloucester while we were outfitting, to say “Hello,” and made a flying trip the day we sailed, to calibrate the transmitter. Since then he has given far better cooperation than I could have hoped for. He has been on daily for over a year right on schedule. Once a breakdown threw us off the air for a week, but he was still faithfully at it when we got back on. If for some reason he had to leave town he would get W1FTR or W1CC to fill in for him. However, it was usually ZB who was there. No matter what time it was or what conditions that New Year’s celebration had left him in, he would still be there when the clock rolled around to sked time. This was a fine example of the true ham spirit that so many people claim is dying out.

I also want to thank Oakes Spaulding, W1FTR, who spent so many early mornings standing by in Hartford when my signals got so weak that his slightly superior location often made the difference between getting a message or having W1ZB struggle to hear it through a maze of electric shaver QRM again. W8IUE receives our thanks for giving a wonderful QSP to many of the families of those on board. The same applies to W8AAU. K5AG, with operator Snow behind the controls, spent many early hours handling traffic to and from the Yankee. W6LZ and W6PSE made possible several direct chats with my folks while they were on an extended trip and some personal business needed attention. To W1TS, W1SZ and W1NI I want to give thanks for many a pleasant chat. It was a great pleasure to chat for a minute or two in good old ham style with various stations and I am only sorry that the supply of energy in the ship’s batteries wasn’t large enough to permit some old-fashioned rag chewing. The following also did their part to render various bits of assistance in one way or another during the course of the cruise: WSHAR, W8PH, W9ALV, K5AA, K5AV, K1FPM, K6N XD, K6OJG, NY2AC, FO8AA, VS1AD, VS3AE and ZELJG.

I had had doubts of what the little 75 watts could do on such long haul contacts, and while its performance far exceeded even my wildest hopes, there were times nevertheless when I was unable to work through. In fact, no amount of power would have broken down the barrier. A synopsis shows that from Gloucester, Haiti, Panama, Galapagos Islands, Easter Island, Papeete, Tahiti to Pago Pago the signals had dropped off again and, coming back up to their former level. However, by the time WCFT reached Pago the signals had dropped off again and, combined with very poor local conditions from surrounding mountains, caused the first break we were to experience. Nevertheless we continued to have contact by combined use of 36 and 18 meters. After experiments early in the trip, during which we tried 8.2, 11, 12.4 and 16.5 Mc. and both 7 and 14 Mc. for the home end, we found
that 8.2 and 16.5 Mc. used in conjunction with 7 and 14 Mc. respectively gave us the best results. Gradually, as summer static increased during May, 1937, on 36 meters in the U. S. A. we shifted all of our operation to the higher frequencies. For the first time during the trip the signals at both ends began to show the effects of the "DX Cycle." While they did not conform exactly to Perrine's findings they did show that there was a definite cycle. Finally, after calling at the New Hebrides, Solomons, New Britain and Papua, we cleared through Torres Straits and that night, entering the Arafura Sea, we had our last contact with the States on 36 meters. Strangely enough, it was with my own station, W81GQ, using only 100 watts on 40 meters. Two nights later not even West Coast signals came through. From then on, as we progressed through the Netherlands Indies, we had difficult contacts at intervals on 16.5 Mc. We still heard W1ZB, and alternates, on 14 Mc. but only S3 and 4. At this time we started to clear traffic through KA1FM in Manila. We continued to have occasional contacts with the East Coast direct until the Yankee left Semarang, Java, which was the last time we were to hear the New England gang for some time.

After a lay-off at Singapore while I left the ship for a trip to Siam, I continued to work KA1FM, but I was unable to hear the United States at all on any frequency. I am referring to amateurs, for KPH and KFS came through, although weakly in comparison to the power they are using. As the Yankee rounded the north end of Sumatra, however, the signals from the U. S. just burst through on 14 Mc., not at the 1000 to 1300 GT period that we had been using up to this time but about 0000 GT. 'Phone and c.w. came through equally loud. I notified W1ZB as soon as I felt certain that these conditions were not temporary. In mid-Indian Ocean I suddenly lost KA1FM. All KA signals dropped out. Five days later I raised W1FTR on 16.5 Mc. and had a solid QSO. Daily contact was established and, though the time that W signals came in shifted very rapidly as WCFT moved across the Indian Ocean, the strength of signals at both ends remained good for some time. The Chagos Islands found the peak on 14 Mc. about 2230 GT while the area off northern Madagascar found it some place between 2100 and 2215. About this stage of the trip KA signals started to come in again, but very weak in comparison to their former strength. Also W's came in during the 1200 GT period, but not nearly so well as the other way around. For that matter W's could be heard on 14 Mc. any time from 1200 through to 0400 GT on good days. This may all sound rather confusing but it should serve as a fairly accurate guide to help those figuring the correct time to listen for those sparsely settled areas of the globe. As this is being written the Yankee is approaching the island of Zanzibar. Here conditions have taken a drastic shift and no signals except South Americans, which are strong, are heard between 2000 and 0300 GT on 14 Mc. Conditions are similar on 7 Mc. This sudden slump is probably due, however, to the approaching winter solstice.

Now let's get away from the subject of radio and look at the other side of the cruise. Here was a year and a half of good fun with no worries. Room and board had been paid at the start and would not bother us until the cruise was over. Just think of a chance to forget two winters and slide quietly along in the tropics, literally on the wings of the wind! After the first few days of getting used to such minor items as the motion of the ship, we got out of the North Atlantic, just beginning to feel winter's hoary finger, and soon sailed into Cape Haitien, Haiti, famous as a rendezvous of Christophe, the black Napoleon of French Colonial days. Then we sailed to Panama for last-minute supplies. This seemed to us to be the final jumping-off place. Here we would leave all civilization such as we had known and drop into a world totally new. In our passage down we had had a taste of sailing. We had sometimes drifted lazily along with hardly steerage way. The hot tropical sun beating down made us lazier every minute. At times we tore along through the night with the deck lashed by driving spray, the wind howling in the rigging. Suddenly all hands would be roused out of a sound sleep to rush on deck, dressed just as they slept, to fight flaying canvas and gear—one hand for themselves and one hand for the ship. Oh, this trip was varied enough to suit anyone.

From Panama we eased slowly down across the Gulf of Panama to the strange Galapagos Islands, which Beebe truly called "The world's end." They are a great natural zoological garden, marine aquarium and geological wonderland all rolled into one.

Then we crossed the great Pacific to Easter, Piteaain, Manga Reva and Tahiti.

At Tahiti and some of the other Society Islands such as Moorea we found some of the beauty spots of the Pacific. Here was the home of beautiful,

(Continued on page 84)
A Feed-Back Compensator for R.F. Circuits

Controlled Negative Feed-back in the Receiver R.F. Amplifier

By H. O. Talen,* W9PYQ

In receivers using a tuned radio-frequency amplifier, the design usually includes no deliberate feed-back from the succeeding stage to the first grid circuit. Sometimes a regenerative feed-back coupling is provided, with marked advantages under certain, but not all, conditions. There seems to be a perennial argument as to whether a regenerative r.f. stage is "constitutional" or not, particularly in a superheterodyne using more than two or three tubes. There is little doubt that feed-backs do occur except when the r.f. stage is neutralized either by accident or by careful adjustment. Let us consider the question further in terms of a circuit in which we can choose any required degree of positive or negative feed-back, in addition to those already existing.

THE CIRCUIT

In Fig. 1 we have a tuned radio frequency stage followed by a regenerative detector, probably the world's toughest spot for a tuned amplifier. The grid circuit tunes broadly and usually behaves itself with almost any degree of regeneration in the next stage. Not so when the antenna frequency or a harmonic differs from the received signal. By appropriate setting of the feed-back compensator, it is possible to offset a heavy antenna load with regeneration, and to nullify any dead spots in the tuning range. By a different setting, any unwanted oscillation of the r.f. stage due to a light load and advanced regeneration in the detector can be eliminated.

In unneutralized high-frequency amplifiers there is always a transfer of energy through the grid-plate capacity of the tube. The phase of this feed-back depends upon the relative tuning of the two circuits; if the plate circuit is tuned to a higher frequency than the grid circuit, regeneration or oscillation will result; with the opposite condition as to tuning, there can be a decidedly degenerative effect on the signal in the grid circuit.

Published tube data show that the plate-cathode impedance of an r.f. pentode is higher than the load impedance furnished by even the best of parallel-tuned circuits. Part of the disparity can be eliminated by regeneration in the second stage. In order to take full advantage of the gain obtainable from an r.f. stage, the regeneration in the second stage must be carried somewhat farther than is usually permitted because of trouble from oscillation in the first stage. The desired result can be secured by stabilizing the first r.f. stage with a judicious bit of negative feed-back.

By gradually introducing more negative feed-back, the grid circuit tunes broadly and usually behaves itself with almost any degree of regeneration in the next stage. Not so when the antenna frequency or a harmonic differs from the received signal. By appropriate setting of the feed-back compensator, it is possible to offset a heavy antenna load with regeneration, and to nullify any dead spots in the tuning range. By a different setting, any unwanted oscillation of the r.f. stage due to a light load and advanced regeneration in the detector can be eliminated.

Conditions Affecting Operation

The first grid circuit is affected by several factors, among which is the antenna "load." Like the weather, we rarely do anything about it. If the antenna is resonant at the received frequency, the grid circuit tunes broadly and usually behaves itself with almost any degree of regeneration in the next stage. Not so when the antenna frequency or a harmonic differs from the received signal. By appropriate setting of the feed-back compensator, it is possible to offset a heavy antenna load with regeneration, and to nullify any dead spots in the tuning range. By a different setting, any unwanted oscillation of the r.f. stage due to a light load and advanced regeneration in the detector can be eliminated.

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* 5532 Tennessee Avenue, St. Louis, Mo.
A Double-Regenerative Superhet
Low-Cost Five-Tube Receiver with Stability and Selectivity

By Byron Goodman,* WIJPE

ONCE upon a time all amateurs built their own receivers, simply because that was the only way they could get them. But that was once upon a time, and nowadays, with the many excellent receivers available on the market, a fellow has to have a fairly good reason for building one. One's pocketbook usually supplies a very good reason; sometimes it's a fellow's pride, and every once in a while it's because some upstart thinks that the commercial receivers are still not as perfect as they might be from an amateur's viewpoint.

Let's take the case of the fellow with the small pocketbook. Likely as not he is using a t.r.f. or even a detector-and-one-audio, both excellent receivers when there isn't too much QRM. But when the going gets tough one really needs a superhet—not necessarily because of any greater sensitivity but because of increased selectivity plus the fact that a superheterodyne won't lock up on strong signals the way an oscillating detector will. But our friend with the already-strained pocketbook can't afford an elaborate receiver, and therefore must compromise as much as possible. And although he can compromise still further than was done in the receiver to be described, it is our feeling that the technical disadvantages will outweigh the few economic advantages.

CIRCUIT FUNDAMENTALS

From the compromise standpoint, it seems that the receiver should have at least five tubes. The mixer and h.f. oscillator are of course essential and should be separate tubes. The customary i.f. amplifier can be eliminated and only a regenerative second detector used for gain and selectivity, but a separate beat-frequency oscillator should be used if we are to avoid the "locking-up" trouble that is the disadvantage of oscillating detectors. An audio stage is necessary as a suitable coupling to the headphones or speaker, and provides an excellent place for the volume control. The receiver should use a 1600-kc. i.f. to reduce the image response, and a regenerative mixer to increase the gain in the all-important "front end." One more thing: a high-C high-frequency oscillator circuit should be used for stability, but a low-C signal circuit should be used for maximum gain, ganged together by the system described in an earlier issue of QST.¹ That the high-C oscillator is well worthwhile is shown by the fact that the plate voltage on the set can be varied 50 volts with a resultant change in signal beat of only about 500 cycles on 14 Mc.

The tubes practically selected themselves for this receiver. The 6L7G seemed to be the only choice for the mixer because of its excellent characteristics and lack of necessity for critical adjustment of oscillator voltage. A 6J7 might have been used, but the oscillator coupling would have been more critical.

Previous experience had shown the 6J5G to be an excellent high-frequency oscillator tube, and its use in this receiver again justified its reputation.


THE DOUBLE-REGENERATIVE SUPERHET

A simple five-tube receiver for the amateur who wants a maximum of receiver performance with a minimum of cost. A larger knob has been placed on the drum dial to facilitate tuning. The b.f.o. adjustment can be seen at the rear of the receiver, on the left-hand side.

A 6K7G was used for the second detector because it goes in and out of oscillation a little more smoothly than a 6J7G. A metal 6K7 was used for the b.f.o. tube, and the 6C5 seemed logical for the audio tube, although no doubt a 6F6 or even a 6L6 could be used if real audio watts were desired. However, for usual head- phone reception the audio volume control is set at about ¾ off, so the audio output was considered to be ample.
A glance at the circuit in Fig. 1 will show that most of the details are straightforward and conform with usual practice. The No. 3 grid of the mixer tube is coupled directly to the grid of the high-frequency oscillator, and the tight coupling doesn’t seem to impair the stability at all. The mixer and oscillator tuning circuits are hand-spread by the usual tapped-coil method, with the additional feature of a high-C oscillator circuit for stability and a low-C signal circuit for gain. Very little difficulty was experienced in winding the coils, although the completeness of tracking will depend entirely on the patience of the builder. However, since the mixer padding circuit is adjustable from the panel, it is not necessary to make the two circuits track exactly. If the coil dimensions given are followed closely, the tracking will be quite good.

It will be noted that the regeneration control for the mixer is a variable resistor placed between two fixed resistors. This gives a variation in screen voltage in the mixer of from 50 to 200 volts instead of the usual 0 to 200 volts, and gives a slight “vernier” effect to the regeneration control.

The second detector employs a tuned cathode circuit for regeneration, saving the trouble of winding a special i.f. transformer. The detector is coupled to the audio tube by means of a 0.1-µfd. condenser and a 500-henry choke. Suitable r.f. filtering is used before the high-inductance choke, and there is no “motorboating” or “howling.”

One thing may appear a little unusual. There is no connection between the b.f.o. and the second detector. This results in slightly-below-optimum coupling between oscillator and detector for strong signals, with consequent “limiter” action. However, the coupling is just about right for weak signals, with the result that the signal-to-noise ratio appears to be exceptionally good, and always brings forth the comment that the receiver seems to be nice and quiet. Such is of course the case, and on strong signals it is only necessary to back off the front-end gain by reducing the regeneration or detuning the mixer, and increasing the audio gain to give excellent signals for copy. If it

FIG. 1—CIRCUIT DIAGRAM OF THE RECEIVER

C1—15-µfd. tuning condenser (Hammarlund HF15).
C2—35-µfd. bandstop condenser (Hammarlund HF35).
C3—35-µfd. tuning condenser (Hammarlund MC-35-S).
C4—10-µfd. bandstop condenser (Hammarlund HF100).
C5—2-plate midget variable for beat-note adjustment (Sickles ATR-21).
C6—100-µfd. mica.
C7—C10, C11, C12—250-µfd. mica.
C13—0.005-µfd. mica.
C14—C19—0.01-µfd., 400-volt paper.
C20—0.005-µfd. mica.
C21—0.01-µfd., 400-volt paper.
C22—0.005-µfd., 400-volt paper.
C23—0.01-µfd., 400-volt paper.
C24—0.005-µfd. mica.
C25—C26, C27—0.01-µfd., 400-volt paper.
C28—0.005-µfd. mica.
C29—C10, C11—0.01-µfd., 400-volt paper.
C30—0.005-µfd., 400-volt paper.
R1—500 ohms, 0.5-watt.
R2—10,000 ohms, 1-watt.
R3—15,000-ohm wire-wound potentiometer.
R4—100,000 ohms, 1/2-watt.
R5—40,000 ohms, 1-watt.
R6—10,000 ohms, 1-watt.
R7—500 ohms, 2-watt.
R8—10,000 ohms, 2-watt.
R9—15,000 ohms, 2-watt.
RFC—2.5-mh. choke.
L1, L2, L3—See coil table.
N—2.5-mh. choke.
T1—1600-kc. airtuned i.f. transformer (Sickles 8084). The grid lead, which is tapped down on the coil in the transformer as it comes from the manufacturer, must be moved to the stator plates of the grid tuning condenser before the transformer is used.
T2, (L4, C24, R4, C6)—1600-kc. b.f.o. unit (Sickles 6631).
Ch—500-henry audio impedance (Thordarson T-3736).
is found that too much oscillator voltage reaches the second detector, the voltage to the plate of the b.f.o. can be reduced, and if too little oscillator voltage is being fed to the detector the coupling can be increased by draping a piece of insulated wire somewhere between the two circuits. The b.f.o. is made to turn off, for 'phone reception, by bending over one corner of the rotor plate of $C_b$, which shorts with the stator plate in the extreme position.

**CHASSIS CONSTRUCTION**

To facilitate home construction, the shielding was reduced to a minimum. It was decided that the first detector was the portion of the set that required shielding, if any was to be used, and so it was housed in a separate box, $4\frac{3}{4}'' \times 6\frac{3}{4}'' \times 4\frac{3}{8}''$ high, with a removable lid for changing coils. The chassis itself was made by bending a $9\frac{1}{2}'' \times 10\frac{3}{4}'' \times \frac{3}{32}''$ aluminum piece into a shallow "U" with $2\frac{3}{4}''$ sides and fastening on a rear strip and the $\frac{3}{4}'' \times 6\frac{3}{4}'' \times 13''$ panel with $\frac{1}{4}''$ square brass rod. The photographs show the construction better than any words. Care was taken to make the chassis rigid, to insure stability. After all the holes have been drilled, the chassis and panel may be given a dull finish by soaking them in a lye solution for about fifteen minutes.

We ran into a condition in this receiver that might easily have been avoided. The completed receiver showed a tendency, especially on the higher-frequency bands, to "jump" from signal to signal instead of tuning smoothly. The grounded rotor-shaft of the oscillator tuning condenser was connected directly to the drum dial, and for some time we refused to believe that the dial was responsible for the "jumping." However, after everything else had been tried, we finally isolated the rotor from the dial by means of an insulated coupling, and our troubles disappeared. The erratic behavior had of course been caused by the several variable ground paths shunting the heavy supporting pillars of the tuning condensers. As the dial was rotated, these shunt paths varied and affected the frequency just enough to make things awkward. This has been pointed out several other times, but it had always sounded like so much "hokum." We know better now, and therefore recommend that any high-frequency oscillator tuning condenser be grounded at only one or two points and not shunted by the dial to ground.

**LINING UP**

Actually lining up the receiver takes only a short while. If a modulated oscillator is available, set it at around 1600 kc. (the exact frequency is unimportant) and connect its output to the grid of the 6L7 mixer. Then tune the i.f. transformer until the signal is the loudest. The b.f.o. condenser (on the side of the chassis) is set at half scale and the trimming condenser in the shield can is adjusted until a beat is obtained between the b.f.o. and the 1600-kc. signal from the signal generator. If no signal generator is available, set the second-detector regeneration control to the point where the detector oscillates and then adjust the b.f.o. until a beat is heard. The primary tuning of the i.f. transformer is next adjusted to the point where the regeneration control must be advanced the farthest to maintain oscillation. The primary will then be in tune with the secondary. If later it is found that the i.f. frequency selected falls on some broadcast harmonic or other unwanted signal, a slight readjustment will be necessary.

Adjustment and trimming of the coils is relatively simple. With a mixer and oscillator coil wound according to the table and placed in the receiver, set the tuning dial at the low-frequency end of its scale and tune around with the oscillator band-set condenser $C_4$ until a familiar marker or amateur signal at the low-frequency end of the particular band is heard. This adjustment should be with $C_4$ set at about $\frac{3}{4}$ full capacity. Tune to the other end of the band to check for the bandspread of the oscillator. If the band doesn't occupy enough space on the dial, move the tap that goes to the tuning condenser $C_5$ down on the coil. If there is too much bandspread, move the tap up on the coil.

To make the mixer circuit track with the os-
oscillator, first tune in a signal at the high-frequency end of the band and peak the signal with the mixer band-set condenser $C_2$. Then tune in a signal at the low-frequency end of the band and see whether $C_2$ has to be increased or decreased to peak the signal. If the capacity has to be increased at the low-frequency end of the band the tuning tap should be moved up on the coil. If the capacity has to be decreased to peak the signal, the tap should be moved down. The adjustments should not be more than a quarter-turn at a time on the 14- and 28-Mc. ranges, but can be half-turns at the other frequencies. The tracking can be made as complete as one cares to go—it is simply a matter of patience. The total number of turns is right if $C_2$ resonates at about half-scale.

Adjustment of the cathode tap on the mixer coil comes next. It is desirable to have the cathode tap and the antenna coil so proportioned that the mixer goes into oscillation with the regeneration control set at about $\frac{3}{4}$ scale. If the mixer goes into oscillation too soon, i.e., with the regeneration control set at something much less than $\frac{3}{4}$ scale, the cathode tap should be made lower on the coil. The point at which oscillation takes place can also be varied by loosening the antenna coupling, either by reducing the number of turns in $L_1$ or by moving it farther away from $L_1$. All antenna-coil adjustments should be made with the antenna connected to the receiver.

When the “front end” of the receiver is working smoothly it may be worthwhile to experiment a little with the second-detector cathode condenser $C_{14}$. If oscillation of the second detector takes place at something less than $\frac{3}{4}$ setting of the regeneration control, $C_{14}$ should be made slightly smaller. It will be found that the two regeneration controls interlock slightly when both detectors are being run too close to the oscillating point, but this can be avoided by running the mixer in a slightly less regenerative condition.

NOTES ON OPERATION

In operation, the second detector is run in a regenerative condition but not oscillating. The h.f.o. is not tuned exactly to the same frequency as the regenerative second detector, but about 1000 cycles to either side. When this is done, a “single-signal” effect is noticed, i.e., the signal on one side of zero beat will be louder than on the other side. This condition is only achieved when the second detector is almost oscillating, and proves very useful in separating two signals quite close together. Although the single-signal effect obtained in this receiver does not approach that which results from the use of a crystal filter or regenerative 450-kc. amplifier, it does result in an S7 signal on one side of zero beat being reduced to an S4 signal on the other side. A little experimenting with the adjustment will make the operator familiar with the process of adjusting for maximum single-signal effect. Incidentally, it will be noticed that more

(Continued on page 106)

COIL TABLE

<table>
<thead>
<tr>
<th>Band</th>
<th>Total Turns and Wire Size</th>
<th>Length of Winding</th>
<th>Cathode R.S.</th>
<th>$L_a$</th>
<th>Total Turns and Wire Size</th>
<th>Length of Winding</th>
<th>Cathode R.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 Mc.</td>
<td>20 No. 24 d.c.</td>
<td>1½&quot;</td>
<td>½</td>
<td>26</td>
<td>4 No. 24 d.c. closewound</td>
<td>1½&quot;</td>
<td>½</td>
</tr>
<tr>
<td>7</td>
<td>26½ No. 20 enam.</td>
<td>1½&quot;</td>
<td>½</td>
<td>8</td>
<td>4 No. 32 d.c.</td>
<td>1½&quot;</td>
<td>½</td>
</tr>
<tr>
<td>14</td>
<td>12½ No. 18</td>
<td>1½&quot;</td>
<td>½</td>
<td>3½</td>
<td>2 No. 24 d.c.</td>
<td>1½&quot;</td>
<td>½</td>
</tr>
<tr>
<td>28</td>
<td>5½ No. 18</td>
<td>1½&quot;</td>
<td>½</td>
<td>2</td>
<td>3 No. 32 d.c.</td>
<td>1½&quot;</td>
<td>½</td>
</tr>
</tbody>
</table>

All coils wound on 1½" diam. Hammarlund forms. $L_a$ and $L_1$ wound next to each other except on 7 Mc, where spacing between $L_a$ and $L_1$ is ½". All coils except 3.5-Mc. $L_a$ are spacewound to occupy winding length given.

* Tap turns counted from grounded end of coil.
### Examination Schedule

The F.C.C. announces its schedule of amateur examinations for 1938. Consult the following list when you need to know when and where examinations will be held. Where exact dates or places are not shown, information may be obtained, as the date approaches, from the Inspector-in-Charge of the district. It should be noted that no examinations are given on national holidays or state holidays. All examinations begin promptly at 9:00 A.M., local time except for New Orleans and Honolulu, where they begin at 8:30 A.M.

<table>
<thead>
<tr>
<th>DISTRICT NO. 1</th>
<th>Boston, Mass., Customhouse, 7th floor, every week day except Thursday.</th>
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<td>DISTRICT NO. 2</td>
<td>New York City, 1024 Federal Bldg., 641 Washington St., Mondays, Thursdays and Saturdays.</td>
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<tr>
<td>DISTRICT NO. 3</td>
<td>Philadelphia, Pa., Room 1200, Customhouse, 2nd and Chestnut Sts., every Wednesday.</td>
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<tr>
<td>DISTRICT NO. 5</td>
<td>Norfolk, Va., Room 402, New P. O. Bldg., every Friday.</td>
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<tr>
<td>DISTRICT NO. 6</td>
<td>Atlanta, Ga., 411 Federal Annex, Tuesdays and Fridays.</td>
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<tr>
<td>DISTRICT NO. 7</td>
<td>Miami, Fla., Room 312, Federal Bldg., each Monday and Friday, by appointment.</td>
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<tr>
<td>DISTRICT NO. 8</td>
<td>New Orleans, La., 320 Customhouse, every Monday.</td>
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<tr>
<td>DISTRICT NO. 9</td>
<td>Galveston, Tex., Room 404, Federal Bldg., Wednesdays and Saturdays.</td>
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<tr>
<td>DISTRICT NO. 10</td>
<td>Dallas, Tex., 302 U. S. Terminal Annex Bldg., every Tuesday.</td>
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<tr>
<td>DISTRICT NO. 11</td>
<td>Los Angeles, Calif., 1105 Rives-Strong Bldg., Mondays and Saturdays.</td>
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**NOTE:** For the convenience of the inspector, examinations are given at his discretion.

**DISTRICT NO. 1:**
- **San Francisco, Calif., 328 Customhouse, Class B, Mondays only; Class A, daily.**

**DISTRICT NO. 12:**
- **Portland, Oregon, 207 New U. S. Courthouse, every Friday.**

**DISTRICT NO. 13:**
- **Seattle, Wash., 808 Federal Office Bldg., every Friday.**
- **Butte, Mont., sometime in May and November.**
- **Spokane, Wash., sometime in May and November.**
- **Juneau, Alaska, P. O. Box 2715, Class A only, for time being, examinations given at convenience of the inspector by arrangement with the office.**

**DISTRICT NO. 15:**
- **Denver, Colo., 504 Customhouse, first and third Saturday of each month.**
- **Salt Lake City, Utah, sometime in March and September.**
- **Bismarck, N. D.; dates can be secured from the Inspector-in-Charge at St. Paul.**

**DISTRICT NO. 17:**
- **Kansas City, Mo., 609 Pickwick Bldg., 903 McGee St., first and third Friday and Saturday of each month, and by appointment.**
- **Des Moines, Ia., April 8th and 9th, July 8th and 9th and October 14th and 15th.**
- **St. Louis, Mo., May 15th and 16th, August 12th and 13th and November 11th and 12th.**
- **Columbus, Ohio, sometime in March, June, September and December.**
- **Cleveland, Ohio, sometime in April, July and October.**

**DISTRICT NO. 20:**
- **Buffalo, N. Y., 514 Federal Bldg., first Friday of each month and by appointment. If the first Friday falls on a holiday, the examinations will be given on the following Friday.**
- **Pittsburgh, Pa., sometime in March, June, September and December.**

**DISTRICT NO. 21:**
- **Honolulu, T. H., Aloha Tower, Mondays and Saturdays.**
- **Hilo, T. H., July 22nd.**
- **Wailuku, Maui, T. H., July 20th.**
- **Kaukakai, Molokai, T. H., July 18th.**
- **Lihue, T. H., August 12th.**

**DISTRICT NO. 22:**
- **San Juan, P. R., 305 Ochoa Bldg., Class A only, for time being, examinations given at convenience of the inspector by arrangement with the office.**

**HEADQUARTERS**
- **Washington, D. C., F.C.C. offices, every Thursday; other days by appointment.**

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**What the League Is Doing**

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

- **Philadelphia, Pa., Room 1200, Customhouse, 2nd and Chestnut Sts., every Wednesday.**
- **Boston, Mass., Customhouse, 7th floor, every week day except Thursday.**
- **New York City, 1024 Federal Bldg., 641 Washington St., Mondays, Thursdays and Saturdays.**
- **Schenectady, N. Y., sometime in March, June, September and December.**
- **Philadelphia, Pa., Room 1200, Customhouse, 2nd and Chestnut Sts., every Wednesday.**
- **New Orleans, La., 320 Customhouse, every Monday.**
- **San Francisco, Calif., 328 Customhouse, Class B, Mondays only; Class A, daily.**
- **Seattle, Wash., 808 Federal Office Bldg., every Friday.**
- **Bismarck, N. D.; dates can be secured from the Inspector-in-Charge at St. Paul.**
- **Denver, Colo., 504 Customhouse, first and third Saturday of each month.**
- **Salt Lake City, Utah, sometime in March and September.**
- **Bismarck, N. D.; dates can be secured from the Inspector-in-Charge at St. Paul.**
- **Phoenix, Ariz., two days in April and two days in October.**
- **San Diego, Calif., 503 New California Bldg., Class A only, for time being; examinations given at convenience of the inspector by arrangement with the office.**
- **Portland, Oregon, 207 New U. S. Courthouse, every Friday.**
- **Butte, Mont., sometime in May and November.**
- **Spokane, Wash., sometime in May and November.**
- **Juneau, Alaska, P. O. Box 2715, Class A only, for time being, examinations given at convenience of the inspector by arrangement with the office.**
- **Denver, Colo., 504 Customhouse, first and third Saturday of each month, and by appointment.**
- **Des Moines, Ia., April 8th and 9th, July 8th and 9th and October 14th and 15th.**
- **St. Louis, Mo., May 15th and 16th, August 12th and 13th and November 11th and 12th.**
- **Chicago, Ill., 246 U. S. Courthouse Bldg., every Saturday.**
- **Detroit, Mich., 1025 Federal Bldg., every Saturday.**
- **Cincinnati, Ohio, sometime in May, August and November.**
- **Columbus, Ohio, sometime in March, June, September and December.**
- **Cleveland, Ohio, sometime in April, July and October.**
- **Buffalo, N. Y., 514 Federal Bldg., first Friday of each month and by appointment. If the first Friday falls on a holiday, the examinations will be given on the following Friday.**
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**What the League Is Doing**

**League Activities, Washington Notes, Board Actions—For Your Information**
The Infinite Rejection Principle Applied to Image Attenuation

A New Method of Eliminating Images in Superhet Receivers

By Karl W. Miles and J. L. A. McLaughlin

An inherent peculiarity of the superheterodyne is its ability to respond simultaneously to signals of two different frequencies which are separated by twice the frequency of the i.f. amplifier. Where the oscillator, mixer and r.f. amplifier tuning condensers are ganged together, as is now accepted modern practice, and the oscillator is tuned i.f. frequency higher than the frequency of the desired signal, the undesired signal of the other response frequency, commonly referred to as the image, will be more or less attenuated because of the selective action of the tuned circuits between the antenna and mixer. The amount of this attenuation, in terms of voltage, is called the image ratio, and will depend on the shape of the selectivity curve of the input circuits. The i.f. amplifier selectivity will in no way affect this ratio.

Now at a frequency of, say, 1000 kc., the image ratio of a superheterodyne with an r.f. stage ahead of the mixer will be of the order of 10,000 or better. That is, the image signal will have to be 10,000 or more times as strong as the desired signal to give the same output. At 2000 kc. the ratio will be down to something like 1000 and at 7 Mc. to about 200. At 14 Mc. a ratio of about 50 is usual and at 30 Mc. a ratio of two or three is considered pretty fair.

Now why does the image ratio become so poor at the higher frequencies? Simply because as the frequency goes up the percentage difference between the signal and image frequencies grows less; in other words, the image frequency is climbing nearer the nose of the resonance curve and approaching par with respect to the signal frequency. If we persist in our attempt to eradicate the image by means of purely selective devices at frequencies in the neighborhood of 30 Mc. and higher, we will find that progress is comparatively slow. We can go on adding preselection to the

AN INEXPENSIVE AND EASILY-BUILT PRESELECTOR WITH IMAGE REJECTION

The range covered is 9 to 16 Mc. The nearer variable condenser is the image rejection control that on the far side the regular tuning condenser. The power-factor correction resistor is mounted on the panel.

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1 The image ratio figures are based on an i.f. of the order of 465 kc. and the use of ordinary tubes and circuits at signal frequency. At the higher frequencies, some improvement in performance can be secured by using acorn tubes because of their lesser loading effect on the tuned circuits.—Ebona.
The i.f. selectivity of the receiver is not included in this curve nor in the curves of Figs. 3 and 4.

Experimental work has been done on single-stage application and on two standard receivers. In one instance, in which the rejector system was inserted in the mixer circuit of a receiver having no r.f. stage, image ratios of over 2000 were achieved at frequencies as high as 16 Mc. Stray couplings by-passing the rejector circuit prevented greater rejection. This gives some idea of the effectiveness of the rejector circuit, however, because an image ratio of 2000 at 16 Mc. is higher than can be obtained in a good receiver with two or three stages of preselection ahead of the mixer.

Figs. 2, 3 and 4 are curves showing the front-end performance of a receiver having one r.f. stage ahead of the mixer, the rejection being applied to the r.f. grid circuit. The i.f. selectivity of the receiver is not included in these curves. In each case the rejector is adjusted to signal frequency plus twice the i.f., the signal circuit being tuned to resonate at 7 Mc. in Fig. 2, 14 Mc. in Fig. 3 and 30 Mc. in Fig. 4. The power-factor correction resistor, R, is in all cases adjusted for maximum attenuation of the image. The plots extend to power-factor correction, no coupling exists at the image frequency. In practice, because of stray coupling or through direct pickup in some part of the circuit beyond the rejector stage, some image signal may leak through, but with careful design the signal-to-image ratio can be made better than 100,000 at frequencies as high as 36 Mc. This is the highest frequency so far attempted.

The i.f. selectivity of the receiver is not included in this curve nor in the curves of Figs. 3 and 4.

Some other means of improving image ratios at the higher frequencies obviously is needed. One method which shows promise is a variation of the i.f. infinite rejection system recently described in QST by the present authors. Similar coupling devices can be made infinitely selective in rejecting the image frequencies.

Fig. 1 shows the fundamental circuit. As in the i.f. system, we have a primary \( L_1 \) which couples to \( L_3 \) through the mutual \( M \) and capacity \( C_3 \). \( L_2 \) and \( L_3 \) together form the signal-frequency tuning coil; \( L_1 \) and \( L_4 \) the image-rejection circuit inductance.

The coupling between the antenna (or interstage) input and the grid circuit is the product of \( M \) and \( C_3 \). For the signal frequency the circuit behaves very much the same as a straight inductively-coupled stage with small capacity coupling at the high-potential side. But for the image frequency, the voltage through \( C_3 \) equals the voltage induced in the mutual \( M \) and, being of opposite sign, cancels out. To make the null infinite, the power-factor corrector \( R \) is necessary. With proper

\[ \text{Miles and McLaughlin, "A New I.F. Amplifier System with Infinite Off-Frequency Rejection," QST, November, 1937.} \]

March, 1938
The variable resistor is the gain control. The output transformer, \( L_{d} L_{e} \), is mounted close to the tube socket. Only a ratio of 10,000, or 80 db; the actual signal-to-image ratio is over 100,000 in all cases.

**AN IMAGE-REJECTING PRESELECTOR**

Because of the worth-while improvement in the complete wiping out of image frequencies that this radically different coupling circuit offers, some practical information should be included in this article. So that interested amateurs and experimenters may be able to adapt such a device to their present equipment, we have built up a simple r.f. stage which may be connected to any receiver. The parts are few and the construction is simple. The frequency range is from 9 to about 16 Mc. and the unit is intended for use on the 14-Mc. band. This is the range in which the average image starts to become bothersome. The circuit diagram and constants are given in Fig. 5.

To get the rejector circuit working properly pick out some band where you know there are images, for example, the region around 13 Mc. Tune over this band until you pick up the image of some 14-Mc. amateur 'phone, and peak up the circuits by means of \( C_{2} \) and \( C_{4} \). Then slowly turn the rejector condenser, \( C_{a} \), until a spot is found where the 'phone drops out or is greatly attenuated. Finally, adjust resistor \( R_{2} \) for maximum attenuation. When you are sure the system is working properly on this frequency, the receiver and preselector can be tuned to the 14-Mc. band and the rejector adjusted to wipe out bad images in this range.

If no rejection point can be found, it may be because \( L_{1} \) is reversed, \( C_{3} \) may be too large, \( R_{2} \) may be too large or too small, or there may be no images at the frequency to which the preselector and receiver are tuned. If a rejection point is found and the image is still audible, see if the image can be picked up with the antenna disconnected. If so, the image signal is getting in at some point past the rejector circuit and shielding should be tried to reduce this pickup.

We should like to give coil information for use on the 30-Mc. band because this is where the rejector is certainly most needed. However, it is difficult to give constants which would have much practical value at these frequencies. The coils have so few turns that the wires leading to them are apt to have as much inductance as the coils themselves, and since \( C_{a} \) may become less than 1 \( \mu \mu \)fd., duplication therefore would become quite difficult. Another reason for not doing so is that at this frequency the rejector preferably should be built into the receiver itself, so that maximum efficiency may be achieved and proper shielding employed to prevent the image signal from being picked up on the output side of the rejector circuit.

The incorrigible experimenter, we know, will wind coils for other ranges—perhaps with happy results. To him we offer this advice. Couple the plate of the r.f. stage to the input of the receiver with the shortest possible lead, and on the 30-Mc. range tune the plate circuit of this tube and couple to the receiver through a low-impedance line. It is important to build up the greatest gain possible at these frequencies. The image frequency is so close (in percentage) to that of the signal that with complete rejection of the image there may be appreciable loss of signal strength. At 30 Mc. the gain may drop to about one-tenth of what it was without rejection, so if the r.f. stage gain is kept high—and a gain of ten can be had at
these frequencies—the desired signal (with the rejector set to the image frequency) will be at about the same level at the receiver as it was before the selector-rejector stage was added. A great deal of this loss can be overcome by careful circuit construction in attaining maximum Q in the tuned circuit, together with the optimum degree of antenna coupling. For example, in a production model of the receiver in which this system is used, there is only a 20 per cent loss in gain with the rejector circuit set for maximum attenuation; with an image ratio of 2000 there is no perceptible loss of desired signal.

At 14 to 30 Mc. the rejector condenser capacity \( C_9 \) ranges from a fraction of a \( \mu \)fd. to but a few \( \mu \)fd. and resistor \( R_i \) is from 250 to 1500 ohms. The higher the frequency the lower the resistance needed. Some interaction between the rejector control and the selector control may be experienced; in a single stage this is of little consequence, but when built into a receiver with all the tuning controls ganged together may be quite serious. To overcome this defect \( L_4 \) (Fig. 1) is employed. The use of this coil increases the voltage in the rejector circuit and reduces the effect of \( C_9 \) on the signal-tuning circuit. When \( L_4 \) is used \( C_9 \) becomes considerably smaller.

Although the value of resistance used for power factor correction must be carefully adjusted for maximum rejection, in practice it has been found that a fixed resistor of optimum value for the band over which the circuit is to work will permit dispensing with one control without undue sacrifice of image attenuation. Provided the proper value of fixed resistance is used, highly effective image suppression can be obtained—not the full capabilities of the system, but still capable of relegating practically all image signals to the back­ground. The fixed resistor could be incorporated in the plug-in coils (or switched with the coils in a band-switching receiver) after the optimum value has first been obtained experimentally by the use of a variable resistor.

To give practical information on coil design and the incorporation of this circuit into existing manufactured receivers is out of the question. No two manufacturers' receivers would require the same treatment and coil design. Also, without the proper laboratory equipment and knowledge the performance of an otherwise perfectly good receiver might be greatly impaired. Third, most manufacturers void their guarantee if any tinker­ing is done with "innards" of their receivers. There is no reason, however, why the circuit could not be tried out on home-built jobs.

The majority of curves and coil information contained in this article are taken from the work done on the application of the infinite image re­jector to a standard "Challenger" type receiver. A rejector was inserted in the r.f. stage and was made to operate over the range from 7 to 30 Mc. The gain of the receiver with and without the rejector in operation is the same for all frequencies up to 20 Mc. Beyond 20 a slight loss of signal is observed when the rejector is adjusted to the image frequency.

The design of an r.f. amplifier is generally a compromise between gain and image rejection. In the conventional cascaded selective coupling circuits gain and image ratio are inversely related because of the broadening of the resonance curves of the individual circuits when the coupling is adjusted for maximum gain. Since in this system the two functions are distinct and separate, the gain of the r.f. stage can be made considerably

(Continued on page 98)
New Approach to Amateur Transmitter Design

By James Millen,* WIHRX

The r.f. exciter in a transmitter can have high "survival value" if it is properly designed. Final stages, buffers, and modulators may come and go (and they usually do, in most amateur stations), but the exciter, like the receiver, should be designed carefully and built as a long-time investment. Such an exciter should be capable of operating at any predetermined frequency in the amateur bands, and the operation of selecting a frequency should be rapid and convenient. If these specifications are completely filled, such a unit can become part of the permanent equipment of the shack to the same extent that a good receiver does.

In the 'phone transmitter, the same considerations apply to the audio preamplifier. If it has an output of about 15 watts, it will serve very nicely either as a complete voice end for grid or suppressor modulation, or as a driver for a Class-B stage. A pair of 838's (these tubes are particularly convenient because they need no fixed bias) require only 7.5 watts of driving power for 260 watts output; where more power is needed a biased tube such as the 806 will supply 660 watts (per pair) with 10 watts of driving power. So 15 watts of driving power is ample.1 The other important requirement of the preamplifier is voltage gain. The amplifier will be satisfactory if it delivers full output with an input of not more than 0.005 volts at the grid of the first tube.

For some time it has been our feeling that it would be a perfectly swell thing if we could have some kind of gadget containing a solution to all of the headaches normally encountered in the construction of a transmitter. The bulk of the so-called headaches are pretty well confined to the speech amplifier and the exciter, consequently if these two could be combined once and for all in one compact cabinet, along with all the necessary power supplies, switches, and accessories, the construction or reconstruction of the rest of the transmitter would be just plain fun.

With this in mind, we took a chassis, cabinet and other parts normally used to make an NC-100 receiver, and tried to build such a device. While from a circuit point of view the results were reasonably satisfactory, the unit was somewhat of a monstrosity mechanically. Certainly it seemed foolish to shift a large catacomb back and forth for band changing when most of the compartments were empty and the contacts therein were used simply for switching purposes.

About this time we became very much intrigued by a type of switch used in the telephones now furnished with the Western Electric automatic exchanges. One of our engineering associates, WIHSV, designed a very compact switch using the same principles which would do everything that the shifting catacomb did, and do it much more quickly and conveniently. Around this switch developed the circuit and mechanical arrangement which is the subject of the present discussion, and which is illustrated in the accompanying diagram and photographs. This particular model is intended for the man who wants especially to operate in the four 'phone sub-bands in the 3.5-, 7-, 28- and 56-Mc. amateur bands. Any one of the four can be selected by pushing in the appropriate button. With one possible exception noted below, all tank circuits are pretuned, so that no additional operations are required to get "on frequency."

The Exciter Circuit

Basically, the exciter circuit is conventional enough. It employs a crystal-controlled 6L6G

*A Malden, Mass.

1 An excess of driver power always is desirable, especially when the driver works into tubes requiring fixed bias, because better voltage regulation is obtained than when the driver is loaded to its maximum capabilities. The driving power figures given in the tube manuals are approximate, while output figures are tube output and do not include losses in coupling devices.—Eorron.
oscillator operating at 3.5 Mc., followed by three frequency-multiplier stages, also employing 6L6G's. Its unusual features are in the details. For instance, single, multiple, or variable-frequency type crystal holders can be used, since adequate space has been provided around the 5-prong crystal socket, and provision has been made for controlling the crystal switch or movable top plate from the front panel by means of a flexible shaft. The use of either of these versatile crystal systems makes it possible to select a convenient operating frequency within the band simply by turning a knob, a convenience whose importance we do not have to enlarge upon here. In most cases the oscillator and doubler tanks are broad enough to require no retuning, but in the special case where crystals of widely different frequencies are chosen for the multiple holder a slight adjustment of the oscillator tank is desirable. For this purpose a tuning control and a meter are provided on the panel. This control also permits securing the best adjustment for any particular crystal and for best keying conditions when using the outfit on c.w. A jack is provided on the front panel for plugging in the key; it is connected in the cathode circuit of the oscillator.

As will be seen from the wiring diagram, Fig. 1, and the bottom view of the chassis, each section of the switch to drive all of the common pentodes and beam tubes used in amateur work, as well as the low- and medium-power triodes. Large triodes will require additional power, but since the driving tube would require high voltage, it seemed more logical to locate it near the final, rather than to attempt to incorporate it in the exciter.

THE METER CIRCUIT
As an aid in tuning the oscillator and doubler tanks, a meter and selector switch are provided on the front panel. A voltmeter with a range of 200-300 volts is used for this purpose, rather than the customary plate milliammeter. Reference to the wiring diagram will show that this meter is switched across the grid bias resistor of the following stage and consequently measures grid voltage. This is a convenient measure of the excitation, since the d.c. voltage being measured is produced by grid rectification of the exciting signal. In fact, the combination of grid, cathode, grid resistor and meter can be regarded as a conventional rectifier-type a.c. voltmeter. In use, the tuning is adjusted for maximum swing of the meter, not minimum swing as in the case of the milliammeter in the plate circuit.

THE AUDIO CIRCUIT
To get sufficiently high gain to handle the now popular crystal microphone and still secure an output of the order of 10 watts or so to drive the average Class-B modulators, it was necessary to use four stages. These consist of a 6C6 pentode resistance coupled to a 76, which in turn is resistance-coupled to the 76 driver for the push-pull 2A3's. It is necessary, of course, to filter each plate circuit separately, and this filtering must be effective in eliminating r.f. as well as in preventing audio feedback.

March, 1938
FIG. 1—CIRCUIT DIAGRAM OF THE COMBINATION EXCITER

L1—32 turns No. 28, on 1" form, 60 turns per inch (3.5 Mc.).
L2—8 turns No. 24, on 1" form, 24 turns per inch (14 Mc.).
L3—3½ turns No. 24, on 1" form, 24 turns per inch (28 Mc.).
L4—4 turns No. 24, on ¾" form, 24 turns per inch (56 Mc.).

Links 2 turns in each case.

L5—30 henry, 20-ma. choke.
L6—10 henry, 50-ma. choke.
L7—10 henry, 160-ma. choke.
R1—20,000 ohms, 1-watt.
R2—20,000 ohms, 10-watt.
R3, R4—20,000 ohms, 1-watt.
R5—100,000 ohms, 1-watt.
R6—200,000 ohms, 1-watt.
R7—7500 ohms, 10-watt.
R8—5 megohms, ½-watt.
R9—1000 megohms, ½-watt.
R10—250,000 ohms, ½-watt.
R11—1 megohm, ½-watt.
R12, R13, R14—20,000 ohms, ½-watt.
R15—2500 ohms, ½-watt.
R16—100,000 ohms, ½-watt.
R17, R18—100,000 ohms, ½-watt.
R19—750 ohms, 1½-watt.
R20—60-ohm c.t. resistor.
R21—500,000-ohm volume control.

C1, C2, C3—Double 25-mfd. variables (National FXT exciter tank assembly).
C5, C6, C7—100 mfd. mica.

RFC—2.5-mh. chokes (National R-100).
Switch—Cam-operated, s.p.d.t. and s.p.s.t. (National ACS-4)
Compact Construction with High Power

A Complete 500-Watt C.W.-'Phone Transmitter of Small Dimensions

By T. M. Ferrill, Jr.,* W5CJB-1

The transmitter herein described was built with two objects in view: First, to provide a completely self-contained transmitter of large output, so small that it could be crated and shipped conveniently, carried in a car or small truck in case of emergency, or installed in small living quarters; second, as an experiment to determine how practical in operation a transmitter built in this manner would be.

The advantages of compactness in transmitter design are obvious. Portability and convenience of operation are two of the major features; in fact, this transmitter is usually placed on the operating desk beside the receiver, where controls directly on the transmitter panels are within easy reach of the seated operator. Relays for switching power supplies, and separate speech amplifiers for convenient control of audio amplification, are thus eliminated. The disadvantages of extreme compactness remained to be found by actual use of the finished unit. Some guess as to the troubles to be expected was made, but their extent and the best methods of overcoming them provided more than sufficient incentive for the undertaking.

For the benefit of those who might be attracted by some of the features of this transmitter to duplicate it, it must be pointed out that the compact design necessitated the sacrifice of other desirable features ordinarily considered important. Furthermore, the composite nature of the transmitter required many hours of painstaking work to adapt commercially-available apparatus to fit into the very limited space. The plate tank tuning condenser of the final r.f. amplifier required eight alterations, each of which involved cutting metal. To install the insulators supporting the final amplifier tank coil, new pieces had to be substituted in the bases, decreasing the space required for the feed-through insulators below the chassis, and allowing mounting of the associated tuning condenser directly beneath the plate coil. Similar fitting was employed in the construction of the power supplies; indeed, the greater part of the work was made necessary by the attempt at extreme compactness. It was necessary to use the smallest number of amplifying stages consistent with good design practice in both the radio-frequency and audio-frequency equipment.

*Massachusetts Institute of Technology, Cambridge, Mass.

March, 1938
the high-voltage power transformers, which is connected to one pair of 866 tubes in the bottom unit. On the panel of the modulator unit are the gain controls and input jacks, the switch controlling the a.c. supply to the audio equipment, and the modulator plate milliammeter. The third unit consists of one power supply for oscillator plate and grid-bias on buffer and final amplifier, one supply for buffer and final amplifier plates, and one supply for the modulator tubes. This unit was built directly on the base of the cabinet. A separate panel was mounted on the front of the cabinet to hold power switches, overload relays, and pilot lights.

To provide adequate driving power for the final amplifier operating as a plate-modulated Class-C stage, it was necessary to use a crystal oscillator with high harmonic output and to realize high power gain in the buffer stage. At the time the transmitter was being designed, an RK23 tube was chosen for the oscillator, to be used as a Tri-tet at all times. One of the beam-power tubes of corresponding size would probably have been the choice for the oscillator, had these tubes been developed. Both RK20 (with proper circuit alterations) and T55 tubes have been used in the buffer stage, and either is perfectly satisfactory. An HF100 tube would also be a very suitable tube for this application, and one of the new beam tubes of the fifty-watt size would be admirable here. It was necessary to use conservatively rated tubes in this transmitter, and to operate them well within their ratings, since the cooling is none too effective at best. An HF300 tube was chosen for the final, after some experimentation with smaller tubes which ordinarily should handle the power which the HF300 takes. The smaller tubes were operated within their ratings but failed to withstand the strain.

**Circuit Details**

For the particular tube arrangement shown in Fig. 1 the most desirable method of coupling between stages would ordinarily be adjustable link coupling, with oscillator and buffer on one chassis and final amplifier on another. Here, space consideration dictated the use of either capacity coupling or inductive coupling with coils built in pairs. Both methods of coupling—capacity and inductive—have been used in this transmitter with almost equal results; the latter, however, gave slightly more efficient power transfer and helped to maintain balance of the tuned circuits, as would be expected.

The keying arrangement shown is used because of its simplicity and lack of desirable keying characteristics. The keyed circuit operates at a high negative potential with respect to the metal cabinet, a relay is provided to isolate the key. This method of keying is very suitable for break-in
It will be noted from the circuits that fixed bias is applied to the buffer and final grids when the key is open, preventing no-signal plate current, although most of the bias is obtained from grid-leak action when the excitation is applied.

The lack of plate-current milliammeters in oscillator and buffer circuits is a bit unusual, but not a great disadvantage. A portable milliammeter was inserted in these circuits when the first adjustments of the equipment were being made, and it is used each time a major change in the circuits is made. For tuning the transmitter, as when changing from one band to another, the grid-current meters are adequate indicators of operating conditions, since it is known from previous measurement that plate-current values accompanying resonance are safe. The meters used for measuring grid current could easily be switched to measure plate current of the first two stages. The voltmeter in the final-amplifier plate supply serves as a bleeder.

In the audio system as well as the r.f. portion of the transmitter, care had to be exercised to allow margins of safety for the components used, to provide for the more than usual heat in which the parts would be operated. First, modulator tubes capable of modulating 500 watts input without difficulty were needed, with required driving power and bias two important considerations. The ZB120 tubes seemed very suitable for this purpose, and were selected for the final audio stage. A simple speech amplifier which would give sufficient gain for the modern crystal microphones, and would easily drive the ZB120 tubes without too much distortion, was the next step. Type 6B5 tubes were chosen for the driver stage, reducing space requirements with the direct-coupled triode drivers, and providing characteristics suited to Class-B driver operation. With the concentration of magnetic fields unavoidable in such a transmitter it was considered important to avoid the use of any transformers for audio coupling, other than the Class-B input and output transformers. This suggested the use of either push-pull speech amplifiers throughout, or a phase-inverter such as one section of a Type 79 tube. The latter was chosen, chiefly because of space limitations, as well as the fact that the other section of the 79 tube used as a triode amplifier, together with the usual pentode first amplifier, would provide ample gain.

Reduction of size of power supplies, without sacrificing quality or the expectation of long,
although no equipment was lost it is reasonably certain that much longer continuous operation of the transmitter would cause very destructive heat and that short life of the equipment could be expected. The transmitter cabinet is provided with louvres at top and bottom of each side; and in addition, the door at the back is punched, top and bottom, giving a cane-like area directly behind the rectifier tubes and the large tubes in the r.f. section. While convection currents were of considerable aid in removing heat from the transmitter, a fan was found to be a necessary addition. After thorough tests of the transmitter without special cooling aid were completed an eight-inch fan was obtained, and after some experiment to determine the position which would give most efficient cooling it was placed as shown in the back view, directly against the top louvres on the warm side of the transmitter. It is operated as an exhaust fan, causing a strong draft of heated air from the transmitter. The induction motor is connected so that it operates continuously while the filaments are heated. Even with the fan, the internal temperature in the transmitter is quite high, and for this reason the remarks in connection with conservative operation apply with the fan as used. A power of 200 watts is dissipated from the filaments alone, and all of 1750 watts except the actual average power delivered to the antenna transmission line is dissipated by the transmitter when it is operated as a 'phone unit.

COUPLING

It is very important that the coupling between the oscillator plate coil and buffer grid coil, and the coupling between the buffer plate coil and final amplifier grid coil, be very carefully adjusted to obtain optimum operation of these three stages. Once set, this adjustment remains fixed for all future operation, since the grid and plate coils mutually coupled are wound as single plug-in units, one for each band, for each coupling position. Thus, the optimum coupling is automatically obtained by simply plugging in the proper coils for any frequency band. As used in this transmitter, the coupling is so close that a very noticeable interaction of tuning exists between coupled tanks. In order to adjust the circuits to resonance, therefore, the two condensers—plate condenser of one stage and grid condenser of the succeeding stage—are adjusted simultaneously, the grid current of the succeeding stage being observed during the process. With this one exception, the usual process of tuning applies to this transmitter.

The antenna coupling arrangement is simply a single turn of wire placed inside each final-amplifier plate-coil form and located centrally within the winding. The coupling is varied by rotating the turn. The ends of the antenna coil are brought out through holes in the top of the form and are cut off so as to leave half-inch
lengths of wire protruding for terminals. The transmission lines used with the transmitter are of the low-impedance untuned type, concentric and twisted-pair, varying from 40 to 100 ohms impedance.

This transmitter as described, has been operated on the 3.5-, 7- and 14-Mc. bands. For output on any of these three bands, a crystal of either the output frequency or half the output frequency may readily be used, supplying sufficient excitation to the buffer to drive the final amplifier adequately for phone or code operation. For code work alone, frequency doubling may be used in both the Tri-tet oscillator and the intermediate amplifier, making it possible to operate the transmitter on twenty-meter c.w. with full half-kilowatt input, using an eighty-meter crystal in the oscillator.

The power which the transmitter may be expected to deliver to the antenna transmission line varies from 300 to 400 watts, depending on the care taken in making adjustments, and the frequencies of output and crystal.

To give definite information on the compactness of this transmitter, the following specifications are listed:

- Height ............ 42 inches, overall
- Width ............. 20.5 inches
- Depth ............. 15 inches
- Weight ............ 350 pounds, equipped for operation

Although it was originally feared that a transmitter as compact as this would be erratic in operation and require frequent repair, this unit has been giving consistent and dependable service. It made a very interesting experiment, with satisfactory results. If equipped with component parts specially suited to this type of construction, there is little doubt that extremely compact transmitters could be built to give complete satisfaction, using effective cooling means.

### COIL DATA

<table>
<thead>
<tr>
<th>Frequency</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 Me.</td>
<td>11</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>19</td>
<td>24</td>
</tr>
<tr>
<td>Length</td>
<td>1/4&quot;</td>
<td>1/4&quot;</td>
<td>1/4&quot;</td>
<td>8&quot;</td>
<td>2 1/4&quot;</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>7 Me.</td>
<td>8</td>
<td>9</td>
<td>9</td>
<td>15</td>
<td>19</td>
<td>12</td>
</tr>
<tr>
<td>Length</td>
<td>1/8&quot;</td>
<td>1/4&quot;</td>
<td>1/4&quot;</td>
<td>3&quot;</td>
<td>2 1/4&quot;</td>
<td>3 1/4&quot;</td>
</tr>
<tr>
<td>14 Me.</td>
<td>6</td>
<td>6</td>
<td>1/4&quot;</td>
<td>8</td>
<td>9</td>
<td>5</td>
</tr>
</tbody>
</table>
| Length    | 1/4" | 1/4" | 3" | 2 1/4" | 2"

L1, L2, L3 — No. 18 wire on 1 3/4" diameter ceramic form.
L4 — No. 12 wire on 4" diameter ceramic form.
L5 — No. 12 wire on 2 1/2" diameter ceramic form, concentric with L4.
L6 — No. 10 wire on 3" diameter ceramic form.

FIG. 3—POWER SUPPLY DIAGRAM

- C1, C2 — 2 µfd, 1000-volt oil condenser.
- C3, C4 — 2 µfd, 2000-volt oil condenser.
- C5, C6 — 2 µfd, 3000-volt oil condenser.
- CH1 — 20-henry, 200-ma. choke.
- CH2, CH4 — 18-henry, 300-ma. swinging choke.
- CH3, CH5 — 12-henry, 300-ma. smoothing choke.
- CB — 20-ampere circuit breaker.
- T1 — Filament transformer, 5 volts, 6 amp.
- T2, T3 — 866 Filament transformer, 2.5 volts, 12 amp.
- T4 — Plate transformer, 600 volts each side c.t., 200 ma., with 3-volt winding.
- T5 — Plate transformer, to give 1500 volts d.c. at 500 ma. through filter.
- T6 — Plate transformer, to give 2000 volts d.c. at 400 ma. through filter.
- P1, P2 — 2.5-volt pilot lights.
- SW1, SW2 — Filament and plate control switches, s.p.s.t.
A Home-Built Velocity Microphone

Constructional Details of a Unit Built from Magneto Parts

By Norman E. Gibbs, W1JXP*

RIBBON microphones have always appealed to the writer because of their simplicity, ruggedness, and good frequency response. Construction of most types of ribbon microphones is quite simple. In essence the microphone consists of a metallic ribbon suspended between the poles of a magnet. Sound waves by their pressure cause the ribbon to move. It thus becomes a tiny generator, since it is a conductor moving in a magnetic field.

The assemblies to be described were made as a result of an unhappy experience with a commercial velocity microphone purchased for use with a 'phone transmitter. The response was very poor and the hum level most annoying. Compared with other types it was a dismal failure. With the feeling that matters could not be made much worse the "mike" was pulled apart, the general idea being to see if the ribbon were correctly centered or if some reason could not be found for the poor operation.

The ribbon in question seemed rather lifeless and apparently was made of foil containing at least some lead as it was quite soft. A new one might effect a cure, so our experiments began at that point. The new ribbon made a new microphone out of the apparent "dud," but still the pickup was not as much as competing makes afforded. The idea of making an attempt at home construction became most attractive.

At the start several demands must be recognized:
1. The expense of construction must be low.
2. Only ordinary tools found in the usual home shop should be required.
3. The proper material must be utilized or success is nearly impossible. By proper materials of course is meant high-quality magnets, high-permeability steel for the pole pieces, and a foil from which to cut the ribbons which possesses proper mechanical and electrical characteristics.

SELECTING RIBBON FOIL

In the hunt for suitable foil for the ribbons, all sorts of metal sheet and foil were inspected. A good source which yields a surprising variety is blown filter and by-pass condensers (paper type). The following properties are demanded:
1. Lightness—a suitable foil is from one-third to three-quarters of a thousandth thick. Usually the thinner ribbons are more sensitive as there is less force required to move their lighter bulk—provided, of course, they possess the quality of elasticity.
2. Elasticity—springiness. Suitable foil makes a tinkling noise when a strip of it is waved with the hand. The noise is distinctly metallic and usually a foil giving this noise will have good ten­sile strength. A lead foil will not have the proper springiness, but may stretch if put under slight strain. A good foil, if slightly wrinkled, can be stretched in the same manner as a coil spring, provided the stretching is not too violent.
3. High conductivity—a bright surface means good conductivity. Tin foil possesses this as well as the other properties. Aluminum foil is

* Old Lyme, Conn.
covered with a transparent coat of aluminum oxide which prevents good electrical contact. This oxide, by the way, causes the difficulties experienced in attempts to solder aluminum, as it forms almost instantaneously.

All in all, that “tinkle” sound is the best rule of thumb to use in judging material. Such foil keeps its bright surface, is easy to provide with proper contacts, and its springiness means lively response in the “mike.”

As a start it was assumed that, within limits, the better and stronger the magnets used the better would be the results. Also it was assumed that the material to be used for the pole pieces would have to be of high magnetic permeability. Obviously the cost of having steel pole pieces machined to order from a high-grade cobalt steel was out of the question.

At hand were two defunct marine magnetos; the magnets and pole pieces were obtained from these. The poles are especially adaptable to our purpose and are of high-permeability steel anyway. Only a hack saw, emery wheel, hand drill, soldering iron, and the other usual and miscellaneous tools were at hand, nor are special tools required. The emery wheel is a necessity.

The following description of the steps taken in construction, together with the sketches and photographs, should give sufficient detail to enable any mechanically inclined person to build a presentable microphone.

MECHANICAL CONSTRUCTION

The magnetos are torn down, care being taken to keep all the machine screws. If desired your local garage and ignition shop can boost the strength of your magnets by placing them in the field of a very strong electromagnet. In assembling the magnets to form an elongated oval be careful to place similar poles together so that the magnets tend to oppose one another. If your magnets tend to draw together you have them in the wrong position. In proper position we have a flat oval magnet with the poles at the junction (on each side) of the assembly. An aluminum strip is used to fasten the magnets together, the holes used being those already drilled for us.

We are now ready to prepare the pole pieces. Fortunately the poles are shaped down to a narrow edge, ideal for our purpose. Our task is to cut one of the magneto poles in half to furnish a pair for the microphone. This is accomplished with the emery wheel. With care a straight and fairly narrow cut can be made. The edges of the pieces should be ground as perfectly straight as possible so that when they are mounted the ribbon slot will have straight sides and not be wider at one end. The sketch shows where the cut is made.

Forming the pole and ribbon assembly is best explained by the drawings and photographs. A number of pieces of strip steel of the type used to bind the cores of b.c.l. power transformers, or strip brass or aluminum, together with angles of the same material, provide means for fastening the assembly rigidly. In the models built by the writer the clearance between the pole pieces was

(Continued on page 78)
Speed Contest Results

The Seventh Corps Area is to be congratulated on winning the Code Speed contest (of December 6, 1937) with a total score of 482.4 points. They had ninety-one members participating with an average speed of 29.7 words per minute. The highest speed attained by them was 45 words per minute.

Complete scores for all Corps Areas are listed below.

<table>
<thead>
<tr>
<th>CA</th>
<th>Total Points</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>112.1</td>
<td>20</td>
</tr>
<tr>
<td>II</td>
<td>155.0</td>
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<tr>
<td>III</td>
<td>280.8</td>
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<td>IV</td>
<td>200.0</td>
<td>29</td>
</tr>
<tr>
<td>V</td>
<td>116.0</td>
<td>20</td>
</tr>
<tr>
<td>VI</td>
<td>112.5</td>
<td>30</td>
</tr>
<tr>
<td>VII</td>
<td>482.4</td>
<td>91</td>
</tr>
<tr>
<td>VIII</td>
<td>295.8</td>
<td>26</td>
</tr>
<tr>
<td>IX</td>
<td>268.0</td>
<td>96</td>
</tr>
</tbody>
</table>

W5GEY won first place in the individual scoring, having copied accurately sixty-five words per minute. He was awarded a "MackKey," which was donated by Terminal Radio Co., New York City. W4AFQ was second with a speed of fifty words per minute. He did not wish to compete in the individual scoring, having won a prize in last season's contest. The second prize, a Billey Crystal, type LD2, donated by Harvey Radio Co., New York City, was awarded to W2BCX, who was next high with a speed of fifty words per minute.

The highest scoring A.A.R.S. members in each Corps Area are as follows, listed according to the length of copy made accurately at speeds indicated:


Non-member W9HUM of the Sixth Corps Area made best copy submitted, having copied one hundred words perfectly at sixty-five words per minute.

Following is quoted from the Eighth Corps Area Bulletin:

"We all have heard this recognized phrase, 'He is a fine op,' and we all would like to have this said about us. We have read about the ham who can copy fifty, and some of us have had the pleasure to know personally such operators. The height of every radio enthusiast's ambition is to make a real operator of himself, but very often the motive is speed only. The 'fast' boys will tell us that speed is all right only as long as accuracy is primary. The foregoing may seem rambling, but it ties up very definitely with what is to follow.

"In the A.A.R.S. are certain signals which are for convenience in operating. They are for the most part purely 'procedure' signals and are used in A.A.R.S. operations to save time. One Army man will doubtless think another a good operator if he is always on his toes and able to use correctly these signals.

"If you have been a careful listener, you have doubtless heard the above-mentioned signals used in drills which have no relation to the Army. It is this incorrect use of forms which will hurt many otherwise good men. When in a drill, or a net, please use the form that is set as standard for that particular net, and when operating in another net use the method prescribed for its operation. Do not mix operations. It will pull down your operating ability in the eyes of the fellows you work with.

"Another thing that seems to have a strong hold upon the activity this year is indifference towards schedules. One does not have to make schedules with a fellow ham just because he is asked to do so, but if the schedule is made, then keep it as regularly as possible. There are times when it is humanly impossible for us to make a program click, but a little time spent on a systematic arrangement of our working time, our radio time and our sleeping time will result in well organized system by which not only will the radio operating become more enjoyable and efficient, but also will the rest of the outside activities. It might be added that even though you are not so 'hot' when speedy operation is desired, regularity in operating will undoubtedly give you an excellent standing with other fellows."

Notes and Comments

From reports submitted for a period of one month, the average amount of traffic originated, relayed and delivered by A.A.R.S. members is 1.58 messages per station per day.

Traffic reports submitted to Corps Area Signals should include all traffic handled by the station. Reports to A.R.R.L. should separate hamband traffic from that handled on the special frequencies. The A.A.R.S. uses A.R.R.L. method of counting traffic.

The main defect in many portable emergency rigs is that they are not portable.

"Accuracy First," and, "Reduce Delay Time" are written in neon lights in the War Department Message Center.

(Continued on page 88)
Speech Versus Sine Waves
A Discussion of Class-B Modulator Capabilities
By Earl I. Anderson,* W8UD

"A little knowledge is a dangerous thing". That, unfortunately, seems to sum up the situation with respect to the modulating capabilities of Class-B audio amplifiers. The fact that speech wave-forms contain, on the average, only about half the power of a pure tone having the same peak amplitude has led too many amateurs to jump to an erroneous conclusion. The author here reiterates, with examples, statements made in QST some two years ago—principles which have been overlooked in the search for something for nothing. Every 'phone man should read it.—EDITOR.

It is a well-known fact that with a sine-wave signal in plate modulation, the audio power required for 100% modulation is 50% of the d.c. input to the Class-C stage. With voice input, however, the average audio power requirements are in the vicinity of 25%, a condition which has led many amateurs to believe that a given Class-B audio stage will modulate twice as much r.f. input with voice as it would with a pure tone. For example, it is assumed that a modulator rated to deliver 100 watts of audio will modulate a 200-watt Class-C amplifier with sine-wave input, and a 400-watt amplifier with voice input.

Unfortunately, this is not true. Average output is no indication of the peak output if the wave-form is not known, and peak power is the important consideration. However, the shape of voice waves is such that, in general, the average power for a given peak power is only about half that for sine wave having the same peak power. But the peak power requirements for 100% modulation are the same regardless of wave form, so the same peak power is required whether the input wave form is that of a pure tone or speech. This means that a given modulator set-up can modulate 100% without distortion only a definite Class-C stage power input; this input remains constant and is not a function of wave-form or average power.

However, since with voice input the average power is less, it follows that the average plate dissipation is less. Consequently, if plate dissipation is the only limiting factor, the operating conditions can be revised to secure more output with voice input than with sine-wave input, because excessive heat will not be developed on the plates. On the other hand, not only plate dissipation but also filament emission and insulation in the tube must be taken into consideration. If the filament emission is adequate, the peak current value may be increased until either it or the dissipation become the limiting factors. Whether or not the peak plate current and plate voltage may be increased depends upon the characteristics of each individual tube type. Operation in excess of ratings should not be attempted in the absence of positive knowledge that it is permissible in the individual instance, and will not result in tube failure or increased harmonic content.

In other words, if the sine-wave ratings are conservative from the standpoint of voltage or current, or both, new operating conditions may be chosen to permit greater output with voice than with sine-wave input, by taking advantage of the reduced plate dissipation with voice. The correct operating conditions would be the same as for the same peak output with a sine-wave signal, and would be calculated exactly as described in a previous article.1

The essential formulas needed for any Class-B calculation are reproduced here for convenience:

\[
I_{\text{pm}} = \frac{I_{\text{pas}}}{0.636}
\]

where \(I_{\text{pm}}\) = peak plate current to each tube

\(I_{\text{pas}}\) = max. average plate current to both tubes with sine-wave input

\[E_{R_p} = I_{\text{pm}} \times R_p\]

where \(E_{R_p}\) = peak voltage developed

\(R_p\) = reflected load impedance to one tube (one-fourth plate-to-plate value)

Minimum voltage drop across tube = \(E_b - E_{R_p}\)

where \(E_b\) = plate supply voltage

Power output = \(\frac{E_{R_p} \times I_{\text{pm}}}{2} = \frac{I_{\text{pm}}^2}{2} \times \frac{I_{\text{pm}}}{R_p}\)

\[R_p = \frac{E_{R_p}}{I_{\text{pm}}}\]

plate-to-plate load = \(4R_p\)

* Douglas, Michigan.


SOME PRACTICAL EXAMPLES

In general, tubes such as 203-A's with all leads out the base cannot be operated at greatly increased voltages because breakdowns in the base or socket, if not in the tube, may result. It may be possible to increase the peak plate current for increased output. At the maximum rating for 203-A's we find the following:

- D.C. plate voltage: 1250 volts
- Max. average plate current (2 tubes): 306 ma.
- Optimum load impedance (plate-to-plate): 9000 ohms
- Power output: 200 watts

Analyzing these figures, we find:

\[
\frac{0.306}{0.636} = 0.482 \text{ amp. peak plate current to each tube}
\]

\[
0.482 \times \frac{9000}{4} = 1080 \text{ peak volts developed}
\]

\[
1250 - 1080 = 170 \text{ volts minimum drop across tube}
\]

From the curves it seems safe enough to run the peak plate current up to about 0.7 amp. At the increased current the drop across the tube would be proportionately greater, so

\[
170 : x = 0.482 : 0.7
\]

\[
x = 250 \text{ volts drop across tube at 700 ma.}
\]

Power output = \[
\frac{(1250 - 250) \times 0.7}{2} = 350 \text{ watts}
\]

\[
R_p = \frac{(1250 - 250)}{0.7} = 1430 \text{ ohms}
\]

\[
1430 \times 4 = 5720 \text{ ohms, plate-to-plate}
\]

By increasing the peak plate current and changing the operation conditions we have made it possible to modulate 700 watts input instead of the 520 watts possible under the sine-wave setup. Under these new conditions the maximum average plate current with sine-wave input for full output would be 0.7 \times 0.636, or 445 ma. With voice input for the same peak output the maximum average plate current would be only about 50\% as great. The 203-A filament will handle the 0.7-ampere peak plate current in good shape, and with voice input the average plate dissipation will be well below the ratings.

With a tube on which the plate voltage as well as the peak current may be increased, a much greater ratio of voice output to sine-wave output may be obtained. The T20 is an example of such a tube. Because its plate lead comes out the top the voltage may be increased greatly without fear of breakdown, and reference to the curves indicates that the filament is capable of emission far in excess of the requirements at the maximum rated output. The maximum sine wave ratings are as follows:

- D.C. plate voltage: 800 volts
- Max. average plate current (2 tubes): 137 ma.
- Optimum load impedance (plate-to-plate): 12,000 ohms
- Power output: 70 watts

Analyzing these figures, we find:

\[
0.137/0.636 = 216 \text{ ma. peak plate current to each tube}
\]

\[
0.216 \times 12,000/4 = 650 \text{ peak volts developed}
\]

\[
800 - 650 = 150 \text{ volts drop across tube}
\]

Suppose we increase the plate voltage to 1000 without increasing the peak current.

\[
P.O. = \frac{(1000 - 150) \times 0.216}{2} = 91.8 \text{ watts}
\]

\[
R_p = 3940 \text{ ohms}
\]

\[
3940 \times 4 = 15,760 \text{ ohms, plate-to-plate}
\]

Inspection of the curves shows that the peak plate current may be increased to 0.3 ampere safely. The drop across the tube will be proportionately greater

\[
0.216 : 300 = 150 : x
\]

\[
x = 208 \text{ volts drop across tube at 300 ma. peak}
\]

At the increased plate voltage and current the calculation would be

\[
P.O. = \frac{(1000 - 208) \times 0.3}{2} = 119 \text{ watts}
\]

\[
R_p = \frac{792}{0.3} = 2640 \text{ ohms}
\]

\[
2640 \times 4 = 10,560 \text{ ohms plate-to-plate}
\]

With sine-wave input the maximum average plate current would be 0.3 \times 0.636 or 191 ma. and the plate dissipation would be greatly in excess of the rated value, but with voice input for the same peak output the maximum average plate current would be only about 100 ma. and the plate dissipation should be approximately the rated value.

In conclusion, it is possible to modulate more input to the final stage with voice than with tone modulation, but the operating conditions must be altered to permit increased peak output—and definite knowledge of the tube capabilities is absolutely essential. The assumption that twice as much input to an r.f. amplifier can be modulated with voice as with sine-wave input in the same setup is entirely without basis in fact, and can only result in serious distortion if attempted. For distortionless 100\% modulation the input to the modulated amplifier must not exceed twice the audio capabilities of the modulator.

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3 This assumption is not strictly correct, since the proportionality will depend upon the tube characteristics. In practice, however, no error of any importance is introduced, since the load resistance and excitation changes necessitated by the new operating conditions operate to maintain the minimum plate voltage fairly close to its original value. —Edron.
A Universal Test Unit for the Study of Television Images

Sweep Circuits, Video Amplifier and an Image Generating Tube Combined in a Unique Set-Up

By Marshall P. Wilder,* W2KJL

At this stage the reader of this series of articles will have a general idea of modern television technique together with enough circuit data to permit him to build a complete receiver. The circuit material has been made intentionally very general in nature in order to facilitate the description of the functioning of the various components. We could, at this stage, proceed with a detailed constructional type of article describing a complete receiver. Since regular scheduled transmissions are still (at the time of writing) unavailable and since the sincere experimenter will demand a still more detailed understanding of practical circuit and adjustment procedure, we have decided to devote this article instead to the description of what can be considered a universal experimental set-up, built around inexpensive equipment and suited for use either as portion of a receiver, as a “test set” capable of producing a complete picture signal for the adjustment of receiving apparatus, or as the basis of an experimental transmitter.

This experimental equipment is built around a most fascinating device, recently perfected for television work, which is actually a test picture generator tube. The device, under the name “Monoscope,” was described by Mr. C. E. Burnett of RCA at a recent convention of the Institute of Radio Engineers. The original tube was a very beautiful affair designed for use in the testing of commercial studio and transmitter equipment and was rather out of the reach of the amateur. The very great usefulness of this device, however, has led other manufacturers to undertake development work aimed at the production of a small and inexpensive unit. Two such tubes under development are the “Monotron” of National Union and the “Phasmajector” of the Allen B. DuMont Laboratories.

These test picture generator tubes consist essentially of an electron gun similar to that used in conventional cathode-ray tubes. This gun focuses a beam of electrons upon an aluminum disk mounted in the position ordinarily occupied by the fluorescent screen of a cathode-ray tube. The picture to be reproduced is printed on this disk. The electron beam is deflected with normal sweep circuits and as the beam crosses the picture, variations in secondary emission from the picture disk result. The secondary electrons emitted are either gathered on a conductive coating inside the tube or on a special collector element, and the video output voltage is obtained either from the picture plate or from the collector.

This experimental equipment is built around a most fascinating device, recently perfected for television work, which is actually a test picture generator tube. The device, under the name “Monoscope,” was described by Mr. C. E. Burnett of RCA at a recent convention of the Institute of Radio Engineers. The original tube was a very beautiful affair designed for use in the testing of commercial studio and transmitter equipment and was rather out of the reach of the amateur. The very great usefulness of this device, however, has led other manufacturers to undertake development work aimed at the production of a small and inexpensive unit. Two such tubes under development are the “Monotron” of National Union and the “Phasmajector” of the Allen B. DuMont Laboratories.

These test picture generator tubes consist

* 55 Kendall Ave., Maplewood, N. J.
The important feature of the whole development from the amateur point of view is that we are to have available an inexpensive method of producing a television signal which is certain to be of enormous benefit in facilitating experimental work. No longer need we wait for commercial transmitters nor, for that matter, need we give up hope of participating in television experiment just because we live beyond the range of the transmitters now operating. Even when we do have a commercial signal available, the new picture tube will make available a test picture of fixed and known quality with which accurate comparative work may be done. It is fortunate also that the necessary associated apparatus is relatively simple. And it is still more fortunate that the equipment built to operate the new tube is all entirely suitable for use in an experimental receiver.

In Fig. 1 is the complete circuit of a picture generating unit. It includes two sweep units, of the type described in the last article of this series, together with a two-stage video amplifier. Also, there is the necessary wiring for the picture tube itself. This unit, with a conventional three-inch cathode ray tube in place of the Monotron, becomes a television receiver by the addition of an r.f. section and a synchronizing pulse separation unit. On the other hand, it becomes a demonstration unit to allow the visual examination of the picture in the Monotron tube by connecting a three-inch cathode-ray tube to the 1000-volt supply, providing a separate voltage divider for focusing, then connecting the control grid of the cathode-ray tube to the output of the video amplifier. The output of the sweep circuits is connected, of course, both to the deflecting plate in the Monotron and in the cathode-ray tube.

Examination of the circuit will show that the sweep unit and the video amplifier correspond very closely to the circuits given in previous articles. Also, the arrangement of the Monotron portion follows exactly conventional cathode-ray tube practice. The only unconventional feature is in the arrangement used to extract from the sweep circuit suitable pulses for synchronizing and blanking. These pulses are obtained from the plate of the second tube in each sweep unit. In order to avoid interlocking between the two oscillators and to insure proper mixing of the two synchronizing pulses, the pulses are passed through a double diode before being mixed. They are then fed directly to the control grid of the Monotron in order to prevent the generation of any video voltage during the return traces of both sweeps. If this were not done, the video voltages would cause irregularities in the amplitudes of the synchronizing pulses. In order to get these pulses in the output of the complete unit, a small portion of the available pulse voltage is picked off a voltage divider and injected into the grid of the first

![Diagram of the complete circuit of a picture signal generator unit.](image-url)
video amplifier tube along with the signals from the Monotron. The output of the video amplifier thus contains the picture voltages plus the synchronizing and blanking pulses. In other words, the output of the unit corresponds very closely to that obtained from the final video amplifier in a receiver tuned to a normal television signal. In setting up the equipment it is as well to have a three-inch cathode-ray tube available. This tube is placed in the socket ordinarily occupied by the picture generating tube and the sweep circuits are then adjusted until the usual scanning lines cover the desired area. Some workers will find it worthwhile to add adjustable positioning controls to permit centering the pattern—the necessary circuits being available in many pamphlets and books dealing with cathode-ray tube technique. With this setup the voltages on the cathode-ray tube may also be adjusted to give the desired brilliance and focus. The operation of the blanking pulses can be checked by removing the diode tube, in which case the return traces will be visible on the screen. All of this suggests that the device, in addition to serving its prime purpose of a picture signal generator, is also an excellent cathode-ray oscilloscope. Additional condensers may be provided in the cathode circuit of the sweep units to give a wide variety of frequencies and the video amplifier may be used to provide amplification of the voltage whose waveform is to be studied. Should the experimenter already have a complete oscilloscope it will not be necessary to build the entire rig. One additional sweep unit may be added to that already in the oscilloscope and the only additional item will then be the video amplifier.

In our experimental work the unit shown in the photograph has been used for a variety of interesting jobs. In its complete form it allows, in the first place, a very excellent demonstration of the fundamental principles of transmission. Also, it immediately permits an examination of the capability of both the Monotron and the cathode-ray tube in resolving a television image. The pattern provided on the picture tube is sufficiently complex in its drawing so that it is possible to receive all the details present only if the equipment is excellently adjusted. Incorrect sweep amplitudes immediately become apparent as a distortion in the breadth or height of the image. Poor high-frequency response in the video amplifier is indicated by poor definition on the edges of lines—particularly when they are vertical. Phase shift is indicated by the edges being reversed in color or by the lines themselves being shifted slightly to the right—giving a ghost of the pattern displaced slightly from the original. Then, the ability of the screen, tube and coupling circuit to reproduce good tone values can be tested by observing whether or not any half tones in the original can be duplicated in the final picture.

The unit is essentially a device for facilitating the construction and adjustment of television receivers, but one needs little imagination to visualize it as a source of modulation for a ham television transmitter. Indeed, such equipment has already been used by some of us for preliminary experimental work with considerable success. This is not to say that the day of practical amateur television transmission is here. This gadget permits the transmission of a single picture only and we must await the development of inexpensive Iconoscopes before the reproduction and transmission of moving images becomes possible. It is important to realize, though, that the necessary technique is being given close study and that before very long we shall find amateur television transmission to be not much more complicated nor much more expensive than 'phone transmission is to-day.

In the meantime, we firmly suggest that the television enthusiasts should study and possibly duplicate a unit such as that described. Its operation will give him a very intimate picture of many of the details of television technique which are so difficult to assimilate in any other fashion and will provide him with units suitable for immediate application to experimental reception.

March, 1938
A Pack Set for 200 and 300 Megacycles
Completely Portable Transmitters Using Acorn Tubes

By L. C. Sigmon, W9YNJ

ALTHOUGH the 300- and 200-megacycle transmitters to be described were designed primarily to be used in a relay broadcast pack transmitter, I believe the description and results obtained will be of interest to every amateur interested in the development of the ultra-high frequencies.

Experimental work was first started in the early part of the summer of 1937 under my amateur license. At that time breadboard models of the ultra-high-frequency transmitters and receivers were constructed. The results obtained were so promising that two experimental licenses were applied for by the KCMO Broadcasting Company for relay broadcasting purposes. The license called for four experimental frequencies—100, 200, 300 and 500 megacycles. To date all frequencies except 500 megacycles, or 0.6 meter, have been used with excellent results for relay transmissions over short distances, the distance depending upon the frequency, power and location.

At the present time not enough work has been done on the 500-megacycle receiver and transmitter to go into details about it, except to say that the most promising receiver so far constructed seems to be of the type having tuned lines in the plate and grid circuits, similar in construction to the 300-Mc. transmitter shown in Fig. 3.

The complete pack set consists of the main case containing a receiver, modulator and “A” and “B” batteries, and separate transmitters which can be attached to the top of the case. The same transmitter circuit is used for both 200 and 300 Mc., the difference being simply in the size of the linear tank circuit. The complete circuit diagram is given in Fig. 2.

LAYOUT DETAILS

Fig. 1 is a picture of the pack set with the 300-megacycle transmitter attached to the projecting pipe. Each end of the pipe is fitted with a four-prong plug so that transmitters of different frequencies may be plugged in. The antenna projecting out of the transmitter is a quarter-wave rod. The antenna to the right, for receiving, also is a quarter wave. All transmitting controls are locked in place after the transmitter is set on frequency. The modulating unit is enclosed in the upper left-hand corner of the pack transmitter proper; the upper right-hand part contains the receiver. The meter on the front reads the total plate current of both transmitter and receiver, the current being approximately 19 ma. The left-hand dial is the regeneration control and the right-hand dial is the receiver tuner. The central bar knob is the audio gain control. The switch breaks both the “A” and “B” voltages. The lower part of the pack transmitter contains three Burgess “B” batteries, No. Z30P, each battery 45 volts, and two Burgess No. F2BP “A” batteries, these being 3 volts each. The total weight of the batteries is only four pounds, eight ounces. In testing the pack transmitter a small power supply was constructed to replace the batteries.

The jacks for the microphone and headphones are located in the left- and right-hand corners on top of the

* Chief Engineer, KCMO, Kansas City, Mo.
pack unit. The back plate of the transmitter pack is attached with self-tapping screws. Four rubber sponges are provided, one on each corner of the back plate, so that the pack will fit comfortably on one's back. A double-button carbon microphone is used. The reason for elevating the transmitter above the pack is so that the antenna projecting from the top of the transmitter will be clear of the person wearing it, and also others in the vicinity.

**THE TRANSMITTER CIRCUITS**

Fig. 3 shows the 300- and 200-Mc. units uncased. The construction is almost self-explanatory from the pictures. The tuned line in the grid and plate circuits was used to provide the degree of frequency stability required by the Federal Communications Commission, as well as to obtain maximum circuit efficiency. The rods used are 2 3/4-inch solid brass, and less than 3/4-wavelength long. The spacing between centers of the brass rods is 3/4 inch. The distance between the rods can be varied, but with greater spacing longer rods will be required.

The problem of insulation is not serious at the ultra-high frequencies with the type of construction shown. The voltage is slightly less than maximum at the tube socket and is minimum (a voltage node) at the ends of the rods. A standard Mycalex socket is used for the 955 acorn tube. The insulators at the end of each rod are inexpensive ameroid pillars. The condenser shunted across the ends of the grid and plate rods is a special high-frequency unit, but a standard mica postage-stamp-size condenser will work as well.
FIG. 4—A SIDE VIEW OF THE 200-MC. TRANSMITTER

Showing how the assembly is mounted to the base plate.

It was found necessary to shield the plate voltage lead. If this is not done standing waves will appear in power leads, and a number of undesirable effects may be expected. The transmitter should only be grounded at one place on the chassis, this being near the grounded filament lead. The shield over the plate voltage lead should also be grounded at the filament lead and the remaining part of the shielded lead insulated from the chassis.

Tuning of the transmitter is effected by means of a penny soldered off center to an 8/32 threaded brass rod. The reason for the penny being soldered off center is to give a vernier tuning effect. Another small plate is soldered to the grid rod to complete the tuning condenser. The details of this construction are shown clearly in Figs. 3 and 4. The plate rod is also tapped for 6/32 screws at intervals of a quarter inch, for a length of approximately an inch and three-quarters from the low-voltage end. This is to locate the proper coupling point for the antenna condenser. Some difficulty was experienced when the oscillator was encased, and those not intending to encase the oscillator will find it necessary to extend the length of the rods slightly. The transmitter proper is constructed on No. 16 gauge aluminum, but copper is preferable when weight is not an important factor. The main case of the pack transmitter is made of No. 22 gauge cold rolled steel.

The modulator unit is of the Heising type, using another 955 tube. The rest of the circuit is self-explanatory.

OPERATING DATA

The quality of voice transmission from the transmitter is good, provided the transmitter is not modulated too heavily. The chief source of distortion is the non-linear characteristic of the regenerative detector used in the receiver. If a low percentage of modulation is used the distortion is not objectionable. All programs broadcast from the relay pack transmitter go through an equalizing circuit which also helps to improve the quality of transmission from the pack.

The greatest distance so far tried for reception was three-quarters of a mile over open country. No doubt greater distances can be covered with higher power. The approximate power of the transmitters is 0.1 watt.

The purpose of the 300- and 200-Mc. pack transmitter at KCMO is not to cover a great distance, but for use inside large auditoriums and for man-on-the-street broadcasts, etc., where it is ordinarily necessary to use several hundred feet.

(Continued on page 88)

FIG. 5—THE RECEIVER REMOVED FROM THE MAIN CASE

The superregen tube is a 955.
While all of us admire commercial-built equipment and usually try to emulate it in our own construction, comparatively few are adept enough to reach the point where visiting hams refuse to believe our rigs are home-made. That, however, is the case with the transmitter recently constructed by W9AXH, Robert E. Stuart, of Indianapolis, Ind., of which two views are shown in the accompanying photographs.

The complete transmitter, used for both 'phone and c.w. in the 80-, 40- and 20-meter bands, is contained in a metal cabinet 78 inches high by 37 wide and 17 deep; three shelves and the base hold the various sections of the outfit. The front panels are made of 3/16-inch aluminum, each 36 inches wide. The final stage, using two 150T's in push-pull, can be operated at inputs from 350 watts to a kilowatt, and is modulated by a second pair of 150T's. A 53 oscillator-doubler, 801 buffer, and 100TH driver complete the r.f. line-up. The audio end built into the transmitter consists of two 76's in push-pull followed by four 2A3's in push-pull parallel which feed the modulator grids.

Looking into the back of the transmitter, the top shelf carries the antenna tuning condenser (used only on 80 meters), final stage and the modulators. A homemade dual fixed condenser, 50 µfd. per section, is beside the variable plate tank condenser, a Johnson 50-µfd. per-section unit, and can be connected in to increase the tank capacity for 80-meter operation. The tank coil plugs in directly below the tank condenser. The neutralizing condensers and filament transformer also are on this shelf. The grid tank for the final is underneath the shelf, link-coupled to the 100TH driver on the next deck below.

All r.f. stages except the final are on the second shelf. At the left is a crystal oven containing four air-gap holders which are adjustable through the top of the oven. The 53 oscillator-doubler with its tank coils, and the 801 buffer and tank, occupy the space between the oven and the shield which separates the 100TH driver from the exciter. Between the exciter and front panel is a shielded compartment containing the audio driver for the modulator, and also power supplies for the driver and the r.f. exciter. The Class-B input transformer is mounted underneath the top shelf and is fed through a shielded line from the 2A3 plates.

Filter components are contained on the third shelf. At the left are two 3500-volt 2-µfd. oil-filled condensers which are connected in parallel.
to form the filter output; the input condenser consists of two 3000-volt 2-µfd. units connected in series. The input swinging choke is 5–20 henrys at 1 amp, the smoothing choke 20 henrys at the same current. The panel to the right on this shelf holds several control relays; that at the left is a Ward-Leonard time-delay for the 872 rectifiers, followed by a Leach keying relay and a Dunco 30-amp. unit for primary control of the plate circuits. On the other side of the panel (not visible in the photograph) are a second 30-amp. Dunco relay for filament control, a homemade relay for the crystal temperature oven, underload relay for the bias circuit, overload relay for the final-amplifier plates, and overload relay for the modulator. The round can below the shelf contains a switch, operated simultaneously with a voltage-changing switch on the high-voltage supply, which changes the bias on the 150T’s to correspond with the plate voltage in use.

The largest item on the bottom shelf or base is the plate transformer, specially built for this transmitter. It is a 3-kva. job with 110–220 volt primary, giving secondary voltages of 3200, 2500 and 1870 each side of the center tap for d.c. voltages of 2500, 2000 and 1500 volts, at a maximum current of 1 ampere. Additional plate-voltage variation in steps of 100 volts to a maximum of 500 either way from these main voltages can be secured by means of an auto-transformer connected in the primary circuit of the plate transformer. The 872 rectifiers are between the transformer and the large baffle. Homemade 1-amp. high-voltage fuses are in series with the rectifiers for protective purposes. The 110–220-volt power connections, remote-control and keying leads, and the 500-ohm audio line are brought in the bottom through appropriate plugs. The transformer at the left is the UTC Class-B output transformer, wound for three different impedances to take care of the power inputs at the three main plate voltages available. The rear doors, four in number, are interlocked with the high-voltage so that the power is cut off when a door is opened.

The front view shows the layout of controls. Radiostats are provided for filament-voltage adjustment on the 872’s and 150T’s; these, with the plate-voltage change switch, are on the bottom panel. In addition, a switch is provided for shorting the Class-B output transformer for c.w. operation. The square plate in the center of the second panel is a four-position switch for selecting various crystals in the oven. The exciter tuning controls, along with filament and plate on-off controls, also are on this panel. The power controls are duplicated on the operating table.

Meters for the various stages are behind the glass window in the third panel. All significant grid and plate circuits are metered, along with the filaments of the larger tubes. The tuning knobs for the final stage and antennas are on the top panel. Antenna ammeters are behind the glass insert.

The grill through which the 150T’s are visible consists of a number of 3/8 by 3/16-inch brass strips separated by brass blocks. Rods run through the blocks to hold the assembly together, and the whole grill is chromium plated.

The operating desk at W9AXH, not shown in the photographs, is directly in front of the transmitter. The receiver, an HRO, is mounted at the bottom of a 30-inch desk-type relay rack. Additional units mounted on the rack include a power supply for the receiver and speech preamplifier; a permanent-magnet speaker; the preamplifier, consisting of a 6J7 pentode-connected working into a second 6J7 triode-connected, the latter feeding a 500-ohm line to the}

(Continued on page 106)
A Continuously-Rotatable 28-Mc. Beam
Rapid Rotation—No Stops—Stationary Feeders

By A. F. Neuenhaus,* W2BSF, and M. E. Schreiner,** W2AJF

DURING the winter of 1935, twenty-meter QRM drove W2BSF and W2AJF to the five-meter band for local QSO’s in an effort to alleviate the situation, and it proved a most interesting and instructive experience. Our work there proved to us that though the “big kilowatt” will usually plough through, a certain bit of skywire called the “antenna” has more to say in getting out than most of us are willing to concede.

The ten-meter band was opening up with its splendid possibilities, but our experience with 20 and 40 had taught us what to expect when it began humming. Here was a band that surely would place the world at our “mike-tips,” but again the big kilowatt signals, which we could not afford, cast a menacing shadow across our anticipations. (We take no issue with the truth that high power, properly adjusted, causes less QRM outside its own frequency than a carelessly-adjusted rig of a few watts.) However, what five meters had taught us could be put to work on ten, and we had convinced ourselves there that the power we cannot afford in the transmitter can certainly be built into the antenna at a cost well within the reach of the average ham’s pocketbook.

Of all the arrays and beams we had tried, seen, heard or read of, the one that seemed to have the greatest possibilities for enhancing our chances of successful QSO’s in any desired direction with a moderate amount of power, was the reflector-director type. It had a particular appeal to us, especially from the viewpoint of its unidirectivity, which very effectively eliminates QRM in undesired directions, and under normal conditions it has worked out exactly the same way on the reception of signals here. In other words, the incoming signal at which the array is pointed is built up while signals from other directions are attenuated to a considerable degree.

Rotatable beams and more of them have put in their appearance and many a fine signal from them has buffeted our speakers around, but most of the designs were too cumbersome for our locations and expensive for our purses. Then, too, the everpresent problem of dangling feeders makes it impossible to rotate these beams completely and continuously through 360 degrees. Stops of various kinds were annoying for the reason that it very often proves necessary to rotate these antennas through 300 degrees to effect a 60-degree change in directivity. Motors, of course, may be used to do most of the work, but they must be reversible in one form or another, thus adding expense.

After all these considerations, it occurred to us that the vertical reflector-director set-up afforded a means of overcoming all of these handicaps and also provided a splendid method for avoiding the usual dangling feeder. In addition, it would give us our long-sought continuous and complete rotation right through 360 degrees in either direction. Instead of rotating the antenna, why not simply rotate the reflector and director around a stationary half-wave “J” antenna and feed through the conventional open-wire transmission line? We immediately got to work and constructed such an affair, and it has been in operation at W2BSF for the past two or three months. To make a long story short, we have been so completely satisfied and gratified with the results, that our immediate thought was to pass it along to our fellow-hams through the medium of our old friend QST.

Actual measurements and, above all, received S-meter readings in all parts of the country and as far away as Honolulu, have shown the beam to have a gain of 4 db over the regular di-pole at the same elevation and with the same power. The front-to-back ratio is at least 16 db. To appease those fellows who entertain worries about vertical polarization, let us say that tests have proved that, outside our own district, the vertical

* 34 Sylvester Ave., Hawthorne, N. J.
** Prospect St., Little Falls, N. J.
polarization effects are negligible, the signal strength maintaining the same level with both horizontal and vertical receiving antennas at the same station. Locally—with a 25 or 30 mile radius—vertical polarization effects are noticeable, but do not seriously affect the signal strength.1

A duplicate of this antenna is in process of construction at W2AJF at the present time and will include some minor improvements and refinements which are shown in the accompanying drawings. Incidentally, this beam can very easily be rotated completely through 360 degrees in either direction, or stopped at any intermediate point, in less than five seconds!

Following is a description of the details of construction:

The dimensions of all elements of the system are calculated strictly in accordance with formulas (for desired frequency) contained in the 1938 A.R.R.L. Handbook.2 The 4-inch by 4-inch mast is 20 feet high so that when complete the antenna will be one-half wave above ground. The half-wave antenna portion consists of a 12-foot length of 1-inch O.D. aluminum pipe, ¼-inch wall, with a brass reducer fitted to the top. A ½-inch I.D. brass nipple is fitted with two set screws and screwed into the reducer. The ⅝-inch O.D. aluminum can be cut to any length above 5 feet and will slide nicely into the brass nipple, making it possible to adjust the half-wave antenna to the proper length and fasten the sliding section with set screws. The 1-inch aluminum pipe will fit through the insulator-block bushings and pulley, which are bolted to the lower horizontal member.

(Continued on page 118)

1 In sky-wave transmission, the polarization of the received waves seldom bears any definite relation to the polarization of the transmitting antenna. From this standpoint, it is a matter of indifference whether horizontal and vertical antennas are used. Ground losses are probably lower when the wire is horizontal, and there is less likelihood of interference with nearby receivers.—Editor.

2 The recommended director spacing in the Handbook is ¾ wavelength; optimum spacing, however, is obtained only after a period of cut-and-try. In connection with element lengths and spacings, there is the possibility of improving the gain of an array of this type by using the spacings and tuning conditions derived by G. H. Brown and described in the Proceedings of I.R.E. for January, 1937.

For example, when only a single parasitic element is used, maximum gain is secured with spacings of the order of 0.1 wavelength, the parasitic elements being adjusted to have the proper reactance for either forward or backward radiation. In the special case of self-resonant parasitic elements (length same as that of antenna) optimum spacing for functioning as a "director" is 0.1 wavelength; as a "reflector," 0.2 wavelength; in both cases the gain is quite near the maximum possible. Where more than one parasitic element is used, the mutual impedances between all elements of the array must be considered in determining optimum spacings and tuning conditions.—Editor.
A Solution to the Tank Circuit L-C Ratio Problem

Variable-Range Condenser for Multi-Band Transmitters

By Frank Lester,* W2AMJ

The old adage, "necessity is the mother of invention," applies in this case for it was because of a job given to the writer that this idea developed. To the best of my knowledge the plan about to be discussed has not appeared in print, nor has it been applied to amateur transmitters. Why this should be so is rather puzzling, for the idea is so simple that it is a wonder several of us have not thought of it previously.

It is a well-known fact—only too well known—that we require an entirely different order of tank capacity for 56 Mc. than for 1.75 Mc. It is also common knowledge that lead lengths and stray capacities play an increasingly important part the higher in frequency we go. Heretofore, because of the fact that maximum efficiency is always the ham's requirement, two or more amplifiers have been necessary when such a wide frequency range was desired. The plan to be discussed tends to eliminate the need for separate final amplifiers when a wide frequency range is to be covered.

Now to get down to business. In this case it is advisable to reverse the usual procedure and consider the low-frequency end first. Let us assume that we want to operate on 1.75 Mc., and also that a fairly good L-C ratio will result if we have approximately 100 µfd. of effective tuning capacity, utilizing a split-stator condenser (i.e., 200 µfd. per section). Usually it will be found that the minimum capacity of such a condenser is too high to permit good L-C ratio on 56 Mc. There is, however, nothing to prevent our taking each one of the sections of this large condenser and splitting it into two parts, which means that we will have three capacity ranges available to cover the six amateur bands. This is just exactly what has been done, and when the construction of the majority of popular variable condensers is considered it can readily be appreciated that the job is not a difficult one. Therefore the cost is small and at the same time one amplifier can be made to function with good efficiency where two or three previously had to be employed.

Fig. 1 shows the entire circuit. All that is needed in addition to the special condenser is a new plug-in coil assembly. This should have seven plugs to take care of connecting in the desired capacities throughout the frequency range from 56 to 1.75 Mc. Obviously, on 56 Mc, the pair of small sections of the variable condenser will be employed. The same capacity also may be used for 28-Mc. operation, although the designer has the choice of using these or the larger sections, depending upon whether a low-C or a high-C circuit is desired. Depending on the wiring of the plug-in coil strips, we may use either the small sections, the large condenser sections or the two in parallel on each side. Each section of the original condenser should be cut so that optimum capacity values can be obtained throughout the frequency range.

With the cooperation of the Hammarlund Manufacturing Company, a sample condenser was made up to the writer's specifications. To give an idea of the capacity ranges possible, these are the actual measurements of the sample condenser:

Using the high-frequency condenser sections, the minimum capacity is 8, the maximum capacity 24.5 µfd. The capacity range of the larger sections—which we will term the "middle frequency" condenser—is from a minimum of 11.5

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*103 Williamson Road, Bergenfield, N. J.

Aside from greater ease of tuning at the higher frequencies with condenser of small capacity range, the merit of the scheme can be judged by comparing the minimum capacity of the smaller sections in series with the minimum capacity of the condenser as a whole without alteration. In the condenser discussed, this "improvement ratio" is better than 2 to 1.

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March, 1938

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to a maximum of 82.5 µµfd., while with the two sections connected in parallel on each side the range is from 19.5 to 103 µµfd.¹

These capacity ranges are not to be confused with the capacity of each section, but represent the net capacity obtained when the condenser is employed in the usual split-stator fashion. The measurements also take into account the effect of the unused sections which are left floating.

The photograph of the sample condenser clearly illustrates what may be termed a revamped 225 µµfd., per section split-stator condenser. The following information should prove helpful to those who may wish to adapt one of their present condensers to this circuit:

The rotor plates are not changed in any way. In order to increase the spacing between the two separate sections of the condenser, one stator plate is removed. In addition to increasing the spacing, this also allows two rotor plates to be employed as the outside plates, forming a more or less effective shield between each of the sections. This decreases the capacity effect between sections, depending on the position of the rotor. As the unused section is left floating, some r.f. current will flow into the plates because of their proximity to the active section; this will increase the minimum capacity slightly, but introduces no particular power loss.

In designing the plug-in coil assembly to be used with this condenser, short leads are readily obtained for the higher frequencies because the two small condenser sections have been located in the center with the two larger sections at each end. As shown in Fig. 1, it is readily possible to vary the length of the coil without having long leads, since it is necessary to employ the entire length of the plug-in coil strip only when the entire capacity of the condenser is to be used.

This same setup may be used in the grid circuit, although in many cases it may not be required because a lower L-C ratio often may be used without any great sacrifice in efficiency.

This idea will undoubtedly appeal to the high power men who must of necessity use large condensers that present quite a problem when 56- or 28-Mc. operation is contemplated.

By-Pass Condenser Needed in "QSL Forty" Circuit Diagram

In Fig. 1, the circuit diagram of the 6L6 oscillator in the article "The ‘QSL Forty,'" February QST, the cathode by-pass condenser, C₄, was inadvertently omitted from the drawing, although included in the list of parts. This resulted in short-circuiting the cathode resistor and key. The correct diagram, with C₄ in its proper place, is reproduced herewith.

Silent Keys

It is with deep regret that we record the passing of these amateurs:

William J. Albert, W6KPU, Whittier, Calif.
J. W. Bush, Jr., W5ZD, Dallas, Texas
Robert H. Cowan, W5EED, El Paso, Texas
T. J. Findley, W6BBN, Los Angeles, Calif.
Fred W. Kinne, W8EOH, Tuwaanda, Penna
William I. Lovett, W7GBJ, Aberdeen, Wash.
Samuel R. Smith, W6MNT, Long Beach, Calif.
Bennis Stein, W2ILU, Irvington, N. J.
Raymond J. Taylor, ZL1BA, Auckland, N. Z.
Robert L. Travis, W4CWH, Demarest, Ga.
Anthony G. Wingerter, W9SAT, St. Louis, Mo.

By-Pass Condenser Needed in "QSL Forty" Circuit Diagram

In Fig. 1, the circuit diagram of the 6L6 oscillator in the article "The ‘QSL Forty,'" February QST, the cathode by-pass condenser, C₄, was inadvertently omitted from the drawing, although included in the list of parts. This resulted in short-circuiting the cathode resistor and key. The correct diagram, with C₄ in its proper place, is reproduced herewith.

Silent Keys

It is with deep regret that we record the passing of these amateurs:

William J. Albert, W6KPU, Whittier, Calif.
J. W. Bush, Jr., W5ZD, Dallas, Texas
Robert H. Cowan, W5EED, El Paso, Texas
T. J. Findley, W6BBN, Los Angeles, Calif.
Fred W. Kinne, W8EOH, Tuwaanda, Penna
William I. Lovett, W7GBJ, Aberdeen, Wash.
Samuel R. Smith, W6MNT, Long Beach, Calif.
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R.F. Interference From Power Circuits

Identifying and Curing Radio Noises

By Robert Y. Chapman,* WIQV

There is no doubt that if it were not for noise we all would be able to hear much more DX.

The writer is a firm believer in the old slogan which goes, "let's clean house at home first." So let's talk about the noises that can originate in the operator's establishment. First we must remember that any form of noise external to the receiver is highly-damped r.f. with a peak in some particular frequency region, and when associated with power lines, will be modulated at a frequency depending on the line frequency and voltage involved. Most noise seems to resonate on about 1700 kc. with an average modulation frequency of about 120 cycles on 110-volt lines and about 400 cycles on 2300-volt lines. The easiest forms of noise to locate are the steady buzzes which sound like bumble bees loving a rose.

The major causes of interference originate on the secondary side of the transformer which supplies the affected district. From the reception standpoint, homes can be divided into three classes. The poorest is the type with open wiring and the meter in the attic, plus gas and electric combination fixtures. Let's discuss this type of location from an operating angle.

First, we have no a.c. line shielding, which means that we have open lines to resonate with the output frequency of the transmitter. Regardless of the transmitting frequency we are practically certain of resonance in some part of the wiring. The unmistakable sign is lighting the lights when they are not turned on. The cure is install a small by-pass condenser across the a.c. line at the light fixture.

The most common source of noise in such an installation arises as the result of the light fixtures being grounded to the gas-line fixtures. This arrangement never gives a solid ground and the least vibration results in loud cracks like the snapping of a whip.

Another form of noise results from poor conduction in corroded soldered connections; the greater the load on the circuit the more noise produced. Sounds like a baritone taking a gargoyle.

If you live in this type of house your chances of causing b.c.l. interference are five times as great as if you lived in a newly-wired house.

The next type is the house having open wiring but with the meter board in the cellar, and having no gas-fixture combinations. The main fault is that when the wiring was done there was no respect for polarity. This installation was in the era of load fuses; they put them all over the house. The fuse blocks get badly tarnished with age; as a result the contact gets poor, and as the load increases heat is generated and the composition boils out and runs all over the connections. This results in a bad noise that sounds like an old '23 Ford throttled down.

Another common source of interference in this type of home is the ceiling fixture having link chain suspension. The only cure is to bond the links. The noise can be identified as a series of snaps with slight buzzes. It must be remembered that in houses with old wiring, bad fixtures and loose connections are almost certain to be found. Also, check the ground connections on all fuse blocks of the type known as "Not-a-fuse". These get loose and cause a bad noise. The water-pipe ground clamp from the a.c. light line also should be inspected.

Next, let's go to the newly-wired homes, complete with BX. Here we do find everything pretty wellbonded, but if it is not we are likely to get common a.c. hum interference in the receiver. A prevalent cause of noise in houses wired with BX is the cable chafing against water pipes, resulting in clicks like those caused by keying. This type of interference is often blamed on some innocent ham.

Incidentally, many a buzz can be traced to a wall-socket that has become burned as a result of poorly-fitting lamp plugs.

When you check your home for noise, tighten all loose connections in the fixtures and replace those that are not positive in action—for instance, where you have to snap the switch several times.

(Continued on page 9)
How Would You Do It?

Non Short-Circuiting Coil Clips

In Problem No. 13, our Hero asked for some ideas on coil clips which, among other things, would not flop over and short-circuit turns. A glance at the drawing will show that his wishes were more than fulfilled. Some of the schemes are simplicity itself while others are not so simple—take your choice.

A very simple and effective clip is shown in Fig. A. This idea was submitted by W2HNX who wins first prize. The clip itself is of the simple type described some time back in the Hints and Kinks section of QST. It may be made by folding a strip of phosphor bronze or similar material and forming the end around a nail or drill of suitable size. Similar clips are obtainable from certain manufacturers.

To prevent the clip from twisting far enough to short-circuit turns, a hole is drilled about halfway up the clip and a small rod of insulating material such as bakelite or celluloid from a knitting needle is inserted in the hole and cemented fast.

In Fig. B is a somewhat different arrangement utilizing the same principle, suggested by VE6AJQ. The clip, in this case, is made of two pieces of heavy spring brass or phosphor bronze bent at right angles, formed at the ends and fastened with machine screws to a strip of insulating material.

W8QPS uses a “pee-kee” clip of the “bulldog” type with the jaws filed down to permit use on coils with closely-spaced turns. The clip is fitted with celluloid strips as shown at C to prevent tipping too far. The same idea was suggested by W8OWL.

Along the same line is the “alligator” type clip, shown in Fig. D. Each jaw is fitted with a peg of insulating material. The design was submitted by Harold W. Hartman of Los Angeles.

Three types of “pressure” clips are shown in Figs. E, F, and G. In each case, sufficiently firm clamping is possible to prevent the clip turning and short-circuiting turns, even when subjected to a strong pull. The design shown at E was submitted by K4EDS. The metal piece is \(\frac{3}{4}\) to \(\frac{3}{8}\) inch wide. The whole at the top is tapped to accommodate the flat-head machine screw. A small piece of sheet metal is soldered in the screwdriver slot to form a wing-screw which may be turned by hand. Two simple types which require the use of a screwdriver are shown in Figs. F and G. The first was submitted by W2DC and the second, which is designed to prevent any possible twisting while tightening, was suggested by W2BXJ.

If anyone feels that he must have absolute insurance against twisting, the design of Fig. H by W9SZN should fill the bill. The metal pieces should be cut from stiff brass of as great thickness as practicable. An “ear” is cut as shown on one of the pieces to permit fastening to the small piece of insulation which effectively prevents tipping. The bottom screw should not be tightened completely as it is only a sort of pivot. The clamping action is obtained chiefly by means of the upper screw.

A rather novel clip is suggested by W6GFK and is shown in Fig. I. The clip itself is first formed from a piece of spring brass. A narrow band of soft brass is then bent around the upper part of the clip. Sliding this band up and down on the clip will loosen or tighten the clamping.

Another highly satisfactory tapping arrangement is shown at J. This idea was suggested by W4PL and E. Ottney, Peterboro, Ontario. We believe it merits second prize which goes to W4PL because of his more complete treatment. Its most serious drawback is that it requires soldering, although it has the advantage over all other schemes in that it may be used with coils of very closely-spaced turns. While an ear or tab of No. 12 or 14 wire may be used for the tap, W4PL prefers to file down the head of a No. 6-32 machine screw and also to file out the screwdriver slot to fit the wire and solder the head to the wire at the point where the tap is desired. A standard ’phone tip is just the right size to take a

(Continued on page 114)
At first glance it may appear an odd thing that this page has not previously presented a word portrait of Dr. Eugene C. Woodruff, the president of the League. After all, Hamdom's most distinguished citizen is surely a personality of interest to amateurs everywhere.

But that is, actually, somewhat a superficial view. This Hamdom page, as it happens, has been primarily a space for facts and figures, where biographical data and vital statistics are condensed into a swiftly-paced pen picture. Dr. Woodruff is not the sort of personality that can be fitted into such compass. His life does not lend itself to being measured with dates and sliced into neatly-packaged sections comprising distinct eras. His philosophy is that of the individualist, and his career reflects that philosophy, and you can't squeeze him into ordinary molds for he just doesn't fit.

It is with the consciousness of considerable temerity, therefore, that we at long last attempt to do this much toward presenting Dr. Woodruff on this page; that we attempt to convey the feeling of the kind of man he is. In order that the light and shadow may have a backdrop on which to play this is the skeletal record of his career: Born in St. Clair, Michigan, in 1871, schooled largely at Ann Arbor, graduating a B.Sc. from the University of Michigan there in 1894, followed by a master's degree in chemistry, physics and music in 1896 and a Ph.D. in physics, mathematics and chemistry in 1900, he chose pedagogy as his life work. Invention has been his avocation, or perhaps, his other life work. He has taught practically every scientific subject in schools and colleges in various locations including Bozeman, Mont., Decatur, Ill., Chicago, and, for the past 25 years, Pennsylvania State College. There he is currently head of the Departments of Electric Railways and Radio, senior classes, and teaches the junior class in general E.E. He is a former athlete and has coached in football, basketball, track and baseball at various institutions. He is a fellow of the American Association for the Advancement of Science and a member in the A.I.E.E. and I.R.E. He belongs to several fraternities and other societies. He was a 1935 medallist for Pi Eta Sigma for scientific attainment.

But to attempt to describe a man in such terms is but to caricature, coldly and lifelessly. The impress of the personality is not gauged by the names and dates. The bloodless symbols of the record book do not vivify the intangibles that are the man; there must be other words to breathe feeling into the portraiture. Dr. Woodruff is a small man, but with a breadth of shoulder befitting an ex-football player of the mauve decade. Sitting or standing—standing he is as comfortable as sitting—he is in repose. There are no meaningless gestures of the hand, no wasted motions. His eyes are bright and deep when he looks at you; but mostly he gazes into the distance as he considers what is said.

His mind is like a complex tool; not a general-purpose tool, but a highly specialized tool, shaped for one purpose only, to perform one function superlatively well. His mind shears off superfluities and retains only essentials. He cannot remember the names of his students, but he knows their features, and identifies them on the mental chart of his classroom which he constantly carries, and he grades the seats rather than the names. He does not forget the grades. At a reunion dinner of old students given him recently he could not recall a name of the forty ex-students present, but he could recall the grade of each and every one.

This is an index. Time was when he could remember the names perfectly well; at Millikan College at Decatur, Ill., and even in the early years at Penn (where he went in 1913) he could remember whole classes, for several years back. But as time went on there were so many names. They became a burden. And they were unimportant; it wasn't the name, but the character, the attitude, the response that mattered. The face was the crux of physical individuality, the grade labelled the mentality. So he remembered the faces and the grades and forgot the names.

Dr. Woodruff is an aloof man, yet a kindly and intimate man. This is the paradox. He is a retiring man, and he shrinks from the light of popular inspection. He is often torn between the

(Continued on page 108)
Universal Antenna Coupler

WICAB has been active in Naval Reserve Communications since 1927, and this made it necessary to have a transmitter capable of working in the 80- and 160-meter bands. Also, like a good many other hams, the urge to hunt for DX is quite strong, necessitating an antenna system that will work fairly well on all bands. Having acquired a new QRA recently, and desiring to keep the antenna system on my own property, I arrived at the conclusion that a 67-foot antenna with Zepp feeders would probably be the best type to use.

For a number of years a Collins network has been a standard piece of apparatus at this station, but with the advent of Zepp feeders it seemed desirable to use the regular series-parallel method of tuning them. Having only the two variable condensers in the Collins network available meant that if they were used for Zepp feeders the Collins network would have to be torn apart.

After a little thought the system shown in Fig. 1, which I have christened a "universal antenna coupler," was devised. Four standoff insulators with banana plug sockets in their ends are mounted in the form of a square about 5 inches on a side (the spacing of these insulators is determined by the length of the coils), and connected as in Fig. 1 (A) with two variable condensers between Nos. 1 and 3 and Nos. 2 and 4 insulators. For the sake of convenience the feeders are marked A and F, A being the one attached to the antenna and F the dead-end feeder. By plugging a coil in sockets 1 and 2 and a shorting bar in sockets 3 and 4 the feeders are parallel tuned, as in (B).

For series tuning, remove the shorting bar from 3 and 4 and plug the coil in these two sockets, as in (C). For Zepp feeder tuning the coil is linked-coupled to the final amplifier.

(D) shows the single-ended pi-section network. Place the coil in sockets 1 and 2, connect F and A to 2, ground 3 and 4, and couple the plate tank through a by-pass condenser to socket 1.

By using two coils, as shown in (E) a two-wire line can be coupled to a push-pull amplifier.

When a Marconi antenna is needed the coil may be placed between 2 and 4, 4 being grounded as in (F). An antenna counterpoise system may be used in a like manner by attaching the counterpoise to insulator 4 instead of to ground.

(G) shows a Western Electric antenna coupler that has worked very well on 2000 kc. The coil is untuned and the coupling is varied by tapping down on both the antenna coil and the plate inductance.

This universal coupler has been used quite successfully at station WICAB for operation on 10 to 160 meters inclusive, and it is hoped that these suggestions will help solve antenna-coupling problems for those who like to work all bands.

—Horace Young, WICAB

Band Checker

HERE is a description of a gadget which I have found handy to have around the station. It is the old absorption wavemeter in new form, and consists simply of a cardboard tube from a flashlight cell, on which a coil of No. 22 d.c.c. wire is
wound, with a mica condenser of capacity anywhere between 100 and 250 µµfd. held inside by Duco cement. Pasteboard disks are cemented to the top and bottom of the tube, and a hole is drilled in the top disk for a flashlight bulb, to which wires are soldered. The bulb is held by more cement inside. All three are connected in series, as shown in Fig. 2. The turns are juggled until maximum brilliancy of the bulb is obtained when placed near a transmitter tank operating on the desired frequency. When the correct number of turns has been determined the coil is heavily doped. Final adjustment is made by squeezing the coil together or spreading turns before the dope sets. One can be made for each amateur band used, and also for troublesome harmonics such as 53 meters, 27 meters, etc.

These pickups are considerably more sensitive than the usual loop and flashlight bulb. An indication is obtained from a low-power transmitter about 7 inches from the tank, using the proper coil. The wrong coils have to be placed almost inside the tank coil before the bulb will light. Likewise, if there is any doubt as to the crystal harmonic to which the tank is tuned, the answer is quickly obtained by holding the indicators near it.

-A Theo. J. Mesh, W1CCO

A T.R.F. Stage for the Two-Tube Receiver

THE circuit diagram of Fig. 3, contributed by Adolfo Dominguez, Jr., CM2AD, shows a simple method of constructing a tuned r.f. stage to be used in conjunction with the QST two-tube receiver (see recent Handbooks). It has been quite successful in increasing selectivity as well as signal strength, and in eliminating the "dead spots" often encountered when the detector is coupled directly to the antenna.

The circuit is arranged so that the detector coils in the receiver need not be rewound. The plate of the 58 r.f. tube is fed through a 2.5-millihenry r.f. choke, and is coupled to the detector grid through a 0.001-µfd. paper condenser. The choke should be connected close to the detector coil, not more than two or three inches from the coil socket. The detector condenser must be adjusted carefully for maximum signal transfer, without making the r.f. stage oscillate.

No band-spread is used on the r.f. stage since the tuning is not critical. The grid coils, Lg, are identical with the detector coils except that they are not tapped. The antenna coupling coils, Lin, are wound as described under the diagram. CM2AD's r.f. stage is enclosed in a metal box measuring 4½ by 7 by 6½ inches. A shielding container is of course necessary to avoid oscillation.

The r.f. gain control is useful in preventing overloading of the detector by strong signals, in addition to the other advantages already mentioned.

Junk-Box 160-Meter 'Phone for Local QSO's

MOST of us have in our junk boxes parts for which we have very little use. Being among those mentioned, I decided to do something about it. So with pencil and paper and with the thoughts of a simple 160-meter 'phone rig in mind, I started. The rig turned out to be simple, as I had hoped, and was made entirely from the junk box, except for two flashlight cells for the microphone. Not long after going on the air with it I was confronted with "how about the dope on your rig, OM?" and before long these little sets began to sprout locally on the 160-meter band.

The boys say they're FB because excess power isn't needed for local work, more of them can be squeezed in the band with less QRM to ham as well as b.c.l.-and of course the low cost makes them attractive.

The rig here is laid out in breadboard style, although many other ways will prove satisfactory. Little difficulty should be experienced in

March, 1938
getting it "perking," as the circuit, Fig. 4, is almost fool proof. Values, of course, are not absolutely critical. Any satisfactory antenna system will be OK for this outfit, the one here being a revamped 80-meter Zepp, with 25 turns of antenna wire on a 3-inch diameter form in series with the dead feeder and a series antenna condenser in the live one. The antenna coupling coil is wound on a bakelite tube that slides over the tank coil.

The rigs so far have only been in operation a short time and results are starting to speak for themselves. My own, with 1.6 watts input, has worked 75 miles with S7. One of my friends has worked 135 miles with 2.5 watts input.

---Floyd Gribben, VE3LR

On the basis of a 250-volt plate supply, the audio output of the 41 is 3.4 watts when working into a 7600-ohm load. For minimum distortion, the plate and screen input to the 78 amplifier should be adjusted to represent a load of this value. Using 250 volts on the 78, this means that the combined plate and screen current should be 33 ma. Lower current values will increase distortion and lead to overmodulation unless the microphone input is reduced. For 100 per cent modulation the dropping resistor Rs and by-pass condenser Cs must be used, in which case the combined plate and screen current should be 30 ma. Under the circumstances this seems a rather unnecessary refinement since the circuit without the dropping resistor will give 90 per cent modulation. —Editor.

VE2EE's Freqmeter-Monitor

The circuit diagram of the freqmeter-monitor described by VE2EE in “Hints and Kinks” in December QST showed a connection between the lower end of Rs and the cathode of the 56 which should not have been there, since it shorts the resistor. Also, the cathode by-pass condenser on the 56, marked “Cs,” in the diagram, should have been labeled “C9.”

Several fellows have written in asking about Rs, which appears in the list of parts but not in the diagram. This resistor was originally in the place occupied by L2, which replaced it, and should be ignored. VE2EE also advises that the 2A7 plate resistor, R3, will be somewhat better if the value is reduced to 1000 ohms.

The HH4AS Rhombic Antenna

The angles at the sides of the rhombic antenna shown in Fig. 5 in February “Hints and Kinks” should be 40 degrees. This dimension was not shown in the drawing.

Protection Against Bias Failure

This system requires an automobile generator cutout, a resistor and one-quarter pound of No. 34 enameled magnet wire. Remove the old windings from the cutout and rewind with the magnet wire. The value of the shunt resistor (Rs in Fig. 5) can be determined by calculation or experiment. The characteristics of the cutout are such that the contacts will close on 12 ma. and open on 3 ma. approximately. The 3-ma. opening current is the reason for using the shunt resistor, as will be explained later.

(Continued on page 116)
Conducted by Byron Goodman

Contests:

We mentioned last month that several of the societies are in favor of the proposals by the W.I.A. and the D.A.S.D. to have six large international continental contests each year, under the auspices of one or two of the member-societies of that continent. It can be pointed out that the A.R.R.L., DJDC, and VK/ZL contests almost amount to that now. The idea certainly seems to have merit, and we rather imagine most of the DX men throughout the world are hoping that some such arrangement is made. It should encourage some of the less active countries to be on the air.

Meanwhile, we will list some of the contests planned for 1938. Complete rules will appear in QST as they are received from the societies.

During January, the S.A.R.R.L. held its second annual DX contest. This was followed in February by the B.E.R.U. tests of the R.S.G.B., which ran concurrently with the N.A.R.A. contest, and the Coupe du R.E.F. and the Coupe de Pays de Culture Francaise of the French society. During March the A.R.R.L. holds its 10th annual contest, the c.w. portion running from March 5-13 and the 'phone portion from March 19-27. On weekends in May the M.R.A.O.E. (Hungary) will hold its contest, and the Polish DX Contest, conducted by the P.Z.K., will run from May 16 to May 30. The Third Annual DJDC Contest will be held during August, with exact rules and times to be announced later. The VK/ZL Contest, conducted this year by the W.I.A. with the assistance of the N.Z.A.R.T., is scheduled for October.

Australia:

By radio via VK2EL we learn of a decided improvement in the amateur regulations in Australia. The W.I.A. has been successful in raising the power limit of VK stations, and they now have a 50-watt maximum power limit without special license instead of the old 25-watt limit. Furthermore, the special licenses for increased power are now good for 24 hours a day, instead of from midnight to 6 A.M. as was formerly the case.

QSL:

The following correction should be made to the October list of QSL Bureaus:

Luxembourg: Service QSL de Reseau Luxembourgeois, 164 Av. de la Fayencerie, Luxembourg.

Periodicals:

We don't know if everyone is familiar with the fact that practically all of the member-societies have their own monthly publications. These range from full-size magazines to small mimeographed sheets. However, every one is interesting to other amateurs, and just in case a few of our readers might be interested in amateur radio periodicals of other countries, we are going to review some of them for you. This month we'll talk about the ones written in English.

One of the oldest and most firmly established is the "T & R Bulletin" of the R.S.G.B. The January, 1938, issue (the latest at hand) is a well-organized magazine of 64 pages, printed on...
good stock, with several photographic illustrations and a large number of sketches. Technical articles on antennas and receivers, feature articles, book reviews, and a number of departments giving personalized news of both English and British Empire stations round out a balanced issue. The "T & R Bulletin" is issued free of charge to members of the R.S.G.B. The annual membership fee is 12/6 for overseas members (about $3.50); the office is at 53 Victoria Street, London, S.W. 1.

Members of the W.I.A. read "Amateur Radio," a compact magazine of 32 pages (the October, 1937, issue). It contains technical articles on break-in operation and a low-power transmitter, material and personalized news of the members. The subscription rate is 1/7.50 per year; address all inquiries to F. H. Petittti, SU1SG, P. O. Box 254, Cairo, Egypt.

For a number of years the S.A.R.R.L. published "QTC," a monthly magazine that enjoyed an excellent reputation. However, it recently became financially uneconomical to continue with the publication, and the news of the League is now circulated by a monthly mimeographed bulletin of 10 pages or more. It deals mainly with official and social aspects of the League, leaving technical development problems to the foreign amateur magazines that are read also by the membership. Address any inquiries to Box 7028, Johannesburg.

WAC:

The following WAC certificates were issued during the period from July 1 through December 31, 1937: John B. Power, W3AXU; Kenneth Bryant Warner, W1IE; D. S. Dirden, W6ABE; Z. T. Chang, W8S2; Donald Powell, G3MD; Stanislaw Bancer, SP1FU; J. Brocynski, SP1BR; R. E. Steargold, G6BS; L. F. Viney, G3VD; C. F. Serbury, G5YU; Jan Simon, ON4AW; D. Jenkins, ZL1SM; J. R. Smith, ZL1JH; F. G. Bell, ZL28X; J. D. Parmentier, ZL2OU; Roger Baffereau, F3LE; A. P. F. Willemsa, F3SW; Cap. Louis Lasaga, XE1AR; Herman Nicholls, ZM2HY; A. H. Chipman, ON4LM; G. A. James, GSCT; T. B. Wimbush, SU9TW; Egl W. Aagaard, LA2X; Richard Uitkel, D4OUT; Rolf Taschner, D4KE; C. Florian, YR5CF; G. Wenzel, W5S0; Percy Beng, XU0L; R. H. Overton, VE2Q; Dan Summers, W6KQH; Sam D. Groos, W1MC; H. D. Bamford, W1APU; Harry X. Geitz, W3H; Henry L. Goodloe, W5GAP; Fred W. Watkins, W1F; Vernon Dameron, W8HGQ; J. P. Jones, W8AS; William M. Allison, W1FFK; George Robert Stewart (Olda, A. & M.); W5YJ; Jack C. Shuler, W6KUR; C. S. Holleben, W2BQK; Edward W. Streets, W2AEP; Frederick R. Lambrecht, W5YE; G. C. Gibson, W3PC; G. C. Gibson, W5FC (phone); Theodore B. Jacobs, Jr., W6LWJ; Joe H. Harms, W6ME (phone); Robert E. Henry, W9ARA (phone); Ross L. Bateem, W7AO (phone); Kenneth C. Bryan, K9M7V (phone); Pedro R. Casellini, LUL7BI (phone); Arthur Luchheim, W8K6; A. L. de Silvia, VP0CPD (phone); B. B. Bocchi, W6SPW (phone); Leslie M. Devoe, WDLQ (phone); Lucien Chanetonn, F37D (phone); Abdol Rahman Saleh, PKIRA; O. H. Diederberg, PK8GD (phone); J. P. R. Kanzert, PK1ZZ (phone); H. H. Vromans, PKAVE (phone); Louis Regnier, F6CP (phone); Maurice Durie, ON4UV (phone); Pierre Gilbert, F8WQ (phone); Maurice Harp, W6XGJ; J. G. Lamers, F1GL (phone); Jean Eybergen, F54KQ (phone); J. F. Verschuyt, PK1VY (phone); O. A. F. Spinder, ULYT (phone); George Oatman, W2AOE; Golden W. Fuller, W5FRR; Wm. A. MacKenzie, W1FDN; Thomas Sue Chow, W6MV; Tier Luigi Barcelloni, I1KS (phone); John C. Wildner, WBNQC; R. G. Schmitt, W6VYD; J. Gilbert Smith, W4AMC; G. E. Asch, W9BHT; Regimental Amateur Radio Station, K5AA; Larry J. Barson, W60CF (phone); Paul Krellik, W8QKE; Jerome F. Cerny, W8LOJ; John S. Davis, W6OA; Robert L. Poucel, W5ATY; B. M. Wastburn, W3AVJ; P. B. White, Jr., W3QQ; George W. Goodwin, W6QV; G. L. Robinson, W3KJ; Robert Engleman, W9OEJ; Jack P. Blundridge, W6AMQ; Winston-Salem Amateur Radio Club, Inc., W4NC; Clyde Kirby, W5FES; Jess Y. Bowman and Jerry Steyer, W6YF; John E. Nelson, W6LMZ; Lloyd C. Hoffman, W5JW; J. P. Furrier, W1PE; Chas. E. Spitz, W6PZQ (phone); Mayo McCullar, W9TUQ; A. E. Goldman, W1CS; Marc Espanol, F3CP; R. P. Freemont, W1P; F. J. G. Zuidema, W5N; George G. Sartor, F4GQ (phone); H. C. Raffa, G6RF; D. A. Richardson, 2ZB (phone); H. Haycox, ZS1AV; Rene Jourdan, F3LO; Yasuo (Continued on page 88).
THE Maxim Memorial Station building will be progressing rapidly toward completion during March. The equipment for W1AW, according to present plans, will be installed during April and May. Many of the several transmitter units are already completed in the League's workshops. The seven-acre site for the new Headquarters station was purchased by the League last summer after exhaustive studies of the available locations. The Executive Committee in the latter months of 1937 opened a large number of bids on the approved architect's specifications. These details and recommendations were placed before your Board of Directors for examination. With studies and opinions completed, the President authorized the work to proceed; 65-foot masts of western red cedar (five of 'em) were set before cold weather. These provide for several long wire antennas besides which there will be erected a 350-foot per side diamond. Those who receive our field organization "family" bulletins have already noted the news on the project from the date of breaking ground in December to the point of completing the foundation in January 1938.

When completed, the station will have four complete separate transmitters, with full amateur power capability for each amateur band and provision for radiotelephone and radiotelegraph work included for each. It will be a station of which any member may well be proud.

Only four miles from the Headquarters offices of A.R.R.L., the site is in relatively open country adjacent to Hartford, in Newington, Conn. The brick and stone building is large enough to allow later addition of more equipment for frequency "marker transmissions" or other purposes. As we write these lines, we’re looking forward to favorable weather that will permit climbing those masts to complete the antenna systems. As you can guess, there are a pile of problems to be solved at every step of a station project. But within the next few months, in May surely, we'll be seeing you via the new W1AW instead of operating on a curtailed schedule in temporary quarters.

Your Board's purpose has been to rehabilitate your station washed out in the 1936 floods (W1MK) and at the same time set up a fine, suitable, and lasting memorial, to keep alive indefinitely the memory and inspiration of the League's First President. W1AW (H.P.M.'s old call), in lieu of W1MK, will soon be ready to carry on the duties and program of your A.R.R.L. stations. This advance information is in response to many inquiries from members on the progress. It will be encouraging to know that the rafters are up and the work on the radio end is well advanced.

Copying Bee participation was up 52.7 per cent, according to reports on that December activity, with interest near the all-time high! In late March those who took part will be getting back their individual reports to enable comparison with the transmitted material. Full results will appear in the next issue of QST, or the following issue.

On Harmonic Interference: It is timely to suggest that all amateurs look into adjustment of transmitters and re-check them carefully! In accordance with the regulations (Par. 381) amateur transmitters must be "as free from harmonics as the state of the art permits"... and that is today a very low value of harmonic intensity indeed.

One S.C.M. writes, "It's time for another warning to 75-meter 'phone members about their second harmonics falling at about 7900 kcs. Heard at least 15 yesterday. QSOed several and advised them of the dangers. One was S9. I listened to him on 7958 (!) and transmitted on 3925." From another, "Telephone harmonics have completely washed out our Corps Area net frequency of 3725 kcs. at times, and the Signal Office advises me that amateurs throwing an unnecessarily strong harmonic on this frequency should be reported to the F.C.C. Can't you treat this matter in QST? Trouble also on Trunk G (3625 kc.) frequency, but unable to identify them yet." The R.C.A.C. office in Washington report some difficulties with c.w. band harmonics from 3.5 Mc. likewise and amateur radiograms are being filed to notify offenders and request remedies in the speediest possible fashion.

We suggest that effort be made to clear these adjustments up, to avoid citations and F.C.C. trouble for individuals and in line with the high standards of the amateur service which has a splendid record of cooperation in giving immediate attention to such things. Improperly high grid bias and excessive plate voltage, high modula-
tion transients, and coupling to antennas of harmonic energy generated by such things is often the source of trouble. Local listening, tests with other amateurs, and careful analysis of transmitter outputs should always prove profitable . . . to all amateurs. Get the energy into your antenna on the desired frequency, operate tubes on the proper sections of their characteristic curves and get better tube life and results!

-F. E. H.

PRIZES FOR BEST ARTICLE

The article by Mr. I. L. Tilden, M.D., K6PGQ, wins the C.D. article contest prize this month. Each month we print the most interesting and valuable article received marked "for the C.D. contest." Contributions may be on any phase of amateur operating, construction, theory (DX, phone, traffic, rag-chewing, clubs, fraternals, etc.), which adds constructively to amateur organization work. Prize winners may select a 1938 bound Handbook, QST Service club membership certificate, League Emblem postcard, eight pads radiogram blanks DX, Map and three pads, or any other combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

"I Don't Want QSL from W's"

By I. L. Tilden, K6PGQ*

SOMETIMES ago I happened to run across this statement following the call of a prominent station in the Western Hemisphere—"I don't want QSL's from W's." My interest was immediately aroused.

I call to mind a very good friend of mine, a boy permanently crippled by infantile paralysis. Born and raised in the heart of Chicago's great west side, he found, not only a fascinating hobby, but a means of livelihood in amateur radio.

He always remembers my first visit to his station. Surrounded by two- and three-story tenement houses, with the roar of the elevated in my ears, I was ushered into his station.

And then he showed me the pride and joy of his life, a homemade C.W. rig, made up breadboard style of second hand parts with a pair of tins in the final, yet electrically sound in every principle. Last but not least, we spent a pleasant hour going over his QSL cards which were carefully indexed alphabetically, according to station and district, and kept in a file. He greatly DX, phone, traffic, rag-chewing, clubs, fraternals, etc.) which adds constructively to amateur organization work. Prize winners may select a 1938 bound Handbook, QST Service club membership certificate, League Emblem postcard, eight pads radiogram blanks DX, Map and three pads, or any other combination of A.R.R.L. supplies of equivalent value. Try your luck. Send your contribution to-day!

* Queens Hospital, Honolulu, T. H.

Oregon Emergency Service

Radio amateurs of Astoria, Oregon, banded together at the headquarters of the local N.C.R. unit, provided communications for that city when a storm in the Northwestern portion of the country destroyed regular wire facilities in late December, 1937. Under the leadership of Ensign Prewitt, W7AGP, N.C.R. unit commander, efficient service was rendered without a let-up for nearly two whole days and nights.

W7BDR at the key of W7GKP, the Astoria N.C.R. station, made contact through a Portland amateur with the N.C.R. personnel in that city and NTATP in Portland was the job. The Seattle N.C.R. station and individual N.C.R. members throughout Washington were also standing by to assist. W7BBO's transmitter was brought to the Astoria headquarters and BBO and W7AJM had it going in little better than an hour (coils had to be wound for the correct frequency, etc.). As radiograms piled up W7BEBQ took the surplus traffic to his station and put it on the air.

At N.C.R. headquarters activity went steadily forward. W7CBA took another batch of the surplus traffic to his station and moved it via 1.75-Mc. 'phone. Regular Navy operators from NPE took a postman's holiday, taking trains at W7GKP after standing their regular watches at NPE. The National Guard kept a supply of hot coffee always ready for the operators. Wire service was partially restored in about two days, although amateurs remained ready to service in the remainder of a week due to danger of floods and slides. It was a job well done—in orderly, efficient fashion.
Briefs

Radio amateur members of the employees club of the San Joaquin Light and Power Corporation have banded together in the interests of their hobby. They have a station in Fresno, California, operating under the call W6HYG. Two nets are maintained, one on 1960-kc., phone, one on 3722-kc. c.w. Members of the group are W6OBT, FKX LDE BKC KOB MIU LQU AHI, NEW LBM QX JMW JDU CVL IYLDXG EAE DTONP LLI. An independent power source is being planned for the Fresno control station (W6HYG) to improve emergency facilities.

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A hook-up consisting of W9YPX, Isle Royale, Mich., W9BBN, Grand Marais, Minn., W9DOQ, Duluth, Minn., and W9DCM, Minneapolis was functioning on December 31st, ready to render whatever service was needed in the worst storm that section of the country had seen for some thirty years. The circuit brought news of the safety of Isle Royale residents and reports on food conditions and damage at Grand Marais. Ice covered all communication and power lines but the wind let up before more serious damage could be done.

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With wire communication disrupted by a severe sleet storm on New Year’s Eve a family at Gillsrock, Wisconsin and W9DCM, Minneapolis was functioning on December 31st, ready to render whatever service was needed in the worst storm that section of the country had seen for some thirty years. The circuit brought news of the safety of Isle Royale residents and reports on food conditions and damage at Grand Marais. Ice covered all communication and power lines but the wind let up before more serious damage could be done.

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Jammed into Times Square, New York City, engaged in the New Year’s Eve celebration, WARTX was surprised by a lusty CQ from a tin horn at his elbow. The natural inquiry, “Say, bud, are you a ham?” brought the reply, “Sure, 20M—who are you?” and thus started a QSO amid the bedlam of the occasion.

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Due to the fast work of amateur radio, VE1EB, who is Division Supt. of Government Telegraphs, was able to complete the installation of cable between Grand Manan Island, Bay of Fundy, and the mainland before winter arrived in earnest. His order for submarine cable, two miles of it, valued at $100,000, was placed with an American company. The cable is being planned for the Fresno control station (W6HYG) to improve emergency facilities.

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On December 28, 1937, due to a sudden moderation in the temperature in Western Canada, numerous and severe snowslides in the Rocky Mountain district resulted in disruption of wire communications. The C.P. and C.N. Railways each had but one line from Toronto to Vancouver and amateur radio was called upon to assist with the traffic load. A group of 14-Mc. ‘phones provided communication from morning until late afternoon when wire service was restored. Stations cooperating were VE6LX and VE5EO, Toronto; VE5HA, Dryden; VE4TM, Calgary, Alta.; VE4NI, Winnipeg, Man.; VE4BD, Biggar, Sask.; VE5CR, Vancouver, B. C. Every message handled was checked back to the sender, making a 100% efficient circuit.

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Traffic for OX2QY, the MacGregor Arctic Expedition, Raindeer Point, Greenland, is being handled via W2BBR. W2CIF handles the traffic for OX2QY and OX2QY handles the traffic for W2CIF. OX2QY uses 14,368-kc. and also schedules WSCJJ.

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South Carolina 'Phone Net

South Carolina has a “160 meter” phone net operating on 1960-kc. each Sunday at 8:00 a.m. EST. W4EOZ is Net Control Station. Divided into four divisions, Northwestern, Central, Eastern and Southern, the net includes W4EJK, W4ETC, W4EZF, W4DRB, W4EOO, W4EGH, W4CHD, W4ETF W4DQY (OPS), W4EOZ, W4BNN, W4BDG, W4EHI, W4DPN, W4CUS and W4FAL. W4EOZ calls the division control stations and receives report on all stations present, then any traffic coming through is handled, being relayed to stations in the most advantageous locations. Control stations maintain schedules with W4DVZ, North Carolina, W4OX, Georgia and W4DOG, Florida, as outlet stations. A number of the net members also operate 28 Mc. phone and relay distant traffic on that band.

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A DE LUXE EMERGENCY LAYOUT

This is station KINT, complete in every detail and ready for emergency service, including 30-watt transmitter, receiver, gas-driven a.c. power plant, collapsible dural antenna masts, and all associate gear. KINT is one of the several stations in the emergency network of the Los Angeles County Flood Control District. A. M. Kennedy, W6KQ, is radio engineer for this network, which comprises both fixed and portable stations. The key station is KIY, located in downtown Los Angeles; 2726 kc. is used for voice work, with a special frequency of 3190 kc. for c.w. operation from the small stations when they cannot be received on voice during the daytime.

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W8JKJ feels that more careful identification should be made by operators on the ultra-high frequencies. Not only should the call be clearly identified but mention of location would also be helpful.

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A new city ordinance in Detroit, Mich., requires that any device or machine which causes interference to radio reception, or to transmission of any program broadcast by radio, must be corrected by suitable filters, shielding, etc., or the use of said device or machine must be discontinued. This ordinance is not directed against radio transmitters and does not affect transmitting radio amateurs or other F.C.O.-licensed stations. Detroit listeners (amateurs and B.C.L.'s alike) who are troubled by man-made interference can obtain relief by notifying the Supervisor of Radio, Detroit Police Department.

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O.B.S.

The following is a supplement to the list of A.R.R.L. Official Broadcasting Stations in October QST (page 50): W2LZL, W4V2Y, W4DQY, W4SN, W5BEC, W5EST, W5KQ, W7GHL, W8SOX, W8BD, W8UN, W8JRI, W8MEU, W8EC, W9OCX.
Michigan Emergency

DURING the afternoon of December 31st a steady rain was freezing as it fell. By nightfall all wires had a coating of ice at least one inch in diameter. WSFTW was advised by a number of operators at WPV, the Detroit Edison Co.'s radio station, that it was decided that this was the best place to get information on ice conditions in the district. The Port Huron District Supervisor of this company has offices in the same building as the radio station. After a phone call through these offices aided them enter board in the radio station, the following conditions were determined: (1) Several high-voltage transmission lines were down in the Thumb district. (2) There was no wire communication with towns to the North. (3) The power company was not very concerned about the breakdown at 11 P.M., December 31st.

WSJIKO and WSDEP got together at 12:55 p.m., January 1st, and immediately a broadcast was put on the air clearing all channels for emergency. The 1.75, 3.5 and 7-Mc. bands were monitored for any possible weak signal from any amateur who might be trying to get out. WSBR and WSNI worked together; while one operated the station on 3.5 Mc., the other monitored the 1.75-Mc. band. An amateur in Deckerville, Mich., one of the stricken points, did his best to inform the public as to conditions. WSDEP contacted the W. U. Traffic Department and found that they had several messages they were glad to get to radio, if a reliable contact could be made. WSNIV and WSCEX were immediately notified of this. While WSJIKO, WSBR and WSDYH were attempting to get through, WSCEX received a personal call from WSCHP of Pigeon, Mich., which is located in the stricken area. Whenever the need of his station he immediately left for home, arriving around 2 A.M. Upon his arrival he immediately contacted WSCEX and made a schedule for the next morning.

At 9:30 A.M. on January 2nd, WSDEP was informed that a direct contact had been made with the stricken area through WSCHP. Western Union filed a number of messages with amateur radio. WSDEP took this to WSCEX and assisted him in getting it through to WSCHP. After WSCHP had cleared the traffic he drove two miles into Pigeon and contacted the Western Union Manager at Bad Axe over the only 'phone line working, and succeeded in getting the messages to him for delivery.

On the afternoon of January 1st, WSIL reported that the power company desired to get in touch with its Bad Axe, Mich., power house very badly. He considered taking a portable rig up there. WSJIKO notified the members of the 3600-ke. A.A.R.S.-A.R.L. Net. This net then established contact with both 3.9 and 1.75-Mc. stations in the district. The Port Huron District Supervisor of the power company was not very concerned about the breakdown, and that the Western Union wires were back on 1.75-Mc. 'phone. One minute later he was in contact with both 3.9 and 1.75-Mc. stations at any rate of his station he immediately left for home, arriving around 2 A.M. Upon his arrival he immediately contacted WSCEX and made a schedule for the next morning.

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WSDEP (SC.M.) and WSJKO

**Briefs**

Alphabetical QSOs are the latest in the coincidence line. At 1:50 A.M., one morning, W6NRE signed off with W6IWIY on 1.75-Mc. 'phone. One minute later he was in contact with W6JWY.

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Frank Chiron Spoon, K7GLD, at Shegong Creek, Alaska, is believed to be the first Eskimo amateur. He maintains several schedules and is reported as being an FB operator.
The Montreal Amateur Radio Club's booth at the "Produced in Canada Exhibition," November, 1937, is a lesson in good planning and execution. The M.A.R.C. and Les Amateurs Canadiens-Francais de la TSF combined their efforts in representing amateur radio at the Exhibition. Each club installed a separate station so that dependable communication for demonstration purposes could be maintained between the two stations in case events were not favorable for outside contacts. VE5Y loaned his station for the L.A.C.F. booth, while the entire shack of VE2DE, Quebec S.C.N., was transported to the Exhibition as the M.A.R.C. exhibit. The usual message was handled and various members of the public were permitted to "talk on the air." Ham parts were on display as well as numerous signs (out of view of the camera) regarding messages being accepted, the object of amateur radio clubs, etc. Amateur radio was given added prestige in the Montreal area due to the efforts of the two clubs.

Hams Afloat

WYFTL is aboard the U.S.S. Tatnuck, NETQ ... W4BYS is Sparks on the Tug Cadmus, WQBL ... W4CPL is on the S.S. Colorado ... Chief on the S.S. Seminole, WNOX, is W1CDF ... WFOH operates WICB, S.S. Brasso ... WIFBX is on S.S. Delag, KITQ ... The rigs on the S.S. Shawnee, WOBG, are a 500-watt Spark and 50-watt tube set—L and W—W1IUW is Chief, W1JOB second op., W4EKB third op ... W8CLL was on the Tug Sulphur, KENQ, on the Great Lakes for the third consecutive year ... W1MS is third mate on the freighter S.S. Tulian, out of N.Y.C. ... W9QV is operator on S.S. Fadey, KECQ, flying between New York and about twenty ports in Western Africa ... W9AQ is third operator, S.S. Escambion, New York and Mediterranean Sea ports ... W9ETB is third op., on S.S. American Banker, New York and London ... W6ISG is operator on WLLF, a fishing boat out of San Diego.

VE3LY is reputed to be the only ham in the world who has worked all four members of the "Caveney Family"; VE3GG, VE3KB, VE3BB and VE3ADZ.

March, 1938 61
How's DX?

How:
The month of March may mean various things to various kinds of people, but to a ham it means only one thing: the DX Contest! And since you people have been so kind in helping out this column with your reports and tips, we felt that we would like to tell you how to win the contest. We aren’t kidding when we say that you'll surely get somewhere if you follow our suggestions, but we aren’t saying where you’ll get . . . .

First of all, you’ll want an electric razor. After seeing some of the advertisements, we're sure that it will be just the thing to use, shaving while you're pouncing brass with the other hand. Connect the razor across the primary of your plate transformer so it will shut off when you turn off the transmitter, or else you will Q5M yourself. If the ads are right, you can even wear your dinner jacket, but this is no real advantage from a radio standpoint.

However, with your well-groomed appearance (and possibly the dinner jacket) your YF or mother should have no objections to serving all of your meals at the operating table. It's really amazing how her attitude will change as long as you remain neat and tidy, and you'll gain time by having all of those meals at the table. Be honest: can you sit through a whole meal at the dinner table when you just know that you're missing some prime DX? Of course you can’t.

Another good trick is to build up a beautiful friendship with a doctor, and then get him to testify that the reason you didn't show up at the office that week was because you were very sick. In this way you won't lose a week's pay, and it will help to explain the black circles under your eyes on Monday morning.

However, from the operating standpoint, there is one very simple way to beat your competitors, and that is to score more points. This can be done in a number of ways, but we can’t tell you now because there's . . .

Where:
That 7-Mc. gang really kicked through this month, and a couple of the best-looking ones are reported on 40. WSATR reports contacts with LXXAS (7142 kc.) at around 4:50 p.m., and Z9AA (7293 kc.) at 5:30 a.m. Some one may be kidding us, but W4BRB reports FU2X (7040 kc., T3) as an officer in the French Foreign Legion, QSL via F8BB . . . . . . . W8DFY reports FQSAB (14,255 kc.) as a fellow who doesn't like to be called slowly but at about 25 w.p.m. His tunes from the middle towards the high end . . . . . . . Many are wondering about the authenticity of I7AA, ex-17FY (14,410 kc., T9), at Addis Ababa, Ethiopia. He's OK, and your card can be sent care of the Italian QCQ Bureau . . . . . . . For the 'phone men, W6FY recommends VR2FR (14,145 kc.) at around 6:30 A.M., CST . . . . . . . J2JJ (14,300 kc., T9) tells us to look for VRAAD (14,260 kc.) and VQSA (14,370 kc.) . . . . . ZB2A (14,270 kc., T9) reported by many, and supposedly in Gibraltar, is quite possibly a phony. At any rate, the RSCG knows nothing about him, and they're supposed to be forwarding his cards. According to G6WY, it is very difficult to get permission to operate a ham station in Gibraltar. "Ham" also tells us about EA9AI, CR6AF, PX2A, and SV6SP (Creté), all on 7 Mc. . . . . . . W5GKZ says to get on 10 if you want Guatemala: TG6AA (28,450 kc., 'phone) . . . . . . . ER1USB says to listen again soon, on 40 with a pair of 204A's. It says VP4AA (7025 kc., T2) is the station of the British Guiana Expedition, in the Amazon River valley about 1000 miles south of Georgetown . . . . . . . YN1AA (14,400 kc., T8) says you can save yourself money by not sending him U.S. stamps or international reply coupons. The U.S. postage is of course n.g. and the postoffices do not honor the reply coupons. He has about $5.00 worth of the latter right now . . . . . . . There has been quite an influx of "phoney" the past month or so. Some of them, like B4UP, B2A, and the like, make no pretense and freely admit that they are aboard a ship somewhere. Incidentally, B4UP told us the other day that he's retiring soon, after 5 years of brass-pounding on the seven seas. But the guys that are in our hair are ones like the fellow somewhere around Washington, D. C., who was signing Y2ED on 20, or the youngster in Richmond, Va., who has been signing HRSKA, HR5AK and KS6DEN, on 20. We also learn that VR2AB and VQ1AB were phoneys. We hope those smarties will be sporting enough to stay out of the DX Contest and not waste everyone's time . . . . . . . They don't all get away with it. The fellow who used TF1A for a while has been turned over to the F.C.C.

When:
That 3.5-Mc. band we have is turning out to be OK as far as DX goes. W8LEZ worked ZL1DI, D4RT (3518 kc.), and a number of K7's . . . . . . . W7FPN worked ZL1DI (3625 kc.) and ZL2TP, and heard ZL3N1 (3670 kc.), ZL2FG, and ZL2FR (3625 kc.); and W7FBK worked ZL1DI, ZL2TP, and ZL1EQ . . . . . . . W3EWP heard ZL1DI, ZL2FR, and ZL4AF (3900 kc.) around 5 A.M. and has worked G6WY (3545 kc., T9), Europeans heard there include G6HB, G6EB, DAGAD, HB6C, B9HU, B9AA, B9AS, H9BC, H9CK and ON4AU, between 2500 and 3650 kc. . . . . . . W3EPD worked D4RT and HB8AS

W2GTZ SPECIALIZES IN ASIAN CONTACTS
Reece Strock, W2GTZ, is an old-timer in ham radio. He started in 1913 with a spark coil and the call 9U4Y, and ended up with W2GTZ and a pair of 46's in 1932. The present rig uses either crystal or EGO, and ends up with a pair of T200's in the final, feeding either a 2- or 3½-wavelength Zepp. The ½-wave Zepp slants, and is used for Asia mostly, the longer wire filling in in the other directions. A sked with V6GSA has been kept for over a year with only 2 misses, and Reece made 114 Asian contacts last year, which isn't too bad for a W2.

(3525 kc.), and W5KWV got ON4AU and G6BB . . . . . . . W1ZI worked 16 countries on the band last winter with 25 watts to a 656L oscillator, and did fair to surpass the performance this time. Most consistent so far are G6WY, DEFY1, HB8AS, G2ZP and G6RR (worked 11 times) . . . . . . . The 75-meter 'phones boom in over here according to G80C and ON4HS, and they remind us that most of the Europeans are not allowed to operate as high as 3900 kc. They suggest that the W 'phones look around once in a while for some of the DX that hears them. It almost appears that the 7-Mc. bunch is ganging up on
some good ones, the latest including 17 AA, CR7 AY (14,030 D4NRF and others ... J2KX (14,340 kc.), J2OV ZU5AQ, SUlWM, ES5D, PY2KX, UKlCC, PAOAZ, ... W5GAI reports VP3TEV (14,430 kc., T9). QSL via VP3BG. Incidentally, the YFS's fist is hard to read, and the boys are still arguing whether his call is STEV or 3TEST. At least he doesn't have to go to "swinging school"! Just in time to make this issue, W2GAI drops in with KAIQL (14,350 kc., T9), VS6AO (14,340 kc., T9), and G5DO (14,300 kc., T9) in the Channel Islands. Heard was ZD9H (14,310 kc., T9) in St. Helena. Jeeves, warm up transmitter No. 7 and swing the beam to 77° east of south!

Reports on 28 Mc. are practically all month but we feel that it is because there is nothing really starting coming through, with the exception of one or two mentioned above. However, the band is in good condition, as evidenced by a long list submitted by W3AKX. The list includes stuff in five continents and some nice ones like HR5O, SV1CA, CE2BE, HJ4EA and a raft of Europeans and K6's. Ten will probably be pretty hot during the Contest.

V7EVN, CASPER, WYOMING, HOLDS W.A.S.

All but three states were worked on 3.5 Mc. Rhode Island, Nevada and Vermont were snagged on 7 Mc. Transmitter uses a 47 crystal, 46 doubler, P.F. 10" final, running at 60 watts output. W7EVN is also an enthusiastic R.C.C. member.

Nothing much of DX contacts on 5, but the boys are still at it. CM7AB has staa down there, on 57, 600 kc., and will be looking for W's. . . . . . W2KKB is on in the mornings, and W7SEV is on in the afternoons. . . . . . .

**What:**

W9EZJ brings up a topic that may bear a little discussing. It is this business of the fellows with the rotatable "beams"

The average gain is usually not more than one or two "S" points, and ordinarily that won't make much difference. Remember, this is the gain over a straight antenna, not the front-to-back ratio. The front-to-back difference is of course else can, you'll probably need a fixed array with its greater...

**Who:**

W8TH ran into a 'phone signal on 14,120 kc., the other evening, and the operator had a marked Oxford accent.

"Ah," says Reg, "a G." When the fellow signed it was J2NG, in Tokyo. Reg raised him and found that the accent has been acquired during seven years of school in Australia. . . . . . . The first WAS in Argentina will go to LU7 AZ if . . . . . . . . W9JZJ says Reg, "a G."
answer many calls. A letter from DeMont Stevens, at Jedda, says that he is on the air for a mining company with three 30EX's. Some, but you're wasting your time if you call him when you hear him testing. The Arabian government only licenses them if their transmissions are confined to within the country. Woe is us! . . . . . OA4AB, well-known "phone, is back in the States and will be signing a W2 call. W4MB has only 457 different Europeans to his credit, including 185 different G's. And incidentally, he has worked G2YL, J2IX, HC1FG, V59YL, and K5M2K—all he needs is an African YL for a YL WAC . . . . . Some nice work at W6KUT includes contacts with YN2A, HC1FZ, YV1AK and YS5A, bringing his total to 77 countries . . . . . With his usual nonchalance, W9KG tells us that he has completed WAC on 40 with stuff like K9AV, J2MO, HR4AE, YS1FM, ZS1CX, HKJD, a flock of EU's, and Europeans including ES, I, EA2, and HB. The 14-Mc. list is a mile long, and includes VU2FX at 9 P.M., VQ4CHS, OQ4AE, V8STM, VY4AX, CN1ICH, KA1AX and N2RT. Keut still has a "Missouri KW" of 18 watts to a pair of T90's, and an even 100 countries! . . . . . HK1X is now HK5A . . . . . W2IXY keeps a 'phone sked with VU2CQ three or weeks a week, and says he didn't sked V59TH as erroneously reported here, but did sked G9PL and OA5AT. The other new working W8JSU hauled up to 40 and worked GM8AT, daylight all the way. He spent the day 100 miles away, pulled back in the evening, got on 20 and his first contact was GM8AT, darkness all the way. It looks like he needs a new receiver and the advice that 40 is darkness band and 20 a daylight band, or something . . . . . W9QHJ worked K9ML (14,435 kc., T9) for WAC at his new QTH . . . . . A welcome report from W5VV tells of his latest, such things as T6C (14,290 kc., T7), Z2ZI (14,460 kc., T9), V112EO (14,580 kc., T9), V99AS (14,125 kc., T9), F958VX (14,440 kc., T9), 17A and others. His total is 100 countries worked, with only 68 confirmed. The thing has reached the point where he is practically off the air—he's in an effort to raise money to buy postage to send letters to get those delinquent cards Wtiner has sold most of his transmitting gear! . . . . . Here's another new one, reported by W3CBT: 3M5AD (29,190 kc., 'phone) in British Samoa. Boyd also worked 7G9AA . . . . . Some of the W1's have decided to enter the contest after all. Yes, W1FH, that pernicious threat, should be out of this year's contest. Wedding bells ring Feb. 27th, and for future reference after your confirmations have been returned to you. Please send postage to cover the return of your confirmations.

A.R.R.L. Headquarters Operators

Hal Bubb, "Hal," Chief Opr. WIAW.

DX Century Club

CENTURY CLUB membership now totals fifteen, W6GRL and W8DFH having recently received their certificates. Congratulations to these new members! "Ham" Whyte, G6WY, is back at the top of the list with a healthy lead. W8CRA has a good grasp on second place. A number of the "under 100" group are moving rapidly towards the century mark, W9KG having only three more to go. We look for several new club members within the next few months.

Check over your confirmations in accordance with the January QST list of countries and send them in as soon as you can present 75-or-more. When sending your confirmations, please accompany them with a list of claimed countries and stations representing each country to aid in checking and for future reference after your confirmations have been returned to you. Please send postage to cover the return of your confirmations.

MEMBERS, DX CENTURY CLUB

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<th>Countries</th>
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<td>W9KG</td>
<td>97 W3EUV</td>
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<td>W1F5</td>
<td>96 W6ADP</td>
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<td>W9FST</td>
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The following have submitted proof of contacts with 75-or-more Countries:

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For the information of those searching for a Delaware contest for W.A.S., we print a list of Delaware stations: WSSL, HK WJ DQ A18 A1W AIW A1K A0P ARM BBP BAK BTQ CPQ CIZ CHJ CUER CWF DIA DRO DMO DMP DNV DNF DNH DNI DNN DNO DOA DHA DQO DRD DRE DSQ DTD DZK DUA DUK EGN EGY EIH EIX EJA EJS EBU EBT EYM FIA FNI FFF GCO GFW FIK FJK FIKI FKT FTO FUW FVX GAU GENG GFD GQQ GGW GVG GYQ GZH HBE HBR HDA HIF MA DTO DZ5.

W2KGN points out that QRK? means, "Do you receive my signals good?" This does not necessarily call for an RST report. QRK? can well be used during long QSO's to check occasionally on whether the other fellow is receiving you OK. QRK? (without the question mark) means, "I receive you well. Your signals are good." W2KGN suggests RST when we desire a actual signal report.

W2SB worked UPOL, the Russian North Pole Expedition, on November 8, 1937, 8:52 to 9:10 P.M. EST. The expedition's frequency was around 13,900-14,000 kc., o.w. W2FBN made contact immediately following W2SB.

Station Activities on page 100
CORRESPONDENCE

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

"The Amateur Is Progressive"

251 Lafayette Ave., Grantwood, N. J.  Editor, QST:

I agree heartily with your reply to the letter by W2GTW in your February issue. When I read such letters it makes me wonder just what some of these boys are getting out of their hobby. If the old adage, "You only get out of a thing what you put into it," holds true in these cases, they certainly can't be getting much. Luckily for them, however, A.R.R.L. is putting in enough to make up for their failure to do so. They spend their time worrying about losing a kilocycle and criticizing the activities of the League, which has made possible the comparatively large number of kilocycles that we now have, without doing anything themselves to warrant the use of same. I hate to think just how many kilocycles we would now enjoy if all amateurs had been, and were now, as selfishly non-progressive as such letters indicate.

The third rule of the amateur's code is, "The Amateur Is Progressive." This should mean, I believe, not only that the amateur should keep his station abreast of science but also that he should keep himself abreast of the times by digestion of as much of the knowledge of the science as is practical, and by as much personal experimentation as his finances will permit. Where would the amateur be now if he had taken such an attitude toward 'phone in the pre-'phone days as this writer (W2GTW) takes toward television?

I believe that I have as much authority as W2GTW and a much more scientific attitude when I say that most amateurs are heartily in favor of the "publicity" on television as articles on model airplane control by radio. The amateur will never lose a kilocycle through his aid in the development of television, but he is very apt to lose several if he fails to keep up the good work of technical advance. The advancement of the science and aid in communication emergencies are the only excuse for the amateur's being. Lacking these, the amateur must gradually give way to more pressing services. With these, he will last indefinitely and need waste no time by worrying over a lost kilocycle.

—H. G. McCann, Jr., W2KWK, ex-W1KAM

Vote of Thanks

85 Overland Ave., Bridgeport, Conn.  Editor, QST:

I wonder how many of us realize the swell job being done for us by our QSL bureaus throughout the country.

If all the rest do their volunteered duty as well as our W1BGY, I sincerely believe we all owe each and every one of them a hearty vote of thanks.

We can all do a small part to help our respective district bureau by seeing that he has one of our stamped, self-addressed envelopes in his office, that he may attempt to keep his files up to date. You might say, "I do not work any DX; there are no cards for me." But don't forget, there may be a few "heard" cards for you.

Nothing brings quite as much happiness and enthusiasm to the "non-DXer" as a heard card from some remote country.

So fellows, let's get behind our local QSL bureaus and send them some envelopes and take advantage of this really fine service.

—Charles A. Taylor, W1DOV

Maybe It Was Two Other Fellows

14 Briton St., Jersey City, N. J.  Editor, QST:

. . . It is not very unusual for stations to work each other on schedule using their second harmonic, but when a harmonic and an image frequency come into the picture through the medium of QSO's then you have something. The 160-meter c.w. band is dead enough at night, but in the afternoon hours it is even deader than dead. However, I used to operate there quite a bit. One day I heard a CQ going on and decided to call the fellow. I got him and he turned out to be a fellow cityite living a little more than a mile away. As I have said, we had about twenty chats when one night he decided to drop over and carry on a ragchew in person. Well, our conversation led us to learn that all the time he was transmitting and receiving on 80-meter c.w. and I, at the same time, was transmitting and receiving on 160 c.w. It turns out that he was copying my harmonic and I was getting his image frequency. Neither had any knowledge of this, and at no time did we make a schedule. When one heard the other calling...
a CQ he gave him a shout. At all times the signals were R99 plus at both ends. - Charles M. O'Brien, WE2QS/WDQY

They Do Work
16 Windsor Road, Somerville, Mass.
Editor, QST:
Who says that directional "CQ's" do not produce results? While QSO with ZS2A this afternoon on 14 mo. he asked me to QSP three messages concerning schedules, particularly on 28 mo. to W9DXX, W6JU, and W7AMX. At my consent, the message wiggled off ZS2A's "bug" in one—two—three.

After a short rag-chew we signed off, and I tackled the job of delivering the messages immediately, so that the schedules proposed therein might be kept by the recipients. Starting up the transmitter (the buffer being used as the output stage with only 165 watts input) I tried a directional CQ. He gave him a shout. At all times the signals were R99 "Alice" took her message solid the after this CQ, and W7FH was heard on the edge of the band already to be found on the other end of the band, the transmitter was shifted to 14,388 kc.

During the three-way QSO that followed W6JJU's "bug" in one—two—three.

The Tulsa Amateur Radio Club in the January, 1937, issue suggested a method of bringing unlicensed 5-meter operators within the law and aiding prospective amateurs in the following plan is a modification of the one submitted by the Tulsa Amateur Radio Club:

1. The exam should be easy, consisting of questions on ultra-high-frequency theory, transmitters, antennas and on amateur procedure as well as knowledge of the code including numerals and some punctuation marks.
2. The term of the license should be no more than one year during which period the operator would be required to pass the Class B exam or forfeit amateur privileges until he does so.
3. The band should extend from 120 to 130 Mc., with further development of equipment even higher frequencies could be used.
4. Only cw (types A-1 and A-2 emissions) should be permitted with 100 watts maximum power since the purpose is to enable the operator to learn the code—not DX.

5. The call could be designated by four numerals, the first being the number of the call as assigned by the operator.

Even with low power and directional antennas distances of 10 miles or more could be worked. Perhaps "bootleggers" would be reluctant to leave 5 meters but radio clubs would be much more willing to report "bootleggers" if they could go to the higher frequency band. Perhaps modifications of this and the other plan would be acceptable to the A.R.R.L. and the F.C.C. if enough support were given it. It would be valuable in training future hams and would aid greatly in cleaning up the 5-meter band and stimulate interest and investigation of frequencies above 60 Mc.

—John G. Dodds

DX Test Technique
Tarboro, North Carolina
Editor, QST:
That letter "Hams and Peace," by WSQN, on page 52 of June QST, with its accusation that hams were doing nothing at all to further the cause of peace, would rather make it appear that the W.F.S.R.A. has been lying down on the job as far as advertising itself is concerned. We have been coming along lately, now having members in 15 countries and 4 continents, and expect to go WAC in membership shortly. In England things have been going even better than here, and there are now more members of the W.F.S.R.A. in England than there are in the United States, much as I blush to have to admit it. In England Mr. Arthur H. Bird, G6AQ, is in charge of W.F.S.R.A. affairs, with the title of Hon. Secretary for Great Britain and Ireland. His QTH is 35 Bellwood Road, Waverley Park, Nunhead, London, S. E. 15. I am still the world secretary, but G6AQ sits in all matters relating to W.F.S.R.A. affairs in the British Isles. You probably recall the requirements of membership from the item on page 74 of July, 1935, QST. The rules are still just the same: It is necessary simply to copy and sign the pledge and forward to me (or to G6AQ, for G members).

The W.F.S.R.A. is doing something to promote peace, WSQN to the contrary notwithstanding! I am enclosing a copy of the Membership Pledge, in case you wish to quote it. —Duane Magill, W6DQD

Emerson's Note.—The pledge: "I hereby promise that I will, to the best of my ability, make such use of my amateur station as will be conducive to international friendships; that I will never voluntarily permit my station to be used as the tool of selfish nationalistic interests; and that I will do what I can, as a radio amateur and as an individual, to promote world peace and understanding." (Continued on page 122)
One of the large radio tube manufacturers recently went on record with the statement that radio tubes had a longer period of service with the filaments always hot than when they were shut off when not in use. The principal reason given for this was that the temperature strains caused by alternate heating and cooling were the most common cause of tube failure. For instance, these strains may lead to strange secondary effects such as leakage from cathode to filament, due to rubbing when parts expand and contract. On the other hand filaments are not harmed by running hot with plate current off and may even have their emitting qualities improved.

This is in line with our own experience. It certainly agrees with the experience of the commercials, many of whom have their HRO's turned on all the time. They do this not so much to save the tubes, however, as to simplify remote control and operating procedure. For instance, some of the airlines have their HRO's located a mile or so from the operating position, where they operate on fixed frequency, unattended. Once thoroughly warmed up the temperature drift of an HRO is negligible, so that by operating with filament power always on no adjustment of the tuning control is necessary. This simplifies remote control to the ultimate degree, for there is no "control," just a stable receiver with an off-on switch in the B-supply lead.

Amateurs do not operate on fixed frequency of course, but it seems to us that this idea of continuous tube heater operation has a number of advantages for the amateur. In addition to long tube life and very high frequency stability, there is the further advantage that the set is always ready to operate with full efficiency at a moment's notice. During DX contests or other heavy schedules this technique is particularly worth while. The power consumption is not an important consideration. At W1HRX (where the power is now per KWH and not per gallon of gasoline, thanks to the new pole line) the rate is about $3.75 cents. On this basis filament power for an HRO is about $7.25 for a full year, twenty-four hours a day, every day. This is also the approximate life of a set of tubes when operated as described above.

Of course, where the set is operated only occasionally, it is hardly worth while to leave the power on. Also, not all sets are designed for continuous duty, and our suggestions above are not a blanket recommendation. All National receivers can be operated continuously however, and we advise doing so. The One-Ten is a possible exception to this rule, because it uses acorn tubes.

The cost figures given above are for receiver filaments only, not including the rectifier. There is no particular virtue in leaving the rectifier on when it is in a separate power supply.

Speaking of fixed frequency, many amateurs operate in one band exclusively. Our experience has been that for this kind of work the HRO Junior is by far the best bet. When purchased with one coil range, it provides a de luxe single range receiver at no more cost than a less efficient general purpose set. Furthermore, extra equipment, such as a crystal filter, or an S-meter, or more coil ranges, can be added at any time. You can choose just exactly the equipment you need, thus getting maximum performance at minimum expense, "tailored" to fit your requirements.

JAMES MILLEN
Fader Control for Electronic Mixers

The Yaxley TRP 609 control, a special one megohm center-tapped potentiometer with a combination right and left-hand taper has won well-deserved popularity as a means of fading two high impedance circuits into the grid of a following tube.

This control embodies the new Yaxley SILENT features of construction and is well-adapted for use in high gain amplifiers because of its noise-free characteristics.

The price is $1.50 list, less knob. You can procure this part from your Mallory-Yaxley Distributor.

P. R. MALLORY & CO., Inc.
INDIANAPOLIS INDIANA
Cable Address—PEMALLO

A Feedback Compensator

(Continued from page 14)

back and simultaneously increasing the detector screen voltage, a stage is reached where signals are amplified very greatly and with perfect stability. The regeneration control is not in the least critical, which contradicts previous experience when raising the output from a regenerative rig. This result was not the one particularly sought for in our experiments, but may easily prove to be the most desirable advantage of the type of control described here. The process can be carried on past the point where the grid-leak detector is an efficient rectifier, judging from results with the experimental set-up.

SELECTIVITY

Examination of the circuit diagram shows that there are several common impedances between the first and second tuned circuits. It follows that the effective selectivity of the rig depends on the degree of coupling and the tuning of the two circuits. The feed-back compensator introduces a controllable degree of coupling in addition to previously existing couplings. Oscilloscope observation of the output, using an r.f. oscillator modulated at 20 kc. as the signal source, shows that the selectivity curve can be modified from a single rounded hump to a "square-shouldered" curve, and finally into a double-peaked curve. These are easily recognized as the series of curves obtained when the coupling of two tuned circuits is gradually increased from less than critical to more than critical values.

It would be impossible to specify the exact conditions under which any one type of curve might be produced in the receiver; suffice it to say that any one of them can be recognized by careful attention to the side bands heard, particularly when tuning through two "adjacent" signals in an amateur phone band. Certainly a phone signal sounds better with a square selectivity curve than with the sharp peak usually associated with regenerative detectors, and also found in superhets with conventional intermediate-frequency amplifiers.

C.W. RECEPTION

There appear to be at least two other effects obtainable with the circuit described above, but they were somewhat difficult to establish with any degree of certainty in practice. The first concerns only the c.w. addict with a conventional 3 or 4 tube receiver. When the feed-back compensator is carefully set in a position which substantially neutralizes the r.f. stage, it is possible to tune in a signal with the r.f. stage "right on the nose," and to have the detector oscillating at a slightly different frequency for the beat note. This trick, comparable to the single-signal effect used in all good superhets, practically eliminates one of the two beat notes heard with an autodyne detector. A small panel-controlled trimmer condenser in the first tuned circuit is very helpful in getting the exact setting required.
THE reporter and the camera-man join hands in bringing to the public the news of the day. And as telegraph wires and radio flash the reporter's story from city to city with the speed of light, the camera-man's pictures travel at the same speed, ready to make the same deadline — ready to appear in the same edition with the story.

The electron tube makes possible the transmission of news pictures by wire and radio — and in every electronic circuit — in the moderate frequencies of wire transmission or in the high frequencies of radio — the insulation must be of the highest quality. In the commercial transmission of pictures Isolantite*-insulated circuits and equipment contribute to the dependability of the service.

In this comparatively new field, Isolantite's long experience in the design of ceramic insulators for every application is at the service of its customers.

* Registered Trade-name for the products of Isolantite, Inc.
The same unique construction and outstanding design principles that account for the tremendous success of Eimac in the power tube field, are incorporated in this new rectifier. RX21 is a tube for the amateur who demands the very finest equipment obtainable; yet in cost it is well below the average for rectifiers of the same rating... (1½ amperes at 3500 volts). Ask your dealer for complete information about RX21, then compare it to others of the same calibre.

SEE FACING PAGE ADVERTISEMENT FOR AN IMPORTANT EIMAC ANNOUNCEMENT

EIMAC
RX21
$7.50

Dynamic Selectivity

The other effect which seemingly occurs at some settings of the controls is that of complete suppression of adjacent channel signals. That happens to be the goal of a lot of miscellaneous experimenting with receiver circuits here, although we have strayed occasionally into nois-suppressors, automatic gain controls, etc. The basic idea seems to be somewhat like this:

Certain adjacent-channel signals are passed through the tube to the second tuned circuit and may be considered to drain off through either the condenser or the coil, depending on whether they are high or low in frequency as compared to the desired signal. If these side frequencies could be fed back negatively to the grid circuit without feeding back the desired signal degeneratively, there should be a definite gain in effective selectivity. Study of the plate circuit impedances shows that, outside of the tuned circuit, the least current flows at the resonant frequency, and relatively larger currents for other frequencies. This discrimination against the resonant frequency can be employed usefully if the currents involved are passed through an impedance representing a noticeable fraction of the total impedances in series in the complete plate circuit.

In the circuit shown in Fig. 1, these currents must flow through the feedback coil in order to complete the circuit from plate to cathode. The coupled impedance of the grid circuit constitutes the load for the feedback currents. In a circuit using a separate primary winding for the second tuned circuit, the by-pass condenser from the low potential end might be connected permanently to point "A" in the circuit, leaving the screen-grid by-pass condenser connected to ground as shown. A previous trial of this circuit trick in various stages of a superhet failed to give a result which was not obscured by the effects of automatic gain control, circuit tuning, etc.

Some Results

The experimental three-tube receiver, using the feedback compensator, included a pentode audio stage working into a dynamic speaker. The frequencies covered were from 12 Mc. to 17 Mc. Most domestic and several foreign short-wave broadcast stations within this range drove the audio stage to capacity. Incidentally, the set exhibited a remarkable tolerance of fading and signals of different levels, possibly because of the automatic gain action of the grid-leak detector. The r.f. tube was a 954 acorn having a sharp cutoff characteristic. There was no noticeable cross-modulation from strong signals when degenerative feed-back was used, except from transmitters within a half mile. Perhaps the substitution of a variable-mu pentode or introduction of an extra tuned circuit between antenna and receiver would help to reduce blanketing by these local stations.

An Added Control

The feedback compensator described here may seem an unnecessary added control, since the same effects can be produced by other means. But...
This Newest Eimac Development Fills a Long Felt Need!

A pair of Eimac KY21 tubes operating in the conventional full-wave rectifying circuit, provides a D.C. output power of 3500 volts at 1½ amperes; regulates the flow of current by means of the grid control; provides the means to key 3 K.W. of power with the simplest low power circuit; eliminates heavy, arcing relays; permits high power operation in congested areas, by practically eliminating all "key clicks."

Eimac KY21 is essentially a mercury vapor rectifier tube to which has been added a control grid, the only tube of its kind available to amateurs, designed and rated for maximum utility, in amateur equipment. The advantages of keying through KY21 tubes is immediately apparent. Since the primary of the transformer is constantly energized, "blinking lights" are minimized. Elimination of arcing relays removes "tails" from signals more completely than an equivalent filter for primary keying. The main filter smooths the R.A.C. and eliminates "key clicks" simultaneously. Such a filter consisting of 8 henries and 1/2 to 2 mfd. will give T9X signals and permit "weights off" bug operation.

"Hams" everywhere are discarding ordinary rectifiers . . . replacing with Eimac KY21. Place your order today . . . there's bound to be a shortage.

YOUR EIMAC DEALER HAS KY21 AND RX21 TUBES NOW
Made by the men who build Commercial Communications Equipment...

THIS RCA AMATEUR TRANSMITTER IS A TOP-NOTCH VALUE

The Model ACT-150 is a top-notch performer at a price that shouts value! Made by the same skilled RCA engineers who create commercial communications equipment, it offers features that prove its quality ... features born of RCA's experience and research in every phase of radio! Look them over — see for yourself.

FEATURES

Conservative 150 watts output (c.w. and 'phone).
Tube line up of modern acclaim: R.F. — RCA 807, 802, two 807's, two 808's. Audio—RCA 677, two 6C5's, two 2A3's, two 808's. Rectifiers — RCA 83, 5Z3, 80, two 866's.
Isolated speech amplifier of special design.
10 to 160 meter operation.
Circuits fully metered including modulation indicator.
Switch for "Tune-up" protection or power output reduction.
Transformers given special impregnation.
Interlock switch for safety to operator.
Neutralized at factory.
Pleasing two-tone gray finish and handsome escutcheon plates on cabinets.
Low tube and extra coil costs.

MODEL ACT-150

Amateur's net price F.O.B. factory with speech amplifier and one set of coils but less tubes, microphone, crystal. Extra set of coils $13.50

For maximum performance at minimum cost — use RCA Radio Tubes.

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

Homebuilt Velocity Microphone

(Continued from page 55)

approximately one-half inch and the ribbon so cut as to leave approximately a sixteenth inch or less spacing on each side.

The bakelite pieces at the ends support the ribbon and are drilled to accommodate the machine screws holding the brass clamps which provide contact with the ribbon. These clamps are so bent that the ends are turned up, thus putting strong pressure upon the ribbon. A very important point is to be sure to use only well-polished brass for these contacts. If the brass is lacquered, be sure to remove the lacquer with fine sandpaper. The use of aluminum or other metals — aluminum especially — will result in poor response and low sensitivity because of contact resistance.

FORMING THE RIBBON

The task of cutting the ribbon demands a little patience, and you must expect to gouge and rip a few trial ribbons until you acquire the right touch. A half-microfarad condenser will furnish plenty of material for a great many attempts.

Place a foot-long strip of the foil upon a piece of flat and rather heavy cardboard. If there are any wrinkles, smooth them out with light, long strokes of the fingers. Place a straight edge — a brass-edged rule is ideal — over the foil so as to leave the desired width of ribbon. Press the straight edge down firmly so that the ribbon will not slip and with a steady, slow motion draw a razor blade along the straight edge. Practice on a few odd pieces will give you the knack and let
THE NEW "SUPER-PRO"

THE new "Super-Pro" with its distinctive design and rugged construction, provides "trouble-free, dependable service" so essential to the critical amateur and professional for his important and exacting air activities. Among the "Super-Pro" features that contribute to this superior efficiency is the husky, self-contained tuning unit, with its unique noiseless band-change cam knife switch. In addition, the tuning unit has 20 separate coil assemblies, with coils wound on highest grade bakelite and mounted on Isolantite bases. The tuning unit also has a shielded 4-gang tuning condenser and 12-gang band spread condenser with soldered brass Midline plates, stainless steel rotor shaft, and steel ball bearings affording smooth and accurate tuning.

Other features of the "Super-Pro" are — two R.F. stages on all bands calibrated band width (3 to 16 kc), available in table model, rack panel, or console for 7½ to 240 or 15 to 560 meters. Console model has a bass reflex sealed sound chamber and a 15" high fidelity speaker.

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Simply send down payment with your order, own one of these fine National receivers NOW, and pay balance at your convenience. Everything we advertise is carried in stock for prompt delivery. We can ship your set within 10 days after receiving down payment. Order parts, too, all under one simple extended payment plan. Write for catalog.

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Pay only $26.14 a month for 6 months or $17.74 a month for 9 months; or $11.93 a month for 12 months.

Complete Band Spread coverage, 1700 KC to 30,000 KC. Nine Tubes (not including rectifier). Two Pre-selector stages. Strictly single-control tuning. Four gang precision condenser with pre-loaded worm drive tuning, 20-1 ratio. Two I. F. stages with Litz-wound coils, air condenser tuned. Beat Frequency Oscillator for "offset" C. W. tuning. Single Signal (Crystal Filter) standard equipment, Direct reading micrometer dial spreads tuning over 500 divisions, numbered every 10 divisions. Buy now on NEWARK's easy 6% Credit Plan.

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ONLY $24 DOWN and $9.47 a month pays for this famous National Model NC-101X. And you can take a year to pay! Or, if desired, pay $8.58 a month for 6 months or $12.50 a month for 9 months. Cash Price, complete with Tubes, Crystal, and Speaker $129.00

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$179.70 CASH PRICE

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TRANSFORMERS

20462A — 750-1000 each side of center, AC, at 300 ma., weight 25 lbs. •••••••••••• $6.75
20462B — 1500-2000-2500 each side of center, at 300 ma., weight 31 lbs. ................... $5.20
20462C — 1000-1250-1500 AC each side of center, at 500 ma., weight 18 lbs. $10.95
20462D — 575-525 AC each side of center, at 500 M.A., weight 13 lbs. ....... $5.20

side of center, 300 ma., weight 25 lbs. .......... $6.75
20462C — 1500-2000-2500 each side of center, AC, at 300 ma., weight 31 lbs. ................... $5.20
20462D — 1000-1250-1500 AC each side of center, at 500 ma., weight 18 lbs. $10.95
20462E — 575-525 AC each side of center, at 500 M.A., weight 13 lbs. ....... $5.20

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FREE

MAGNETS, POLE PIECES AND RIBBON SUSPENSION BEFORE THE RIBBON IS PLACED IN POSITION

you determine for yourself how much pressure to use so that the ribbon will cut rather than tear. Cut the ribbon at least a couple of inches longer than necessary.

Assuming that you have cut a ribbon of desirable width, i.e., about \( \frac{3}{8} \) inch narrower than the ribbon slot, the next problem is to put a crimp in it. This wrinkles the ribbon slightly and gives it extra springiness so that it can be stretched when mounted and yet will respond to very slight sound pressure. The wrinkling process gathers the ribbon together and it will stretch like a coil spring. In mounting the ribbon we make use of this property to keep the ribbon snug so that the changes in position of the microphone do not cause it to sag. After crimping, a ribbon will withstand considerable pull but be careful not to make it too tight. The photograph should be self-explanatory as to method of crimping. Only slight pressure is used on the gear which is run over the ribbon. The felt mat allows the ribbon to give and accommodate itself to the teeth.

Now that you have the ribbon ready and the entire pole assembly rigidly mounted to the magnets, you are ready for placing the ribbon in position. The pole pieces should be “dodged” around slightly by loosening the machine screws in the assembly so that the ribbon slot will be straight and of constant width. The brass contacts should be in position but sufficiently loose to enable the ribbon to be slipped beneath them. Slip each end of the ribbon under the contacts. Leaving an inch or so over-extension, clamp the ribbon into the proper position at one end. You will have to pull...
You have, no doubt, found out that it is impossible to make an inductor or capacitor with zero resistance.

For reasons, which we shall try to clarify, it is also impossible to make a perfect resistor without any inductance or capacitance in it. If you just want to change electrical energy into heat you can run current through most anything, a hunk of baling wire or a barrel of salt water, and they'll both give off B.T.U.'s. But if you want a real resistance, one that has constant impedance from DC up to 30 megacycles or higher, you've asked for something.

Most people think of any carbon resistor as pure resistance. Extremely delicate measurements of several types of carbon units indicate that they have negligible inductance (if you keep the leads short) but considerable distributed capacity. This is caused by the relatively large amount of "binder" material used in most types of carbon resistors to hold the particles together in a solid mass. We have reduced this distributed capacity in the IRC "Type F" resistor by making it in the form of a thin film, less than three thousandths of an inch thick, bonded to the outside of an insulating cylinder, which is then encased in a protective Insolantite sleeve.

The result of this design is a resistor with very small changes in impedance when operated at high frequencies. Many of the "pill", molded, or extruded types of carbon resistors change appreciably and this becomes more severe the higher the resistance value; at twenty megacycles a representative molded carbon "one megohm" resistor measures only 0.17 megohm! An IRC "F-1 Type" resistor of the same initial value measures 0.7 megohm at the same frequency.

Now we also make the BT Type insulated resistor and it is an excellent job for audio or broadcast frequencies. It is at least the equal of the ordinary carbon resistor at high frequencies, but if you want an exceptional high frequency resistor we recommend the "F Type."

What good is all this? Well, try some "F Type" resistors in the R.F., oscillator, and mixer circuits of your superhet and see if they don't improve the performance. Regardless of which band you're on you can be sure that your 50,000 ohm grid resistor isn't behaving like a 10,000 ohm.

If your R.F. amplifier is cursed with U.H.F. parasitics it can sometimes be cured by inserting in the grid circuit as close as possible to the grid connection of the socket a 100 ohm Type F-1 resistor with eight turns of No. 18 wire wound on the body and soldered to the metal ends.

It will often improve the A.V.C. action of a receiver (even a broadcast receiver) to replace the decoupling resistor in the A.V.C. circuit, if it is a molded carbon or insulated type, with an F-I of the same value.

We saw a neat little grid condenser in a U.H.F. job. It consisted of two small copper plates bolted to the body of the F-1 grid resistor and connected to the ends, thus taking advantage of the insulating sleeve as a support.

Don't infer from the above discussion that you should use resistors with a flat frequency characteristic throughout a set. The insulated resistor (IRC Type BT) is fine up to, say, 10 megacycles, but for operation at higher frequencies do what the leaders do, use IRC "Type F".

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SYLVANIA
Set-Tested Radio Tubes

OUTPUT CONSIDERATIONS

The impedance of the ribbon is on the order of half an ohm. This must be matched to the impedance of the input circuit of your amplifier. If you are going to use the "mike" in close proximity to the preamplifier, say within 6 feet or so, it is possible to run the leads from the ribbon to a ribbon-to-grid transformer. In general, it is preferable to utilize a ribbon-to-line transformer, matching the ribbon to a 50- or 200-ohm line. This was mounted in the little cupola of the case, as shown in the photograph. Lines may be up to a thousand feet long without heavy losses.

The cable should be shielded and this shielding bonded to the magnet assembly and the core of the ribbon-to-line transformer. Lacking a transformer of this type, a working substitute may be found in a universal output transformer such as is used in coupling speaker voice coils in receivers. By connecting the ribbon to the lowest-impedance taps and the line to the primary of the transformer, a suitable combination may be found. A good transformer costs but little, and the better performance and hum-free operation from use of correctly designed units and good grade microphone cable are well worth the extra expense. Shielded wire may be utilized for cable, but a definite increase in gain will be observed when using the microphone cable.

Success of velocity microphones depends also upon the preamplifier used, and the manner in which the lines are coupled or matched has considerable to do with not only the gain but the hum level. A good input transformer, line-to-grid, is desirable. If you cannot afford one of the better balanced-winding types which tend to minimize magnetic pickup, use an ordinary one and if necessary place it in extra shield cans and even mount it in a position a few inches from the chassis in a spot which gives minimum hum pickup. Shielded leads, well-grounded preamplifier, and a decent input transformer mean low hum level, surprisingly good pickup, and freedom from "headaches."

As to results, the following method was used in making comparisons with other types of microphones, including commercially-available products of both high and low cost. A speaker in a remote room in the house was connected to the output of the amplifier. A number of individuals listened to the various tests. A regular alarm clock can be heard ticking some 20 feet away...

Say You Saw It in QST — It Identifies You and Helps QST
Again RCA encourages the amateur and television experimenter by making available the basic units for the construction of Kinescope deflecting circuits. These parts are of traditional RCA design, include the finest engineering features and are manufactured to give long service. They are for use with RCA 5- and 9-inch Kinescopes, Types 1800 and 1801.

**DEFLECTING YOKE**... For RCA 1800 and 1801 Kinescopes. Has windings for both horizontal and vertical deflecting circuits. Designed to have uniform flux distribution. Size: Outside diameter, 2½ inches; Inside diameter to fit RCA 1800 and 1801 Kinescopes. Length: 3½ inches. Stock No. 9831. . . Net Price $10.00

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**POWER TRANSFORMER**... For 1801 Kinescope, plate winding of 2,500 volts and two 2.5 volt heater windings. Stock No. 9839. . . . Net Price $10.00

**VERTICAL OUTPUT REACTOR**... A fine auto-transformer for matching output of deflecting circuits to deflecting yoke vertical circuit. 120 henries inductance. 3800 ohms DC resistance. Stock No. 9833. . . . Net Price $5.00


**HORIZONTAL OUTPUT TRANSFORMER**... Has extremely wide frequency response and special characteristic to pass at 13,200 cycle saw-tooth voltage. Matches output of horizontal deflecting circuit to horizontal winding of deflecting yoke. Stock No. 9836. . . Net Price $9.50

**POWER SUPPLY CAPACITOR**... For RCA 1800 Kinescope. Contains one .025 mfd, 4,000 volt unit and one .05 mfd, 3,500 volt unit. Oil filled. Stock No. 9840. Net Price $5.50

**POWER SUPPLY REACTOR**... Newly designed for Kinescope filter circuits. Ensures good regulation in power supply circuit when used with Stock Nos. 9837 and 9840, shown here. Stock No. 9838. Net Price $4.75

**RCA KINESCOPES 1800 and 1801**... Especially designed for television reception. They provide a clear picture of slightly yellowish hue. RCA 1800—9-inch Kinescope, $60. RCA 1801—5-inch Kinescope, $40.

---

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

Ask your distributor, or send 10 cents to Camden, N. J., for a commemorative advertisement on RCA's television tube announcement.
Fidelity and frequency response were checked by placing the mike in the same room with an electric phonograph and picking up the actual sound emitted from it. Using a frequency test record giving notes continuously variable from 10,000 to 30 cycles, the microphone picked up and carried all frequencies from 7000, the upper reproduction limit of the phonograph, to the deepest recorded. Similar tests on the air yielded similar results.

In direct comparison with an RCA PB-90 velocity microphone (this is the type formerly used with the 20-watt portable public address equipment and at Radio City) the home-made microphones gave a creditable performance, although the commercial product is somewhat more brilliant and has slightly higher output. All in all, the comparison was very favorable to the home product, and, considering the difference in cost, the results are most satisfactory and highly pleasing to the constructor.

A few precautions must be taken in using microphones of this type on the operating desk. They will, of course, pick up hum by induction from near-by power transformers and speaker fields. Accordingly they must be so located as to pick up minimum hum when used near receivers. Generally a three-foot separation will reduce hum to a negligible level from this cause.

However, they do allow the operator to sit back in his easy chair, to make notes at his leisure, without the necessity of holding the mike to his lips, and if visitors are present all can take part in the conversation from their chairs without stirring. At W1JXP two of these mikes are used, connected in parallel, giving a pleasing binaural effect. The pair so connected can hardly be distinguished in performance from the RCA mike previously mentioned.

Room echo and reverberation, of course, enter the picture prominently if full sensitivity is utilized. For close talking purposes the gain can cut to reduce background and room noise. Curtains, wall drapes, and bare windows all exert influence either by sound absorption or reflection. A rug hung on the wall at the rear of the operating desk and directly behind the microphone prevents, to a great degree, the reflected sound wave from the wall entering the rear of the mike and causing echo effect.

The cases shown were made from basswood, the rods are dowel sticks and the grill cloth thin silk. Little, if any, cavity response or boominess seems evidenced from the use of four instead of two magnets to increase magnetic intensity, nor from the housing.
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4th Edition

Say You Saw It in QST — It Identifies You and Helps QST
Imagine the kick...

sitting on board your "Little Betsy," 20 miles at sea and talking by telephone (just like the one at home) with your friends, your office — and other ships. Think of the safety it affords — keeping you constantly in touch with shore stations all along the coast — and then, too, — if your prize dog has pups they can call you directly from home with up-to-the-minute details. This is what our mariner looks like —

HARVEY Marine 12

Ship Radiotelephone is licensed for use on ships under patents of the American Telephone & Telegraph Company. It is compact, with crystal controlled transmitter and receiver in one cabinet — easy to operate, only one master control — range, 50-100 miles. For a more complete description write to Harvey Radio Laboratories, Inc., 25 Thorndike Street, Cambridge, Mass., for folder M12.

All in all, from pleasing appearance to fine pickup and faithful reproduction, the home-made velocity microphone is well worth the effort and trouble demanded in its construction.

The writer wishes to extend his thanks to his brother for his assistance in solving various mechanical details of construction.

A.A.R.S. Activities

(Continued from page 84)

One of the most interesting phases of the Army Amateur System is cryptanalysis, which is taught and conducted by each Corps Area Signal Officer, with experts in each Corps Area. Cryptanalysis in itself is a very fascinating hobby.

During the Christmas Holiday traffic season, KA1HR numbered originated messages consecutively from 1 to over 2000.

Using information obtained by radio, several Corps Areas work problems in locating unknown stations.

3.8% of the total number of amateurs in the United States are A.A.R.S. members; 80% of the A.A.R.S. members are also members of A.R.R.L.

On December 13, 1937, Oklahoma City vicinity suffered a severe sleet storm with ice-covered power, telephone and telegraph wires. The situation was efficiently handled by local amateur operators.

On February 5th, amateur traffic handling in Shanghai, China, was discontinued.

Another speed contest is contemplated this season, the transmission to be made from both the East and West Coast. Details will be announced later.

Briefs

WSPAJ, Clarksburg, W. Va., worked all states within about three months after getting his call; he uses a pair of tuns in the final stage.

An example of the real spirit of amateur radio is given by W1EHT. He writes, "On the summit of South Pack Monadnock, Peterborough, N. H., there have been erected two masts about twenty-five feet in height. On one is mounted a Pickard, on the other a matched impedance antenna, both complete with spaced feeders of sufficient length that by parking a car in the right position both can be used, one for receiving, the other for sending. These were erected by W1CJT and an S.W.L. named Sawtelle, and are left there all summer for any ham who wishes to use them. It is an excellent location, the mountain being 2280 feet above sea level, and only about 50 miles from Boston. Here's a chance for some good portable work, thanks to W1CJT and his friend."

The membership list of the League is not available for commercial circularizing but may be made available, in a Section or an area not exceeding one Division, for pro-amateur and non-commercial purposes, upon the application of any member and at his expense. Thus for some years past the headquarters office has supplied lists of names or has addressed envelopes for convention committees, candidates in A.R.R.L. S.C.M. and Director elections, etc., whenever requested to do so. The service is available of course to all candidates in elections, or for other worthy pro-amateur purposes. The actual cost of materials and labor is charged. Because this section of our office is heavily burdened, however, we require at least two weeks' notice to do the work,

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You can't melt graphite, but all metals melt — and before metals melt they soften. Just another good reason why Speer Graphite Anodes make better tubes. Speer Graphite Anodes do not fuse, warp or distort at any temperature. They carry heavier loads and last longer in continuous service.

When you buy tubes, buy tubes with Speer Graphite Anodes. Leading manufacturers make them. Write us for list and Graphite Anode Booklet 80.
**BLILEY CRYSTALS**

_for Every Amateur Band_

5-10-20 Meter Bands

- **HF2 20-METERS**: $5.75
- **B5 20-METERS**: $7.50

**BLILEY** has brought precision frequency control to the higher amateur frequencies. Look at the new **B5 20-meter unit** — it brings the advantages of low drift to this popular band and costs only $7.50. Then there's the medium drift **HF2 20-meter crystal unit**, priced at $5.75, that provides economical frequency stability. And for working 5-meters there's only one answer — the **HF2 10-meter (28 Mc.-30 Mc.)** crystal unit. It simplifies the construction of stable 5-meter transmitters and assures more DX by concentrating the carrier power on a single frequency. See your nearest distributor for complete information on these and the other Bliley Crystals described on this page. Bliley Electric Co., Erie, Pa.

40-80-160 Meter Bands

- **LD2 80-160 METERS**: $4.80
- **B5 40-METERS**: $4.80
- **VF1 80-METERS**: $7.50
- **BC3 40-80 METERS**: $3.35

**THE 40, 80, and 160-meter bands are covered by four precision Bliley Crystal Units.** The **B5 40-meter unit** is a superior mounted 40-meter crystal priced at $4.80. For the same low price, the time-proven **LD2 low drift crystal unit** stands first with amateurs in the 80 and 160-meter bands. With the **VF1 80-meter variable frequency crystal unit**, dodging QRM is easily performed by a mere twist of the control knob. . . . When quadupling to the 20-meter band, instantaneous frequency shift of 38 Kc. is readily obtainable. Last, but not least, the **BC3 X-cut crystal units** are an excellent buy at $3.35 for the 40 and 80 meter bands.
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Filament Voltage: 6.3 volts
Filament Current: 2.0 amps
Amplification Factor: 45
Mutual Conductance: 3500 ohms.

A Pack Set for 200 and 300 Megacycles
(Continued from page 48)

of clumsy microphone cable. The signal received is piped back to the station through a remote amplifier and telephone lines.

The reason for the receiver in the pack set is so that the one wearing the pack can receive instructions from the remote engineer, or so that when two pack transmitters are used in conjunction, each announcer carrying the pack will know what the other is saying and doing.

The receiver used in the pack transmitter was designed after an article in November, 1934 QST. The circuit diagram is shown in Fig. 2. The receiver used for picking up the signal from the pack transmitter is a National 1-10. It was found necessary to make some slight changes in the 1-10 receiver so that it could be tuned more conveniently at 300 megacycles. The removal of two stationary plates from each of the tuning condensers, plus spreading the turns of each coil, usually will accomplish this. Output transformers also were added to match 50- or 500-ohm lines, these transformers being shunted across the plate circuit of the 6C5 audio tubes. The antennas used with the 1-10 receiver are of the tuned type, being made from a 72-ohm concentric transmission cable. The outside copper tubing is an odd number of quarter wavelengths, the projecting wire being half wavelength long. In our first test quarter-wave antennas were used on both transmitter and receiver. It was found that by using half-wave antennas on the receiver and the transmitter about 4 or 5 db gain could be expected. The antennas now being used are one-quarter

1 Hull, "Practical Communication on the 244-Mc. Band," QST, November, 1934.

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chance of a lifetime. He should hold a commercial second-class telegraph license, have had plenty of experience working both DX and TFC, "know his onions" when it comes to ingenuity in making the parts available do the trick in repair work, and be able to live congenially with eighteen people in close quarters for a year and a half. Sailing experience is useful but by no means necessary; as this boat is run entirely by an amateur crew it is best to be as well-equipped as possible. Many people meet a few of these requirements but the person who is versatile has just that much better chance when it comes to competing for the berths. On the present cruise the party is made up of eighteen in all; the skipper, his wife, a small son, the cook, two girls and twelve boys. The latter were chosen from over a thousand applications. The average age of the whole crew is 22 years.

So remember, WCFT sails again in the fall of 1939 and is in need of an operator who will be chosen from amateur ranks. If anyone is interested in sailing on her get in touch with me.

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Among tests of interest that have been made was one of enclosing the pack transmitter in a completely copper-plated cabinet. The receiver was at a distance of approximately two hundred feet. There was very little drop in signal when the transmitter was completely enclosed, either on 200 or 300 megacycles. One of the most remarkable things about the 300-Me. signal is that no interference of any kind has been received, and very, very little on 200 megacycles. The reason the above frequencies were chosen was because of the lack of interference and the greater compactness possible in construction as compared with frequencies in the vicinity of 40 megacycles.

One of the most serious problems so far experienced on 200 and 300 megacycles is the variation of signal strength because of interference effects in and around metal structures. This condition seems to be more severe on 300 than on 200 megacycles. It is not noticed in the open until the transmitter is a half mile or more away from the receiver. Rapid physical movements of the person wearing the pack transmitter had no effect on the reception within reasonable distances. A tap dance was even done and described by the announcer with the pack on the back with perfect reception.

Twenty fifteen-minute periods of broadcasting using the 300-Me. transmitter have just been completed for the Kansas City 1938 Auto Show, held in the Exposition Hall of Kansas City's Municipal Auditorium. The conditions under which the ultra-high-frequency equipment worked are undoubtedly as severe as will ever be generally experienced, due to the number of large metal posts, balconies, and steel auto bodies. It was found necessary on several occasions to move the receiver to different locations during certain broadcasts. Another interesting experience was that the reception of the 300-Me. signal was very spotty even at close distances when working under low ceilings that contained a great deal of steel construction. It was found that reception was more dependable during our 6:00 P.M. broadcasts when the crowds were lightest.

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I. A. R. U. News

(Continued from page 68')

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- Speaker In Cabinet To Match Design Of Receiver

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Guy wire in the secondary and primary connections. Check the condition of the switch blades in the main switch. Now on the distribution transformer secondary or in other houses in the neighborhood, the causes of noise other than those already described will probably be from some of the following:

Source of noise
1. Secondary wires in trees
2. Loose taps at the transformer
3. Guy wire in the secondary lines
4. Appliances:
   a. Electric razor
   b. Oil burners
   c. Water pumps
   d. Floor Sanders
   e. Electric train
5. Thermostats

Now the transformer pole; first, check all connections on both sides of the transformer, primary and secondary, next the lightning arrester, then the insulators. Dry-process porcelain insulation will cause a low-pitched interference in dry weather, but in wet weather there will be no noise because of direct grounding. Cut-out boxes often leak, and occasionally the fuse in the box becomes loose.

Last but not least, check the ground connection on the transformer.

On the line, check for guy wires rubbing the primary line, burned insulator pins, loose underground services and trees which the primary line runs through. Tree noises are worst when the sap is in.

On the street-lighting circuit look for safety coils, bad lamps, bad insulators, swinging fixtures and loose fixture heads. Remember that few noises pass from the secondary lines to the primary lines, but all primary noises are heard over several secondaries. If your noise is only on in the evening, check house wiring and look for street-light circuit trouble.

The writer still uses the “persuader” system for finding the source of interference on the primary lines, and this is it:

Material: one large heavy wooden mallet, good auto radio installation.

Procedure: Smack every transformer pole and listen for results. They usually respond nicely. I have had everything from the noise disappear to transformers fall at my feet.

Results: Equipment replaced either because defective or missing.

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—providing Remote Frequency Control from operating position.

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Two frequency doubling circuits on all bands (except 160) minimize effects of load on oscillator frequency resulting in maximum stability.

Eliminates one or two doubler stages in your transmitter as power output is more than sufficient to drive a low-power stage such as RK-29's, 802's, 210's, 807's or similar tubes — directly on the frequency you wish to work.

Unbelievable frequency stability — superior to that of many crystals — obtained by use of special Hi C electron coupled oscillator circuit and dual buffer arrangement to isolate load. Rigid, foolproof construction insures against changes due to ordinary handling and usage. Maximum variation of calibration observed during 21-day actual operation at W9WW1 under varying conditions of temperature and humidity was .008% or 300 cycles at the operating frequency of 4,000,000 cycles (75 meters). Frequency shift with load variation, tested during this period, was less than 500 cycles from full-load to no-load.

Entirely revolutionary stand-by system, never before used in apparatus of this type — permits tubes to remain at essentially constant operating temperature whether exciter is in use or standing-by thus eliminating all possibility of thermal frequency drift.

Selective-Automatic operation — internal relay system permits exciter (1) to be "killed" with transmitter by present "stand-by" switch; (2) to remain in operation independent of transmitter for frequency-check, etc.; or (3) to remain "dead" independent of transmitter as when crystal exciter is being used although kept in operating condition and ready for instant use when desired. Any of the three operating conditions instantaneously available by a 3-position selector switch on front panel of unit. Only other control besides tuning adjustment is a simple "On-Off" switch.

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Every unit laboratory-tested for operation and frequency-stability on all bands.

Available with or without built-in power supply.

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he would joyously accept this supernatural event as a reward to his implicit faith. And as faith, hence the mountain - Faith in his source of supply impresses the consumer. Consistently and effectively satisfying the consumer creates an acceptance of a merchant's products. LEEDS RADIO has, for 16 years, consistently given the amateur merchandise of the highest quality at the lowest possible price. Our constant endeavor to improve our relations with you insures your receiving the utmost in service.

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Image Rejection

(Continued from page 88)

higher than is normally permissible, thus compensating for slight attenuation of the signal when the rejector is in use in the 30-Mc. band.

With higher than normal gain in the first tube, a better signal-to-noise ratio can be obtained over the frequency range below 30 Mc., with complete freedom from images.

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 United States and five Canadian districts. In order to secure such foreign cards as may be received for you, send your district manager a standard No. 10 stamped envelope. If you have reason to expect a considerable number of cards, put on an extra stamp so that it has a total of six-cents postage. Your own name and address go in the customary place on the face, and your station call should be printed prominently in the upper left-hand corner.

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W7—Frank E. Pratt, W7DXZ, 5023 So. Ferry St., Tacoma, Wash.
W8—F. W. Allen, W8GER, 324 Richmond Ave., Dayton, Ohio.
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NEW ENGLAND DIVISION

CONNECTICUT—SCM, Fred A. Ellis, Jr., WICTI—AXB, UE and AF8 made B.P.L. AXB has schedules covering the New Year's party. AF8 got B.P.L. total from Trunk Line "C." JXP reports for Connecticut A.A.R.S. that AJB has a new YL operator. New A.A.R.S. members: KAY, AMQ and AXB. KFN and HXK keep New Haven on the map. JTJ takes care of O.R.S. BDI attended Horsetraders meeting held at Middlesex HS to keep New Haven on the map. JYE takes care for New Haven, APA for Bridgeport and HYF for New London. A.A.R.S. that AJB is contesting and RM nights. His own station JTD was awarded O.R.S. covering all U.S.A., Hawaii and Canada. AFB got JBJ is rebuilding modulator with one 107 DMF, G to BAX is back on. Our sympathy to gang around Manchester. BEQ is grid-modulating a pair of 56 Mc. DJC has 100 watts on 4 Mc. remotely controlled. JRF and KSL are giving phone. KZE is new ham in Woodland operating on 1.75-Mc. circuits. For 3.5-Mc. cw, the final. GBX is building a new home and will have a special Connecticut Brass Pounders Association (C.B.P.A): BCG, JFN 431 JMY 350 (WLGQ 40) KFN 270 KV 246 (WLGI 49) Pres.; EJI, Vice-Pres.; DJC, Secy.-Treas. New officers of the hookup worked out on the spur of the moment. APZ took a trip down south, and sails for England on business trip this month. BCG is building a new rig with 805 final. O.R.S. is having a club W.A.S. contest for 1938. The leader at present is IGO. IZF has new rig perking on all bands. IKU, EJL, UJ and KHE taking part. AXB has schedules with KOU to handle traffic. KEZ is new O.R.S. prospect. There has been plenty of activity in getting new O.R.S. lined up, as can be seen from the reports. Several nets have been started, let's all stay together and keep it in motion. There is a feeling with the boys generally that traffic reports are only accepted from Official Stations. Please take every opportunity to change this feeling and urge all stations you are handling traffic to report same on the 16th of each month.

Traffic: WIGQJ 742 KOU 286 ISI 210 EWN 134 INW 114 IJS 110 IBR 64 KBN 63 KJ 45 EFR 41 JUV 28 BIS 29 FIV 3 DEH 1 KRE 4 FJ 30 CPR 237.

EASTERN MASSACHUSETTS—SCM, Sam Gross, W11WC—AKS kept schedules with emergency rig during Christmas rush. IWC is rewriting 20v. d.c. generator for 110 v. JKR runs 300 watts to a V-65. EPF needs N. Mex. station for W.A.S. on 3.5 Mc. HXK was heard in England on 56.2 Mc. BEF wishes clubs would send him recommendations for Emergency Coordinators. HXK is doing well job as Emergency Coordinator for Lawrence. JAP and KBQ make an effort to get one up to speed and getting schedules lined up. KMY's antenna let go during Christmas traffic rush. KBQ is getting Asst. Coordinators lined up in Haverhill. FDB has FB first report. JFV is new E. Mass. Wireless Assn. member. BMW is getting a break in getting B.P.L. total from Trunk Line "C." IWC had a grand time. Plans are under way for another party this year. AEW is still working the DX in spite of poor conditions. AKS, HLI, IWC, EMG, JCR and KF II made B.P.L.

Traffic: WIALS 793 HII 616 IWC 603 EMG 544 JCK 505 (WLGV 24) EPE 297 JFS 238 KH 222 BFE 220 HWO 190 JMS 182 QA 179 KEP 160 HIW 117 KMQ 115 JY 107 DMP 101 ASI-KMY 88 K8 88 HRE 76 JSM 75 AGX 74 FDB 69 QW 71 (CCIC 30) JNP 65 (WLGV 55) IQ 60 EFJ 40 FN 17 BMW-BPR 14 HIL 8 HXK 3 TY 210 JBF 91 JRU 68 JRM 5 KRM 47 JTP 17.

WESTERN MASSACHUSETTS—SCM, William J. Barrett, W1JRA—IOET leads the traffic parade with nice total. IOR is B.P.L. on deliveries. BYR is active on 1st C.A. A.A.R.S. 'Phone Net-QRG 1995 kc. Perce is also new O.P.S. ZB raised county total to 124 with HSI1B, F18AC and ZS3F. Carl breaks the news that he is soon to move to Maryland. F18W and BKQ are active on 3.5 Mc., with reporting satisfactory progress on the Super. EOB reports a new bug. AJK threatens to forsake 7 Mc. long enough to work some on up of 3.5 Mc. LKQ sends first report since last September. AKS, JRF, HAN is on when permit, which is too seldom. KEJ visited Racine gang while on business trip to Wisconsin. KFJ has joined Army and gone to Canal Zone. BNJ has new band-chwig exciters—per Oct. QST. BKQ is confining activities to 56 Mc. AJK is still up in Nashua, with only a small rig in operation. JDF is having a bit of fun in the US, where the Portland Amateur Wireless Assn. had its annual election of officers, Jan. 4th, with following results: TE, Pres.; FIV, Vice-Pres.; CRF, Secy.; GVS, Treas.; FBJ, Chief Operator. IJSF says new BDI party was a success. JFV, KNK and JRM is getting ready to go to New Bedford Bay are forming net meetings to be held over the air, Sundays. KEZ is new O.R.S. prospect. There has been plenty of activity in getting new O.R.S. lined up, as can be seen from the reports. Several nets have been started, let's all stay together and keep it in motion. There is a feeling with the boys generally that traffic reports are only accepted from Official Stations. Please take every opportunity to change this feeling and urge all stations you are handling traffic to report same on the 16th of each month.

Traffic: W1OJ 702 (WLGN 179) IOR 416 BVR 198
(WLG 225) BTV 164 ZB 126 AW 98 EOB 56 AJ 45 KJO 34 JAH 15 KJK 13 BNL 7 DUZ 5.

-CPV and KYK signed up with A.A.R.S. HCW is thinking left for Ohio to work. FCI is sending traffic covering ski and are still looking for Laconia, Hanover and Woodsville.

The NHN on 3840 kc. now includes HTJ in Portland. We ESB is now proud owner of an RME-69 receiver. HJM has to Concord and is active on 3.5 Mc. HOV has the staff of Radio Today in New York City. 2FDD moved have a tape-sending machine for Morse practice.

56 Mc. The Providence Radio Association held its annual election; GTN is again Pres., with HRC Vice-Pres. JDX have much more sensitivity, selectivity and stability.

(FI) DIV 164 ZB 126

FQG hold O.P.S. No. 13 and O.R.S. No. 13. ITK, KIN have a number of pupils for Morse practice. JFU received his first card from CW.

W2LU--W2LU has weekend schedule with 2AHC.

NEW JERSEY-SOM, Fred C. Read, W2GGM-BCX, HON and KJG are active again. HRZ is active on 1.7 and 28-Mc. 'phone and is in O.R.S. Bulletins. 3EML installed a pair of 808's and runs 600 watts input. CHX's motto is one QSO a day on 14-Mc.; he has had 238 QSO's since Nov. 14th. HFO tried a 14-Mc. beam. JAI is trying 56 Mc. as his long range plan to send traffic to a 600 watt rig. IMY is trying 56 Mc. input to a rotary beam antenna. EXR has new HRO and rig. IXY participated in 1.75-Mc. DX tests. ELK is secretary of the New Jersey Radio Research labs. KYU is new Brooklyn station, operating on 14-Mc. HHT took the final step and is now one of the...
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3EZ has a glorified oscilloscope arrangement whereby he may demonstrate variation effects of rectification, inductance, capacitance, etc., by throwing a few switches from operating position and...
and EYA are on 7 Mc. EXX has a new NC-SX. DSQ keeps the club transmitter busy on 1.75-Mc. 'phone. The W4NC gang enjoyed having the fellows there for the Floating Club meeting. QG worked the O.R.S. Party from 4NC. 1.75-Mc. 'phone net was also in operation. EXW kept a 3.9 Mc. DWB is doing a good job with the A.A.R.S. and Trunk Line "C." DCW is having fun on 3.9-Mc. 'phone. DCQ is back on after rebuilding; all his speech equipment is new. OJI has his 2-kw. air; he plans to give the other fellows a fit during the DX Contest. A11F, who lives next door, also plans to pass the fellows a fit in the contest!

Traffic: W4DPT 146 CZA 95 KB7 37 DNR 29 ALT 24 EPI 17 EQP 17 DDO 15 EQM 15 BQG 15 CQX-EFZ 6 ELW-FRM 4.

VIRGINIA—SCM, Charles M. Waff, Jr., W3UVA—P.A.M.—R.M.'s—W3GFC, 30GP, 3GTS, 3DBQ, 3BJX—The S.C.M. wishes to express here his appreciation to the League.

EPJ 17 EOP 17 EDO-EOZ 15 BQM

W4NC gang enjoyed having the fellows there for the Floating Club meeting. OJI has a new NC-81X. DSQ keeps the club transmitter busy on 1.75-Mc. 'phone. The A.A.R.S. gang is active on 1.75-Mc. 'phone. EFH has a new beam antenna. ERF has joined the N.C. D.N.B. and is doing nice job on 3.5 Mc. ERB is working 1.75-Mc. 'phone. DRB is active at Moultrieville. DTU has new rig on the air. EQZ is active on 1.75-Mc. 'phone. CQV has new e.c. frequency meter and monitor. CE has pair of 3.5-Mc. c.w. and not on 'phone as reported by S.C.M. last month. DQY has his O.P.S. and works 1.75 Mc. BDT did an outstanding job in the ARRL member contest. AllF, who lives next door, also plans to give the fellows their best...

In addition to the regular operators, the members of the club are enjoying some measure of success has been attained; will you continue to pass the fellows a fit during the DX Contest. Always glad to have you with us, OM.

Traffic: W4BDT 146 OZA 95 EWB 37 DNR 29 ALT 24 ALT 24 WLMG 282 WE 8 DW-DHR 7 DGVeda DZS 6 OG-CXM 4 CYB-EAM'2, 105

December 3700 k.cs. HD, BOK and JRL already have been appointed by the S.C.M. New O.R.S.: PTJ. Officers for 1938 Wheeling Radio Club: CWY, Pres.; BWK, Vice-Pres.; Ex-WSEOO, Secy. The 1.75-Mc. 'Phone-C.W. Net is getting under way. Both these nets, as well as the 28-Mc. phone net...
A Double-Regenerative Superhet

(Continued from page 18)

signal is obtained by using a regenerative detector and a separate b.f.o. than is obtained by turning off the b.f.o. and making the second detector oscillate, another argument in favor of the separate b.f.o.

No trouble should be experienced with image response. The presence of images simply indicates that the antenna coupling is too tight, and loosening it should cure the trouble. A separate tuned antenna circuit also will help reduce image response, but it adds another control and also makes the regeneration setting of the mixer more critical, and is therefore not recommended except where absolutely necessary.

This receiver was designed for the fellow who now owns a regenerative receiver and wants something better. In order to get the reaction of that type of amateur, the receiver was "farmed-out" to a W1 who has worked considerable DX in spite of having only a t.r.f. receiver. He was asked to be as critical as possible, giving his honest reaction and experiences. After a few days he brought the receiver back to complain about the "jumpy" tuning previously mentioned, a fault that hadn't shown up in our laboratory adjustments. The fault was corrected as described, and our friend returned to his shack. He tells us that the signal-to-noise ratio is much better than with his t.r.f., that he can hear many signals he couldn't touch before, and that he can now work right up close to the big fellows without their locking him up. There is only one thing he didn't tell us. He failed to mention when he will return the receiver.


W9AXH

(Continued from page 44)

transmitter; and a Triplet modulation indicator and carrier-shift indicator. The microphone is a Brush Type BRS-2.

Two Q antennas are used, one a half wave on 14 Mc., the other a full wave. They run at right angles to each other and are supported by two 65-foot telephone poles plus a smaller iron pole. A Ward-Leonard antenna relay is used to shift the antenna in use from transmitting to receiving.

Since the latter part of April, when the transmitter was finished and put on the air, contacts have been made with many foreign countries, most of them being the "100%" type. Most of the operation is carried on with an input of 900 watts, although the full kilowatt is frequently used. At the maximum input the final r.f. tubes show so little color that the glow on the plates can be seen only in a darkened room.

The call W9AXH was issued to its present owner in March, 1923, and a station of one type or another has been on the air ever since. The transmitter shown here is a far cry from the lone 202 which comprised the first outfit!
The New 1938 Edition of the
RADIO AMATEUR'S HANDBOOK

TWELVE men, each a specialist in some phase of amateur radio,
collaborated four months in the production of the 1938 edition
of THE RADIO AMATEUR'S HANDBOOK. Virtually thousands
of hours of effort have been expended in a thorough-going re­
writing of the book. Larger than ever before and still more profusely
illustrated, the HANDBOOK is without question the most compre­
hensive ever produced. Further, the selection of the material and its
arrangement have resulted in the most understandable presenta­
tion. • Two entirely new chapters have been added — the first a
thorough treatment of workshop practice covering the problems
faced in working with raw material, assembling and wiring the com­
ponent parts of station equipment. It includes designs for work
benches and operating tables. The second new chapter is devoted
to the ever-important field of emergency and portable equipment.
Designs are given for the last word in emergency gear and special
attention is paid to the power supply problem. • In response to wide
demand, an entirely new chapter has been written on the general
subject of fundamental principles. The new chapter is aimed at
those individuals, young or old, who have absolutely no knowledge
whatever of electrical and radio phenomena but who demand a
painless introduction to the subject. • The remaining chapters have
all been vigorously rewritten, involving an entirely new text. Those
dealing with apparatus construction have benefitted from a three­
months' laboratory program devoted to the design and construction
of modern transmitters, receivers and power supplies, incorporating
modern tried and proven circuits. In all these circuits and in the
equipment built around them, a special attempt has been made to
avoid anything freaky or unusual. Indeed, the work has been greatly
that of selecting from the maze of good, bad and indifferent circuits
only those which comply strictly with modern practice. In contrast to
previous editions of the Handbook, many of the apparatus designs
were prepared especially for the book and are exclusive to it.

$1 postpaid in Continental U.S.A.—$1.25 postpaid elsewhere
Spanish edition $1.50 postpaid

American Radio Relay League • West Hartford, Conn.
NEW LOW PRICES

**TAYLOR TUBES**

<table>
<thead>
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<th>Tube</th>
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**RAYTHEON TUBES**

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<tr>
<td>866</td>
<td>$1.50</td>
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</tbody>
</table>

**The New H-K 54**

Plate MA-150
Plate Volts — 2000
At 100 Megacycles

**$6.75**

__U. T. C. AMATEUR SPECIALS__

<table>
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<tr>
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<td>524FS</td>
<td>Swinging Choke — 5-25 Hz, 2000 MA, 115 ohms DC Resistance, 2500 Volts Insulation</td>
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<td>Swinging Choke — 5-25 Hz, 550 MA, 55 ohms DC Resistance, 6000 Volts Insulation</td>
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__NEW LOW PRICES__

**CONTINUED FROM PAGE 81**

Hamdom

(Continued from page 81)
desire to please by public appearances and the wish to withdraw to his blessed privacy. His college class is like a family, and they live with an astonishing community of interest and experience and inspiration. He eschews ponderous professional formalities. His radio class, indeed, spends many of its hours (in class and out) in his own private ham shack (it is really a laboratory). These are his intimates, and with all such he is regarded as the king of choice spirits. Strangers find his reserve a bit difficult to penetrate; this is not because he wishes it so, but because the contours of his thought processes fall in lines too lofty and direct for immediate understanding.

He is a man who will be a legendary figure. About him legends have already arisen — legends perpetrated by students, by colleagues. These legends are not malicious, nor are they wholly untrue. They are bits of fiction erected on small bases of fact. They are entertaining mosaics which are built and re-built as they are told, and to which new pieces are constantly added — it being natural to add bright, shiny pieces to so fascinating a pattern. This situation disturbs the good doctor at times, but he consoles himself with the reflection that it doesn't do any real harm.

The cause is probably that highly-selective memory of his again. People ask him for details as to what he has done, and he can tell them of the technical ramifications, but such puerilities as names and dates and places he cannot tell them. He was honored, once, for his inventive genius, with an elaborate banquet, and speeches, and a medal. Before that, they asked him for biographical details; but he could not please them. So they went to the dean, and he prepared a long and impressive list, and the doctor was as interested as anyone to hear it. It was probably accurate enough, at least in broad outline, he feels; at any rate he hopes so. They gave him a medal, but it was lost, and now he has difficulty recalling the name of the society. He belongs to several Greek-letter fraternities, and has turned down bids from others; but he cannot immediately recall the names of any of them. Why burden himself? There are so many more important things to remember and to think about.

An ideal breeding-ground for legend, that attitude. It leads to attempts at interpretation, and interpretation leads to theorizing, and theorizing leads to romancing. Apart from the legends, however, his career has been extraordinary. He has held numerous patents, but his major contributions (mostly in the field of electric railway engineering) he has never patented. He has given them into the public domain. He has not even sought the publicity attendant upon the presentation of formal papers (sometimes to the dismay of the college authorities). He merely tells his ideas to other people. In this informal way he has served as consultant to many railroads and manufacturing firms. For the most part he passes his
HEAR HIM and RAISE HIM

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Combination List Prices

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>Price</th>
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<td>GD-2</td>
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<tr>
<td>1004</td>
<td>Stand alone</td>
<td>$10.00</td>
</tr>
</tbody>
</table>

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**DX CONTEST IS COMING—GET THAT NEW EQUIPMENT FROM W9ARA**

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<table>
<thead>
<tr>
<th>Model of Receiver</th>
<th>Cash Price</th>
<th>Down Payment</th>
<th>12-Month Payments</th>
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<td>Breting 14AX and Super Skyrider</td>
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<td>RME-69s</td>
<td>151.20</td>
<td>30.24</td>
<td>10.69</td>
</tr>
</tbody>
</table>

Similar terms on PR-15, NC100, NC100X, HRO Jr., Super Pro, ACR-111, Sargent receivers. And on Harvey, RCA, RME, Temco transmitters and Utah, Progressive, Stancor, All Star kits.

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to satisfy himself concerning certain technical problems arising there.

President Woodruff is doubtless best known to hams in general for his famous "bag o' tricks." He is an indefatigable constructor of unique pieces of apparatus with novel and ingenious applications—all of which he builds himself, to the last detail—and these he has exhibited at conventions and hamfests in practically every state. Indeed, Doc Woodruff and his blue Duesenberg with the call W8CMP on the trunk, in which he accomplishes his convention hogiras, have become a tradition at ham conventions.

His connection with A.R.R.L. dates back to 1925, in which year he was elected director of the Atlantic Division, succeeding such well-known figures as the late Horace Beale and Dr. G. E. Bidwell. Consistently re-elected, by 1936 he had become the dean of the League's Board. As such he was chosen as the chairman of the Board for its first meeting following the double loss of President Maxim and Vice-President Stewart. So effective was his performance in this capacity that he became the Board's choice for the presidency, and he took office immediately upon election in May, 1936.

As was said before, Dr. Woodruff is an individualist. He believes in individualism. His creed is that the mass cannot rise higher than the individual unit, and it is therefore the unit that must be trained and developed. The keystones of civilization and culture are enterprise and ingenuity, he feels. It is this conviction which forms the basis for his intense faith in amateur radio as a force for good. He sees in the training which the art of amateur radio has afforded so many thousands—young and old, of all walks of life, in lines of thought and action—a concrete force of incalculable good. He recognizes that there must be an outlet for latent energies above and beyond those required for the simple acts of living, and he believes that these outlets can be made to lead in any direction—good or bad—solely through the pressure of environment of habit. The cultural discipline of amateur radio in shaping such outlets is, inevitably, certain to advance the broad front of civilization as a whole.

Such is the destiny he envisions for amateur radio. The amazing counterpoint is that his own life and accomplishments so ably illustrate that vision.

—C.B.D.
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Problem No. 15

Thanks to the suggestions of his many friends, Our Hero's radio equipment is working very smoothly (for the time being, at least), in fact, perhaps a little too smoothly for one of his nature who delights in tinkering. It now happens that he would like to install his rig in the basement or in that special shack he has had in mind for so long. The YF, however, visualizes climbing flights of stairs or long trips to the shack whenever she would have a word with him. Our Hero thinks he ought to be able to find most of the necessary material in his junk box with which to build an inter-communicating telephone system between the shack and the house, thus solving the difficulty. He would like to see diagrams with all values of the simplest system which will work satisfactorily on lines up to 100 or 150 feet in length.

How Would You Do It?

(Continued from page 80)

6-32 tap so the tip may be threaded onto the screw. If a tap is not available, the threads of the screw may be filed off until the 'phone tip may be slid on over the screw and soldered in place. Contact to the tap is made by means of a standard 'phone jack which will also fit on the No. 12 or 14 wire.

Still another scheme is shown at K. This idea comes from W2GS1. A contact from a small knife switch, properly formed to fit the wire, is fitted to a standard Eby binding post. This post has a hole passing through the shaft which will pass No. 12 wire. The clip may be slid along the wire to the desired point and tightened by the clamping action of the binding post. The wire support, which also serves as the lead to the tap, holds the clip at right angles to the axis of the coil.

We believe the idea shown at L deserves honorable mention. While it seems that the idea must have been used before we have never happened to see it. An ordinary small soldering lug is soldered to the wire and then almost any type clip will provide good contact with little danger of falling over on adjacent turns, or the wire may be fastened on with a machine screw. If taps must be made on every turn, the lugs may be staggered. This idea comes from WSNDV.

Thanks also to the following whose schemes could not be presented because of space limitations: W2DOD, 2GNE, 3BFK, GJEI, 8GWF, SHKT, 9BSP, 9EGE, 9IKY, 9YZII, VE1KE and H. C. Hawkins.

Rules under which the contest is conducted are as follows:

1. Solutions must be mailed to reach West Hartford before the 20th of the publication month.
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Famous Improved Model (Illus­
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Be popular. A good, fast sender is always popular whenever he comes on the air. The New Improved Vibroplex develops a degree of sending proficiency seldom attained by users of the old type straight key. Don't envy good, fast senders -- be one! Get a New Improved Vibroplex semi-automatic key -- standard the world over for clarity, speed and sending ease. Easy to learn. Simply press lever -- Vibroplex does the rest. Costs no more than imitations. So why not get the best? Insist on the Genuine Vibroplex. Your old Vibroplex accepted as part payment on a new Vibroplex. Money or registered mail. Write for FREE catalog.

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Say You Saw It in QST — It Identifies You and Helps QST
TAKE A LOOK AT THE SCRULOK developed by BIRNBACK

Always a pioneer, Birnback again leads with the new Scrulok solderless connection. Test leads and prods using this new principle need no soldering or tightening with wire-cutting screws. Every port is assembled with a tight mechanical and electrical contact.

Ask your jobber for the new Birnback Test Prods, Test leads, Banana Type Plugs, Insulated Pin Tips, etc., featuring the Scrulok principle.

If he cannot supply you, write direct to us.

145 HUDSON ST., NEW YORK, N. Y.

Hi Queridos Señores!

La edición 1938 del "THE RADIO AMATEUR'S HANDBOOK" se puede ahora conseguir en lengua española traducido por la Revista Telegráfica de Buenos Aires, Argentina, reconocida como la más antigua establecida y la más importante publicación de literatura de Radio en Sudamérica.

El "Handbook" (libro manual) está reconocido como el libro modelo en su clase. El por tanto tipo esperado y sugestionado libro manual (Handbook) estamos seguros que su edición en español encontrará una acogida extraordinaria. Ha sido cuidadosa y escrupulosamente traducido. Ha sido impreso en una imprenta que está reconocida como la mejor de Sudamérica.

Nosotros estamos orgullosos del hecho que la Revista Telegráfica haya producido este libro manual (Handbook) y estamos seguros que su edición en español encontrará una acogida extraordinaria. Ha sido cuidadosa y escrupulosamente traducido. Ha sido impreso en una imprenta que está reconocida como la mejor de Sudamérica.


AMERICAN RADIO RELAY LEAGUE

Say You Saw It in QST — It Identifies You and Helps QST
THE "PRECISION" SERIES 840L

A.C. - D.C. VOLT - OHM - DECIBEL - MILLIAMMETER
including a 2500 VOLT A.C. and D.C. RANGE
and a 1000 M.A. RANGE

Accuracy guaranteed by use of wire wound shunts of 1% tolerance and matched resistors of 1% tolerance.

Endorsed and used by leading engineering concerns, broadcast stations, institutions, amateurs and servicemen.

Complete line of "PRECISION" testing equipment available. See these and other instruments in our store.

SPECIFICATIONS

* 6 A.C. - D.C. Voltage Ranges from 0 to 2500 volts at 1000 ohms per volt.
* 4 D.C. Current Ranges from 0 to 10 ma.
* 5 Output Ranges.

Net price to amateurs $19.95

Less batteries and test leads

SERIES 840F incorporates same specifications as the 840L, but is housed in an attractive black leatherette covered portable case with removable cover. Size 9 x 10 x 6. Net to amateurs...

$21.95

OUR,~ALUE IS OUR RECORD Of LOYAL SERVICE

103 WEST 43rd STREET • NEW YORK, N. Y.

CABLE ADDRESS: "HARADIO"

WE CARRY A COMPLETE STOCK
OF ALL NATIONAL PRODUCTS
including the popular
NC-80X and NC-81X

Advanced circuit details, including wide-range crystal filter and high IF frequency for image rejection. These receivers have set a new standard of performance in the low priced field. IN STOCK . . . come in, listen and taken them with you . . .

AVAILABLE FOR IMMEDIATE DELIVERY
the 2 LATEST TYPE TUBES

TAYLOR T-40 and TZ-40
They fill the gap between the T-20 and the T-55.

New—CARDWELL type "J"
Fixed Air CONDENSERS

These "plug-in" type fixed capacitors can make the tank condenser you use on 40, 20, or 10, resonate an Inductance designed for 80 or 160 meter operation. The correct L to C ratio can be obtained on any frequency, using only one variable capacity.

Type JD-80-OS — 80 Mmfd., .125" airgap, 5000 V., Alsimag 196 insulation. Net price ............... $3.30
Type JCO-45-OS — 45 Mmfd., .250" airgap, 7500 V., Alsimag 196 insulation. Net price ............... $3.30
Type JB — Jack base for fixed air condensers. Fits either unit.
— Alsimag 196 insulation. Net price ............... 60¢

Our TAYLOR T-20, T-55
TRANSMITTER KITS
are satisfying the many amateurs who purchased them. They are still available. See our ad in the November issue, QST, page 108.

THOUGHT OF THE MONTH

SALESMANSHIP is the art of selling products which will not come back . . . to customers who WILL.

W21JL W2KWI W2KXP

OUR,~ALUE IS OUR RECORD Of LOYAL SERVICE

103 WEST 43rd STREET • NEW YORK, N. Y.

CABLE ADDRESS "HARADIO"
FOR BOTH AC AND DC TESTING
Use Model 666
DEALER PRICE $15

Pocket Volt-Ohm Milliammeter
Uses large 3" sq. Triplett Instrument. Has molded case, selector switch and all necessary accessories. A complete instrument for all servicing needs. Size — 3 1/16" x 5 1/6" x 2 1/4". See Your Jobber — Write for Catalog.
The Triplett Electrical Instrument Co.
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GET YOUR NEW SKY CHALLENGER II
at H & E Easy Time Payments
$77.00 CASH PRICE
(less Speaker, Crystal)
$10.00 DOWN
$6.10 PER MONTH (12 Months)

DAY TRIAL
Enjoy the superior performance of the New Sky Challenger while you’re paying for it at H & E liberal terms. Friendly, personal service you’ll enjoy, with satisfaction guaranteed. Ask any H & E customer.
MAIL THIS COUPON NOW!
Please send me complete information about the New Sky Challenger II and your easy time payment plan.
Name ___________________ Call __________
Address ___________________ 

A Continuously-Rotatable Beam
(Continued from page 46)
The brass collar should be fastened about 3 feet 9 inches from the bottom of the 1-inch aluminum pipe to allow 3 feet 6 inches for fastening to the mast and 3 inches clearance for the pulley and ropes. The 1-inch aluminum pipe supports the whole affair and is anchored to the two upper pyrex insulators with a heavy-gauge brass strap which completely encircles the pipe. The bottom end of the pipe is anchored to a single pyrex standoff insulator with a heavy brass mounting screw through the pipe. Also, a hole is drilled at this point and tapped for a 10/31 brass machine screw which connects the stub to the antenna. The four vertical bracing members (two each side) are bolted in place to make the entire framework rigid, and they eliminate the possibility of the top horizontal member’s lagging behind the bottom one and snapping the director and reflector from their support. Lengths of both reflector and director are adjustable.

Wherever possible, brass hardware is used to withstand the weather, and all wood members are heavily varnished. The rope used is a good grade of hemp. From the bottom pulleys the rope ends come into the shack, where the rig can be operated merely by pulling the ropes. Alternatively, the rope can be fastened to a wheel for more convenient rotation; you will most likely want to incorporate your own ideas in the rotating control. Since only a few pounds of tension are necessary to rotate the beam, we simply pull the ropes here. Our indicating device consists of two flashlight bulbs tapped across a few inches of the director and reflector—a green bulb in the director and a red one in the reflector.

The drawings and photograph clearly show all other details. The methods for adjusting the quarter-wave linear transformer and coupling the transmission line are described in the Handbook.

New Transmitter Design
(Continued from page 88)

gain amplifier of this type the importance of carefully shielding the mike cord and plug is generally realized. Many microphones are now furnished with a shielded plug and cord as standard equipment.

POWER SUPPLY
The single power supply which serves both the exciter and the audio amplifier has to be considerably husker than if individual supplies were used. The cost of building a single husky power supply offers quite a saving over that of two separate power supply units, however, even with the special heavy filtering required. Aside from being designed to handle the combined power requirements of the audio and r.f. circuits, it is quite conventional. Oil condensers are used, rather than electrolytic, as the operating voltage
AMATEUR RADIO Map of World

I.A.R.U.—W.A.C.
Principal cities of the world

Divisions
Six colors and black

All known districts and sub-divisions

Countries designated by prefixes

180 prefixes in large red letters

2% accuracy for distance measures in miles and kilometers

U. S. inspection districts and examining points

30° 40'

230 countries indexed

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LEAR N CODE
the way you'll be using it-

by SOUND

PROBABLY the best way to learn to read code is by listening to code. Probably the best way to learn to send code is by hearing your own sending repeated back to you. With the New All Electric Master Teleplex Code Teaching Machine you learn code the natural, easy, fascinating way. Only instrument ever produced which records your sending in visible dots and dashes—then SENDS BACK your own key work at any speed you desire. We furnish complete course, lend you the New All Electric Master Teleplex, give you personal instruction with a MONEY BACK GUARANTEE— all at a surprisingly low cost per month. Write today for FREE catalog Q-3. No obligation.

"HAM" SPECIAL

Standard Teleplex—a highly efficient code teacher using heavy specially prepared waxed paper tape, having two rows of perforations. Write for Free folder "Q.T.-3."

We are the originators of this type instrument

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

LEARN CODE

probably the best way to learn to read code is by listening to code. probably the best way to learn to send code is by hearing your own sending repeated back to you. with the new all electric master teleplex code teaching machine you learn code the natural, easy, fascinating way. only instrument ever produced which records your sending in visible dots and dashes—then sends back your own key work at any speed you desire. we furnish complete course, lend you the new all electric master teleplex, give you personal instruction with a money back guarantee—all at a surprisingly low cost per month. write today for free catalog q-3. no obligation.

"ham" special

standard teleplex—a highly efficient code teacher using heavy specially prepared waxed paper tape, having two rows of perforations. write for free folder "q.t.-3."

we are the originators of this type instrument

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say you saw it in qst — it identifies you and helps qst

get rid of feedback!

model t-9 has no peaks to start feedback. its response is honestly flat. you can work it close to speakers with less danger of howl. sound from the back of t-9 is sharply reduced. this means less noise pickup. it's high level too—plusses 52 db.

here is a mike that really takes abuse. the shock proof cartridge prevents breakage and noise.

compare it with any higher priced microphone. hear it at our store. come in or send in your order by mail—today.

$11.47 net

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2208 4th ave., seattle, washington
licensed under patents of the brush development company

special to amateurs

piezo-electric crystals — $2.50 each postpaid

until supply is exhausted ... we offer 80 meter band crystals unmounted; accurate calibration, excellent oscillators. limited quantity.

scientific radio service
"the crystal specialist since 1925," university park, hyattsville, md.
WE ARE GOING TO MOVE

SO WE CELEBRATE
A MONTH OF VALUES!

In another month we leave our present home to move into our own newly built 2-story building where every modern facility will be available to amateurs, experimenters and technicians. All departments will be enlarged ... but more about that later. In the meantime we are reducing stocks before removal. You'll find it well worth while to visit us this month or if you live too far away, send us your list of requirements and we will be happy to quote you. Hundreds of BARGAINS every day ... all month long!

STANCOR TRANSMITTER KIT
48 circuit combinations available from one kit. Special at...
Write for Free literature and HAMANUAL... SPECIAL DOUBLE BUTTON CARBON MICROPHONE. Modernistic finish. Excellent response. Special at.
RCA-ACR 155. Formerly $74.50. Reduced to...
TAYLOR - EIMAC - RCA - RAY- THEON - AMPEREX X'MITTING TUBES IN STOCK.
NATIONAL NC80X AND NC81X in stock. Price with tubes, $99.00.
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A COMPLETE STOCK OF PAR- METAL PRODUCTS IN STOCK. WRITE FOR BIG FREE CATALOG.
NATIONAL, HRO, HRO Jr., NC 100X, NC 101X and the complete National line of parts carried in stock. Write for Free Catalog.
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1000 M.A.
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48 circuit combinations available from one kit. Special at...
Write for Free literature and HAMANUAL... SPECIAL DOUBLE BUTTON CARBON MICROPHONE. Modernistic finish. Excellent response. Special at.
RCA-ACR 155. Formerly $74.50. Reduced to...
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A COMPLETE STOCK OF PAR- METAL PRODUCTS IN STOCK. WRITE FOR BIG FREE CATALOG.
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THE NEW TEMCO "50"
We are among the first to show this job! For phone and C.W. best accessaries...
For C.W. exclusively...

NOW! A Perfected AUTOMATIC SENDER
Let the Automatic Sender raise your stations. Repeats calls or messages indefinitely, sends 2 to 70 words a minute. Entirely automatic. Built-in tape perforator. Complete with 4 rolls of tape and full instructions. No extra equipment needed. Fully Guaranteed.
A New High-Speed RELAY
Faster — More Compact — Quieter Moisture Proof — More Applications

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Where to buy it
A directory of suppliers who carry in stock the products of these dependable manufacturers.

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JAMAICA, L. I. 90-08 166th Street Wholesale Radio Service Company, Inc.
NEWARK, N. J. 219 Central Ave. Wholesale Radio Service Co., Inc.
NEW YORK, N. Y. 100 Six Avenue Wholesale Radio Service Co., Inc.
NEW YORK, N. Y. 80 Cortlandt Street Wholesale Radio Service Co., Inc.
POTTsville, PENN. Evans Radio & Supply Co., Inc.
READING, PENN. 404 Walnut St. George D. Berbey Company
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Triplet
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READING, PENN. 104 North Ninth St. Sylvester Radio & Supply Co., Inc.
WASHINGTON, D. C. 938 F Street, N. W.
Sun Radio & Service Supply Co.

Listings on this page do not necessarily imply endorsement by QST of the dealers or of other equipment sold by them.
Correspondence Department

(Continued from page 66)

Did You Say QRM?

1215 Rodman, N. E., Massillon, Ohio

If all those guys who howl about traffic conditions and QRM on the 40-meter band would try to copy on the 124-meter police band, and I mean really do some traffic work on that band, 40 meters would sound like the 10-meter band. Why not a police traffic net and trunk line to handle long haul traffic requests for information and descriptions? This would be a real service. We could use one right here in Ohio just to handle traffic between the major cities now that the F.C.C. is enforcing Rule 331.

—W. Hinman, W6UX

QSL Troubles

La Paz, Bolivia, South America

Editor, QST:

Here is a pack of trouble for your "QSL YL." My Hq plus a long wall. We all like to think that we are a bit more honest than the "other guy," but I have heard more kicks from W stations that they never received my QSL cards than from old CT2BK. At least 70% of the stations worked from here that were also worked from CT2BK complained of non-receipt of CT2BK’s card. Well, I think that I can honestly say that a card has been sent to every station with whom either CT2BK or the present CP1AA has ever Q5O’d.

This QSL business is a pretty expensive one for DX stations in any case, as practically every contact is DX. I, myself, have sent 126 cards since the 24th of last month. Cost of printing, mail, etc., has cost me over $3.00 just for this lot. When fellows ask me why I only use a type 48 in my final with 20 watts they might care to know that since 1934 I have spent over $35.00 on the QSL side of running my rig and have no money left to buy equipment! Why in heck don’t some of these lads get in touch with their A.R.R.L. QSL Bureaus? That arrangement was set up for this specific purpose but I really think that rafts of my cards are waiting the addressee at these Bureaus.

In future I send one card and no more, not even if I get a direct letter from a station asking for the card for a QSO. I am here for several years and hope during that time to effect two or more thousand QSO’s and at approximately 8 cents per QSO this runs into real money. Let the boys ask their QSL bureaus for cards.

—H. E. J. Smith, CP1AA—ct-CT2BK

To End CQ

P. O. Box 3804, Phoenix, Ariz.

Editor, QST:

We seem to yet have much unnecessary QRM and difficulty in identifying a signal in a desired area with a minimum of time and effort, with even directional CQ’s striking a low average. I would like to suggest to amateurs at large a discontinuance of what I believe is now obsolete—the use of CQ for calling practice—and in its place substitute a continuously identifying type of call. This can be the prefix of the country in which the calling station is located; where a single letter is used, the district number may follow:

W6 W6 W6 W6 de W6FZQ W6FZQ W6FZQ AR
ZL ZL ZL de ZLHH ZLHH ZLHH AR
VK VK VK de VK3XP VK3XP VK3XP AR

Of course in raising a particular locality not heard at the time of transmission, for example a W1, we could alternate the letters CQ with W1, repeating as deemed necessary.

In this manner, the origin of the station in its general inquiry call is easily known, with little time lost by any one desiring to contact the area of the caller, or hunting for him over the band. I am sure this would stop the present abuses of long CQ’s and CQ DX, as no one would then have to listen to such rot. The ease with which our English brethren are so easily recognized is a known fact. We could also then use the use of this system tell whether or not we would wish to follow an inquiry call or not through a barrage of R9 QRM.

—Charles E. Spitz, W6FZQ

Say You Saw It in QST — It Identifies You and Helps QST
HAM-ADS

(1) Advertising shall pertain to radio and shall be of nature of interest to radio amateurs or experimentalists in their hobby.

(2) No display of any character will be accepted, nor can any artistic or typographical arrangement, such as all or part initial letters be used which would tend to make one advertisement stand out from others.

(3) The rate is 15¢ per word, except as noted in paragraphs 4 and 5.

(4) Remittance in full must accompany copy. No cash or contract discount or agency commision will be allowed.

(5) The rate is 15¢ per word which will apply to advertising which, in our judgment, is obviously non-commercial in nature, and which is paid for by a member of the American Radio Relay League. Thus advertising of bona fide surplus equipment owned, and for sale by an individual or apparatus offered for exchange or advertising inquiring for special equipment, if by a member of the American Radio Relay League the rate is 7¢. All attempts to deal in apparatus in quantity for profit, even if by an individual, is subject to a higher rate, and the rate to be determined on a case by case basis.

Having made no investigation of the advertisers in the classified columns, the publisher of QST can under no circumstances be vouch for their integrity or for the grade or character of the products advertised.

QUARTZ—direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Drill Carbono, 710 World Bldg., New York City.

RAE—radio, engineering, broadcasting, aviation and police radio servicing, marine and Morse telegraphy taught thoroughiy.

SLQ'S, W2BN, Helmetta, N. J.


Quartz, V-3's, V-4's, and UR-5's, as used in the magnetic-circuit type of radio. Send postpaid $1.25, or a whole year (four issues) for $4. (In foreign countries $1.35 and $4.35.) Your call and QRA printed.

QUARTZ—direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Drill Carbono, 710 World Bldg., New York City.

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QUARTZ—direct importers from Brazil of best quality pure quartz suitable for making piezo-electric crystals. Diamond Drill Carbono, 710 World Bldg., New York City.
Cryals, thereby increasing your chances. 40 and $1.60, 7300-7100 kc range $2. Rugged X cut, fully guaranteed. Coming DX Contest. Our reasonable prices allow more frequent use.

COMET-Pro crystal model W8ANT. Queen Village, N. Y.; or Eidson's, Temple, Texas. O.O.D.'s accepted. Sold by Pembleton Labs., Ft. Wayne, Ind.; Accept no substitute.

W9ARA, Butler, Mo.; Hieronymus Radio, 88-34 209 St., Queen Village, N. Y.; or Eidson's, Temple, Texas. O.O.D.'s accepted. Sold by Pembleton Labs., Ft. Wayne, Ind.; Accept no substitute.

EXCHANGE. Write to Southern Ohio's only amateur owned amateur equipment store.

USED FBXA, W8ANT. FOR sale: pair R.K.8's; factory scaled cartons; $25, each or both for $45. W9DII.

USED RK30, W8ANT.

USED FBXA. W8ANT.

COMET-Pro crystal model W8ANT.

KENYON transformers. W8ANT.

NATIONAL one-ten, used. W8ANT.

USED 160 meter phone, 25 watts. W8ANT.

USED 1507T. W8ANT.

USED 50T. W8ANT.

PLATE transformers, W8ANT.

FILTER condensers, specials, W8ANT.

RCA AC9111; used. W8ANT.

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USED 50T. W8ANT.

PLATE transformers, W8ANT.

FILTER condensers, specials, W8ANT.

RCA AC9111; used. W8ANT.

ALL lines of new and used amateur equipment bought, sold, exchanged. Write to Southern Ohio's only amateur owned amateur equipment store.

USED 160 meter phone, 25 watts. W8ANT.

USED 1507T. W8ANT.

USED 50T. W8ANT.

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Your Nearest Dealer Is Your Best Friend

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

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

<table>
<thead>
<tr>
<th>ATLANTA, GEORGIA</th>
<th>NEWARK, N. J.</th>
</tr>
</thead>
<tbody>
<tr>
<td>925 Peachtree Street</td>
<td>219 Central Avenue</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BALTIMORE, MARYLAND</th>
<th>NEW YORK, N. Y.</th>
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</thead>
<tbody>
<tr>
<td>3 N. Howard St.</td>
<td>51 Vesey Street</td>
</tr>
<tr>
<td>Everything for the amateur</td>
<td>Fair dealings plus fair prices. Anything in radio</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BOSTON, MASS.</th>
<th>NEW YORK, N. Y.</th>
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</thead>
<tbody>
<tr>
<td>110 Federal Street</td>
<td>100 Sixth Avenue</td>
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<thead>
<tr>
<th>BRONX, NEW YORK</th>
<th>NEW YORK, N. Y.</th>
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</thead>
<tbody>
<tr>
<td>542 East Fordham Road</td>
<td>100 Sixth Avenue</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>BUFFALO, NEW YORK</th>
<th>NEW YORK, N. Y.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio Equipment Corp.</td>
<td>Harrison Radio Company</td>
</tr>
<tr>
<td>326 Elm Street</td>
<td>12 West Broadway</td>
</tr>
<tr>
<td>W80BK — Ham, service and sound equipment</td>
<td>“The Friendly Ham Supply House”</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BUFFALO, NEW YORK</th>
<th>PHILADELPHIA, PENNSYLVANIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dymac Radio</td>
<td>Eugene G. Wile</td>
</tr>
<tr>
<td>216 E. Genesee Street</td>
<td>10 S. Tenth Street</td>
</tr>
<tr>
<td>Complete Line Ham and BCL Equipment</td>
<td>Complete Stock of Quality Merchandise</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ELMIRA, NEW YORK</th>
<th>RICHMOND, VIRGINIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miller’s Radio Shack</td>
<td>The Arnold Company</td>
</tr>
<tr>
<td>205 Railroad Avenue</td>
<td>Broad at Harrison St.</td>
</tr>
<tr>
<td>Fine equipment for amateurs</td>
<td>W3GPV—“The Virginia Ham Headquarters”—W3FBL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>JAMAICA, L. I.</th>
<th>ROCHESTER, NEW YORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-08 160th Street (Merrick Road)</td>
<td>244 Clinton Avenue, North</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MONTREAL, CANADA</th>
<th></th>
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<tbody>
<tr>
<td>Canadian Elec. Supply Co., Ltd.</td>
<td></td>
</tr>
<tr>
<td>285 Craig St., W.</td>
<td></td>
</tr>
<tr>
<td>Quality parts and equipment for discriminating buyers</td>
<td></td>
</tr>
</tbody>
</table>

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

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

Quoted from QST's advertising rate card.

Every conceivable need of a radio amateur can be supplied by the advertisers in QST. And you will know the product has the approval of the League's technical staff.
The 510X Frequency Expander
by RME

For the 5-Meter Band

A practical and economical unit introduced to put the ultra-high frequency band to work. Connect the frequency expander ahead of your present RME-69, set the controls of the 69 per instructions accompanying the new unit, and tune the 510X to cover the frequency range from 27 to 70 mc.

*Real* sensitivity, *real* selectivity, *real* calibration at a price well below anything now available to obtain *real* results.

And there will be *real* exploring going on in this five-meter band.

RADIO MFG. ENGINEERS, PEORIA, ILLINOIS

Say You Saw It in QST — It Identifies You and Helps QST
VARITRAN VOLTAGE CONTROL UNITS

FEATURES
- Smooth control
- High efficiency
- Excellent regulation
- Low cost

APPLICATIONS
- Motor control
- Heat control
- Rectifier control
- Light control
- Line voltage control

The UTC VARITRAN makes possible continuously variable output voltage, using a sliding contact riding over the turns of an auto-transformer. Standard units are designed for 115 volts input, 0-130 volts continuously variable output.

Model V-1. 570 Watts — 5 amp. maximum rating, complete with cord, plug and switch, net $10.00
Model V-2. Same as V-1, but uncased, with terminal strip for rack or panel mounting, net $9.00
Model V-3. 850 watts maximum rating, 7.5 amps., uncased, with terminal board and provisions for mounting, net $14.00
Model V-4. 1250 watts — 11 amp. maximum rating, uncased, net $20.00
Model V-5. 2000 watts maximum rating, 17.5 amps., uncased, net $32.00

ULTRA COMPACT HIGH FIDELITY AUDIO UNITS

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Application</th>
<th>Primary Impedance</th>
<th>Secondary Impedance</th>
<th>Your Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-10</td>
<td>Low impedance mike, pickup, or multiple line to grid</td>
<td>50, 125, 200, 350, 333, 500 ohms</td>
<td>50,000 ohms</td>
<td>$6.00</td>
</tr>
<tr>
<td>A-12</td>
<td>Low impedance mike, pickup, or multiple line to push pull grids in one or two grids</td>
<td>50, 125, 200, 350, 333, 500 ohms</td>
<td>80,000 ohms overall, in two sections</td>
<td>$6.00</td>
</tr>
<tr>
<td>A-14</td>
<td>Dynamic microphone to one or two grids</td>
<td>50 ohms</td>
<td>50,000 ohms overall, in two sections</td>
<td>$5.40</td>
</tr>
<tr>
<td>A-16</td>
<td>Single plate to single grid</td>
<td>8,000 to 15,000 ohms</td>
<td>8,000 to 15,000 ohms</td>
<td>$4.80</td>
</tr>
<tr>
<td>A-18</td>
<td>Single plate to two grids</td>
<td>8,000 to 15,000 ohms</td>
<td>8,000 to 15,000 ohms</td>
<td>$5.40</td>
</tr>
<tr>
<td>A-20</td>
<td>Mixing, low impedance, mike, pickup, or multiple line to multiple line</td>
<td>50, 125, 200, 350, 333, 500 ohms</td>
<td>50, 125, 200, 250, 333, 500 ohms</td>
<td>$6.00</td>
</tr>
<tr>
<td>A-24</td>
<td>Single plate to multiple line</td>
<td>8,000 to 15,000 ohms</td>
<td>50, 125, 200, 250, 333, 500 ohms</td>
<td>$6.00</td>
</tr>
<tr>
<td>A-26</td>
<td>Push pull low level plates to multiple line</td>
<td>8,000 to 15,000 ohms each side</td>
<td>50, 125, 200, 250, 333, 500 ohms</td>
<td>$6.00</td>
</tr>
<tr>
<td>A-27</td>
<td>Crystal microphone to multiple line</td>
<td>100,000 ohms</td>
<td>50, 125, 200, 250, 333, 500 ohms</td>
<td>$6.00</td>
</tr>
<tr>
<td>A-30</td>
<td>Audio choke, 300 henrys @ 2 MA 6000 ohms D.C. 75 henrys @ 4 MA 1500 ohms D.C. Inductance with no D.C. 450 henrys</td>
<td></td>
<td></td>
<td>$4.20</td>
</tr>
</tbody>
</table>

The UTC Ultra compact audio units represent the state of the art in small, light-weight units where portability or size is of paramount importance. Through the use of new design methods, high fidelity is obtainable in all individual units, the frequency response being ± 2 db from 30 to 20,000 cycles on all units. There is no need to resonate one unit in an amplifier to compensate for the droop of another unit.

All units employ true hum balancing coil structure, which combined with a high conductivity outer case, afford a maximum of inductive shielding.
WHEN building or remodeling your transmitter, remember there is no substitute for National Radio Products, either in quality or in price. Genuine National parts will insure better performance of the old rig and peak operating efficiency of the new. A highly efficient exciter may be built around the group of parts illustrated above. They are ideally suited in every particular for this application. Nothing less will do.

The numbered parts shown above are as follows:

1. CHT and CHV Crystal Holders
2. R-100 R.F. Choke
3. HRO Dial, Type 10-0
4. UM and ST Condensers
5. XR-6 Coil Form with Square Socket
6. BM Dial
7. 6-prong Socket
8. FXT Fixed Tuned Exciter Tank
9. O Dial, Type 0-100
10. XM-10 Transmitting Socket
11. TMSA-50 Condenser
12. UR13 Buffer Coil Form Assembly
RCA Announces
MAJOR PRIZE WINNERS IN
AMATEUR CONTEST!

For the best statement on "Why I Use RCA Tubes"

FIRST PRIZE
Mr. Philip Rosenblatt, W2AKF
P. O. Box 905
Hoboken, N. J.
Mr. Rosenblatt wins a new RCA Amateur Receiver—ACR-111

SECOND PRIZE
Mr. Wm. Leonard May, W3APJ
11 W. Kirk St.
Chevy Chase, Md.
Mr. May wins a new RCA Amateur Transmitter—ACT-20

For the best statement on "Why I Don't Use RCA Tubes"

FIRST PRIZE
Mr. Paul E. Kreilick, W8QQE
322 Garland Ave.
Kalamazoo, Mich.
Mr. Kreilick wins a new RCA Amateur Receiver—ACR-1

SECOND PRIZE
Mr. Dwight Stebbins, W9WLK
614 Atlantic Ave.
Morris, Minn.
Mr. Stebbins wins a new RCA Amateur Transmitter—ACT-2

THE OTHER 196 WINNERS HAVE BEEN NOTIFIED DIRECT BY MAIL.

RCA takes this opportunity to thank all who entered this contest. Naturally, we are gratified to know that RCA Radiotrons are held in such high regard by so many. (We received four entries giving reasons for using RCA Radiotrons to every one telling us why these tubes were not used.)

We are grateful, too, to those who went to the trouble of telling us why they do not use our tubes. We admit we are not perfect. We want to correct any shortcomings. That's why we offered prizes for your objections to RCA Tubes in order that we might do everything in our power to correct the faults you found.

Again, we thank you. We are going to use many of the suggestions you sent in, so that in the future, all amateurs will proclaim RCA Tubes "the tops"!

RCA Announces
MAJOR PRIZE WINNERS IN
AMATEUR CONTEST!

FIRST PRIZE
RCA Amateur Receiver
ACR-111

Won by Messrs.
Rosenblatt and Kreilick

This RCA Receiver gives you custom-built performance at low cost. Has 16 tubes—professional design and appearance. Offers razor-like selectivity and exceptional sensitivity. Brings in stations you never heard before. Other features include Electrical Band Spread, Noise Suppressor, 2 r-f and i-f stages, high Signal-to-Noise Ratio. We know Messrs. Rosenblatt and Kreilick will be pleased with this instrument's excellent performance.

For maximum performance at minimum cost—use RCA radio tubes

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

Ask your distributor or send 10c to Camden for a commemorative advertisement on RCA's television tube announcement.