RADIO

ESTABLISHED 1917

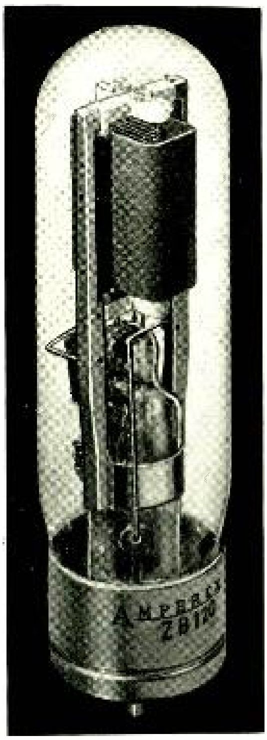
MAY, 1937 | 30c in U.S.A. and Canada
1/8 in the United Kingdom; 2/- in Australasia | NO. 219

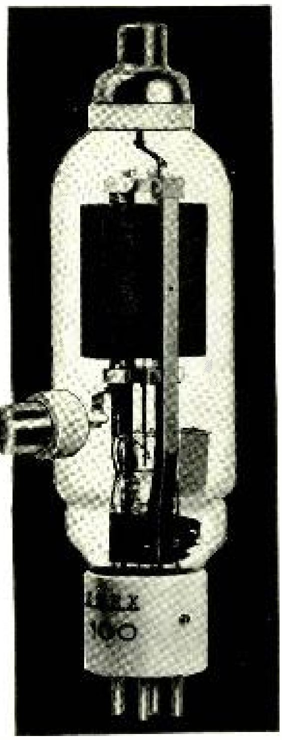
THE WORLDWIDE TECHNICAL AUTHORITY • OF AMATEUR • SHORT WAVE AND EXPERIMENTAL RADIO •

This Month

Two Champions

Each a Leader in Its Class





★

AMPEREX ZB 120

The new amateur CLASS "B" TUBE that is winning instant acceptance from amateurs. It is a practical distortionless Zero Bias Amplifier, a high current low voltage tube that also lends itself readily to all experimental operation. (The Amplification Constant of 90 is sufficiently high to allow practical zero bias operation.) Ideal for use in a Class B Modulator stage, Class B Linear stage, Frequency Multiplier or as a Grid Modulated Power Amplifier.

Amplification Factor..........90
Grid to Plate Transconductance at 100 ma...........5,000
Filament Voltage..........10 volts
Filament Current..........2 amps
Maximum Allowable Plate Dissipation..........75 watts

$10.00

★

AMPEREX HF 100

Thank you, amateurs . . . for your many letters of praise. In designing this HF 100, we presented you with a tube that we realized would be "Tops." For, even though it has produced amazing results in the ultra high frequency field, its range of operation extends into various stages of R.F. and audio, delivering power outputs usually obtained from tubes selling for almost twice its cost.

Filament Voltage 10 volts, Current..........2 amps.
Amplification Factor..........23
Grid to Plate Transconductance at 100 ma...........4200
Direct Interelectrode Capacitance:
Grid to Plate..........4.5 μμf
Grid to Filament..........3.5 μμf
Plate to Filament..........1.4 μμf

$12.50

AMPEREX ELECTRONIC PRODUCTS, Inc.

79 WASHINGTON STREET • BROOKLYN, NEW YORK

Phone YOrk 7226
Published by Radio, Ltd.

RADIO

7460 BEVERLY BOULEVARD
LOS ANGELES

Cable address:
Radiopubs, Los Angeles

New York Office:
17 East 42d Street
Phone: MUrray Hill 2-5973

Direct all correspondence to the home office at Los Angeles except as otherwise requested.

Chicago Office:
3618 No. Bernard Street
Phone: JUNiper 5575

Rates and Notices

Single Copy Rates
(except for special issues)

On newsstands:
30c in U.S.A. and Canada
1/8 in the United Kingdom
2/– in Australia and New Zealand

By mail, postpaid from home office:
Current issue:
30c in U.S.A., Canada, Newfoundland, Cuba, and Mexico
35c in countries which take the $3.00 subscription rate
40c elsewhere.
Back issue (if available):
35c in U.S.A.; 40c elsewhere.

Subscription Rates

	1 Year†	2 Years†
U.S.A.* (and possessions), Canada, Newfoundland, Cuba, and Mexico	$2.50*	$4.00*
Andorra, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Nicaragua, Panama, Paraguay, Peru, Salvador, Spain (and possessions), Uruguay, and Venezuela	$3.00	$5.00
United Kingdom	14/6	24/6
Elsewhere, except New Zealand	$3.50	$6.00

New Zealand, 18/6 annually from Te Aro Book Depot, Ltd., 64 Courtenay Place, Wellington.

**In California, add 3% sales tax*

Duties, if any, are not included in above rates.

†FREQUENCY

Published monthly (in the month preceding its cover date) except for August and September; ten issues yearly including enlarged special annual number. Special numbers will not be included with subscriptions for less than five issues; subscriptions cannot be started with back issues.

Terms and Remittances

Remittance in full must accompany all orders and must be payable *at par* in continental U.S.A., Canada, or the United Kingdom; British and Canadian postal notes accepted. Currency, etc. is at sender's risk. No stamps, please, unless other means of remittance are not available.

IF YOU MOVE

notify us *in advance* (first week of month preceding cover date); we cannot duplicate copies already sent to your old address; under U.S. postal laws these will be *destroyed* unless you have left forwarding postage with the postmaster (usually 5c per copy in U.S.A.)

◆

DISTRIBUTION IN BULK

In the continental U.S.A. (except New York and Chicago), Hawaii, and Canada, RADIO is distributed to the trade through dealers associated with the Kable News Co., Mt. Morris, Ill., to whom inquiries should be sent. In New York and Chicago, consult our local office. In U.S. territories (except Hawaii) and in foreign countries the trade is supplied direct from our home office at Los Angeles.

◆

PRINCIPAL FOREIGN AGENTS

Canada: J. A. Holmes, 615 W. Hastings St., Vancouver.

Europe: N. E. Read, 37, Willow Street, Oswestry, Shropshire, England.

Australia: "The Bulletin", Box 2521BB, Sydney.
McGills, 183 Elizabeth St., Melbourne.
Swain & Co., Ltd., Pitts St., Sydney.

South America: F. Stark, Caixa 2786, Sao Paulo.
Revista Telegrafica, Peru 165, Buenos Aires.

The Staff

Technical and Editorial Department

Editor
W. W. SMITH, W6BCX

Technical Editor
RAY L. DAWLEY, W6DHG

Associate Editors
K. V. R. LANSINGH, W6QX
B. A. ONTIVEROS, W6FFF

Assistant Editors
HERBERT BECKER, W6QD
GEORGE D. WALKER,[1] W4CTO
E. H. CONKLIN,[2] W9FM
CHARLES A. HILL, W6BRO
RUFUS P. TURNER,[3] W1AY

Technical Consultants
J. N. A. HAWKINS, W6AAR
RALPH O. GORDON, W6CLH
JAMES M. SHARP, JR., W6DMY
CHARLES D. PERRINE, JR., W6CUH

Laboratorian
FAUST R. GONSETT, W6VR

Laboratory Assistant
MARTIN A. BROWN, W6ABF

Editorial Secretary
D. O. WORTHINGTON

◆

Business Department

Los Angeles

Publisher
K. V. R. LANSINGH
Managing Editor
M. M. LLOYD
Circulation Manager
B. L. HOVER

New York

Eastern Advertising Manager
CLARENCE W. EMERSON
New York Circulation Representative
EDWARD J. BYRNE

Chicago

Midwestern Advertising Manager
CLYDE W. NELSON

◆

Correspondence and Manuscripts

Address all correspondence and manuscripts to the home office at Los Angeles except as follows:

1. *Radioddities, Strays*, and the like may be sent to Rufus P. Turner[3].
2. Calls Heard may be sent to George Walker[1]; also dx news and station descriptions from eastern America and from transatlantic countries.
3. Advertising inquiries may be directed to our nearest office, but all copy and cuts should be sent direct to Los Angeles.

Unusable, unsolicited manuscripts will be destroyed unless accompanied by a stamped, addressed envelope.

◆

Printed in U.S.A. by
GLENDALE PRINTERS, GLENDALE, CALIFORNIA

[1]Box 355, Winston-Salem, North Carolina.
[2]512 N. Main St., Wheaton, Illinois.
[3]159 W. Springfield Street, Boston, Massachusetts.

HERE'S THE SOLUTION!

CHICAGO AREA RADIO CLUB COUNCIL
INCORPORATED
CHICAGO, ILLINOIS

March 10th, 1937

TO ALL AMATEUR RADIO CLUBS

Much discussion is being heard on the air about the individual amateur having a direct vote in deciding important questions affecting all amateurs

The American Radio Relay League is the recognized authority speaking for Amateur Radio.

You are the League!

You should decide important questions!

This is your right — for without you there is no League!

Our directors are doing a wonderful job but they are handicapped. They can't talk to every Amateur personally.

A REFERENDUM IS THE ANSWER

A Referendum is the only way in which each individual amateur can have a direct vote in determining important decisions affecting Amateur Radio.

Mere discussion will not give us a referendum. Action is necessary.

At an open meeting of the Council attended by the leading amateurs of the Area and after serious discussion the enclosed Resolution was adopted. It was the unanimous opinion of those present that the right of referendum was the only solution for the amateur's difficulties

Since this is a question of such tremendous importance to all amateurs we are enclosing copies of the resolution in such form that it can be adopted by your club and forwarded to your director should you desire to take such action. It is also thought desirable that as many individual amateurs as possible sign the enclosed petitions

We would be interested in knowing the reaction of your club on this important matter and would appreciate hearing from you

73
CHICAGO AREA RADIO CLUB COUNCIL

ADDRESS CORRESPONDENCE TO
Room 1306 — 10 North Clark Street
Chicago, Illinois

AND HERE'S HOW TO DO IT!

TO THE BOARD OF DIRECTORS of the
AMERICAN RADIO RELAY LEAGUE.

We, the undersigned, being duly licensed Radio Amateurs do respectfully petition the Board of Directors of the American Radio Relay League that the Constitution of the American Radio Relay League be amended so as to provide that upon the request of any three (3) duly elected Directors of the American Radio Relay League any question affecting the general interests of amateurs shall be submitted to a vote of the entire amateur membership of the League and the result of the vote shall be binding upon the Directors and Officials of the League

CALL	NAME and ADDRESS

This Petition When Completed Should be Forwarded by the Club to Your Director

TO THE BOARD OF DIRECTORS of the
AMERICAN RADIO RELAY LEAGUE:

I, ______________________ do hereby certify that I am the Secretary of the ______________________ CLUB and that at a regular meeting of said Club held on the ____ day of ______________ A. D. 1937, the following Resolution was adopted, to-wit:

RESOLUTION

WHEREAS, since the formation of AMERICAN RADIO RELAY LEAGUE the amateur fraternity has continuously grown and the membership of the League has constantly increased, and

WHEREAS, the problems confronting the amateurs of the United States have and are becoming increasingly involved, and

WHEREAS, it is the consensus of opinion of the amateurs present at this meeting that problems affecting the amateurs be submitted to the entire group of the amateur membership of the League

NOW, THEREFORE, be and it is hereby

RESOLVED:

That the constitution of the American Radio Relay League be amended so as to provide that upon the request of any three duly elected directors of the American Radio Relay League any question affecting the general interests of amateurs shall be submitted to a vote of the entire amateur membership of the League, and the result of the vote shall be binding upon the directors and officials of the League.

DATED this ______ day of ______________ A. D. 1937.

____
Secretary.

After Resolution Has Been Adopted This Form Should be Executed by the Secretary and Forwarded to Your Director

Get complete information and blanks from:

CHICAGO AREA RADIO CLUB COUNCIL

ROOM 1306—10 NO. CLARK ST., CHICAGO, ILLINOIS

This Space donated without charge by the Publishers of "RADIO"

RADIO, May, 1937, no. 219. Published monthly except August and September by Radio, Ltd., 7460 Beverly Blvd., Los Angeles, Calif. By subscription, $2.50 yearly in U.S.A. Entered as second-class matter February 6, 1936, at the postoffice at Los Angeles, Calif., under the Act of March 3, 1879. Registered in the G.P.O., Wellington, as a newspaper.

PERFORMANCE AT A NEW HIGH *on* 10 *Meters*

THE NEW 10 meter "Super-Pro" introduced only last month has already been acclaimed by experienced amateurs, professional operators, engineers, and advanced experimenters, as a truly superior ultra-high frequency receiver.

Such is the unanimous verdict because the new "Super-Pro" using two stages of R.F. on all bands, including the 20 to 40 megacycle band, affords a sensitivity of 0.8 micro-volt (30% modulated) with a signal to noise ratio of 6 to 1 at 28 mc.! In addition, "Super-Pro" image rejection is so high as to provide complete freedom from "two-spot" tuning except in exceedingly rare instances. To be specific, the image rejection ratio at 28 mc. is 150 to 1.

The special design of the new "Super-Pro" electrical band spread system permits the 28 to 30 megacycle amateur band to be spread over 90 divisions of the dial. This affords comfortable non-critical tuning without an unnecessary amount of dial twisting. Tuning is so arranged as to require only one setting of the main tuning dial for reception on all amateur bands. Switching from one band to another, automatically places the desired amateur band in the center of the band spread dial, thus affording truly single dial tuning.

"Super-Pro" selectivity is another outstanding feature. With the variable band-width panel control set at 3 (the most selective position) the band width at 100 times input is only 8.5 kc. With the control set at 16 (the least selective position) the band width at 100 times input is 24 kc.

Every "Super-Pro" is accurately calibrated for direct tuning on all bands. Receivers are individually checked with crystal controlled oscillators and calibration is held to within a tolerance of plus or minus ½%. The 10 meter model provides a tuning coverage of from 1.25 to 40 megacycles in 5 bands.

A crystal filter model of the new "Super-Pro" is also available. The crystal filter circuit is so designed as to afford the hair-breadth selectivity required for completely successful C.W. reception, as well as a wider degree of selectivity required for practical "phone" reception.

There are countless other unusual features in this new "Super-Pro" among which are—calibrated band-width, beat oscillator, audio and sensitivity controls; stand-by switch; AVC-Manual switch; C.W.-Mod. switch; phone-speaker switch; 8 metal and 8 glass tubes; separate humless power supply; rugged self-contained tuning unit with trouble-free cam operated knife switch, etc.

The performance of the new "Super-Pro" sets a new high mark! Complete details appear in a special bulletin. Send for your copy now!

MAIL THIS COUPON!

HAMMARLUND MFG. CO., INC. **R-5**
424-438 W. 33rd St., New York

☐ **Please send me new "Super-Pro" bulletin.**
☐ **Please send me new "37" catalog.**

Name..

Address..

City.................................**State**.......

PRECISION PRODUCTS FOR BETTER RADIO

HAMMARLUND'S 25TH YEAR

THE WORLDWIDE TECHNICAL AUTHORITY OF AMATEUR, SHORT WAVE, AND EXPERIMENTAL RADIO

RADIO

The publishers assume no responsibility for statements made herein by contributors and correspondents, nor does publication indicate approval thereof.

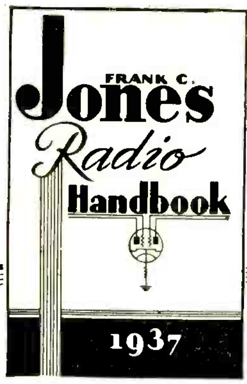
No. 219 May, 1937

CONTENTS

"RADIO" CONTRIBUTIONS

Contributions to our editorial pages are always welcome; though they will be handled with due care we assume no responsibility for those which are unsolicited; none will be returned unless accompanied by a stamped, addressed envelope. We do not suggest subjects on which to write; cover those you know best; upon request, we will comment on detailed outlines of proposed articles, but without committing ourselves to accept the finished manuscript.

Since we regard current "chiseling" policies as decidedly unfair, a small payment will be made, usually upon publication, for accepted material of a technical or constructional nature. Freehand, pencilled sketches will suffice. Good photographs add greatly to any article; they can easily be taken by the layman under proper instructions. For further details regarding the taking of photographs and the submission of contributions see "Radio" for January, 1936, or send stamp for a reprint.



"JONES RADIO HANDBOOK"

(1937 edition)

Formerly known as the "Radio Handbook"

BY FRANK C. JONES

AUTHORITATIVE

UP-TO-DATE

. . . COMPLETE

Over 400 pages, profusely illustrated. Greatest work of its kind ever published. Order from us direct.

$1.50 per copy prepaid in continental U. S. A.

Elsewhere, $1.65 or 7/-

Use the coupon on page 93.

RADIO with the EDITORS

Empty Bands?

Henry Wilson of W6NCT recently sent us a copy of a letter on the subject of putting some signals in the empty band from 29 to 30 Mc. before someone comes along and assigns it to the police, who rapidly have been using up their part of the spectrum. He also mentioned the unused 160 meter band from 1715 to 1800 kc.

The last time we listened, 160 meters was blank except for one ham set at an armory, working nobody—but that was about 1931. Lately, reports of crowded conditions have reached us, so on receipt of the above report in regard to the code portion, we went over to see W9KJY whose 101X covers that band. A quick run over the dial produced ten signals in the 85 kilocycles—not crowded, certainly, but more occupied than the enormous range from 29 to 30 Mc. Huntoon, W9KJY, mentioned that a number of army-amateur nets in Chicago operate on one-point frequencies, so that a single signal heard on, say, 1723 kc. might have represented as many as twenty stations, most of them listening at the moment. Furthermore, these stations seldom bothered with more power than a receiving tube or two, but sometimes worked out 1000 miles. Usually, however, these low power transmitters cause little or no QRM several hundred miles away, and probably do not reach the west coast and the ear of W6NCT.

Still, with 80 meters poking out so well, we think that much of the work within 50 miles now handled on the 80 and 40 meter bands should be moved to 160 meters (code portion). Self-excited oscillators can be made very stable on that band, and every junk box contains enough equipment to build an auxiliary transmitter, using a low power supply in the regular rig.

The next time you work someone within 50 miles or so, why not suggest finishing the QSO on 160?

Write Your Director

If anything is to be done during the next year to clear up the interference at 28 Mc., it will be done in May at the annual directors' meeting of the League at Hartford. We present some of the arguments and possibilities in the 28 Mc. problem which may suggest a solution to propose to your director before the meeting.

The interference has been caused largely by the piling up of stations at, or close to, 28,000 kc. with few if any stations beyond 28,500 or 28,800 even though the band extends to 30,000 kc. The other factor is that both code and phone stations can get close to the edge. Obviously an improvement will result if one or the other group is moved away from the edge. More improvements might result if the phones are moved, if for no other reason than the fact that they require 10 or 15 kc. each for a communication channel, while code stations less than a kilocycle apart can be copied. Also there is the practical problem of whether code *can* be ordered out of a "phone band"—in spite of the feeling of many that code has no "right" in the phone bands. On the other hand it is clear that phone can be moved or restricted.

In making any proposal regarding frequency restrictions, we should first look to the inconvenience that might be caused. Foreign stations seldom are given the consideration due them. The necessity to purchase new crystals is very important. Let us consider this last point.

At the present time, all 14 Mc. phone stations have crystals to operate between 14,150 and 14,250 kc., while all code stations use frequencies on either side of this range. Foreign operators avoid our phone QRM by using crystals falling in our "code" band, with many concentrated in the vicinity of 14,100 and 14,300, thus also avoiding the congested edges.

Now let's see what happens when this is extended to the 28 Mc. range. Code stations usually have crystals falling between 28,000 and 28,300, also from 28,500 to 28,800, but concentrating near 28,000 and 28,800. The foreign stations use these same frequencies but mostly are found around 28,200 with some scattered signals, and another slight concentration around 28,600. The phones in this country are ready to use the 28,300 to 28,500 range because of their 14 Mc. frequencies.

The above leads to a conclusion that if everyone can use the same crystals as on the 14 Mc. band, it will be least disturbing to all. Now this shouldn't be taken too literally, for the high frequency limits need not be set at this early date. Further, the changes in frequencies will not need to be permanent inasmuch as they will

[Continued on Page 84]

An Experimental 56 Mc. Dx Superhet

By Lloyd M. Jones, W6DOB

For those who are interested in pioneering dx on 56 Mc., for those who feel the need of a more selective type receiver for local rag chewing, we present this receiver with the assurance that it is far superior to any super-regenerative receiver we have yet tested.

In the past, many superheterodyne receivers have been used on 56 Mc. with some success. However, most users complain of the terrific auto ignition noise which is present on a u.h.f. superheterodyne. The initial cost of such a receiver plus a two or three tube noise suppressor is more than most fellows can afford in comparison with a super-regenerative receiver. A new type of noise limiting device (see Radio for January, 1937, page 109) has been incorporated in this receiver *without* additional tubes, and is by far the most satisfactory system yet tried.

After trying many types of circuits and combinations, the final result is a superheterodyne of conventional circuit, conventional application, but with a few special considerations in regard to construction and parts. These make it sensitive to weak c.w. signals and just broad enough to receive *most* all of the modulated self-excited phone signals with good readability. The constructional details will cover only the important points. Other details are to be treated in a conventional manner.

The special i.f. transformers used have optimum coupling and are tuned to 5000 kc. This places any possible repeats of local strong signals 10,000 kc. from the wanted frequency. The placement of parts is not altogether important so long as care is taken to keep the r.f. leads of all circuits extremely short.

The placement of i.f. and second detector parts in the receiver shown is the result of originally planning to use only one i.f. stage. Two stages were found necessary. The cure was to put in one more i.f. transformer and i.f. tube. The second detector then was mounted under the chassis on a small bracket.

The high frequency portion employs a 6K7 r.f. amplifier, 6J7 mixer, and 6J7 oscillator. R.f. injection to the mixer is from cathode to cathode. The value of the cathode coupling condenser, mixer cathode resistor, and oscillator grid leak and condenser should be close to the values specified in order to obtain maximum conversion. The low value oscillator grid leak is the secret of eliminating "birdies".

The exact placement of the taps can be determined only by experiment. The regeneration in the mixer stage interacts upon the r.f. stage to the extent that the r.f. stage becomes regenerative. The antenna is coupled up tight enough to prevent oscillation when the mixer screen grid voltage is at the most sensitive value. In the case of the receiver shown here the mixer screen voltage is about 30 volts for optimum results. Only *small* (physically) mica bypass condensers are used in the h.f. portion. The values are not critical but should not be less than .001 μfd.

The Coils

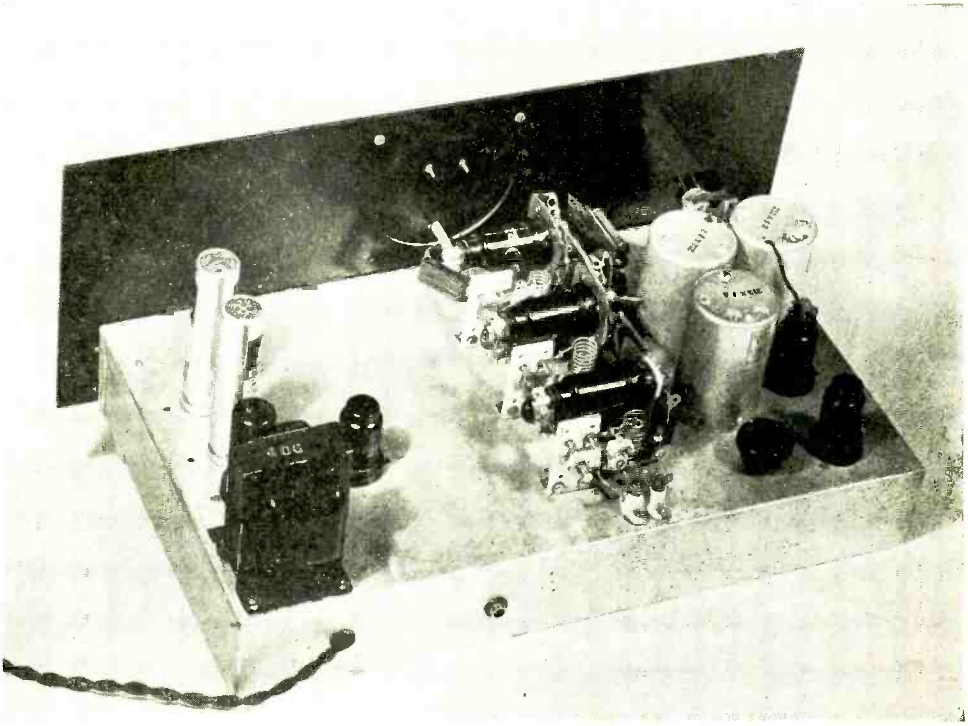
L_1 and L_3 are 5 turns of number 30 d.s.c. L_2, L_4, and L_5 consist of 8 turns ½ inch diameter, number 18 bare copper wire. L_1 and L_3 are coupled to L_2 and L_4 respectively, in the manner shown in the sketch. The d.s.c. affords ample insulation if a little care is used in winding, and gives optimum inductive coupling with a minimum of capacity coupling. An alternative would be to space-wind the no. 18 wire on a ½ inch form and then interwind the no. 30 wire so that they could be secured to each other with a *little* coil dope. Remove the form after the dope is dry.

The only objection to using the latter method is that while trying different positions of the taps the dope interferes with soldering.

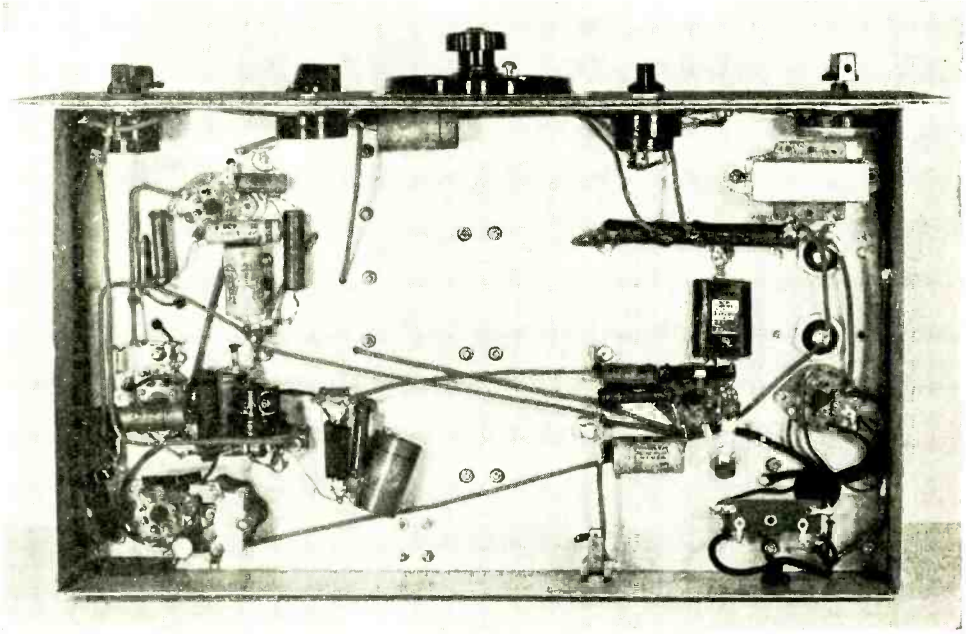
Small padders are used on the oscillator and r.f. stage to facilitate adjustment and band setting. The mixer inductance is well loaded by the r.f. plate coil and for final tracking the coil can be squeezed in or stretched out. The tuning condensers are ganged UM-15 "ultra midgets", revamped by removing all the rotor plates except one, which meshes between two stator plates. This gives a wide range coverage with plenty of overlap at each end of the band.

The I.F. System

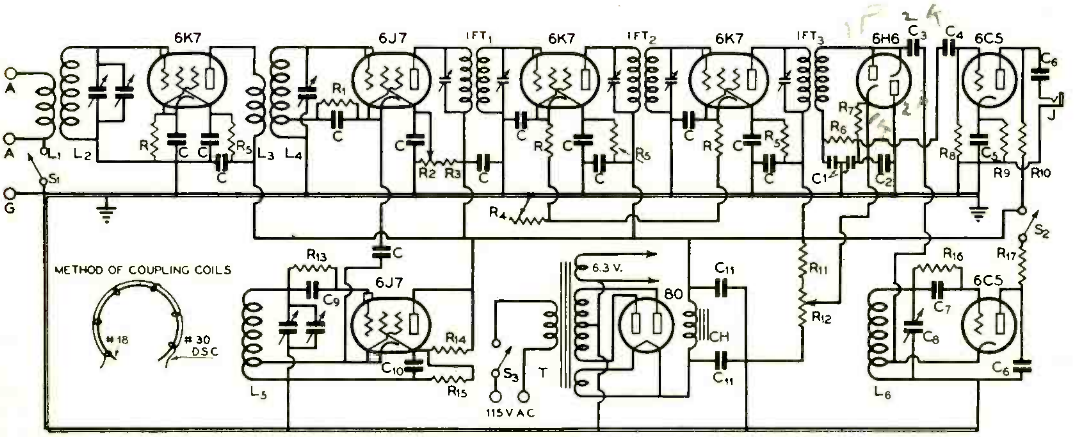
Two 6K7 tubes are used in the i.f. stages. The new type transformers were developed especially for this type receiver and are tuned to 5000 kc. at the factory. Optimum coupling permits maximum gain. The i. f. still is broad enough to pass the signals of about 90%



Showing Mechanical Construction Used to Obtain Short Leads



Under Chassis View of the Experimental U.H.F. Superhet



Wiring Diagram of the 56 Mc. Superheterodyne

R—300 ohms, 1 watt
R_1—5,000 ohms, 1 watt
R_2—50,000 ohms, 1 watt
R_3—50,000 ohms, 1 watt
R_4—10,000 ohms, 1 watt
R_5—100,000 ohms, 1 watt
R_6—50,000 ohms, ¼ watt
R_7—500,000 ohms, ¼ watt
R_8—1 meg., 1 watt
R_9—2,500 ohms, 1 watt
R_{10}—50,000 ohms, 1 watt
R_{11}—50,000 ohms, 1 watt
R_{12}—10,000 ohms, 1 watt
R_{13}—10,000 ohms, ¼ watt
R_{14}—20,000 ohms, 1 watt
R_{15}—30,000 ohms, 1 watt
R_{16}—50,000 ohms, ¼ watt
R_{17}—50,000 ohms, 1 watt
C—.006 μfd. midget mica
C_1—.0001 μfd. mica
C_2—1 μfd. paper tubular
C_3—See text
C_4—0.1 μfd. tubular
C_5—10 μfd. electrolytic
C_6—0.25 μfd. tubular
C_7—.0001 μfd. mica
C_8—100 μμfd. midget variable
C_9—.0001 μfd. mica
C_{10}—0.25 μfd. tubular
C_{11}—8 μfd. electrolytic
CH—20 hy., 45 ma.
T—250 each side c.t., 5 v., 6.3 v.
IFT—5000 kc. tuned transformers
H.F. tuning condensers: See text

of the self-excited phone-modulated signals. The other 10% are so badly frequency-modulated that they sound terrible even on a super-regenerative receiver. The i.f. gain is controlled by the 10,000 ohm potentiometer. I.f. plate decoupling resistors of 300 ohms may be necessary in this receiver to prevent oscillation.

The Noise Silencer

A 6H6 is used to perform the duties of detecting and noise limiting. It is suggested that reference be made to the January issue for detailed explanation of this system. There is no tendency toward regeneration, instability, nor critical adjustment. The same method is used in the writer's 28 and 14 Mc. superheterodyne with good results. The method of obtaining bias in this set is somewhat different from that shown in the original article. However, the action is the same. If a.v.c. is used it will be necessary to use the circuit in the original article.

The method of securing bias in this receiver eliminates the use of a heavy dropping resistor in the power transformer negative-high-voltage lead and high-capacity filtering condenser. It also was found that the values of resistors and capacitors in this combined second detector and noise limiting circuit were not the least bit critical. The 1 μfd. condenser from the variable tap on the potentiometer to ground is used mainly to eliminate scratches when the "pot" is varied.

The B.F.O.

A 6C5 is used in the beat oscillator circuit and is coupled to the diode detector through a small capacity, C_3, made by twisting together two pieces of push-back wire until sufficient coupling is had to produce a good beat with the incoming signal. The beat oscillator coil was made by scramble winding four feet of number 32 double silk covered wire on a half-inch wooden dowel, with the cathode tap taken off at six inches from ground. The coil is tuned wtih a 100 μμfd. condenser.

For earphone reception one stage of audio using a 6C5 is ample. For loudspeaker reception a power pentode should be used. A heavier duty power supply would then be necessary.

The power supply is conventional and the filtering is adequate for the tubes used. If an 8 μfd. condenser is placed from the screen grid of the high frequency oscillator to ground, it will help give a cleaner signal when receiving crystal T9 signals.

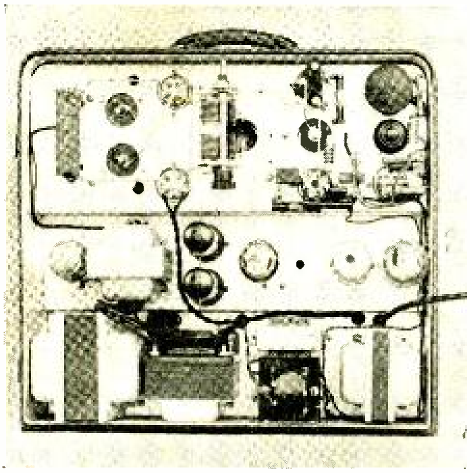
The alignment of the high frequency and intermediate frequency circuits is simple, and those who have built their own superhet for use on lower frequencies should have no trouble.

A Portable: Combined P.A. and Transmitter

By Bert Williamson, W6JCW

During the past few years there have been many articles printed concerning a great many different types of portables. In each case there has been one or more things that in the writer's opinion made the unit unsuitable for his personal use. However, by remembering the good features that had been incorporated in each, when the material at hand was brought out the layout was made easier. After due consideration and much time spent in moving the various parts from here to there, the layout shown was decided upon.

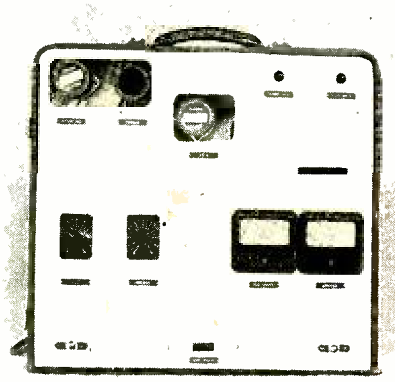
Upon consideration of the completed transmitter the following features will be found. First, the unit is complete. All the necessary tubes (even spares), the microphone, and the power supply are contained in the one cabinet. Also, the unit is movable without the use of the proverbial "ten ton truck" required by so many portables. This is quite remarkable when



Back View with Cover Removed

you consider the fact that the transmitter is capable of handling an input of 40-60 watts on all the ham bands from 160 through ten meters. Also incorporated is a modern design high-quality speech amplifier-modulator system capable of fully modulating the transmitter. An auxiliary output is also provided for using the speech amplifier as a high power public address system.

The carrying case measures 15" wide by



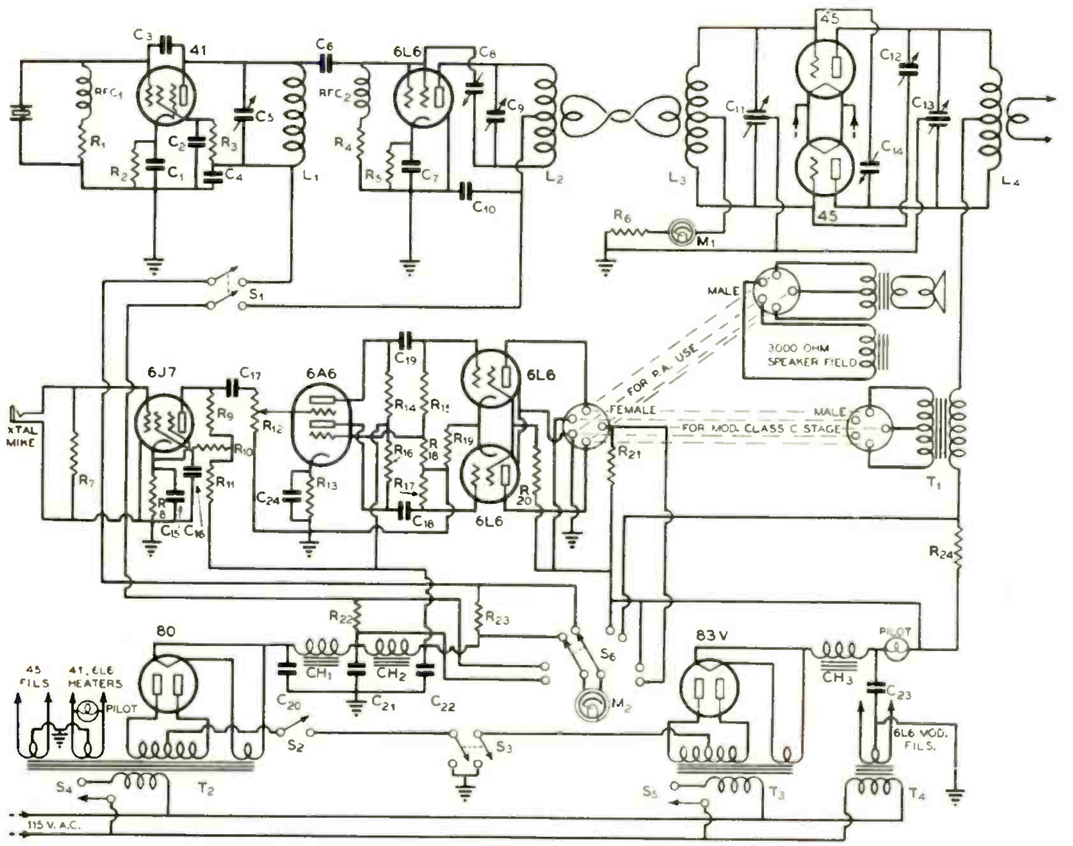
All Set to Go Traveling

14¾" high by 7" deep and has removable doors both front and back. It is of a type generally available at large luggage stores. A band of 18 gauge galvanized iron 6" wide was made which just fits the inside of the case. Into this band was riveted the peculiar chassis illustrated. The various offsets and levels of the chassis were made to accomodate the different stages of the complete rig.

Looking at the rear view photograph and reading from left to right on the upper deck can be seen: first, the mounting for the final tank coil and next, the slotted shafts of the two final neutralizing condensers, which are mounted on a strip of mycalex. Then come the sockets for the final tubes and the grid tuning condenser. Further to the right are the by-pass condensers, neutralizing condenser, socket, and associated parts of the 6L6 buffer stage. At the extreme right can be seen the crystal and associated parts of the crystal stage.

On the next deck below can be seen the rectifier for the high voltage supply, the modulation transformer, the speech amplifier, and to the extreme right the rectifier for the low voltage supply. The bottom section is mostly occupied by the various power transformers, chokes, and filament transformers needed to complete the power supplies.

The front panel view needs little explanation. Of course everything appears in inverse order to that of the back view. A few things,

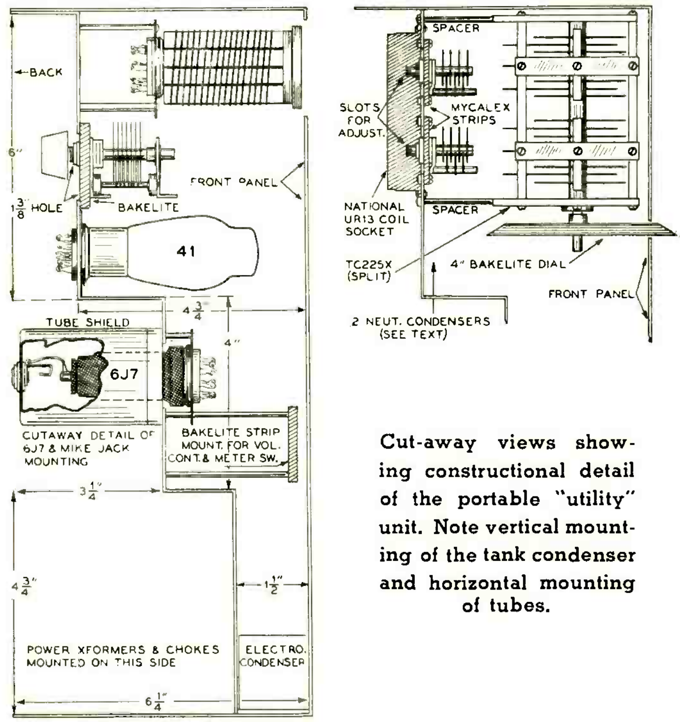


Wiring Diagram of the Combination P.A.-Transmitter

C_1—.01 µfd. mica
C_2—.01 µfd. mica
C_3—1½" twisted hook-up wire
C_4—.01 µfd. mica
C_5—100 µµfd. midget
C_6—.0001 µfd. mica
C_7—.01 µfd. mica
C_8—15 µµfd. midget
C_9—100 µµfd. midget
C_{10}—.01 µfd. mica
C_{11}—100 µµfd. per section split-stator midget
C_{12}—35 µµfd., 2000 volt midget (two stator and two rotor plates removed)
C_{13}—Split 225 µµfd. 3000 volt condenser (110 µµfd. per section)
C_{14}—Same as C_{12}
C_{15}—10 µfd., 25 volt electrolytic
C_{16}—0.25 µfd., 600 v. tubular
C_{17}—0.1 µfd., 600 volt tubular
C_{18}, C_{19}—0.1 µfd., 600 volt tubular
C_{20}, C_{21}, C_{22}—8 µfd., 450 volt elect.
C_{23}—8 µfd., 600 volt electrolytic
C_{24}—10 µfd., 25 volt electrolytic
R_1—50,000 ohms, 1 watt
R_2—400 ohms, 10 watts
R_3—50,000 ohms, 2 watts
R_4—25,000 ohms, 10 watts
R_5—400 ohms, 10 watts
R_6—25,000 ohms, 10 watts
R_7—5 megohms, ½ watt
R_8—2000 ohms, 1 watt
R_9—250,000 ohms, ½ watt
R_{10}—1 megohm, ½ watt
R_{11}—10,000 ohms, ½ watt
R_{12}—½ megohm potentiometer
R_{13}—2500 ohms, 1 watt
R_{14}—250,000 ohms, 1 watt
R_{15}—500,000 ohms, ½ watt
R_{16}—250,000 ohms, ½ watt
R_{17}—500,000 ohms, ½ watt
R_{18}—15,000 ohms, ½ watt
R_{19}—250 ohms, 10 watts
R_{20}—10,000 ohms, 10 watts
R_{21}—20 ohms, wire-wound
R_{22}, R_{23}, R_{24}—20 ohms, wire-wound
S_1—DPST toggle sw.
S_2—SPST toggle sw. send-receive
S_3—DPST switch
S_4—SPST toggle sw.
S_5—SPST toggle sw.
S_6—Double pole, four position meter switch
L_1, L_2, L_3—Wound on 1½" dia. forms
L_4—Wound on National UR-13 form
Coils—See Handbook for appropriate values for band desired
T_1—P.p. 6L6 to 3800 ohm load
T_2—Power trans. 750 c.t. 125 ma., 6.3 v. and 2.5 v. fils.
T_3—1000 c.t. 250 ma., 5 v., 3 amp.
T_4—6.3 volt, 3.3 amp. fil. transformer
CH_1—12 hy., 125 ma. filter choke
CH_2—12 hy., 125 ma. filter choke
CH_3—350 ma. swinging input choke
M_1—0-50 ma. square case meter
M_2—0-200 ma. square case meter

however, should be mentioned. The two small "bulls-eyes" in the upper right hand corner are signal lamps to indicate when the plate and filament voltages are on. Directly below these is the tuning "dial" for the final plate tank. The balance (the switches, meters, volume control, etc.) need no further discussion.

The circuit details of the r.f. section are entirely conventional. The mechanical layout, however, is quite unconventional and needs some explanation of the less obvious points. The sockets for all the coils except the final plate coils were mounted on spacers to bring the coil tops flush with the front panel. This aids greatly in enabling the coils to be inserted and removed more easily when changing bands.



Cut-away views showing constructional detail of the portable "utility" unit. Note vertical mounting of the tank condenser and horizontal mounting of tubes.

Both the final grid and plate condensers are mounted with their shafts vertical to make the various tank leads more short and symmetrical. The grid condenser must be tuned from the back but the plate condenser has a four inch dial mounted upon its shaft, the edge of which projects through the front panel. Thus the final plate condenser can be tuned from the front panel in somewhat the same manner as the old Atwater Kent and Grebe receivers were tuned. The balance of the constructional details can be gathered from the photographs and diagrams.

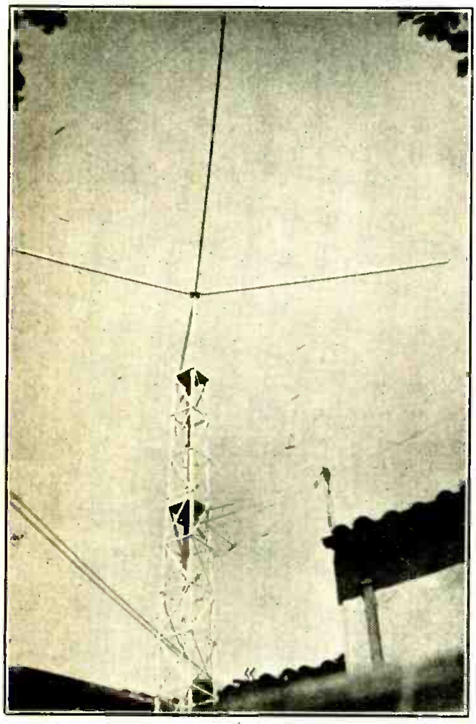
One thing more on construction: be very sure thoroughly to shield each circuit (especially the 6J7 input and crystal mike leads) from the other by properly placed baffles and shields.

The speech system is very simple but does have ample gain for a diaphragm type crystal mike. A 6A6 is used as a phase inverter and, with normal signal, gives ample gain to drive the 6L6's to 25-35 watts output either as a modulator or as a public address system. The p.a. speaker must be a good one to stand the audio power. Also, its field coil should have a resistance of 3000 ohms for best operation.

Coils, tuning up, etc., are entirely conventional and need not be described. The following list of plate voltages and currents to be expected on the various stages will help to indicate normal operation of the rig.

Crystal plate current	30 ma.
Crystal plate voltage	300
Crystal screen volts	150
Buffer plate volts	325
Buffer screen volts	225
Plate current (doub.)	75 ma.
Plate current (buff.)	50 ma.
Final Amplifier	
Plate voltage	425
Plate Current	100-140 ma.
Grid Current	18-20 ma,
Modulator (2 tubes)	
Plate volts	425
Plate Current (no sig.)	115 ma.
Maximum Sig.	135 ma.

Signal Squisher Suggestions



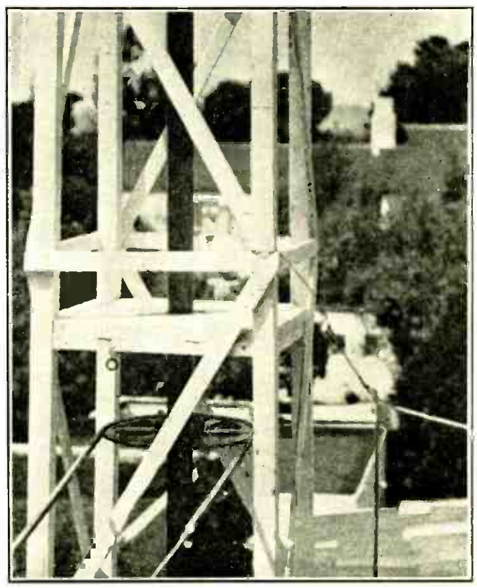
Here is the 20 meter "Squisher" of W6LEN. The tower rests on the ground, not the house as one might be led to believe from the photograph. Mounting a tower on a roof is "out" when the roof happens to be California tile. The "clothesline" construction keeps the radiator taut and makes a neat installation.

The rotatable array described by Smith in the last issue may be used horizontally instead of vertically with slightly improved performance when the array is used for receiving. Transmitting there will be little difference between the vertical and horizontal orientation. When used horizontally, it is more readily apparent that the array is quite similar to the Kraus "Flat Top Beam", from which sprang the "Signal Squisher" idea.

In the horizontal position, it is somewhat more desirable mechanically to make the matching sections ¾ wave long instead of ¼ wave long. The losses will be slightly higher with the longer matching section, but still so low that one need not worry about the losses. The losses do not become appreciable unless the stub is made 7, 9, or more odd wavelengths long.

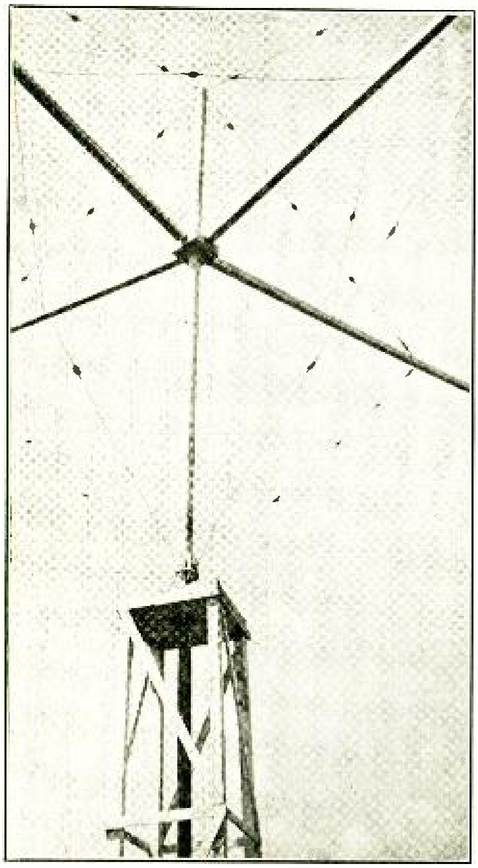
The accompanying illustrations show three "Squishers" as installed by Beverly Hills, California, amateurs. All three are horizontal, have quarter wave matching sections, and are for 20 meter operation (about 17 feet on a side). Their owners report substantially improved reports over the antennas formerly used. One of the arrays is also tiltable, as described in the caption.

It might save some preliminary "cut and try" to give the approximate distance from the shorting bar the feeders are attached to the matching section. The feeders attach quite a bit closer to the shorting bar than in a conventional "J" antenna system, the distance being around 12 to 16 inches for a 400-500 ohm transmission line at 14 megacycles, and a corresponding amount on other bands.



A bicycle sprocket and short length of chain rotate the W6LEN array through 200 degrees, more than adequate. A half dozen pulleys and some oiled clothesline cord make the array rotatable from inside the station.

The correct position of the shorting bar should be determined as has been often described for the J type antenna system. The antenna should be shock excited from a half-wave doublet stretched out on the ground nearby, and a thermogalvanometer run up and down the matching stub to determine the resonant point.

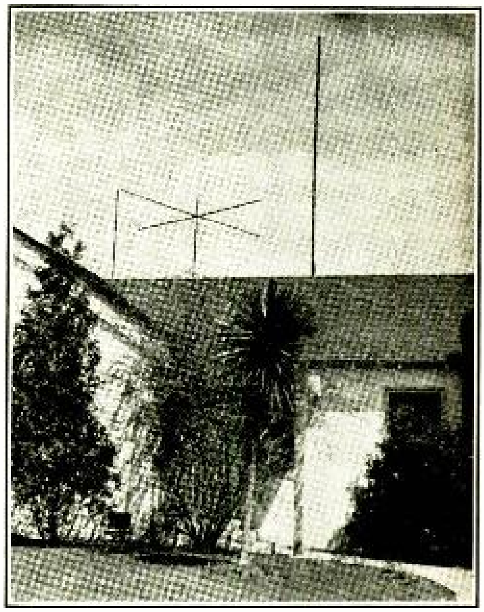


Closeup of the arms supporting the radiators. The arms are fastened by hinges to the block, which slides up and down the round vertical support stick. Before erecting, the block is slid up towards the top until the radiators are under slight tension and then nailed to the vertical stick. The guy wires shown are then added.

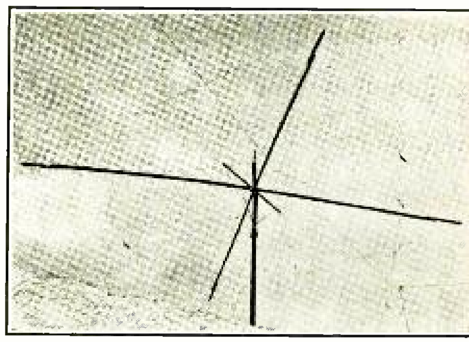
After the shorting bar is attached at this point, the feeders are attached about as above, and then slid slightly up or down as necessary to remove completely all standing waves from the transmission line.

Receiving on Rotatable Arrays

It seems a shame with the already large and ever increasing number of users of rotatable beam arrays that more do not realize the wide range of usefulness of the system on the *receiver* as well as on the transmitter. In the first place,



The 20 meter "Squisher" of W6MLG is supported from a cable run between the two poles formerly used to support a "Q". As the framework is "hung" from the top, the guying problem is made much more simple.



W6FTU has his 20 meter "Squisher" hinged so that in addition to being rotatable it is also tiltable. He is thus able to control the vertical angle as well as the horizontal directivity. His also is suspended from a rope between two poles formerly used to support a doublet. All movements of the "Squisher" are controlled from within the station, both in a horizontal and a vertical direction.

it seems a bit foolish to make such exacting calculations and adjustments as to the direction of the beam when it is really so much easier and more accurate to hook the system to the receiver and then rotate until the desired dx signal comes in best. After all, that is really the best direction of propagation between your location and that of the dx station. Also, by using a direct system such as this, you do not have to worry about "deviation from true North", "effect of surrounding objects upon the space pattern", and kindred but somewhat indefinite considerations. Since signals travel in the same horizontal angle (vertical plane) in both directions between the two points, if we have the best angle for reception it will also be the best angle for transmission to that point.

Another good reason for using the beam on the receiver as well, is that QRM from stations off the side will be reduced by an amount proportional to the horizontal selectivity of the beam.

The switching of the feeders from the transmitter to the receiver can easily be accomplished by means of one of the many types of d.p.d.t. a.c. relays now on the market. It is best that the relay feed the energy to the receiver when in the "non-operated" condition. In this way the coil of the contractor can be connected across the primary of one of the plate transformers in the transmitter. Thus, when the plate power for the transmitter comes on, the relay will immediately switch the feeders to the rig.

Our stenographical staff has threatened to make a patchwork quilt from cards received in our QSL contest.

Magnetic Variation from True North

By B. A. Ontiveros,* W6FFF

Several inquiries have been received from readers asking for information as to finding true north from magnetic compass readings in their particular localities, as they wish to point their beam antennas for greater accuracy of direction.

There is a series of points running from Marquette, Mich., down through several states in a rather crooked fashion and out through Savannah, Georgia. This forms a line known as an *agonic line* and at the present time locations on this line have little or no declination either towards the east or the west; that is, the compass readings taken on this agonic line are close to true north. Easterly of this line the "west declination" becomes greater and greater, which means that the compass needle points *west* of north by a larger and larger number of degrees (as great as 20 degrees at Eastport, Maine, and 24 degrees at points in eastern Canada).

West of the agonic line, the same thing holds true in the *opposite* direction; that is, as one goes farther west the magnetic needle will point *east* of north by an increasing number of degrees.

Another factor that makes magnetic readings somewhat unstable is that in various areas the magnetic lines of force change slowly in cycles of a couple of hundred years, swinging slowly in one direction and then changing direction and slowly swinging back. These changes on the earth's magnetic map are known as *lines of annual magnetic change* and vary from 1′ per year to 3′ in a year, depending on the location and season. Beside these changes there are declinations which swing slightly over 24 hour cycles, and magnetic storms lasting from a few hours to several days which sometimes produce minor fluctuations. Minor fluctuations are occuring most of the time (1 or 2 minutes deviation).

Of course these variations which are constantly occuring in a small way are of no importance to users of beam antennas, but when using this type of antenna in connection with a great circle map it is desired to set the planned direction within 5 degrees; so the data reproduced herewith shows roughly the points which the various lines of east and west equal magnetic direction touch in 5 degree steps east and west of the agonic line.

For those desiring further information or closer readings, a map of the United States has been made by the U. S. Coast and Geodetic Survey which shows all the lines of magnetic declination in 1° steps as well as the lines of annual change. This map is titled "Lines of Equal Magnetic Declination and of Equal Annual Change in the United States for 1935." The number is 3077. The price is 20 cents. A small booklet, "Magnetic Surveys", Serial Number 272, supplements the map and costs 5 cents. These may be secured from the Superintendent of Documents, Washington, D.C. (No stamps are accepted.)

The agonic line on which there is, generally speaking, no deviation from magnetic north and true north enters the United States through Lake Superior and runs down through Marquette, Mich.; Muskegon, Mich.; Fort Wayne, Ind.; Cincinnati, O.; Lexington, Ky.; Knoxville, Tenn.; Aiken, So. Carolina; and through Savannah, Ga.

West Declination

5°—Sault St. Marie, Port Huron, Mich.; New Castle, Penn.; Clarksburg, W. Va.; Charlottesville, Va.; and out to sea at Cape Lookout.

10°—Enters U. S. between Syracuse and Rochester, N.Y.; extends through Scranton, Penn.; and Trenton, N.J.

15°—Between Ottawa and Montreal, Can.; Plattsburg, N.Y.; Rutland, Vt.; Lowell, Mass.; and Nantucket Island.

20°—Quebec, Can.; through Eastport, Maine.

East Declination

5°—Down between Hibbing and Duluth, Minn.; Grantsburg, Wis.; Dubuque, Iowa; St. Louis, Mo.; Carruthersville, Ark.; Macon, Miss.; and Mobile, Ala.

10°—Fargo, N.D.; Yankton, S.D.; Concordia, Kan.; Jacksboro, Tex.; and slightly east of Laredo, Tex.

15°—Kenmare, N.D.; slightly west of Rapid City, S.D.; Wheatland, Wyo.; Delta, Colo.; and Imperial, Calif.

20°—Havre, Mont.; Andrews, Ore.; and Yreka, Calif.

*Associate Editor, Radio.

The expressions here remind us of a bunch of amateurs examining the door prize at a hamfest. The little fellow directly behind the receiver (scratching his ebony noggin) is wondering if those terminals are for a doublet or a Marconi.

The Congo Calls on 20 Meters

By C. R. Stegall*

The longer I live, the less I seem to know about this business of radio. I first came in contact with it back in 1912. Those were the days I was floundering in calculus at Georgia Tech. At that time I knew nothing of calculus; I did know something of radio because at that time there was little to be known. During vacation I climbed up in my father's hay-loft, cut a lot of lengths of hay baling wire and made a spark coil which really produced a spark. And my signal was heard a full mile away. At least a sympathetic friend claimed that he heard it.

And had I been privileged to remain in America at that time when radio was still in its swaddling clothes so that I might have grown up with it, as it were, I might still know something about it. But alas! In 1915 I was sent as a missionary of the Presbyterian Church to the heart of the Belgian Congo where the people had their own "radio" systems and codes, talking long distances by drums. And while I have learned a little about drum-talking during these intervening 22 years, I realize that I am a hopeless back number when it comes to dealing with tubes, quartz crystals, and such gadgets.

Nevertheless I have hanging on the wall of my African hut a big green certificate of which I am rather proud. It bears in bold type the letters "WAC". And I am proud of it not because it is rare, for it is not; but because of the difficulties, some heart-breaking, which were overcome before accomplishing this feat. Also because it was done on very low power, since this station has never been operated on anything save a single type 210 tube. The story of these sometimes seemingly impossible difficulties may bring hope and encouragement to others in hard places. For this reason it is told.

The long years between 1915 and 1923 may be hurriedly passed over, for these were years of longing rather than of accomplishment. Many is the time during those years that I wondered what radio signal was finding its lonely way into the vast equatorial forest in which I lived. That signals were reaching me I had no doubt. But no ear had ever heard them.

It was in 1923 that I was able to take the first faltering steps toward accomplishing something with the ether. At that time I secured, through

*OQ5AE (formerly ON4CSL), the Reverend Carroll R. Stegall, Lubondai, via Tshimbulu, Kasai, Belgian Congo.

the help of some friends in Chattanooga, my home town, my first receiver. Herein lay the first of a long series of disappointments. The receiver was a standard long-waver and would not bring in the short waves. In fact the only thing this receiver ever produced in my ear phones (it had no speaker) was the worst roar of static which has ever impinged on human aural organs. I put the phones on the head of our most intelligent native. In terror he snatched them off and gasped, "I thought you said the Great War in Europe was over!"

The World's Static Factory

I thought then and am still of the opinion that Central Africa is the great generating plant of the static of the world. One must actually hear it, or rather *feel* it to believe its appalling volume. But it was something to hear even static. In any case it was the first time since man had ears that static had been heard in this part of the world, and I felt that I had made real progress.

I did not then know what I have subsequently discovered, that it is only when one drops down to as low as 42 meters that one is able to read a signal through the QRN. Even the 20-meter band is sometimes impossible, although it is usually quite free from this difficulty. This is the only band ever used with success at ON4CSL. The 10- and 5-meter bands have yet to be tried.

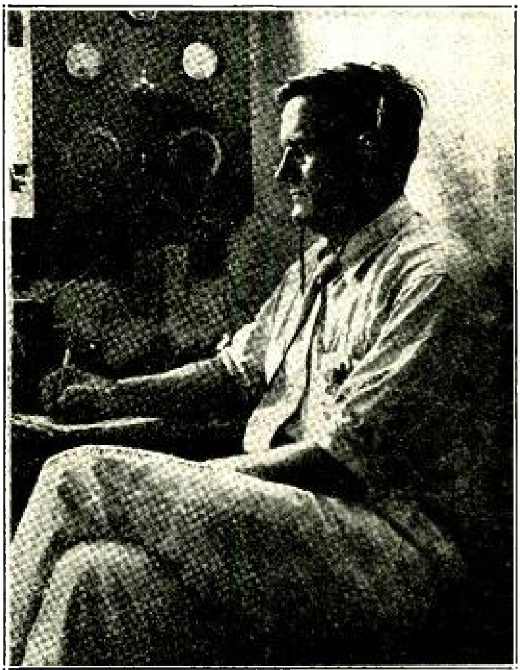
One cannot say that my original receiver was an entire loss for I learned many things from my failures, principally that a long-wave receiver would never work in Congo. I was at that time taking two American radio magazines and was reading them avidly. I learned of the great strides made in short-wave work; of the remarkable distances covered; of the freedom from static; of its comparative simplicity. This latter appealed to me immensely. Perhaps if it were real simple I could master it.

In 1925 I went to America with the avowed purpose of learning something about this business of short-wave radio. I was going on sick leave, having just passed through a severe attack of sleeping sickness. A transmitter was far beyond my fondest dream. All I dared hope was that I could make a receiver work in Central Africa. If I could make a receiver work, perhaps some day a transmitter would be forthcoming. So I made the acquaintance of a gentleman who had been a radio operator in the Navy. He was then, as he called himself, a "radiotrician" and was operating a repair shop. He kindly permitted me to work in his shop, making repairs under his direction until I was able to assemble a kit. I bought two Aero short-wave kits and assembled both. They were humdingers too. We even heard Los Angeles and Panama from our shop in Asheville, N.C.! Perhaps I could hear the outside world from the Congo! It was only a dream but it was worth a try. The day I left for my steamer my radiotrician friend gave me a check for $25 for one of the sets and I sailed with the other. Some months after I reached Africa my bank returned the check to me marked "Unknown" and I had added one last lesson from my radiotrician friend.

But I had learned to operate that 3-tuber, the receiver which was later to become known as the "pickle bottle receiver" for reasons which will appear later.

Success

I unpacked it and the various and sundry batteries, A, B, and C, and had a native climb a couple of palm trees outside my hut and stretch an antenna wire. Early in October I was ready to try her out. Late one night I plugged in the phones and turned on the juice. It oscillated. I turned the straight line frequency condenser until I picked up a nice whistle, then



ON4CSL (now OQ5AE) at the Key of His Former Transmitter

QRZ? An African "drum talker" ripping it off at a fast clip. He is strictly a c.w. man, incidentally. We understand these boys will challenge any group of 5 meter hams to a QSP field day contest. We are putting our money on the boy in the photograph.

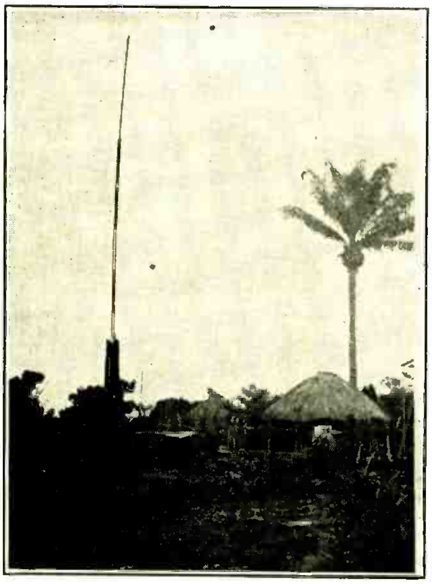
backed off the tickler coil just below oscillation. "Strike two!" I heard the announcer call. I jumped straight up. The World Series games were on and so perfect was reception that I could easily hear the bat smack the ball or the ball plunk into the catcher's mit, as the case might be. I was listening to WGY's short-wave broadcasting station W2XAD, for many years the stand-by of American short-wave broadcasting stations, and still among the best.

Until one has gone through such an experience one can never know what this meant to me. Not only did it mean that my faith and labor had been vindicated; it meant that we were in touch with the outside world. The world had opened up. Remember that at that time it required from ten to twelve weeks for a letter to travel from the States to me. We were as isolated as the fictitious Martians. Suddenly America was brought right into our African hut. We could hear music and voices from home! Who can know the thrill of such an experience to one who had for years been cut off? It was a dream come true.

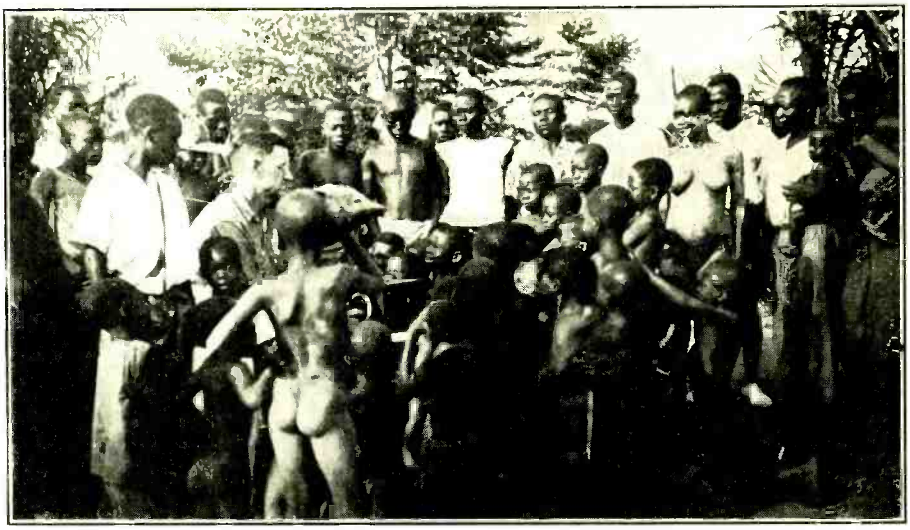
But all was not to be smooth sailing. I noticed on the case of the B batteries "Store in a *dry, cool* place." Now such a place does not exist in the tropics. All the places I have discovered are just the opposite. They are *damp* and *hot*. So at the end of six months I found to my dismay that my B batteries were dead. I say "dismay" meaningly. Elsewhere in the world a set of dead B batteries is simply replaced. Go down town and buy a new set. Or write to the mail order house and get a set in a few days time at a cost of less than five dollars. For me, however, the situation was quite different. I knew as a result of long years of experience in ordering goods from the States that twelve months was the shortest possible time in which I could hope to receive new batteries. In the meantime my receiver was dead and another World Series would be on in a few months' time. Distress? I'll say!

Saved by Pickle Bottles

The only solution was to make my own B batteries. I carefully removed all the little carbon rods from the dead B's. Fortunately the local Mission Hospital had a supply of manganese dioxide and sal ammoniac on which I could draw. But where could I get containers? I needed ninety of them! A raid on my wife's pantry produced only twelve empty jam and pickle bottles. So I sent an SOS to all the white people living in a radius of 200 miles begging for empty pickle bottles. Some of them



One of the 52-foot masts used to support the rhombic antenna used at ON4CSL (now OQ5AE).



A group of natives gathered around the Reverend Mr. Stegall to hear the little black box make magic talk from white man in far off country. They never cease to be amazed at what emanates from the phones. Stegall now has an FB-7 and speaker.

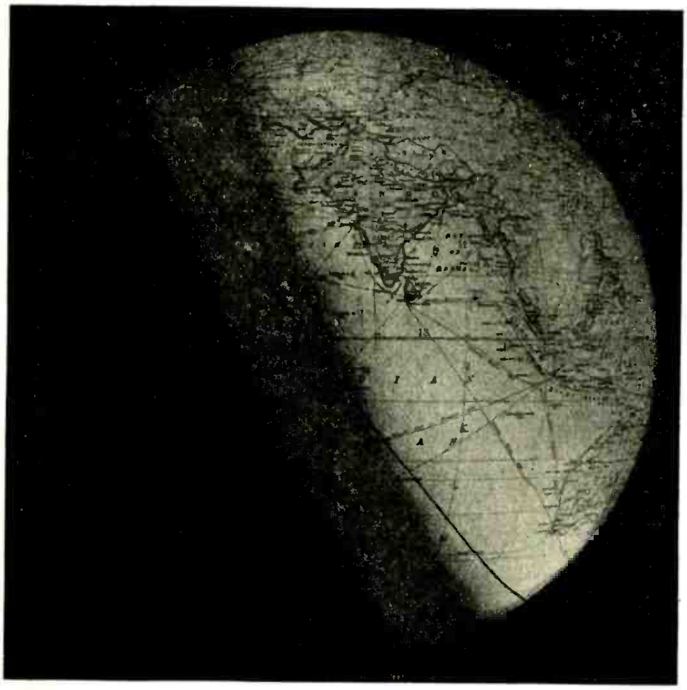
thought that the sleeping sickness had affected my brain, but nevertheless sent the bottles. The spirit of cooperation and liberality in the far off places is a beautiful thing. Some of those folks gave me their last empty bottle, and bottles are valued highly in the Congo. Thus I secured more than 100 bottles with which I built up the "pickle bottle" battery. Theoretically it would give me 135 volts. Actually, due to internal resistance and other losses, it never gave more than 70 to 80 volts and was a source of constant trouble. But trouble or no trouble, it worked and I used this motley assortment of bottles until I received regular batteries from the States.

I became sufficiently proficient in the code to be able to handle press dispatches from commercials, notably from DIS/DIH, and I discovered to my delight that I was able to pick up amateurs from all over the world. My old log shows many W stations heard. Here are a few of them: 1BAD, 2EL, 2DH, 1CMX, 2OA, 2BWC, 2MB, 6CH, 2ARB, 1UH, 2ZG, 2BFM, 2AMR, 2CM, etc., etc. So I began to itch for a transmitter. Perhaps you know that feeling. But for me this was made difficult due to the fact that I did not possess even a passing acquaintance with vacuum tube transmitters. Furthermore, my nearest ham neighbor who might advise and help me was in South Africa, some 2000 miles away. Nevertheless it is to a ZU that I am indebted for my first transmitter, for ZU6S made and shipped me a bread-board Baby Colpitts for use with a type 201-A tube. I erected a fine zepp antenna, suspended between two tall palm trees. The dowel rod spreaders on the feeders were most impressive and mysterious to the natives. One asked me if this was a new method of climbing into heaven.

The sad fact that I never held a two-way QSO with this transmitter was not due to any failure on its part or on mine. It performed well, within the limits of its possibilities. But it was just expecting a little too much to hope that a signal of only one watt would be heard some thousands of miles away.

The First QSO

In 1932 I was moved from my old post at Luebo to a new post some 180 miles to the south, called Lubondai. The local hospital was supplied with a 32-volt lighting system consisting of a bank of 75-amp.-hour Edison cells. These are charged with a turbo-generator driven by steam from a wood-burning boiler. This outfit was placed at my disposal. Surely the time had come for me to go on the air. I decided on the simplest outfit possible. I built up a tuned-grid tuned-plate rig using one 210 tube. The filament voltage of 7½ was secured by placing a resistor in the 32-volt line. I did not have a variable resistor, so I made one by wrapping some wire around an old porcelain tube and using a large battery clip for the



Around the World Radio Echoes

By A. C. Peterson, Jr.*

Since the earliest experiments with long wire telephone circuits, echoes have been a source of annoyance. They normally are caused by the reflection of energy at impedance irregularities along the transmission path. In radio transmission, where the signal energy is confined only by the earth and the ionosphere, echoes are caused by the signal arriving at the receiver after traveling over different paths. Since these paths may differ considerably in length, there is a corresponding difference in the time of arrival of the signals, and thus the effect on reception is similar to that of echoes caused by reflection on wire lines.

Radio waves passing between two points on the earth follow great circle paths, that is, paths lying wholly in a plane determined by the two points and the center of the earth. For any two points which are not diametrically opposite each other there is only one such plane, but there are two directions that a radio signal can take in passing from one point to the other. This is illustrated at the left of figure 1 for transmission from London to New York. One path extends westerly from London in the great circle plane and the other follows a reverse track around the earth in an easterly direction from London. The direct signal, having much the shorter distance to travel, reaches New York first, while the reverse-path signal, traveling farther, arrives later, and appears as an echo.

Besides these two paths in opposite directions there are also echo paths, due to signals passing

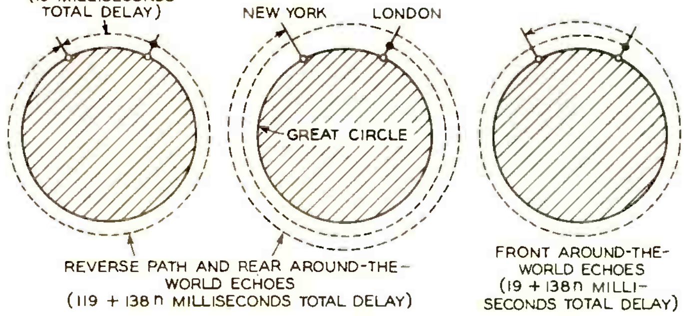


Figure 1

A radio signal from London to New York may cause an echo by traveling around the world in either a westerly or an easterly direction, and in either direction it may encircle the earth one or more times.

*Bell Telephone Laboratories; prepared for the Bell Labs. *Record*.

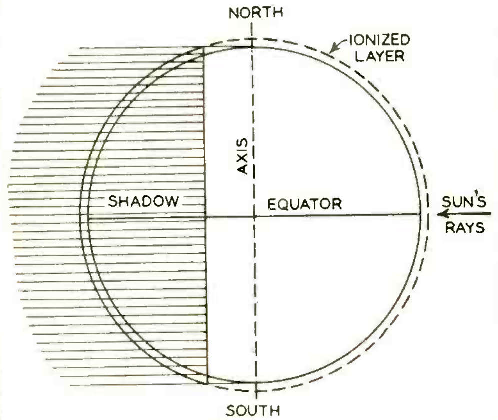


Figure 2
One half of the surface of the earth is always illuminated by the sun, but at an altitude of 150 kilometers the illumination extends about 12 degrees beyond the illuminated surface of the earth, as shown above.

the receiver, completely encircling the earth one or more times, and being received again on each transit at a diminishing intensity. A signal may start easterly from London, reach New York, and then continue on around the world one or more times before it becomes inaudible. Such echo paths are illustrated in the center of figure 1. A signal also may start westerly from London, and after reaching New York continue on around the world as indicated at the right of the illustration. From the point of view of the receiver, echoes fall into two groups: one group, called front around-the-world echoes, reaches the receiver from the same direction as the direct signal; the other group, including the reverse-path and rear around-the-world echoes, is received from a direction 180 degrees from the direct signal.

Short-wave transmission over long distances depends largely on the reflection of the waves back and forth between the earth and the ionized layer high overhead. The reflecting behavior of the ionized layer is a function of both the frequency of the waves and the exposure of the layer of light from the sun. When the ionized layer is in darkness, frequencies above about 10,000 kilocycles are not reflected for the most part, and thus long-distance transmission at these higher frequencies becomes poor. When the layer is illuminated, however, these frequencies are reflected, and long-distance transmission becomes possible. As a result of these facts it is common practice in radio transmission to use the higher frequencies for daylight conditions over the transmission path, and the lower frequencies for nighttime conditions. For the transition period between dark and daylight, frequencies in the neighborhood of ten thousand kilocycles are employed.

Since the altitude of the refracting layer is from 100 to 250 kilometers, an around-the-world signal path is never entirely in darkness so that frequencies much below 10,000 kilocycles seldom experience around-the-world echoes. On the other hand, there are times of the year when certain paths may be completely in daylight. Under these comparatively uniform and favorable conditions of illumination, there

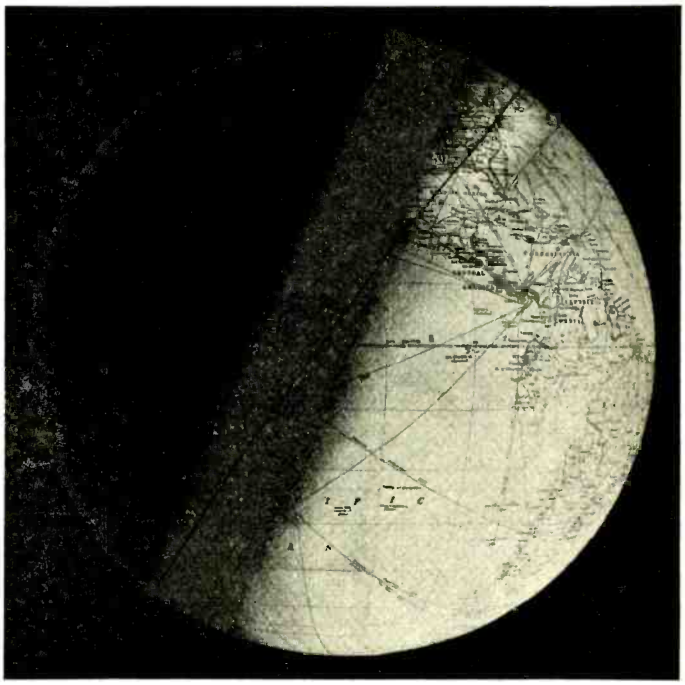


Figure 3
Lighting conditions for the position of the earth at 1:30 p.m. Greenwich Mean Time for December 21.

is every likelihood that around-the-world echoes will be prevalent at higher frequencies.

Illumination of the ionosphere beyond the shadow line at the earth's surface is illustrated by figure 2, which represents conditions when the earth's axis is at right angles to the sun's rays. This occurs around March 21 and September 21. During winter in the northern hemisphere, the north pole is tilted about 23 degrees away from, and in summer the same amount toward, the sun. The tilt is such that only great circle paths passing within some 4000 kilometers of the poles are ever totally illuminated at ionized layer heights of 150 kilometers. It is not to be expected, therefore, that echoes will occur frequently on around-the-world paths that are more than this distance from the poles. The time of day and season of the year when they are most apt to appear on favorable paths may be readily determined by computation.

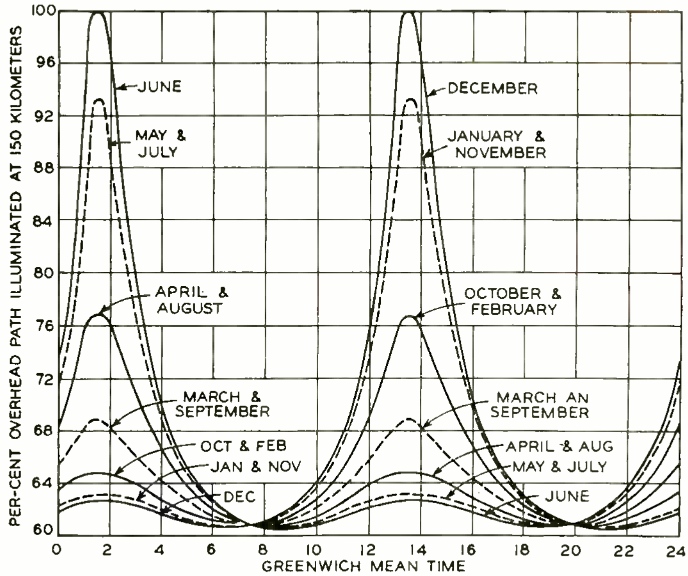


Figure 5

Percentage illumination of the around-the-world great circle path from London to New York for various months of the year.

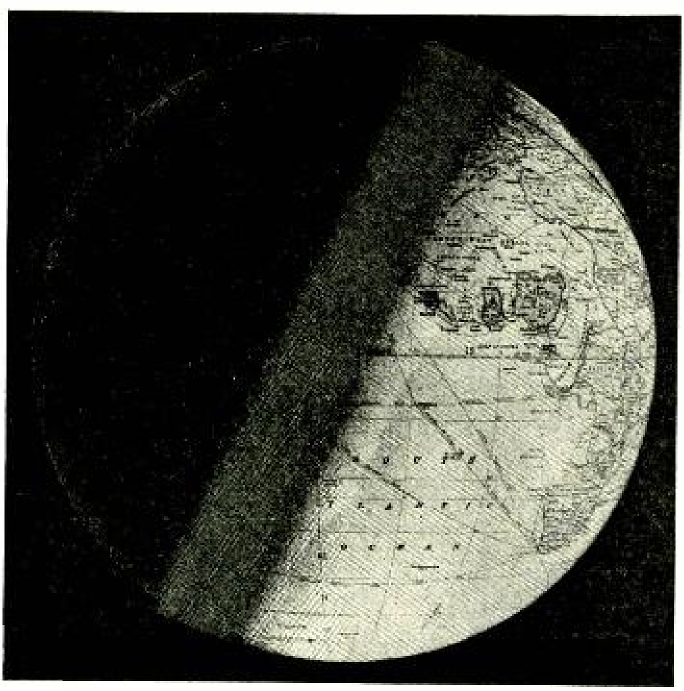


Figure 4

Lighting conditions for the position of the earth at 7:30 a.m. Greenwich Mean Time on December 21.

At an altitude of 150 kilometers the great circle path between New York and London is entirely illuminated around June 21 and December 21 at certain times of the day. The accompanying photographs of a globe illuminated by sunlight illustrate the seasonal shift of sunlight effects. The light areas in each case correspond to illumination at a height of 150 kilometers. The picture at the head of this article represents conditions at 1:30 a.m., Greenwich time, on June 21, and figure 3 shows conditions at 1:30 p.m., December 21. At both these times the great circle path between New York and London, which is marked on the globe, is entirely illuminated; around 7:30 a.m. and at 7:30 p.m. on any day of the year only about sixty per cent of the

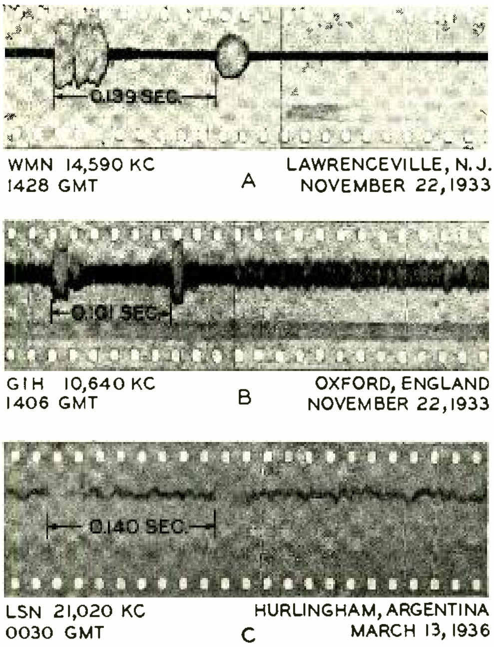


Figure 6
Around-the-world echoes as they were recorded at Netcong, New Jersey.

transmission. The echo signal is rarely found to have serious effect on the intelligibility of fixed-carrier radiotelephone circuits.

Oscillograph records made at Netcong, New Jersey, of around-the-world echoes received on various short-wave radio circuits are shown in figure 6. When the receiver and transmitter are located close together, the direct signal will have a negligible time of transmission, while the around-the-world echo will be delayed by about 138 milliseconds. This is shown by "A" of the illustration. For a reverse-path echo, the difference in time of reception is the difference in the lengths of time required for the signal to go around the reverse path and along the direct path. For the London to New York circuit this amounts to the difference between 119 and 19 milliseconds or 100 milliseconds, and is illustrated at "B". For a front around-the-world echo, illustrated at "C", the difference in time of reception will be the time required for the signal to encircle the earth. Assuming that the signals travel at the velocity of light, the actual measured echo delays would require a path length about three and three-tenths per cent greater than the circumference of the earth.

path is illuminated, as shown in figures 4 and 5. Curves showing the percentage illumination of the New York-London path for the various months are illustrated by figure 5. Observations indicate that the average intensity of the echoes varies in about the same way as the percentage illumination. Although total illumination occurs on paths through New York and Buenos Aires, around-the-world echoes are only rarely encountered here because these paths have to pass over the polar regions where the attenuation is great. The most likely time of occurrence is around the equinoxes, and echoes are then occasionally observed.

Due to the long around-the-world path, the echoes described above are considerably attenuated even on occasions when conditions are favorable for their

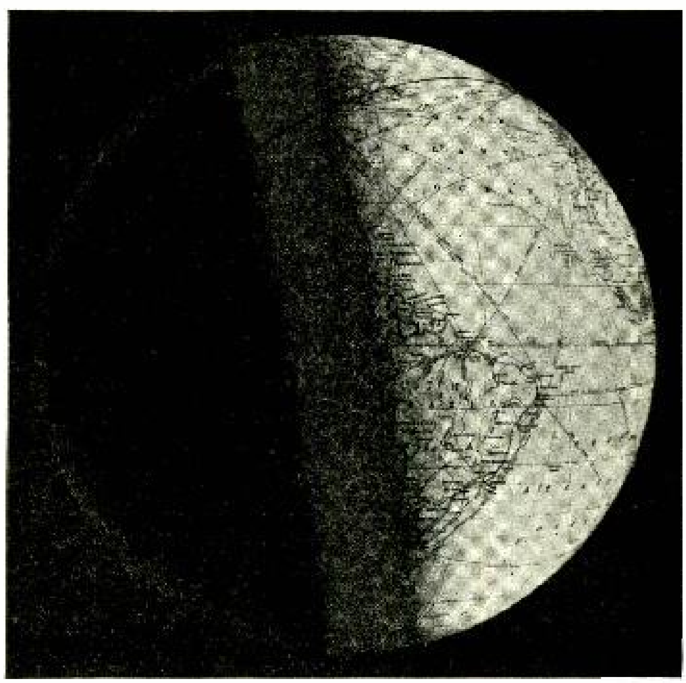


Figure 7—Early morning in April or September.

Thermionic Emission of Electrons*

By P. G. Day, G6PD

Thermionic emission is the name given to the emission of charged particles from any substance under the action of heat. Thermionic emitters are often used when a stream of electrons is required, but we are chiefly concerned in the present article with the application of thermionic emission to radio valves.

During the latter part of the 17th century, physicists observed that the air became electrically conductive near the surface of a heated body, but it was not until the close of the 19th century that Elster and Geitel found that heavy metals gave off positive and negative electricity at low and high temperatures respectively. In 1883 Edison discovered that an electric current could flow through a tube containing an incandescent filament of carbon, and a cold metal electrode which was maintained at a positive potential with respect to the filament. When the latter was made negative with respect to the filament, no current flowed. Somewhat later the arrangement was modified by Fleming, who thus produced the first thermionic rectifier. The nature of the emission from hot filaments was not definitely established until 1899, when J. J. Thomson was able to prove that it was a stream of electrons (fundamental units of negative electricity) by measuring the ratio e/m, "e" being the charge of a single particle and "m" its mass.

Between 1901 and 1903 Richardson developed a theory of emission and tested it experimentally. The experimental arrangement consisted of a hot filament and a cold concentric metal cylinder to which could be applied any desired potential with respect to the filament. As the potential was increased to a high positive value the current increased up to a certain "saturation" value above which it was impossible to go, however high the potential was raised. Further, it was found that the saturation value of the current increased as the temperature of the filament increased, so Richardson supposed that saturation occurred when *all* the electrons emitted by the filament were collected by the anode, and he assumed that the electrons were those responsible for the ordinary electrical conductivity of the filament. Whilst still in the filament some of the electrons receive a sufficient increase in their kinetic energy (due to high temperature and consequent thermal agitation) to enable them to overcome the surface forces and to escape into the surrounding space (which, of course, is a very high vacuum). From this theory an emission equation was derived mathematically and verified experimentally for the metals platinum and sodium and for carbon.

An important discovery was made by Wehnelt in 1904, when he found that filaments coated with the oxides of calcium, strontium and barium gave much higher emission currents than the pure metal, and at a later date it was found that all substances which can be heated to a sufficiently high temperature without disintegrating are capable of emitting electrons.

Richardson's theory of emission was based on the classical electron theory, which assumes that free electrons exist in the interior of metals; this theory was later abandoned by physicists, so it was necessary to look for a fresh explanation of the phenomenon of emission. This was supplied by Sommerfeld in 1928 by the application of quantum mechanics, and the consideration of the wave properties of electrons as well as their particle properties. Although the new theoretical treatment is different, the present-day view as to what actually happens when thermionic emission takes place is the same as that originally put forward by Richardson in the pre-quantum days.

It was discovered by Langmuir and Rogers in 1914 that tungsten filaments containing up to 2 per cent of thoria showed an electron emission far greater than that from pure tungsten after they had been subjected to special heat treatment. Very high emission currents were obtained with filament temperatures below 2,000 degrees Absolute. (Degrees Abs. equal degrees Centigrade plus 273.) The following treatment is employed for producing thoriated-tungsten filaments:

First, the filament is prepared so that it contains about 2 per cent of thoria (ThO_2). The electrodes (filament, plate, grids, etc.) are then assembled in the glass envelope and the whole thoroughly de-gassed with the filament operating at about 2,000° Abs. A film of some "getter"

*Reprinted with permission from *The T. & R. Bulletin* (England).

is then deposited on the glass walls to remove all traces of oxygen and the whole sealed off from the high-speed vacuum pumps. The temperature of the filament is then raised to about 2 800° Abs. for two minutes, and then maintained at some temperature, called the "activating temperature" (between 1,800 and 2,200° Abs.) for a comparatively long time.

When the filament is first "flashed" at 2,800° Abs., the thoria is dissociated into free thorium and oxygen, the former being distributed throughout the metal. During the activation process thorium atoms diffuse to the surface and form a layer, thereby increasing the emission. Throughout the normal life of the filament more thorium continually diffuses towards the surface so that the initial high emission is maintained. Immediately the filament is formed the emission is about the same as that from pure tungsten, but it very rapidly increases to about 1,000 times this value. It is common practice to give thoriated tungsten filaments a hydrocarbon treatment, so that some of the tungsten on the surface is converted into tungsten carbide, and the layer so formed decreases the rate of thorium evaporation, and thus improves the performance of the filament.

It is interesting to note that the emission from pure tungsten is .001 amp. per $cm.^2$, whilst for a fully activated thorium-coated filament it is of the order 2.8 amps. per $cm.^2$.

Thorium is not the only element which can be used to produce an atomic film emitter, and caesium, potassium, rubidium and sodium have been successfully used; in fact, the rule that any of the alkali or alkaline earth metals absorbed on the surface of any of the metals tungsten, molybdenum, nickel or platinum reduce the work function of the metal and improve the emission appears to be obeyed.

We now come to the topic of oxide-coated emitters. As was mentioned earlier the presence of a visible layer of oxide of calcium, strontium or barium greatly improves the emission from a filament of pure metal.

The method of preparing oxide-coated filaments is as follows: The material of the metal carrying the oxide (the core) may be one of many alloys such as platinum and titanium (Konel), and the coating mixture may be a suspension of barium carbonate and strontium carbonate in amyl acetate. The mixture is sprayed on to the core, which is then heated for a few seconds to a temperature of about 700° C. in an atmosphere of carbon dioxide. This treatment firmly bakes the coating on to the core. A very thin layer of collodion is then applied. The oxide-coated filament is now complete, and it is only necessary to activate it by suitable means, and it will be ready for use. The method employed varies according to the nature of the core, but for Konel cores the method is to heat strongly the filament to a high temperature for several minutes and then reduce the temperature until it is only a little greater than the normal operating value. During this process the carbonates have been dissociated into the corresponding oxides, and the gases evolved completely pumped away until the residual pressure is less than 10^{-5} mm. of mercury. The temperature of the filament is then reduced to the normal operating value of about 800° C. The presence of any trace of oxygen in the residual gases is highly undesirable, so some "getter" is always employed to extract the last traces of gas. Normally the emission from an oxide-coated filament is between 0.1 and 1.0 amp. per $cm.^2$, but under special circumstances emissions up to 5 amp. per $cm.^2$ have been recorded.

One theory of the operation of oxide-coated filaments is as follows: Free barium (and/or strontium) is produced during the activating process, and good electrical contact is established between the oxide layer and the core. It is possible for the barium to diffuse through the oxide to the surface and back again to the core, so that eventually a state of equilibrium is reached between the rate of diffusion to the surface and the rates of evaporation and diffusion from the surface. Consequently, a definite equilibrium concentration of barium is set up in the surface which effectively reduces the work function. In addition to depending on the work function, the activity of the filament depends upon the number of electrons available in the oxide beneath the surface; in other words, it is dependent on the electrical conductivity of the oxide. This, again, increases as the amount of free barium in the oxide increases. The manner in which the barium is liberated in the oxide is uncertain, but it is definitely not due to simple thermal dissociation of the barium oxide; probably it is due to electrolysis of the oxide and to thermo-chemical reactions which occur between the oxide, the core metal and any impurities such as hydrogen and carbon which happen to be present in the oxide. Positive ion bombardment probably also produces free barium in the oxide.

Amateur Radiophone Station XE1G

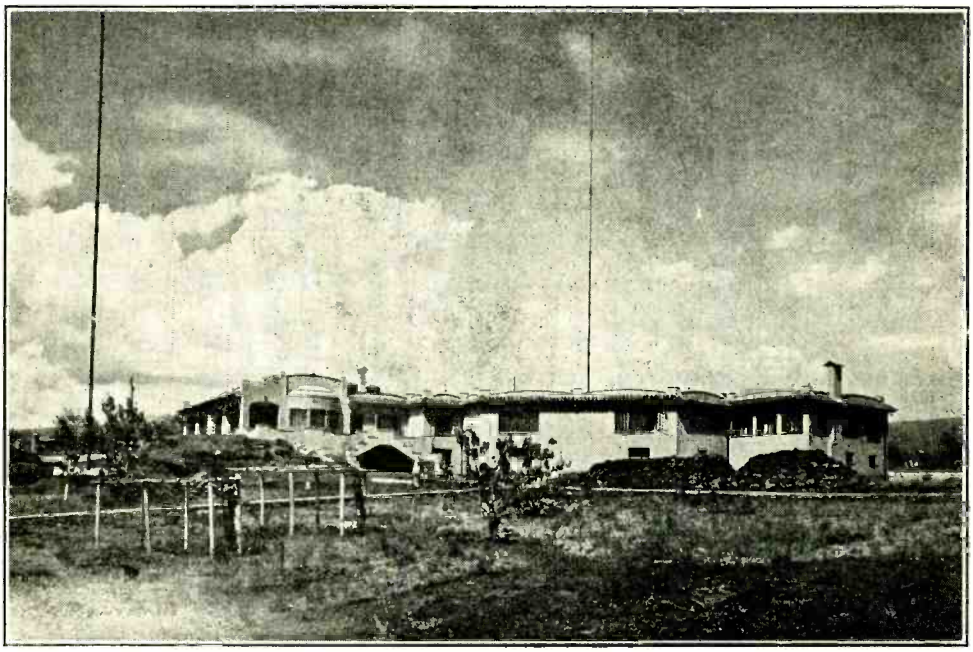
Some time ago RADIO published photographs of Dr. Jas. M. B. Hard's station in Mexico City. The doctor recently sent us the accompanying photographs of his station at his "suburban" home, in the town of Cuernavaca, state of Morelos.

The radio shack may be seen to the extreme right in the illustration of the bungalow style house. The shack is connected to the house by means of a corridor over 150 feet long. This permits the doctor to reach the shack in any kind of weather without danger of getting a chill. The house itself is much larger than it appears from the photograph, as it is quite deep, extending back considerable distance from the side from which the photograph was taken. The doctor sent us snapshots showing the rest of the house, but unfortunately they are not suitable for reproduction.

The three poles, two of which may be seen in the photograph, are over 160 feet high. By a system of weights, steel cable, and pulleys, any of the radiating systems may be raised, lowered, or placed at an angle of 45 degrees at will.

Inspection of the interior view of the shack discloses the various antennas coming through the roof through glass plates installed for the purpose. At the extreme left is the dual-diversity receiver built for Dr. Hard by Jim Lamb and J. L. A. McLaughlin. To the right is the audio amplifier for this receiver, and above this the loud speaker with its tweeter. In the background, against the wall, may be seen the kilowatt transmitter to the left and the 100 watter at the right. In the center against the wall are the meters that show the voltage and current coming into the shack.

All apparatus is manipulated from the easy chair in the foreground. The only switch used



The above view is of the back of the house; from the front it is much more pretentious. The three masts, two of which may be seen above, are over 160 feet high.

when on the air is a single Federal anti-capacity switch. On top of the control panel may be seen an RME69 with a Peak pre-selector. To the right is an oscilloscope, and next a frequency meter. The clock in front of the frequency meter gives an alarm when it is time to call or stand by for a station schedule. To the right of the clock is a "Variac" to give any desired voltage from the 230 volt line without impairing the regulation.

Dr. Hard has his own private 3000 volt high tension line for over a half mile from the main line of the power company. About 800 feet from the shack is a "pole" transformer reducing the voltage to 240. The 240 volt power is brought the whole 800 feet underground. All lines in the house are in iron conduit, embedded in the floors in concrete. The ground for the shack consists of a heavy copper ribbon, 2 inches wide, buried under the foundations of the building. A section of the ground system also runs along the clay pipe that goes to the septic tank, a distance from the building.

"The Doctor", as he is known to his many amateur friends, has gone to considerable trouble to get the best reception possible and to put out a good signal. And from the ease with which he works stations all over the world, it looks as though his efforts have brought worthwhile results.

◆

OPEN FORUM

Tylerton, Miss.

Sirs:

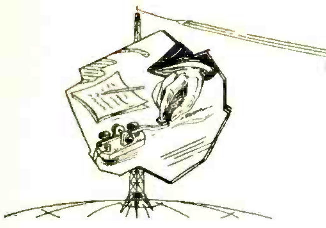
I write this with my teeth showing (I don't mean smiling, either). I would gnash them but am afraid I might bust 'em—they are false. It's all because I just had a very fb QSO ruined by some sap head who popped up all over my man to play with his (new?) bug. I guessed it was new from the way he couldn't handle it.

So, since everybody is trying to tell everybody else how amateur radio and the government and supreme court should be run or not run, I will air my ideas.

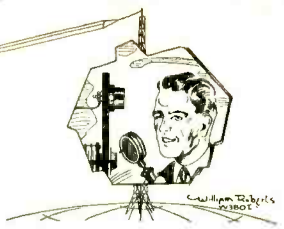
I think the F.C.C. should set aside a band called the "Brainless, Weightless Bug Band" and let those guys try and work each other. If one were caught sending properly or anywhere near that, his license would be taken from him and his dang head cut off.

You see, it's the unnecessary QRM that hurts.

E. L. Felder, W5FSS.



CALLS HEARD AND DX DEPARTMENTS



Numeral suffix indicates "R" strength. Send Calls Heard to Calls Heard Editor, not to Los Angeles.*

Robert Mele, W8EMW, 142 Roney Road, Syracuse, N.Y.

January, 1937

(7 Mc.)

D4IZI; F8AT; HAF8C; HJ1K; OE6AZ; OK1AQ; OK3AC; ON4NO; SU1LF.

(14 Mc.)

CE3AR; CE3EQ; CE3NR; CE4AD; CN8MI; CN8MQ; CN8MU; CP3ANE; CT1BD; CT1BPC; CX1BG; CX1CB. — **D** 3BMP; 3BWU; 3CBK; 3CFH; 3DLC; 3DSR; 3FZI; 4DLC; 4KMG; 4WXL; 4XCG; 4XKG; 4XVF; 4YBF. — EI4J; EI5F; EI7L; EI8B; EL2A. — **F** 3AM; 3GM; 3LG; 8CP; 8GI; 8IG; 8JJ; 8KW; 8LG; 8LU; 8NL; 8UK; 8VJ; 8WG; 8WQ; 8WK; 8XC; 8YZ. — FA8DA; FA8IH; FB8AB; FM8AA; FM8AD. — **G** 2DH; 2DK; 2HU; 2IT; 2IY; 2KO; 2KR; 2LB; 2LU; 2NG; 2QN; 2TD; 2VD; 2ZY; 5BJ; 5FQ; 5IB; 5JU; 5KT; 5MD; 5MW; 5PH; 5QY; 5SR; 5SB; 5YH; 6BY; 6CL; 6DT; 6FO; 6JW; 6LV; 6NJ; 6NX; 6PC; 6QX; 6RJ; 6SR; 6UD; 6UG; 6VC; 6XI; 6YO; 6YR; 8BD; 8BP; 8CN; 8CU; 8CV; 8FZ; 8IA; 8TZ. — GI2KR; GI6TK; HAF8C; HAF8D; HAF8N; HB9AK; HB9BD; HB9BN; HB9T; HC1JW; HC2JM; HK5JD; HR7WC; I1LY; I1TKM; I1ZZ; J2JJ; J3CR; J8CD. — **K** 4BNH; 5AA; 5AC; 5AJ; 5AY; 6AKP; 6NLD; 6NSD; 6OAR; 7EVM; 7FBE; 7FYI. — LA2X. — **LU** 1CA; 1JH; 2AM; 3EV; 4DQ; 5AN; 5FJ; 6AX; 7AZ; 7BH; 8DJ. — LY1J; OA4AK; OA4J; OE1FH; OE7EF. — **OH** 1NL; 2OI; 3NP; 3OI; 6NN; 6NS; 6HG. — OK1DL; OK2HX; OK2PN; OK2RM. — **ON** 4AW; 4BDO; 4BR; 4CD; 4DS; 4FQ; 4GQ; 4LZ; 4NC; 4VW; 4CSL. — **PAO** ALO; AZ; DC; DS; GN; LR; MF; MG; UN; UB; XM. — **PY** 1BR; 1IF; 1MK; 2EH;; 2FR; 2FY; 2GS; 2HN; 2JO; 3AB; 4AD; 4AP; RAB; 5QG; 8AE; 8AG. — PZ1AB; SM6QP; SM6VX; SP1HN; SU1KE; U2NE; U4AL; U5HE; U5OF; U9AF; U9AL; 7OMI. — **VK** 2AEK; 2FM; 2HP; 2PX; 3AL; 3BW; 3EG; 3GP; 3IW; 3KR; 3MR; 3VU; 4FJ; 4KX; 5FM; 6AS; 7AB. — VS7RF; VU7FY; XU3FK; YJ1RV; YR5CD; ZD2Q; ZE1JO; ZE1JG; ZE1JS; ZE1JY. — **ZL** 1HH; 1HQ; 1CK; 2DS; 2FA; 2MN; 2OQ; 2II; 2PM; 2QA; 2AM; 2SX; 3HK; 4AO; 4FW. — **ZS** 1AN; 1AV; 1B; 1Y; 1Z; 2X; 4U; 6AD; 6AJ; 6AY. — **AT** 1B; 1Q; 2D; 2Q; 5P; 5Z; 6AH; 6AL; 6AQ; 6AU; 6AY; 6N. — ZU5G; ZU6AF; ZU6E; ZU6L; ZU6P.

G. Moore, VK2AM, 92 Princes Hy., Anncliffe, Sydney, N.S.W.

Jan. 27

(14 Mc.)

W 2IXY; 3EWW; 4AEO; 4AZK; 4DBC; 4DLH; 4DRZ; 5DEW; 6BKY; 6IIH; 6NKX. — CE1AH; CX1BN; H5PA; HL7G; HK1Z; HS1RJ; JZ1AA; J3EM; K6CMC; KA1AK; KA1BH; KA1DL; KA1ER; KA1JZ; KA1KY; KA1MD; KA1RB; LU1EX; LU6KE; LU7ET; OA4AB; OA4AI; OA4N; OA4R; PK1JR; PK1RA; PK3GD; PK4AU; PK4MY; PK4DG; PK6AI; SU1CH; VS6AB; VS6AG; VS6AH; VU2AU; VU2CQ; VU2DY; V2LM; VU7FY; XU3FK; XU3GG; XU3XA; XU6SW; XU8HR; XU8HW; XU8MT.

Don McVicar, VE4PH, Edmonton, Alberta

Feb. 27 to March 14

(28 Mc.)

CM2RU-7; D3DSR-7; D4BUF-6; D4GAD-7; D4QET-6; D4XCG-5; EI4J-6; EI8B-7; F3GS-7; F3KH-7; F8EO 7; F8LX-5; F8NJ-7; F8RR-7; F8WK-7; FA8IH-6; G2NH-6; G2PL-7; G5OJ-7; G6CJ-6; G6NF-6; G6XC-5; GI6TK-5; GM5YG-5; GM6NX-6; HA8D-6; HA9C-5; HB9BY-6; I1TKM-5; J2CB-7; J2CF-5; J3FJ-6; J4CT-6; K5AC-8; K6CGK-5; K6ILT-7; K6MVV-7; K6NWE-5; K6OGK-6; LU9AX-7; LU9AZ-4; LA4K-3; MX2B-4; OA4J-5; OE1ER-6; OE3AH-6; OH2NB; OK2HX-6; OK2LO-7; OK2OP-6; OK3VA-6; ON4FE-7; OZ2B-6; OZ2M-6; OZ7G-6; PA0AZ-7; PA0PN-7; PA0XR-6; SM6SS-6; SM6WL-7; SP1LM-7; VE4IZ-3; VK2GU-8; VK2LZ-8; VK3CP-7; VK3MR-6; VK3XP-5; VK3YP-6; VK5KO-4; VK5KL-6; VK5KX-5; XE2N-6; XE2UE-6; YL2BB-5; YL2CB-6; YM4AA-7; YR5AA-6; YU7DX-6; ZE1JR-5; ZL1BC-7; ZL1RX-6; ZS2A-7; ZU1T-6; ZU6P-5.

R. D. Everard, "Oakdene", Lower Sheering Road, Sawbridgeworth, Herts, Eng.

Jan. 6 to Feb. 14

(28 Mc. phone)

W 1AAK; 1AEP; 1APF; 1BJE; 1CGM; 1DEY; 1DJK; 1DQK; 1DSV; 1FZA; 1GGV; 1HHU; 1HIO; 1HQN; 1ILQ; 1JCX; 1JIL; 1JPM; 1JZF; 1KJJ; KQM; 1WV; 2ADI; 2BAA; 2DKU; 2DYR; 2EOA; 2EXI; 2FLG; 2FWZ; 2GAH; 2GUU; 2HTQ; 2HVQ; 2HYJ; 2IEF; 2ITI; 2JIR; 2JKI; 2JOA; 2KAP; 2KAY; 2KDD; 2MH; 3AIR; 3AKX; 3AYG; 3CRY; 3CWQ; 3EIK; 3FAR; 3FEG; 3FVD; 3GPM; 3PC; 4CPG; 4CYU; 4DEK; 4DFU; 4EBM; 4EC; 4EDD; 4FT; 5AXY; 5BXM; 5DUK; 5DUQ; 5ZA; 6AQK; 6ERT; 6QZU; 6ITH; 6MTB; 6NLS; IANO; IBDO; ICFD; 8CUM; 8CMA; 8CMT; 8CPC; 8CYT; 9AGO; 9AIW; 9ARK; 9BBU; 9BCT; 9BHT; 9CET; 9CLH; 9DDF; 9DK; 9DN; 9DRQ; 9DWU; 9GHY; 9GRV; 9GYD; 9HVZ; 9IWX; 9JNT; 9JWI; 9LQT; 9MTN; 9OSO; 9OXS; 9PEP; 9PWU; 9PZI; 9QI; 9RMQ; 9RRD; 9RSQ; 9SBV; 9TII; 9TIZ; 9TP; 9UHI; 9UPX; 9UWV; 9UYD; 9VKZ. — CO2AU; VE1DT; VE2CA; VE2EV; VE2KX; VE3AEL; VE3AGO; VE3TY; VE4BD; VE4KX.

(14 Mc. phone)

CE1AH; CE3DW; CT2AB; CX1AA; EA9AH; HI7G; K4ENY; KA1BH; KA1KY; LU1EX; LU1UA; LU4BH; LU5CZ; LU6KE; LU7AG; PK1MX; PK1QU; PY2CK; PY2EQ; PY2ET; PY3CY; PY5OQ; VE3EO; VE4WR; VE5TV; VK2AP; BK2BW; VK2IG; BK2QR; VK4LO; VP6YB; VS2AK; VU2CQ; ZE1JU; ZS6A; ZS6AJ; ZT2G.

D. A. Cf. Edwards, 2ANT, Selwyn House, Pilkington, Av., Sutton Coldfield, Warwicks, Eng.

Jan. 1 to 31

(28 Mc. phone)

W 1ACS; 1ADR; 1AEP; 1AIQ; 1ARB; 1BEF; 1BJE; 1CAV; 1CQM; 1DBE; 1DBH; 1DEY; 1EMV; 1DSV; 1EAO; 1FH; 1GWK; 1HIO; 1HTP; 1IAO; 1IOZ; 1IP; 1IPC; 1IPV; 1IYT; 1JAR; 1JEC; 1JVB; 1KC; 1KJJ; 1KW; 1NW; 1PBY; 1WV; 2ADI; 2AIF; 2AVY; 2BAA; 2BYT; 2CQD; 2CRO; 2DJX; 2DKJ; 2EGN; 2EJO; 2EXI; 2FPQ; 2FWK; 2GAH; 2GJK; 2GMR; 2GUU; 2HFS; 2HGU; 2HQJ; 2HTG; 2HVQ; 2HYJ; 2IEF; 2IKS; 2IP; 2IPI; 2ISA; 2IUA; 2JAD; 2JAO; 2JDX; 2JIE; 2JIQ; 2JIT; 2JNP; 2JOA; 2JUJ; 2JXI; 2KAP; 2KDD; 3AKX; 3AXR; 3BDI; 3BMW; 3BRA; 3CYK; 3DDI; 3DLH; 3EUA; 3FJH; 3FMQ; 3FPL; 3FVO; 3GHS; 3GIZ; 3IRV; 3IU; 3IWA; 3JME; 3PC; 3RL; 4BHV; 4BPC; 4BWM; 4CTG; 4CYU; 4DEK; 4DRZ; 4EBM; 4EEB; 4FT; 5AXY; 5BB; 5BQJ; 5DFR; 5DPY; 5DUK; 5DUQ; 5EJZ; 5EZH; 5FHN; 5FRA; 6IBS; 6ITH; 6MAV; 6MDN; 6MWD; 6NSI; 6NWQ; 6QF; 8AYY; 8BDO; 8BYE; 8CJM; 8CKY; 8CYT; 8DJM; 8DLT; 8DLU; 8DW; 8EBS; 8FFA; 8FJJ; 8FJP; 8FSA; 8FYC; 8GWX; 8IWQ; 8IWT; 8JFC; 8JLQ; 8JNO; 8LAC; 8LHM; 8MAH; 8MDH; 8MWL; 8NJS; 8NJZ; 8NMU; 8NQG; 8NXF; 8OEQ; 8PTN; 8PTX; 8QDU; 8RV; 8WMI; 9AGO; 9AGS; 9ARW; 9AZE; 9BBU; 9BHT; 9BYW; 9CIV; 9DEK; 9DHP; 9DKU; 9DN; 9DQT; 9DRK; 9DRQ; 9EKD; 9EYE; 9HDZ; 9IPS; 9LQT; 9MPN; 9PWU; 9PZI; 9RFB; 9RQ; 9RSQ; 9SBV; 9SRS; 9TBX; 9TII; 9TLQ; 9TP; 9TTB; 9UPX; 9UUN; 9VBK; 9CER; 9VUH; 9WO; 9WOV; 9WSE; 9WXT.— K4EJF; VE1AW; VE1CR; VE2BV; VE2CA; VE2EM; VE3BD.

Eric W. Trebilcock, BERS195, 40a Nelson Street, St. Peters, South Australia

Dec. 27, 1936 to Jan. 24

(14 Mc. phone)

W4BYY; W4DBC; W4DLH; W4DRZ; CE1AH; CO7CX; EA9AH; HI7G; J2IS; K6JLV; KA1BH; KA1KY; PK1MX; PK4AU; SU1CH; VS7AB; VU2CQ.

(14 Mc.)

W 1AXA; 1BXC; 1CC; 1CO; 1COP; 1DQS; 1DUJ; 1FM; 1FTR; 1GDY; 1HIU; 1HKK; 1HRJ; 1ICI; 1IGU; 1IWA; 1JA; 1JIZ; 1JGP; 1LN; 1RY; 1SZ; 1ZE; 2AIW; 2AOA; 2ATF; 2AYS; 2BCR; 2CFK; 2CJM; 2CPA; 2CTC; 2DGJ; 2DNQ; 2DRJ; 2DVU; 2GJF; 2GJR; 2GOM; 2HHF; 2HUQ; 2HUK; 2HVQ; 2IRV; 2JDM; 2JHS; 2HLA; 2QY; 3AAL; 3BIA; 3BKZ; 3BSM; 3CBV; 3CVA; 3DCR; 3DHZ; 3ENX; 3EZQ; 3FDL; 3FQP; 3FRE; 3GEH; 3GGE; 3IR;

---

*George Walker, Assistant Editor of Radio, Box 355, Winston-Salem, N.C., U.S.A.

3MD; 3QP; 4AGI; 4BPF; 4BT; 4BWZ; 4CFD; 4CYP; 4DLG; 4DLH; 4DTF; 4DTR; 4DQX; 4DXW; 4DZO; 4EAK; 4EDB; 4EFN; 4EG; 4ELG; 4EMK; 4EAV; 4SV; 4TR; 4ZH; 5DZU; 5FAE; 5QL; 6BVX; 6CS; 6HZB; 6KQH; 6KRI; 6LDJ; 6LHN; 6LYM; 6TJ; 8AXN; 8AYQ; 8BCK; 8BCT; 8BKP; 8BTI; 8CNX; 8CRA; 8DFH; 8DLB; 8DOD; 8DPS; 8DUP; 8DXE; 8FCB; 8FJN; 8GRZ; 8IER; 8IXS; 8JMP; 8KKG; 8KWI; 8KWW; 8LDA; 8LYQ; 8MZE; 8NQC; 8NQS; 8OFN; 8OCQ; IPTC; 8SR; 9EAG; 9FEY; 9FS; 9KFX; 9MHM; 9SCH; 9VCD; 9WMT. — CM2AO; CM7AB; CM8AH; CR7AL; CR7GF; CR9AA; CT2AB; D3DRF; D4BQO; D4MOL; D4TDB; D14J; F3AD; F8KW; F8LG; F8NR; F8VT; F8ZZ; FB8AD; FM8AD; G2-FZ; PU; XN; ZP; 5IL; 5MD; 5MY; 5JO; 5SR; 5SS; 5WP; 6DL; 6DT; 6JW; 6LC; 6QX; 6XF; 8DL; 8IW. — GI5NJ; HAF8D; HAF8N; HB9AK; HB9AT; HB9AY; HB9BG; HB9S; HC2JM; HH3L; HH5PA; HS1RJ. — J 2CC; 2CN; 2KO; 2MF; 2MH; 2NA; 2NF; 2IR; 3EM; 3EN; 3FI; 5CE; 5CC; 5CL; 5CO; 9CA. — K4RJ; KRAA; K5AF; K5AG; K5AY; K6BNR; K6CGK; K6ILT; K6OJG; KA1AN; KA1ER; KA1HR; KA1SL; KA1US; KA7NU; LA2B; NY2AE; OE1EK; OE3AH; OH2N6; OH2OB; OH3NP; OH6NS; OA4J; OK1FD; OK1KX; OK1WX; OK2FO; OK2MA; OK2OP; ON4CSL; ON4FP; ON4PA; ON4TA; OZ2M; LU7AZ; PA0AZ; PA0MQ; PA0XF; PA0ZJ; PK1BX; PK1GW; PK2DU; PK3WI; PK4KO; SM5UD; SM5WM; SM5XW; SM6UA; SU1CH; SU1FS; SU2TW; SV1AZ; SV1KE; VQ4CRH; VQ8AA; VQ8AF; VQ8AG; VS6AB; VS6AH; VS7RF; VS7JW; VS7RA; VE1HK; VE3AEX; VE3QS; VE3AH; VU2AU; VU2BA; VU2BN; BU2DB; VU2DP; VU2FH; VU7FY; XE1AM; JE2N; U1BC; U2NC; U3AS; U5AE; U9AL; XU1A; XU2FB; XU3DO; XU3GG; XU3FK; XU3YK; XU8MR; XU8IS; XU8SM; ZC6AQ; KE1JV; ZE1JZ; ZS6AY; ZT4P; ZT6AL; ZT5Z; ZT6K; ZT6N; ZT6Y; ZT6Z; ZU1T; ZU5AF; ZU6L; ZU6P.

Donald W. Morgan, 2CBG, 15 Grange Road, Kenton, Middlesex, Eng.

Jan. 1 to Feb. 1

(14 Mc. phone)

W 1ACQ; 1BLO; 1CHI; 1FG; 1GFG; 1KJ; 1NW; 1QM; 2AYV; 2ELO; 2GMG; 2HCI; 2HDK; 2HFH; 2IXY; 2KFH; 2UK; 2ZC; 3FPU; 3EMD; 3EMM; 3EOV; 4AZK; 4BRY; 4CPT; 4OEA; 8DIA; 8EQZ; 8GLY; 8LAC; 8NTI; 8QHA; 9BCQ; 9MV. — CN8MB; CO2HY; CT1AY; CT1OZ; CT1ZZ; EI6G; EI8L; EI9J; F3AW; F3DJ; F3GS; F8MJ; F8QD; F8WQ. — G 2AK; 2BY; 2DV; 2JB; 2LQ; 2XV; 2ZY; 5BJ; 5HG; 5ML; 5NI; 5PP; 5PW; 5TH; 5ZJ; 6BO; 6JQ; 6JW; 6TV; 6XN; 6XR; 6XX; 6ZA; 8CNA; 8CN; 8DM; 8FY. — GI5MZ; GI6TK; GI6XS; HAF8N; HB9AY; HB9B; HI7G; HP1JG; I1KS; I1IT; LA4N; LA4R; OZ9R; PA0WN; PY1AK; PY2AC; SM5YS; SM6QC; SM6QV; SM6VX; SU1CH; SU1KG. — VE 1BC; 1BR; 1CR; 1DC; 1ET; 1JA; 2BG; 2EE; 3NB; 3ND. — VO1I; VO1J; VO2Z; VP6TR; VP6YB; VP9R.

(14 Mc.)

W 1GDQ; 1JZD; 1KGN; 1QTW; 2ACO; 2BEF; 2CTC; 2ECT; 2FDD; 2GCD; 2HAW; 2HMQ; 2HUQ; 3ANT; 3AOK; 8AAU; 8CNX; 8KAW; 8KWW; 8MZE; 8NQE; 8NVC. — CT1QQ — D 3AOG; 3AOK; 3CSE; 3DFE; 3GPF; 3XWK; 3YUY; 4AJJ; 4ALV; 4CHA; 4DLC; 4GFF; 4OAR; 4ORT; 4TDB; 4TKK; 4UVD; 4WAL; 4WTK; 4XJF. — EI5J; EI7L; EI8J; EI9F; F8AR; F8HO; F8NF; F8PX; F8YQ. — G 2BY; 2CX; 2JX; 2KA; 2LA; 2OF; 2TV; 2XC; 5GQ; 5HG; 5HS; 5NM; 5RF; 5BR; 5UX; 5YN; 6AJ; 6BO; 6CJ; 6CL; 6CP; 6CR; 6DT; 6LG; 6NU; 6NX; 6OT; 6PR; 6QO; 6RH; 6TF; 6WN; 6XA; 6XX; 8AH; 8AU; 8AW; 8DL; 8JK. — GI2KR; GI2UO; GI5OY; GI5WK; GI6TK; GI6WG; GI6XS; HAF5C; HAF8D; HAF8N; HB9A; I1KS; I1AR; LA3J; LA3Y; LA5K; LA5L; LA5R; LU7AZ; OE1EK; OE3AH; OE3FL; OE6DK; OE7EJ. — OH 2NE; 2NM; 2OB; 2OQ; 2OT; 3NK; 3NP; 3OE; 5NV; 5OA; 5OH; 6NI; 6NN; 6NO; 6NS; 7NA; 8NH; 8NK. — OK 1BA; 1CX; 1DX; 1FK; 1KX; K1X; 1MB; 1OM; 1RX; 1XA; 1WFX; 1WX; 2PN; 3CF. — ON4JJ; ON4VK; ON4VV. — OZ 1JW; 2B; 2H; 2K; 2M; 2XA; 2Z; 3D; 3ES; 3FL; 3H; 3K; 3Q; 3R; 5FT; 5P; 7A; 7FK; 7FL; 7L; 7OM; 7ON; 7PH; 7Q; 7S; 7UF; 7UU; 8A; 8J; 8R; 8V; 8X; 9A; 9Q; 9X. — PA0AQ; PA0BE; PA0GA; PA0GN; PA0IW; PA0KN; PA0NV; SM5GS; SM5QL; SM5SM; SM5UK; 5UX; 5ZL; 6UX; 7UC; 7UT; 7XF; 9QF. — SP1MD; VE1BK; VE1CA; VE3CAL.

Edgar H. Adler, W1DYV, 6 Clinton St., Taunton, Mass.

March 8 to March 10

(20 meter phone)

CX1CT; G5ML; G5NI; VO2N; VP3BG; VP9R; YU5AB.

(14 Mc.)

W 6AL; 6GHI; 6GHU; 6JKH; 6JWL; 6LXY; 6LYM; 7BTG; 7EK; 7FAQ; 7FYR. — CM2EA; CM8AI; D3DSR; D4SMO; FA8AD; FA8DA; F3KH; G5DS; HA5C; HA8C; HA8D; K5AC; K5AG; ON4HC; PA0CE; PA0GN; PA0PN; PA0QF; PA0QQ; PA0UN; PA0UV; PY1BR; PY4AZ; SU1SG; VP13B; XE1DG; YR5AR; YU7DX.

(28 Mc.)

W 6BAM; 6BYB; 6CXW; 6DOB; 6DTB; 6EJC; 6FQY; 6FXL; 6GRK; 6HEW; 6IED; 6JJU; 6JNR; 6KIP; 6KRI; 6MPK; 6NYA; 7AAZ; 7EYS; 7GBI. — D3DSA; D4GDF; D4WXD; D3XCG; EI4J; EI8B; EI9G; F3TK; F8EO; F8FC; F8LX; F8RR; F8WK. — G 2DH; 2GC; 5BM; 5VU; 5QY; 6DH; 6RB; 6XL; 6XN. — GI6TK; HA8C; K5AY; OE1EK; OE1ER; OK2LO; OK2OP; PA0AZ; PA0PN; SM5VW; SM6SS; SM6WL; SU1SG; VE4OB; VE4SH; VK2LZ; YL2CD; YR5AA; ZS2A; ZU9A.

Earl M. Reichman, W8NBK, 409½ East First St., Uhrichsville, Ohio.

Dec. 28, 1936 to Jan. 28

(14 Mc. phone)

CE1AH; VK2ABG; VP6TR; VP6YB; VP9R; VU2CQ.

(14 Mc.)

CE2AR; CE3AR; CP3ANE; D4DLC; EA4MA; EL2A; F3AD; F3KH; F3KB; F8EO; FB8AF; FB8EA; FM8AA; FM8AD; FM8IH; G5IL; G5YH; G6CL; G6NJ; G6XN; G8FZ; GI6TK; HAF5C; HB9BW; HC1JW; HC2CG; HH3L; J2NB; J3FK; KA1US; K4RJ; K4DRN; K5AA; K5AC; K5AF; K7JP; K7PQ; K7AD; K7FRU; K7FYI; LA2XE; LU1DR; LU1JH; LU3HK; LU4BA; LU4EX; LU6AZ; LU8DJ; OA4J; OH3OI; OZ8JB; OZ9QM; PA0LR; PA0XF; PA0ZJ; PY1AZ; PY1BR; PY1CI; PY1DW; PY2AC; PY2AI; PY2AR; PY2DO; PY2DW; PY2GS; PY2HN; PY8AH; SM5ZL; SM6NA; SV1KE; U5RE; U9AL; U9ML; VK2FD; VK2VA; VK2XO; VK3EG; VK3GE; VK3VF; VK5MD; VK5JU; VK5WA; VK5XB; VK5ZX; VK6HB; VU4DQ; VU7FY; VO1DW; VP6MO; XE1FS; XE2N; XE2CB; XU9SR; YM4AA; ZE1JG; ZL1CV; ZL1HY; ZL2LB; ZL3HK; ZS1AL; ZS2N; ZS2X; ZS6AU.

J. J. Michaels, W3FAR, North Wales, Pa.

March 1 to 15

(29 to 30 Mc. code)

W6QG; W9FJR.

C. J. Nolf, ON4NC, Chateau de Rameignies, par Thumaide, (Hainaut), Belgium

Nov. and Dec., 1936

(28 Mc. code)

CN8AP; CN8MQ; D4SXR; F8CT; F8EO; F8HZ; F8OL; FM8AA; G2PL; G5KH; G5OJ; G5QY; G6DH; G6NF. — OH 3NN; 3NP; 3OI; 5NR; 5OD; 5OH; 6NG; 6NV; 7NC; 7ND; 7NF; 7NJ; 7NI. — PK3ST; SP1ER; SP1KZ; SU1SG; U1AD; U1AJ; U1CO; U1CR; U2NC; U3BX; U9MJ; U9ML. — VE 1AU; 1EA; 2CA; 2KA; 3ADM; 3AEY; 3ER; 3KF; 3WA; 4JV. — VK2GU; VK3CP; VK3YP; VK4AP; VK4EI; VO1N; VO1X; VS6AH; YL2BB; YL2CD; YL2CM; YR5OR; YR5VC; YT7MT; ZE1JR; ZL1CD; ZL1DV; ZL2BP; ZL2PC; ZL3AS; ZS1H; ZT2B; ZU6P. — W 1AEP; 1AK; 1ALB; 1APQ; 1BGY; 1BUX; 1CGM; 1CJL; 1CKG; 1CQR; 1CSR; 1DHD; 1EBR; 1ELR; 1FSK; 1FTB; 1GIL; 1HDV; 1HIO; 1IBF; 1IPV; 1IYL; 1JNL; 1LZ; 1NW; 2ACY; 2AOG; 2BPD; 2BZB; 2COK; 2CTO; 2DVV; 2ENY; 2EVI; 2GJB; 2GMM; 2HVM; 2HYT; 2IIQ; 2JPN; 2JQM; 2JXJ; 2MB; 3AIR; 3AUC; 3AXR; 3AXU; 3BHT; 3BIW; 3BTQ; 3BWB; 3CBK; 3CYK; 3DOD; 3ENX; 3FAR; 3FMQ; 3FVO; 3FVZ; 3GAP; 3GHS; 3MD; 3PC; 3VF; 4BBP; 4BBR; 4BJX; 4DBU; 4EC; 4NT; 4SR; 5BEE; 5DRF; 5EHR; 5EOG; 6BAM; 6BVX; 6GPB; 6HB; 6IEK; 6JBO; 6JJU; 6JNL; 6JNR; 6LRD; 6MFR; 6NWQ; 6QD; 7NS; 8ANN; 8ASI; 8BIX; 8BTI; 8BTK; 8BWC; 8CJM; 8CKY; 8CLS; 8CYT; 8DLT; 8EQQ; 8ERX; 8FYC; 8HZR; 8IFD; 8IIL; 8IJZ; 8IWG; 8IXM; 8IXS; 8JAK; 8JFC; 8JJY; 8JLQ; 8JTJ; 8JTW; 8KH; 8KYY; 8MAH; 8MWL; 8MWY; 8MZE; 8NK; 8NQD; 8NYD; 8OKC; 8PLK; 8PYO; 8PZT; 8QDU; 8SR; 9ADN; 9AIW; 9BBU; 9BPU; 9DN; 9DSC; 9EF; 9FS; 9GDH; 9GKZ; 9GZK; 9HUV; 9HYD; 9ICW; 9ISM; 9JDD; 9JFB; 9JNB; 9JZJ; 9KPD; 9LF; 9LKI; 9LQU; 9MIN; 9PTF; 9PWZ; 9RXL; 9SIE; 9TFP; 9TMM; 9UIF; 9UYD; 9VEK; 9VWW.

(28 Mc. phone)

CO2WZ; VE2CA; VE4BD; VK2GU; ZL1CD. — W 1AS; 1BLO; 1CKF; 1ETD; 1GDY; 1HQN; 1HVS; 1IXO; 1JDV; 1QP; 1WV; 1ZD; 2AOG; 2BRI; 2CYM; 2DJX; 2DVV; 2EVI; 2GAH; 2HVK; 2IBM; 2IIQ; 2INX; 2JAD; 2JIE; 2JOA; 3AIR; 3AKX; 3AUC; 3CYK; 3FMQ; 3FPL; 3GIZ; 3PC; 3WA; 4AZK; 4BMR; 4DGO; 4DHM; 4EC; 4FT; 5BEE; 5EOG; 5QQ; 6FQY; 6MFR; 6NFA; 8CJM; 8CKY; 8EBS; 8FSK; 8FYC; 8JFC; 8KH; 8KTW; 8KYY; 8MDH; 8MNJ; 8MWL; 8NXF; 8PK; 8PTX; 8PZT. 9AGO; 9BHT; 9BOF; 9DKU; 9LQT; 9SNO; 9SQE; 9UYD.

[*Continued on Page 75*]

28 Mc. Opens Wide for Contest

By E. H. Conklin, W9FM

The ten-meter band was good to us in February and early March, providing many contest QSO's and some good records. On February 24, OH2NB worked all continents in an hour and fifty-five minutes from 13:30, G.m.t., his contacts being with VK2GU, U9ML, VE3DU, SU1RJ, HK1JB, and G5ZN. Then on February 28, beginning at 11:25, G.m.t., G6DH worked them all in a single hour, contacting VU2LJ, VK2GU, FB8AB, W8JFC, PY2AC, and YT7KP.

By the time that the March contest started, there was much enthusiasm over the way dx was coming through every day, and in fact we find that many stations worked more dx on "ten" than on any other band. VE4PH raised about four stations an hour on 28 Mc., and finally raised 24 countries on this band compared with 23 on 14 Mc., in spite of the fact that on March 9, 13, and 14 no Europeans came through there. Many W9's found 14 Mc. a hopeless mess of QRM and raised much more dx on ten meters, which was consistently good here. F8EO is reported as being the most consistent European, coming through after all others there faded out. All continents were worked by many W's. We doubt if any really high scores will be turned in by stations not using the ten-meter band in the contest.

Receiving Antennas Again

W9GES put up a horizontal half wave with some of that new flexible concentric line, and claims that the improved pick-up amounts to two or three R points. This was his first experience with resonant antennas on this band.

One of the Wheaton gang, W9RHK, has been after a "J" for that w.a.c. certificate but had not heard any Asians. We induced him to put up a "lazy H" type antenna as described in Radio for November, 1936, by W3AIR (a horizontal double-zepp for 28 Mc. with another below it, fed in phase, using a tuned feeder). The thing worked well on receiving, and W9RHK raised a J on both 20 and 10 meters early in the contest. Because Europeans were fairly loud off the side, we were in for some razzing until it was pointed out that auto ignition noise was heard not when cars were closest but when "on the nose" of the relatively broad beam. When the thing was shifted to point to Europe, the latter signals on all bands were very much louder. In fact, dx could not be raised in the evening QRM on 14 Mc. until the beam was put on the transmitter. The gain was just enough to lift the signal up over other stations on the edges of the band and six stations were raised that evening. On "20" the gain does not come from directivity—the antenna then being only a half wave long—but from the vertical stacking which forces lower angle radiation. The upper wire was only thirty feet high. We feel that vertical stacking of practically any horizontal antenna is a fine way to double the low angle power without giving horizontal directivity.

Receivers

Our readers often mention the improvement in signal-to-noise ratio obtained by using a tuned horizontal antenna for receiving (see above). This, of course, brings the signal level up to a point where it is large in respect to the "shot effect" or thermal agitation noise in the first tube in the receiver. The other important factor as mentioned in this column before, is to get high non-regenerative gain early in the receiver before the tube noises are amplified materially. A few weeks ago we tried a receiver in the $100.00 class that made it possible to demonstrate this point. The set had one control for the gain of the r.f. stage, another for the audio. By turning up the r.f. on a signal not strong enough to block the early tubes, and holding down the a.f. gain, the only audible noise on ten meters was a slight crackling sort that came in through the antenna. Then we turned down the r.f. while increasing the audio gain, holding the signal level at the same point. Set noises in the form of a "Sh-h-h" noise came up very materially, almost obscuring the signal. This test convinced us that the receiver had a very fine preselection gain, apparently the main reason for the good signal-to-noise ratio. Try this test on your own receiver, even if you must put a temporary gain control on the first tube. If there is not a noticeable improvement in the signal-to-noise ratio with the first stage running wide open, you probably have to replace a tube, or have a rebuilding job ahead of you.

New Ones on 28 Mc.

The letters this month contain a number of calls not seen in the ten meter reports previously. They are VQ4KSL, VQ3AA (Senegal), PK3ST, FM8AA, ZA6F (Albania), YU7DX and YU7GL, MX2B, UK3AH, FT4AB, YT7MT, and YT7KP. We don't have the frequencies—and wish that reports would give frequencies of the more unusual calls.

Predictions

For the two years that we conducted the 28 Mc. department, we have ventured to make seasonal predictions of conditions on 28 Mc., even to the point of predicting the months and time when J's can be worked from the central and eastern U.S. We are bold enough to try again.

The summer will permit working the distant South Americans consistently—if the few stations there are on the air. This will be almost an all-day proposition with peak signals perhaps in the late afternoon. Some South Africans may be heard, though possibly later than recently—afternoons rather than mornings. Also, occasional VK or ZL stations will come through —between sunset and midnight in the middle west. A very few Europeans may sift through in mid-afternoon, but with very weak signals. Japan will be out until late fall.

Sixth district work with central and eastern U.S.A. will not be consistently good as it has been since last September, but will be more erratic, and contacts generally will be confined to shorter distances until about next September. Many stations will desert the band in late April or in May during a temporary lull in conditions, though those who stay around will find signal strengths high for distances varying from 400 to 1200 miles when a station is on the air at the proper distance to provide a contact. The gang will come back to 28 Mc. in large numbers in about September. The band will sometimes be open until after midnight.

We suggest that the gang listen to 28 Mc. before going to a lower frequency band. If no station is heard, leave the carrier on the air or put a brick on the key for several minutes before calling CQ. In this way, a listener will have a better chance to find you by the time you start calling. It is quite surprising how often you can raise a station on a "dead" band if you spend a little time calling. NY2AE and K6MVV worked each other several hours one day last spring when neither could hear or raise another station.

BI-PUSH NOTES

20, 40, and 80 Meter Operation

Many amateurs will want to use the Bi-Push exciter on 20, 40, and 80 meters with an 80 meter crystal. The 80 meter coil consists of 34 turns (center tapped) of number 22 d.c.c. close wound on the same forms used to wind the set of 10, 20, and 40 meter coils. The jumpers are connected as shown for the coil number 1 in the diagram accompanying the article on the deluxe bi-push exciter, which appears elsewhere in this issue. The 40 meter push-push coil is wound with the same number of turns as the 40 meter push-pull coil, *but is jumpered the same as shown for coil number 2*. The 40 meter *push-pull* coil is not used with an 80 meter crystal. Another 40 meter coil, connected with "push-push jumpers", is needed.

The 20 meter coil is okeh "as is". In other words, if you have a set of coils to go with a 40 meter crystal, you need only two more coils to hit three bands with an 80 meter crystal. The 20 meter coil is the same with either a 40 or 80 meter crystal. Be sure when using an 80 meter crystal to get the *push-push* 40 meter coil in the coil socket of the following stage. The push-pull 40 meter coil will not work; it is used only with a 40 meter crystal.

Bugs

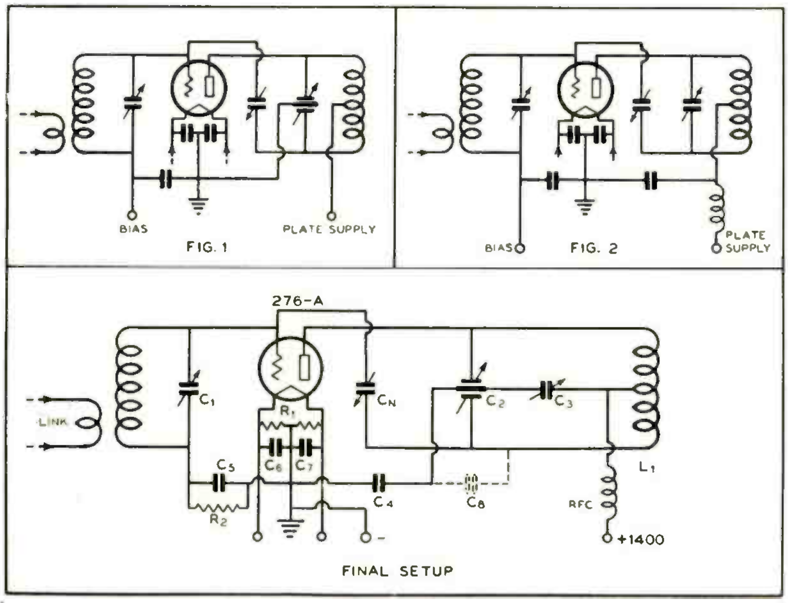
If the 10 meter coil does not quite resonate even with the condenser plates completely unmeshed, it means that either the tank leads in the 6L6 circuit are too long or the minimum capacity of the tuning condenser is too high. The easiest way is to correct for this by taking a half turn off the 10 meter coil, but the preferable method is to remedy the difficulty by shortening the leads or using a condenser with a lower minimum capacity.

Just because you happen to use a metal chassis, do not get the idea that it is permissible to dispense with the ground bus. All grounds should be made to a piece of heavy copper wire or strap, which in turn should be bonded at several points to the metal chassis.

When using a metal chassis, do not rely upon fiber insulating washers to support the 6L6 tank condenser from the chassis. At the higher frequencies the washers provide very poor insulation. Mount the condenser on midget stand-off insulators, after first drilling a hole in the front panel large enough to clear the shaft.

Controlled Transmitter Regeneration

By J. R. Connolly, W7EAZ



Showing the Evolution of the Circuit Described

C_1—35 μμfd. midget
C_2—75 μμfd. per section, 3000 volt spacing
C_3—100 μμfd. midget
C_4—.002 μfd., 5000 volt mica
C_5—.002 μfd. mica
C_6, C_7—.004 μfd. mica
C_8—Optional condenser for high-capacity tubes. Equal to plate-filament capacity of tube.
R_1—100 ohms, 10 watts, center-tapped
R_2—7500 ohms, 50 watts
L—Plate tank coil tapped at exact

There is scarcely a ham who has contemplated high frequency operation who has not been confronted with the problem of obtaining sufficient grid drive. We are all familiar with the two most common tank circuits, the split stator tank condenser type, figure 1, and the split coil type, figure 2. The split stator type is more widely used on high frequencies, not because it is the easier to drive, but because the amplifier is much more stable than the split coil type.

The split stator system is harder to drive whereas the split coil arrangement is unstable on the higher frequencies. On low frequencies where its use is permissible, the split coil system is quite easy to drive because it is somewhat regenerative. From this it follows that all we have to do to accomplish our purpose is to strike a compromise between the two systems. The circuit of a highly successful attempt now used at W7EAZ is shown in the final setup. The only difference between it and figure 1 is the addition of C_3. This might be termed a regeneration control. By means of C_3 we may add some regeneration to the conventional split stator circuit to provide an arrangement that is considerably easier to drive. This may be carried to any degree you choose, the more capacity at C_3 the more regeneration and the easier the stage is to drive.

For c.w. work, where stability is not of prime importance, the amplifier may be made regenerative practically to the point of oscillation. This should be done only in case of severe lack of excitation as it is not good practice. For phone operation use just enough capacity at C_3 to obtain class C operation of the stage with the usual driver.

At this station the system put a WE-276A back in service after it had been laid away on

[Continued on Page 48]

DECIBEL TABLE

Voltage-Current-Impedance Relations at a Glance

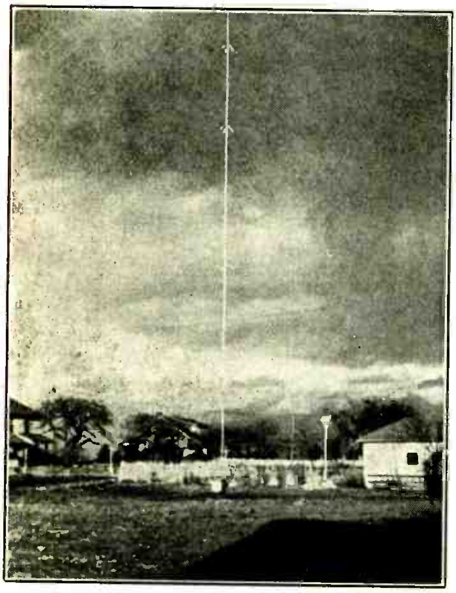
(Courtesy, Commercial Radio Equipment Co.)

POWER IN WATTS	Zero Db. = .006 Watts	Zero Db = .0125 Watts	600 OHMS Rms. Voltage	600 OHMS Peak Voltage	600 OHMS Current in Milli-Amperes	500 OHMS Rms. Voltage	500 OHMS Peak Voltage	500 OHMS Current in Milli-Amperes	200 OHMS Rms. Voltage	200 OHMS Peak Voltage	200 OHMS Current in Milli-Amperes
6x10—9	—60	—63.19	.0019	.0027	.0032	.0017	.0024	.00346	.0011	.0016	.0055
6x10—8	—50	—53.19	.006	.0085	.0102	0055	.0078	.0109	.0034	.0038	.0173
6x10—7	—40	—43.19	.019	.027	.032	.0173	0243	.0346	.0109	.016	.055
6x10—6	—30	—33.19	.06	.085	.102	.0548	.0777	.1095	.0346	.038	.173
6x10—5	—20	—23.19	.19	.27	.316	.1732	.232	.346	.1095	.16	.546
6x10—4	—10	—13.19	.6	.85	1.02	.5478	.777	1.095	.346	.38	1.73
.000755	— 9	—12.19	.673	.953	1.13	.614	.869	1.23	.386	.546	1.94
.000951	— 8	—11.19	.755	1.07	1.26	.689	.976	1.38	.433	.613	2.18
.001197	— 7	—10.19	.818	1.20	1.42	.774	1.094	1.55	.487	.682	2.44
.001507	— 6	— 9.19	.952	1.35	1.58	.868	1.228	1.74	.546	.773	2.75
.001897	— 5	— 8.19	1.07	1.56	1.79	.974	1.378	1.95	.613	.866	3.08
.002388	— 4	— 7.19	1.19	1.68	2.03	1.09	1.541	2.19	.687	.973	3.46
.003007	— 3	— 6.19	1.35	1.91	2.24	1.23	1.74	2.45	.775	1.1	3.87
.003786	— 2	— 5.19	1.51	2.14	2.52	1.38	1.95	2.75	.870	1.23	4.34
.004766	— 1	— 4.19	1.69	2.39	2.83	1.54	2.18	3.09	.971	1.37	4.88
.006000	0	— 3.19	1.89	2.68	3.17	1.73	2.45	3.46	1.095	1.54	5.46
.007553	+ 1	— 2.19	2.13	3.01	3.56	1.94	2.74	3.89	1.22	1.73	6.14
.009509	2	— 1.19	2.39	3.38	3.99	2.18	3.08	4.36	1.37	1.94	6.89
.01197	3	— .19	2.72	3.85	4.47	2.48	3.51	4.89	1.56	2.22	7.72
.01250	3.19	0	2.74	3.88	4.57	2.50	3.54	5.00	1.57	2.23	7.9
.01507	4	+ .81	3.02	4.27	5.03	2.75	3.89	5.49	1.73	2.45	8.66
.01897	5	1.81	3.38	4.78	5.74	3.08	4.36	6.16	1.94	2.74	9.74
.0239	6	2.81	3.79	5.36	6.33	3.46	4.89	6.91	2.18	3.08	10.9
.0301	7	3.81	4.26	6.03	7.11	3.89	5.51	7.76	2.45	3.47	12.3
.0379	8	4.81	4.76	6.74	7.96	4.35	6.15	8.70	2.74	3.88	13.7
.0477	9	5.81	5.35	7.57	8.94	4.88	6.92	9.76	3.08	4.36	15.7
.06	10	6.81	6.00	8.49	10.20	5.47	7.74	10.95	3.45	4.88	18.31
.6	20	16.81	19	26.9	31.7	17.32	24.5	34.64	10.9	15.4	54.8
6.0	30	26.81	60	85	104	54.77	77.5	109.5	34.5	48.8	173
25	36.19	33.	122.2	171	204.3	111.8	158	223.9	70.3	99.5	353
50	39.21	36.02	173.5	245	288	158.2	224	316.1	99.5	140.5	500
75	40.10	36.9	212	300	354	193.5	273.5	387.5	121.9	172	613
100	42.22	39.03	244	346	410	222.6	316	447	140.5	199	708
150	43.98	40.79	300	425	502	274	388	548	172.5	244	865
200	45.23	42.04	346	489	578	316	415	631	199	282	999
250	46.2	43.01	388	549	646	354	502	707	223	316	1,120
500	49.21	46.02	548	776	915	500	707	1,000	315	446	1,580
1,000	52.22	49.03	775	1,097	1,295	707	1,000	1,414	446	631	2,240
2,500	56.2	53.01	1,222	1,710	2,043	1,118	1,580	2,239	703	995	3,530
5,000	59.21	56.02	1,735	2,450	2,880	1,582	2,240	3,161	995	1,409	5,000
10,000	62.22	59.03	2,440	3,460	4,100	2,226	3,160	4,470	1,405	1,990	7,080
25,000	66.2	63.01	3,880	5,490	6,460	3,540	5,020	7,070	2,230	3,160	11,200
50,000	69.21	66.02	5,480	7,760	9,150	5,000	7,070	10,000	3,150	4,460	15,800
100,000	72.22	69.03	7,750	10,970	12,950	7,070	10,000	14,140	4,460	6,310	22,400
500,000	79.21	76.01	17,350	24,500	28,800	15,820	22,400	31,610	9,950	14,090	50,000

POWER IN WATTS	74 OHMS Rms. Voltage	74 OHMS Peak Voltage	74 OHMS Current in Milli-Amperes	50 OHMS Rms. Voltage	50 OHMS Peak Voltage	50 OHMS Current in Milli-Amperes	37 OHMS Rms. Voltage	37 OHMS Peak Voltage	37 OHMS Current in Milli-Amperes
6x10—9	*This impedance used only in radio frequency transmission lines and seldom with powers less than 25 watts*			.00055	.00077	.01095	*This impedance only used in radio frequency transmission lines and seldom with powers less than 25 watts*		
6x10—8				.00173	.0024	.0346			
6x10—7				.0055	.0077	.1095			
6x10—6				.0173	.0244	.346			
6x10—5				.0548	.077	1.095			
6x10—4				.173	.244	3.46			
.000755				.194	.274	3.89			
.000951				.218	.308	4.36			
.001197				.244	.346	4.87			
.001507				.275	.389	5.46			
.001897				.308	.436	6.14			
.002388				.344	.478	6.79			
.003007				.389	.55	7.84			
.003786				.436	.616	8.7			
.004766				.487	.689	9.75			
.006000				.546	.773	10.95			
.007553				.614	.869	12.3			
.009509				.679	.96	13.8			
.01197				.784	1.11	15.4			
.01250				.792	1.12	15.84			
.01507				.87	1.23	17.3			
.01897				.975	1.38	19.4			
.0239				1.095	1.55	21.8			
.0301				1.23	1.74	24.4			
.0379				1.38	1.95	27.5			
.0477				1.54	2.18	31			
.06				1.73	2.44	34.5			
.6				5.48	7.75	109.5			
6.0				17.3	24.4	345			
25	42.3	59.8	582	*This line impedance seldom used where power levels exceed 6 watts, and then mainly for audio applications*			30.4	43	822
50	60.8	86	821				43	60.8	1,162
75	74.5	105.2	1,008				52.7	74.5	1,425
100	86	121.6	1,161				60.8	86	1,643
150	105	148.5	1.450				74.5	105.4	2,015
200	121.5	172	1,644				86	121.5	2,325
250	136	192	1,840				96.3	136	2,600
500	173	244	2,590				136	192.3	3,679
1,000	272	388	3,675				192.3	272	5,220
2,500	423	598	5,820				304	430	8.220
5,000	608	860	8,210				430	608	11.620
10,000	860	1,216	11,610				608	860	16,430
25,000	1,360	1,920	18,400				963	1,360	26.000
50,000	1,730	2,440	25,900				1,360	1,923	36,790
100,000	2,420	3,880	36,750				1,923	2,720	52,200
500,000	6,080	8,600	82,100				4,300	6,080	116,200

An Inexpensive, Vertical Steel Radiator

By E. F. Trego, Jr.,* W9WKC



Cheaper than dural, and still light enough to be practicable. 67 feet straight up, weight about 70 pounds.

When it was learned that the duralumin for a mast like that of W8ZY, described in the January issue of Radio, could be obtained only after waiting four to six weeks, some substitute just had to be found. The answer was a type of electrical conduit known as "Steeltube" which comes in 10 foot lengths. The cost of the Steeltube for a 67 foot mast is $8.43 and that of the welding, $3.00. We purchased 30 feet of 2", 20 feet of 1½", and 17 feet of 1¼" material having the following actual measurements:

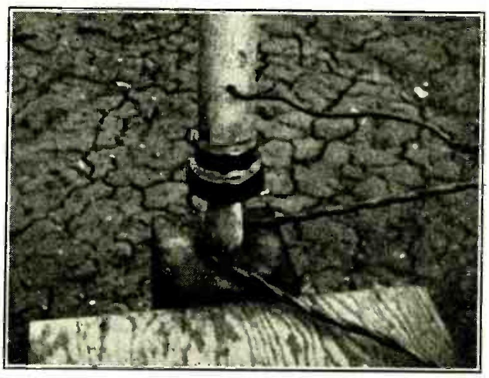
Size	*Inside Diameter*	*Outside Diameter*
1¼"	1.380"	1.508"
1½"	1.610"	1.738"
2 "	2.067"	2.195"

This material weighs about 70 pounds compared with 40 pounds for duralumin, still light enough to handle without difficulty.

The sections were joined by butting the ends together and welding. To weld the large diameter tube to a smaller one it is necessary to cut "V's" in the end of the larger tube to reduce the circumference to that of the smaller. The guy wires are fastened to the pole by welding a piece of angle iron about 2" long to the tubing at the desired spot and drilling a hole in the projecting side. The mast is guyed in four directions at approximately 15, 30, 45, and 60 feet. The guys are anchored 40 feet from the base. Strain insulators in the guys are the cheap "egg" variety with the wire looped through in the usual manner to avoid loss of the guy wire if the insulator cracks. Those at the pole, however, should be long, of good quality and high tensile strength—in this case, Johnson "7 inchers".

The insulator at the base is an ordinary ceramic power line insulator, screwed on the usual crossarm oak peg which is set in a six foot 6 x 6 creosoted post placed 3 feet in the ground.

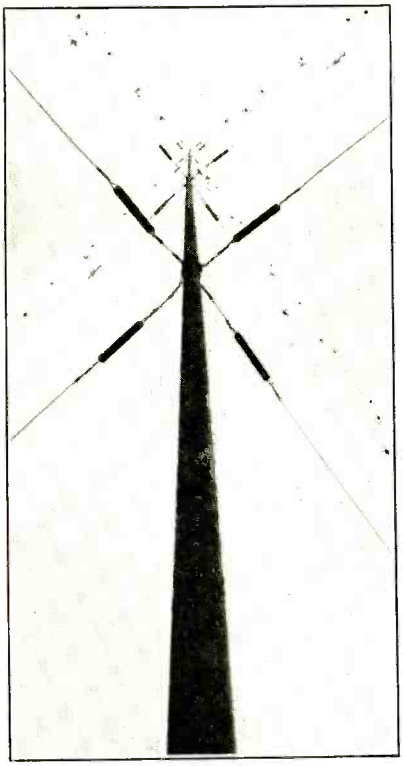
Before raising, the Steeltube was painted with aluminum paint on the outside. It comes already coated with enamel inside. The top can be plugged to keep out moisture.



The base of the mast rests on a power line insulator, screwed on the usual crossarm oak peg which is set in a husky post. The wood is well oiled to minimize moisture absorption.

When the completed mast was lifted at its center, both ends remained on the ground in a most discouraging manner. We thought of lifting the top end on a ladder to make the curvature concave as viewed from above, then pushing the base toward the top, along the ground, against the strain of the upper guys, so that it would lift itself. However, it seemed easier to pull the top up on a two story house, pull

*830 E. Maple Street, Hoopeston, Illinois.



The pole presents quite a majestic sight when looking directly up at it from the bottom.

the top guys until the whole mast was vertical, then carry the bottom over to the base insulator. While it behaved very much like a rope when on the ground, the erection job was simple.

Figuring conservatively, taking one and a half times the projected area of the longest unsupported section, the mast will stand a 100 mile per hour wind (one of hurricane proportions) with a small factor of safety. Without attempting to set specifications to apply to an amateur tower, we will hazard a guess that this is considerably stronger than most ham installations.

So far, the mast has been used only on the 80 and 160 meter bands, fed from the bottom with a single wire which continues to the transmitter. A transmission line soon will be tried using a ground or counterpoise. Results give the peculiar impression that the signal strength on the west coast is as good as at much nearer points.

◆

A number of Signal Squishers have been put up in and around Los Angeles, some vertical, some horizontal. All have given a worthwhile gain over a standard horizontal "Q" reference antenna working in its best direction (broadside) and a large gain over working "off the ends" of the "Q". The difference is most noticeable at distances over 4000 or 5000 miles away, where low-angle radiation is desirable.

Showing how the guys for one direction all terminate at the same point. The gadget shown is the equivalent of separate turnbuckles in each of the four guys.

◆

"Air Conditioning" the Rig

The majority of transmitter components such as transformers, chokes, filter condensers, tubes (especially mercury-vapor rectifiers), and resistors are designed to operate at a certain temperature rise *above* the surrounding air temperature. This rise, usually 20 or 30 degrees C, assumes that the surrounding air temperature will lie in the range of from 0 to 50 degrees Centigrade, or from 32 to 122 degrees Farenheit. If the surrounding air becomes much hotter than this (and this can very easily happen in an enclosed or semi-enclosed rig), insulation in transformers and chokes approaches the breakdown temperature. Also, the power factor of the dielectrics used in condenser manufacture rapidly increases; and the higher the power factor the higher the losses (which result in still further increases in temperature). The result of this, of course, is greatly accelerated condenser breakdown.

Another result of increased air temperature is to reduce the maximum allowable inverse-peak plate voltage on mercury-vapor rectifiers. This maximum rating on the 866 tube applies only for a maximum temperature (of the coolest part of the bulb) of 60 degrees C (140 degrees F). Since the coolest spot on the bulb

[*Continued on Page 75*]

But What of the Man?

By J. W. Paddon,* G2IS

Before a contest or when we have a special schedule coming up, we lavish much care and work on the station. The whole works is checked over and adjusted. When zero hour comes around, the rig is in the pink of perfection—but what of the man?

The efficiency of the operator is as important as the efficiency of the rig. This is well borne out by the numerous cases where immature operators—fellows in their "teens"—have pulled off extraordinary stunts under the noses of their more experienced elders. Write it down to the youngster's resistance to fatigue.

Since this question of the operator's efficiency is purely a technical one, the problem was referred to specialists in that line: a doctor, a psychologist, and a trainer. The data set forth below is perfectly simple to follow and should cause no inconvenience in execution.

Preliminary Details

Line the rig up to your complete satisfaction several days before the contest, then lock up the shack and forget it till "zero hour". During this preliminary period get a normal amount of sleep. Don't try to store up sleep, as that will only get you out of your normal habit and it will be even more difficult to readjust yourself for the contest.

During this period make sure that all bodily functions are normal. Don't eat heavy food; we all eat too much anyhow. Take a consistent amount of light exercise.

Atmosphere and Such

The most common cause of fatigue and dopiness is what we call in England "fug", in other words, a stuffy, stale atmosphere. It is of paramount importance to have a steady change of air. This does *not* mean that the operator sits in a draught, but that the station is planned in order that the whole volume of air is slowly changing.

The operating table should be wide enough to support the operator's elbows in comfort and at normal height. If the height of the table is noticeable and causes a subconscious irritation or a noticeable degree of discomfort, it should be altered.

The light should, of course, be out of the operator's eyes. It should shine on the receiver and other controls as it is very fatiguing to look from one degree of brightness to a lesser or higher degree. Each time the glance passes from one to the other, the pupils (iris) expand and contract with the attendant muscular fatigue.

The operating chair should be comfortable without encouraging slouching. All controls should be grouped so that the operator does not have to be continually bending and twisting while running his equipment.

A large supply of well-sharpened pencils should be at hand. The log paper, which ought to be of a dull color such as ordinary typewriting "second sheets", should be placed close by; tacking it to a bit of ¼" ply is a good idea. The operating table should not be messy; a lot of odds and ends in one's face and eyes eventually causes mental irritation. If we want to concentrate on the job, we must keep away from any irritant that gives the mind, conscious or subconscious, anything to fuss about.

No Coffee, No Hamburgers

Right! You kick off at midnight. It is now 7 p.m. and you have been good enough to place yourself in my hands. I have had a word with the OW (or mother) and here is a light supper for you. Eat it slowly—and I wouldn't bother about that hamburger if I were you. No! No coffee just now and, if you touch that beer, I'll brain you. Stick your large hooves on the mantlepiece and smoke a cigarette while I see what films are on. Ah! Here's a dizzier one than usual. We'll go to that. Your sister will drive us down and we'll walk back.

Got a cigarette? No? Splendid—neither have I! Now, let's hike. It's only a mile and this night air is good. Here we are, with half an hour to go. You can have the key to that shack at 11:45 and no sooner. In the meantime, go and put on that loose pair of old tennis flannels and no belt—all right, let 'em come down. If you have anything tight over that fat stomach of yours, you'll get nice and dozey in about 15 minutes. Borrow your old man's suspenders, then; he won't want 'em tonight. Stick on that old flannel shirt and stuff a silk handkerchief, cowboy style, around your neck. Pull a pair of thick wool socks over your feet and some loose carpet slippers.

*Bussock Hill House, Newbury, Berkshire, Eng.

More QSL Contest Entries. The Winning Card Is In the Lower Right Hand Corner.

Mi gawd, you look like old home week in the monkey house, but—let's go!

Coffee at Last

All set? That super of yours does haul them in. Now, here's a mug of the strongest black coffee you'll see for years and that's all you get for a long time. Here is some rock candy (no, I'm not crazy) ; that stuff has more concentrated energy in it than an overfed bulldog. When you feel muzzy, have a hunk. Smoke that pipe, but no more than you have to. Cigarettes are out. Now go to it, old timer, and I'll look in at 5 a.m.

* * * *

Five Hours Elapse

Well, you look pretty good; Feeling OK? Swell! Let's have a look at that log. Holy Moses, you have been knocking 'em off! Let those G's go for a minute and lie on your back on the floor and "ride a bicycle". The idea is that you want to use your stomach muscles to drive blood out of your inside and into your brain.

Makes more of a difference than you think, eh? You carry on two hours more, then bed for you while I take over. Sure, same procedure tomorrow but don't worry about it now—isn't that CQ coming from YR?

Inexpensive Time Delay Protection

WILLIAM R. JONES*

It is well known to users of vacuum tubes that an interval of time delay between the application of filament and plate voltages is good insurance toward long life. This is especially true where mercury-vapor rectifiers are concerned. But commercial time delay devices are costly; hence most of us have gone without them. The majority of us entrust our vacuum tubes to our patience in allowing ample time for the tubes to come to operating temperature before

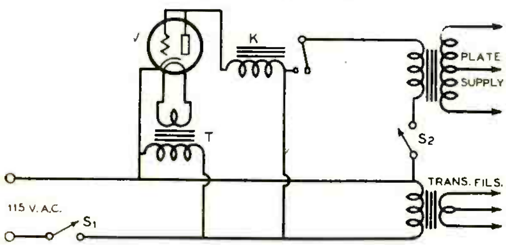


Figure 1
Simplest Time-Delay Circuit

applying the plate voltage. Too often some one becomes impatient and throws the plate switch without allowing sufficient warm-up time. The results, especially with high-powered expensive tubes, are frequently destructive.

However, by taking advantage of the slow heating properties of the heater-cathode types of tubes, the enterprising amateur can readily devise time delay protection for his equipment at a minimum of cost.

Figure 1 shows the simplest time delay circuit in the form first tried. In operation, closing line switch S_1 supplies heater power to control tube V at the same time the filament power is applied to the tubes in the rig. As the tubes in the transmitter come up to temperature the control tube V will also be heating. When the space current through V is high enough to close the relay K it will be possible to operate the transmitter by closing the plate switch S_2. Until the control tube has come up to temperature, closing this switch will have no effect. The delay introduced will be dependent upon both the control tube and upon the current required to operate the relay K.

There are many objections to the use of this elementary circuit, the most important being the lack of protection if S_1 is turned off and on quickly after the circuit comes into operation.

Figure 2 shows a circuit which minimizes this major objection. K is a simple 2PDT relay, the coil voltage being unimportant as long as the current sensitivity is not too low, since R will serve as a voltage multiplier if required. However, one designed to operate from 110 volts a.c. will be best. V can be any heater-cathode tube whose heater voltage matches EF. Multi-element tubes serve well as a rectifier when the grids are tied to the plate as shown.

In operation, closing S_1 applies power to T, the heater of control tube V, and the filaments of the transmitter. The No. 2 contacts are, when resting, such that the filament circuit to V is completed through the left contact of the group and the armature.

When V attains the critical temperature, current will pass through R, V and the coil of K, all in series. K will then close, the armature contacts moving to the other side. This completes the primary circuit through no. 1 contacts and at the same time the filament of V is opened and a short placed from cathode to plate of V by the transfer of no. 2 contacts. Thus V is allowed to reset by cooling and K remains energized. Then if S_1 is turned off and on, V must again go through its heating cycle before K functions. Unless S_1 is rapidly turned off and on within a few seconds of the closing of K, an idiotic procedure in any case, no possibility of failure will arise. With the relay energized in this manner, after the warm-up period the transmitter is controlled simply by throwing the switch S_2 on or off.

In using the circuit of figure 2 it is well to note that winding EF must not be grounded and can be used only for V, as it is tied to the a.c. line. However, if a 3PDT relay is available the extra set of contacts may be used to short V; EF is thus isolated and may be used for other service.

Unfortunately all relays, especially those generally kicking around the "junk box", can't be put across a.c. without audible protest in the form of a raucous 120 cycle buzz. So because nerves and microphones have no appreciation for that serenade, steps must be taken to make

*24 Myrtle St., Springfield, Mass.

their operation noiseless. The addition of one more tube to our TD circuit will accomplish this nicely, without undue complication and, as will be explained later, at little, if any cost.

Reference to figure 3 shows the method of obtaining quiet operation where a.c. relays are not available. The circuit is similar to that of figure 2, but V_1 has been added and acts as a half wave rectifier in such a way that K continues as a d.c. operated device after TD tube V has functioned. R, as before, is merely a voltage multiplier for the coil of K. R_1 has been added in series with the heater of V and will give the user some measure of control over the time constant of V. This is not at all necessary though entirely practical. S_2 is also added and is merely suggested for use as a stand-by control in the conventional manner. As noted in the explanation of figure 2, care must be taken to keep winding EF isolated, especially if V_1 is a filament type tube such as the '45 or '80.

No mention has been made as to specific types of control tubes to use. The reason for this seeming lack is easily explained by the fact that most any tube will do as long as three simple requirements are met. First, the heater voltage must approximately match that of winding EF. For instance in one setup the writer used a 6.3 volt 41 tube as V and an 80 (plates tied together) as V_1 on the same 5 volt winding. The under-rating in voltage on V eliminates R_1 of figure 3.

Secondly, the tube must pass momentarily the current required to close K. If the circuit of figure 3 is used it is well to remember that V is in series not only with R and K but with

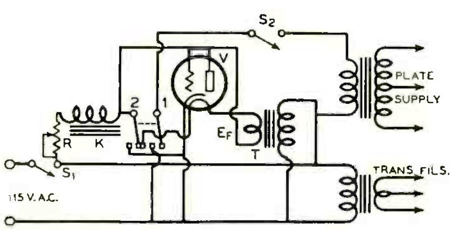


Figure 2
Improved Modification of Figure 1

V_1, so that to reduce the IR drop a high capacity tube is desirable for both V and V_1.

And lastly is the desirability of using the slowest heating control tube that has ever tried your patience (among those tubes which will satisfy the other two requirements). By prop-

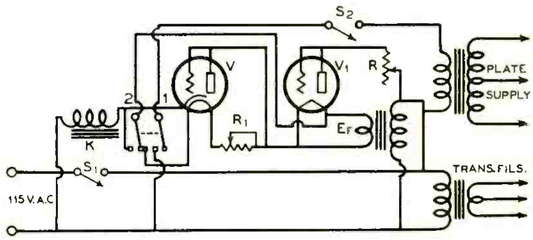


Figure 3
Quiet A.C. Operation of the Relays

er selection of control tube and R_1 of figure 3, time constants of from 10 to 40 seconds may be realized.

In connection with this selection of tubes, it won't make any one feel bad to realize that the oldest specimen you can get your hands on will work as well or better than a newer one. So just look over those tubes you were going to throw out last month and select a likely one.

And now a word as to the control relays. As mentioned before, the current sensitivity of the coils must not be too low, as they are to be operated in series with a relatively low-capacity receiving tube. Proper selection of the multiplier R will protect the relay if the coil was designed for use across low voltage. If the relays available for use are unsuited for such usage it is generally a simple matter to rewind the coil. Using small wire and plenty of it will do the trick. If needed, spare sets of contacts are easily added to relays by tacking on an outrigger of bakelite and putting the extras on it.

In the diagrams shown the minimum of components were included. In circuits where high power is used, the time delay circuit will probably be used with the control contacts (no. 1, figures 2 and 3) operating an auxiliary contactor in the primary of the power circuit.

◆

The "ant-eye" capacity switches the boys are always yapping about on the air must be tiny gadgets!

◆

Absent-minded dope to his barber: "Crop it close, and don't forget to leave the *sidebands* square."

Plate Modulation: A Recapitulation

By F. Alton Everest*

In figure 1 is shown the fundamental method of operation of the system of plate modulation sometimes called *Heising* modulation in honor of the man who introduced it. The main distinguishing point between plate and bias modulation is that in plate modulation the bias point and amplitude of the radio-frequency excitation voltage remains substantially constant. This is shown pictorially in figure 1. The dynamic characteristic curves for four plate voltages between zero and 1000 volts are shown as straight lines for the purpose of this discussion. In the unmodulated condition, the voltage on the plate is the *entire supply voltage*, which we shall designate as 500 volts. The audio voltage from the modulator, which has a peak value of 500 volts, is introduced in series with the plate lead so that the audio voltage is superimposed upon the 500 volts supply voltage. At each instant the voltages add algebraically so that we have a plate voltage which is driven to 500+500 volts or 1000 volts on positive audio peaks and to 500—500 volts or to zero voltage on the "troughs".

The thing that makes the operation of the plate modulated class C amplifier hard to visualize is the fact that the operation on any two successive instants is not on the same dynamic E_g-I_p curve. The cutoff point is given at least approximately by the expression:

$$\text{Cutoff bias} = \frac{E_p}{\mu}$$

where E_p is the instantaneous voltage on the plate of the tube and μ is the amplification factor of the tube. If μ is 10 (and remains constant at 10 as it would [approximately] in practice), the cutoff at $E_p = 500$ is equal to —50 volts, at $E_p = 1000$ volts it is equal to —100 volts, and at $E_p = 0$, the cutoff bias also is zero. The reason then, that modulation is accomplished by variation of the plate voltage, hinges entirely upon the fact that, as the plate voltage changes, the plate current cutoff point also is changed.

In figure 1, in the unmodulated condition of $E_p = E_B = 500$ volts, the cutoff point is then at —50 volts and the plate current pulse will not begin to flow until the instantaneous voltage upon the grid (the r.f. excitation) reaches the point (C), or —50 volts. The plate current pulse then will be of a value proportional to the distance (C-E). As the plate voltage is increased to +750 volts, the plate current cutoff point is moved back to —75 volts and the plate current will start to flow when the instantaneous grid voltage reaches the point (B), and the plate current pulse will attain a peak that is proportional to the distance (B-E). And so on to $E_p = 1000$ volts, where the cutoff point is —100 volts, the plate current pulse will be proportional to the distance (A-E), which point will correspond to positive modulation peaks. In this way it is seen that the *peak amplitude of the plate current pulses is determined by the instantaneous voltage on the plate, for it is this voltage that determines the plate current cutoff point.*

Power Relations

The modulated pulses of plate current as shown in figure 1 give rise to an r.f. current in the tuned load impedance. This current flowing through the tuned load impedance Z_L gives rise to the load voltage E_L which varies as shown in figure 2. This is the useful output of the modulated stage. The plate current pulses are rich in harmonics, but the tuned load impedance causes the harmonics to be ineffective, for it provides a high load impedance only to the frequencies very close to the fundamental, which would include the carrier frequency and the sidebands.

The instantaneous power output is given by:

$$\text{Power output} = \frac{(E_L)^2}{Z_L}$$

This says that when the voltage across the tuned load impedance is doubled (as it is on 100% modulation peaks), the instantaneous power output is increased four times, because it is proportional to the square of the voltage across the load. Averaged over a period of time, *the continuous power output with 100% sine wave modulation is 1.5 times that for the unmodulated condition.* The power input from the plate power supply remains constant when averaged over the modulation cycle. If the con-

*Instructor in Electrical Engineering, Oregon State College.

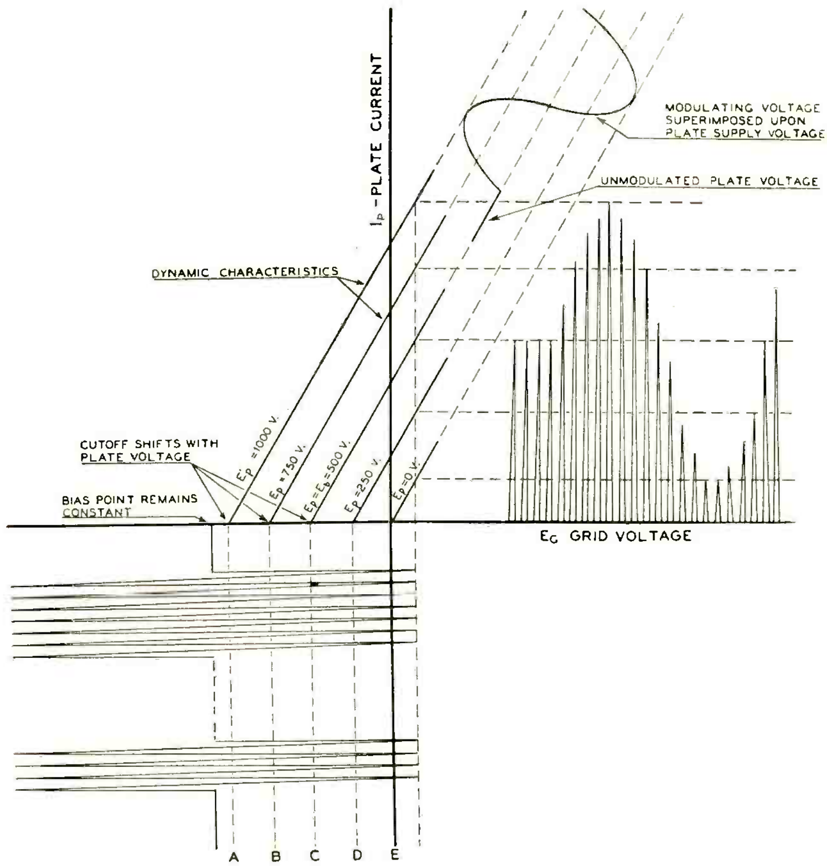


Figure 1
Dynamic Characteristic of Plate Modulation

tinuous output on modulation peaks is 1.5 times the unmodulated output and the input remains constant, then where does this 50% increase in power come from? The answer is that this power is that which comes from the modulator, and goes into the generation of the side-bands. In the final analysis, this power in the side-band frequencies is the power which conveys the intelligence. It is possible to eliminate the carrier at the transmitter and re-introduce a carrier of the same frequency from a local source at the receiver and obtain excellent results. The power in the carrier is only a means to an end—that of getting power into the intelligence-conveying side-bands. This power into the side-bands increases very rapidly (as the square) with percentage of modulation as shown in figure 3. To increase the percentage of modulation from 40 to 60 would give an increase in side-band power of 20 units, while increasing from 80 to 100% modulation would give an increase of 36 units, almost twice as much for the same change in percentage of modulation. For this reason it is very advantageous for amateurs to work at high degrees (but not over 100%) of modulation for, after all, a high power carrier does cause lots of adjacent channel interference.

Let us take a specific example of a fellow who has 50 audio watts (peak) available. If he were to adjust his modulated amplifier for about 100 watts input, he would modulate the carrier 100% on modulation peaks, getting the maximum of intelligence-conveying power into the air. On the other hand he could adjust

TABLE I

Showing equivalent conditions as far as intelligence-conveying side-bands are concerned.

Modulation Percentage	*Modulator output power, watts*	*Modulated amplifier input, watts*
100	50	100
80	50	150
60	50	275
40	50	625

the modulated amplifier input to about 275 watts input (if it would stand it), and with the same 50 audio watts, modulate the carrier 60%. In this case, the same amount of intelligence-carrying power would be radiated and his coverage would be essentially the same as the 100% modulation case except that he would be radiating 175 watts of unnecessary carrier power to heterodyne others on the band.

Summary

1) Plate modulation is based upon the fact that the cutoff point (and hence the plate current r.f. pulse amplitude) is varied as the plate voltage is changed at the audio rate.

2) The maximum possible plate efficiency of the plate-modulated class C amplifier lies between 78 and 100 per cent and in practice is usually from 55 to 65 per cent, depending upon the relation of load to plate resistance.

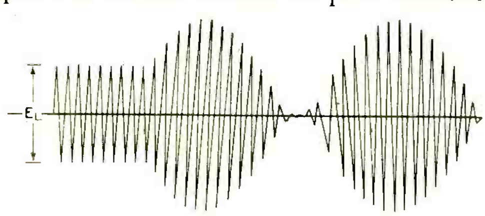


Figure 2
Output R.F. Voltage at 100% Modulation

3) The degree of modulation depends upon the amount of plate voltage swing, being 100% when the peak audio voltage is equal to the power supply voltage.

4) Bias should be adjusted to approximately twice the unmodulated cutoff point.

5) The value of load impedance should be at least twice the value of plate resistance of the modulated tube.

$Z_L = (\omega L) Q$ — Z_L = Load impedance in ohms

$\omega = 2\pi$ (resonant freq. in cycles)

L = inductance of tank coil-henrys

$Q = \frac{\omega L}{R}$ of circuit

6) The modulator must be capable of supplying approximately 0.83 P_0 watts of audio signal for complete sine wave modulation when P_0 = carrier power of modulated amplifier.

7) For a given amount of modulator power available, the input power to the modulated stage should be adjusted for high (but not excessive) modulation to cut down heterodyne interference.

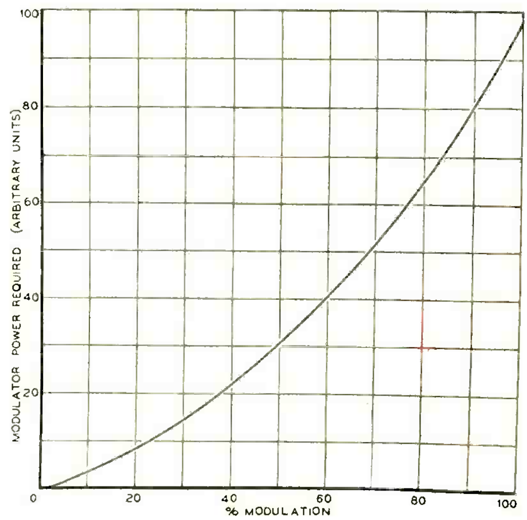


Figure 3
Sideband Power Versus Percentage Modulation

◆

Controlled Regeneration

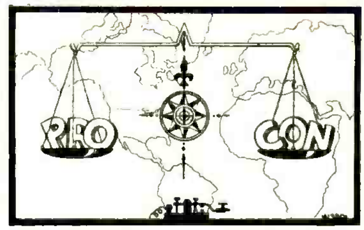
[*Continued from Page 38*]

the shelf when 28 Mc. operation was started. An 801 with 650 volts at 90 ma. is used to drive the 276A with 1400 volts at 175 ma. to 45 ma. grid current through 7500 ohms grid leak resistance. The system has made operation on ten meters as pleasant and nearly as easy as seventy-five meter operation.

A word of caution. The stage should be well balanced and the tap on the plate tank coil should be at the *exact* center. A condenser equal to the plate-filament capacity of the tube to ground from the neutralizing end of the tank condenser helps the balance in the case of high "C" tubes.

◆

THE OPEN FORUM



NO MORE TEARS, PLEASE

Berkeley, Calif.

Sirs:

I took up "ham" radio for the pleasure I could get out of it. When it ceases to afford me any diversion, I'm going to wrap up the "rock crusher" in moth balls and take up golf or pinochle. I seem to have the misconception that 50,000 more or less other "hams" took up radio for the same purpose. I say "misconception" because it would appear from your "Open Forum" that there is no pleasure, or nothing to be thankful for, in amateur radio. It looks like the "ham" fraternity is a moaning, groaning, fighting, discontented group of persons who take their radio more seriously than their daily bread or their religion (if any). Looking through back issues of an otherwise optimistic magazine, we find nothing but complaints about the other fellow.

For instance, W8LTH (in January, 1937, RADIO) is mad at you because you tried to clear up conditions on 160. He forgets that the only way information and some constructive criticism can be circulated to violators is by means of a magazine.

Rus Sakkers, W8DED (in February, 1937, RADIO) groans about the QRM from traffic and moans that only five per cent of the traffic is worth while. Apparently Rus never worked for a telegraph company. I've handled traffic and I work for a telegraph company; my experience has been that the "ham" traffic has the same apparent importance as the messages for which the public pays. And, after all, a "ham" takes up traffic for the enjoyment he gets out of it. Who is Rus to criticize?

Howard Pyle, writing in the February issue, "packs a sort of disgruntled grouch" because the QRM is so bad on 40. Howard seems to have forgotten the sound of his spark sigs 28 years ago. He also fails to remember that when he punches out his supposedly perfect continental, he adds to that QRM and that probably some fellow who can copy just as good as Howard can, and who has just as clean a note, is inwardly cussing Howard for the QRM. If Pyle doesn't enjoy 40, he can try any of the other bands he suggests for the uninitiated. If he doesn't want to do that, he can still do as I intend to do when amateur radio is no longer a pleasure: pack up and quit.

George Carlson voices his discontent in the March RADIO because radio magazines publish articles on small phone rigs. What would George think if, when he was a newcomer to "ham" radio, someone came out with the suggestion to limit the radio publications to descriptions of half kw. jobs? How would George (or any new "ham" in the game) ever get started? Maybe the phone boys want to use phone because they enjoy it? Who knows?

Jim Tracy, W9KNQ, in the March issue, wants to restrict c.w. That's easy to say. It is no problem to suggest restricting the other fellow, but I'll bet none of Jim's suggestions would hinder his operation. Suppose Jim were restricted, at some "ham's" suggestion, to 160 c.w.? He probably would yelp until they could hear him in Australia.

L. A. Wilcox bemoans the 13 w.p.m. requirement for license. Then in another breath he says, "the QRM from lids is too bad." It's funny how a fellow always thinks the fellow who causes the QRM is a lid. In telegraph parlance, a "lid" is a fellow that can't take it and can't dish it out. There will be less lids and more "ops" with a 13 w.p.m. requirement.

It seems that W8SZB, who offers a free antenna, and W6DDS (our friend, the "Mayor" of Moss Landing), and a relatively few others with worthwhile suggestions really are enjoying "ham" radio. But, the majority has nothing good to say for our hobby.

I suppose someone reading this is asking, "Who is this guy, that he should tell me what to do?"

I am not trying to order anyone around. This is my only plea: don't try to tell the other "ham" what to do. If you are not enjoying amateur radio, get out of it. The old adage, "Don't marry a man to reform him", might well be applied to "ham" radio.

For those who say, "Well, smartie, what would you do?", I'll add, not as advice, my method of enjoying my hobby.

Treat the other "ham", regardless of his note, his fist, or other characteristics, just as you would wish to be treated.

Before you criticize any "ham" or any group of "hams" (phone vs. c.w., dx vs. rag chew, traffic vs. dx, etc.) remember that you are a "ham" as well as the rest and that you therefore belong to one of the major groups. Remember that others with different opinions have a right to their ideas just as you have to yours.

If some amateur is operating in violation of the law, tell him—don't talk behind his back. Chances are that he does not know he is in the wrong. If your polite and friendly information cannot remedy the situation, the R.I. can. If your pet peeve is within his rights, then he has as much right on the band as you have.

If 75 phone gets so hot your "flea power" (and that's what I have) will not get through, put in another rock and work c.w. Don't cuss the kw. boys. If you can't get through the QRM on 80, build a low-power job for 40. If all the bands are so congested that it is impossible to work anyone, the chances are you are not as good as the fellows on the band who have QSO's. Admit it. Go to a show or pick up the latest issue of RADIO and spend a quiet hour off the air before you get disgruntled. Nobody likes a crab.

If the dx is coming through, try to work it. If you cannot get through or can't read the dx because of QRM, rag chew with the "ham" across town or in the same block. Some of my most enjoyable hours have been spent gabbing with W6DDO across the bay and W6CML, who is so close he can almost copy me without any transmitting antenna.

Give the newcomer a break. It never hurts a 45 w.p.m. man to slow down for a lid. I have a lot of respect for W6HHM, one of the 45 w.p.m. boys who was considerate of me when I couldn't copy any more than 10 solid. I have some mighty good friends gained by slowing down to QSO. You cannot tell what kind of a fellow you are going to meet on the air simply by judging his speed. The lid may make a better friend than the speed burner.

Do not let "ham" radio make a confirmed grouch out of you. Don't let it master you. In other words, ride your hobby, don't let it ride you.

From those whose names or calls I have mentioned, I request a fair trial. I have not criticized your opinions or methods of operation. I have criticized only your gloomy attitude. I cannot help agreeing with some of you and I respect your opinions. I feel, however, that little good can come of your belligerent attitudes which may be detrimental to our hobby.

H. E. (DOC) ELSEN, W6KMQ.

•

THREE PHASE R.F.

Chestnut Hills, Mass.

Sirs:

I would like to submit the following as an entry in your "oddity" contest.

The accompanying illustration is of a 56 Mc. *three phase* oscillator installed on top of the science building here at Boston College. The tower is a self-supporting structure, and

Three phase 56 Mc. transmitter and radiating system. The transmitter is installed in a glass carboy, which was split and put back together with windshield rubber. This protects the gear from the weather.

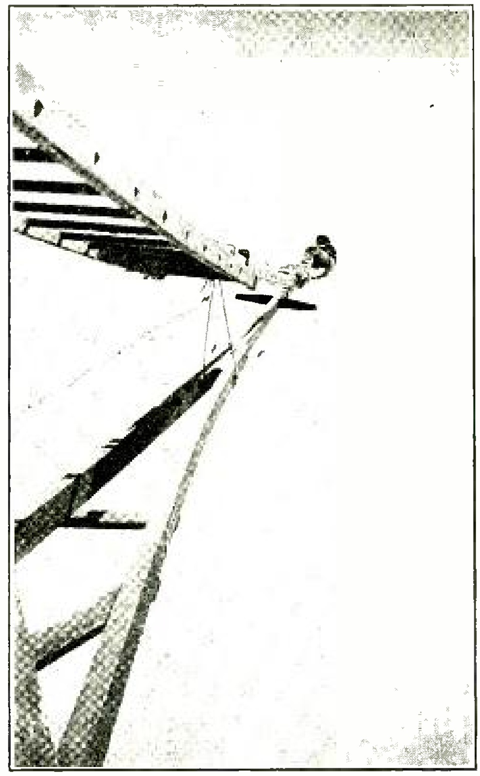
contains at its top a "three phase antenna," matching section, and feed line to the large glass "carboy". The latter contains a three phase oscillator using three type 800 tubes at reduced plate voltage. The system is remote controlled from the radio club rooms some floors below.

The system really does produce three-phase signals. Polyphase generation and radiation of radio frequency energy is new as well as odd, I believe. The system offers many possibilities.

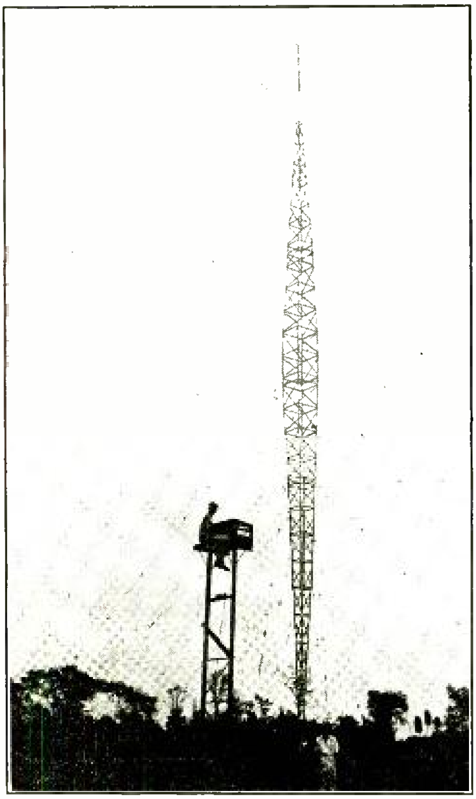
[*Continued on Page 76*]

There also have been suggestions that "general interest" photographs with a radio flavor be published. We don't know just what these are, but would be glad to see your idea of one. A minimum of $1.00 will be paid for each published.

A number of readers have suggested that we run some photographs of YL's who are hams in their own right. We'll be glad to do so if the response is sufficient. Call must be given. If the photograph is sent in by someone other than the YL herself, written permission for its publication must be secured.



A sure-fire method of replacing a broken halyard — if the ladder is long enough. W9GLY aloft.—W9ASV.



Bringing Mohammet to the mountain. Remote controlled 210 on 14 Mc., inclosed in weatherproof steel box. A 20 meter vertical zepp. drops from the 64 foot tower to the transmitter below, 20 feet off the ground.

" . . . It is inexpensive to construct; most amateurs will find practically all the parts in the 'junk box'."—VE3QC.

Antenna Gain Without Horizontal Directivity

By Elmer H. Conklin,* W9FM

We hear about two kinds of directivity of antennas, vertical and horizontal. The latter is not generally desirable for amateur work except (1) for point-to-point work between stations regularly communicating with each other, (2) where several broad antennas are so placed as to cover most useful directions from a given location, and (3) when the beam may be directed by electrical or mechanical rotation.

It has been said that great horizontal directivity can be used, provided that the beam is not narrower than perhaps 5°. Several years ago, Friis[1] studied the angle of reception of trans-Atlantic signals to confirm the theory that waves accurately follow the great circle path at all times—for if they didn't, how would one be able to point a beam with very much confidence in its being correctly aimed? He used two small receiving antennas, spaced 1/3 wavelength, broadside to the approaching signal, each feeding a separate receiver. Alternate plates of an oscilloscope were connected to the receivers so that any phase difference at the antennas would give an eliptical pattern on the 'scope. The results indicate that the signal followed the great circle path or was within a few degrees of that path a good share of the time, although during the test, a deviation as much as 30° from the true direction was observed.

This is an apparent deviation, which can result from wave interference or a slight delay in the waves reaching one end of a beam antenna, so that the wave front is no longer perpendicular to its path, and may not be a real deviation at all.

In fact, another study was made by Schelleng[2], using a transmitting antenna in which provision was made for deviating quickly the direction of the signal maximum by about 5°. Two receivers, in England and Scotland on paths differing by about 3° were used during a short test. An analysis of the results indicates that the *maximum* signals cluster closely about the great circle path—perhaps within 1°.

A study of fading effects which might result from too much horizontal directivity in a transmitting antenna was made by R.C.A.[3] between Rocky Point, Long Island, and Marshall, California, about 2600 miles away, over a period of half a year. The observers never failed to find an improvement in signal proportional to the directivity except for one or two very rare and short periods. Nor was there evidence of any difference in amount of fading between a plain dipole and any of the directive antennas. It therefore seems that great horizontal directivity in a transmitting antenna—beyond that available to amateurs—can be used for point-to-point work.

Vertical Directivity

It is *vertical* directivity that usually is discouraged with the idea that it may cause fading or be at the wrong angle for communicating a given distance.

In looking into this, let us note that the vertical plane pattern of an antenna may be somewhat misleading unless properly interpreted. Take the example of a horizontal antenna a half wavelength above a perfect ground. This gives a rather pretty pattern but if it is used at a time when only radiation at altitudes between 0° and 30° return to earth (the limits may be narrower, particularly above 14 Mc., varying with time of day, season, sunspot cycle, etc.), then only that part below 30° is useful radiation. With this system, it is evident that possibly 60% is wasted power radiated above the assumed useful limit of 30°. It is obvious that any attempt to radiate most of the power below 30°, without reducing the radiation at *any* angle, would result in a better signal at any distant point—even though the shape of the pattern may *appear* to be sharper.

Let us look to another experiment made by R.C.A.[3] with an antenna of *very* sharp vertical directivity. At Rocky Point, Long Island, a model "B" long wire array was erected (see figure 1) so that the tilt of the long wires could be changed. This required one high tower and one somewhat shorter toward the receiving location. In fact, in order to obtain really low

*Assistant Editor, Radio.

[1]H. T. Friis, "Oscillographic Observations on the Direction of Propagation and Fading of Short Waves", *Proceedings I.R.E.*, May, 1928.

[2]J. C. Schelleng, "Some Problems in Short Wave Telephone Transmission", *Proceedings I.R.E.*, June, 1930.

[3]P. S. Carter, C. W. Hansell and N. E. Lindenblad, "Development of Directive Transmitting Antennas by R.C.A. Communications, Inc.", *Proceedings I.R.E.*, October, 1931.

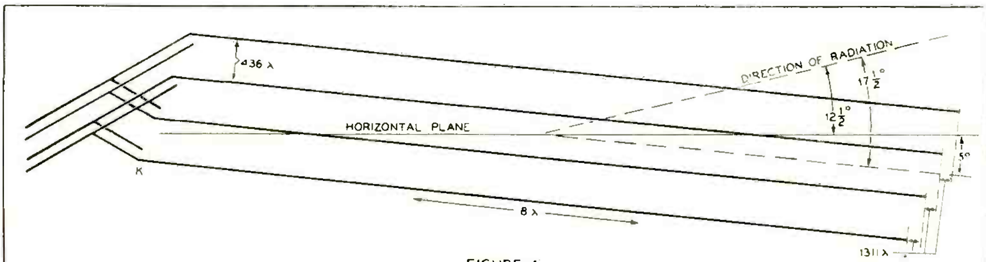


FIGURE 1

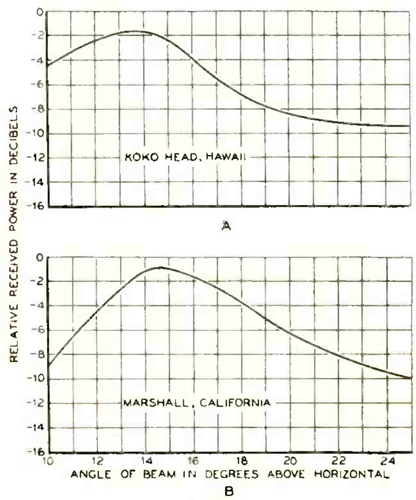


FIG. 2

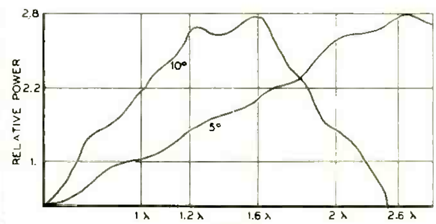


FIG 3

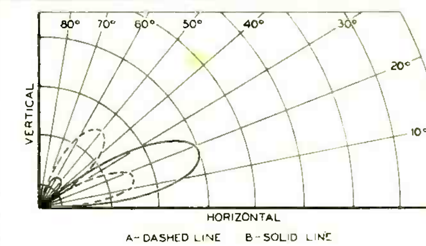


FIG. 4

angle radiation, a trench was dug below the far end of the array and at low angles, the bottom wire actually was in part *below* ground! This array is considerably sharper in the vertical plane than anything usually available to the amateur.

Transmissions on 16 to 17 meters were received at Marshall, California (2600 miles) and at Koko Head, Hawaii (5000 miles). For each angle, the signal from the directive antenna was compared with that from another used as a standard. The results (see figure 2) show a peak at 13 to 14 degrees above the horizontal for Koko Head and a sharper peak at 15 degrees for Marshall. In either case, the power dropped off 3 db—50%—on only a 3° increase in the angle. These angles are not the angles at which the antenna would radiate in free space, but the true line of maximum radiation which in this case was about 5° higher than it would be in free space, due to ground effects. The steep rise in the curve for Marshall has been attributed to the increasing directivity from the ground reflection, the decreasing radiation efficiency and the ground absorption in the trench at low angles. The lowest angle not involving excessive ground losses is best, even at the nearer point, Marshall. The similarity of the curves suggests that the lowest possible angle is best for a large range of distances—excluding, perhaps, those nearby points in which case a lower frequency band may be better anyway. Because of the effect of ground reflection, absolutely horizontal radiation does not appear possible above average ground. We must conclude that too sharp vertical directivity or too low an angle of radiation will not trouble the amateur even with complicated antenna arrays for transmitting.

A half-wavelength high horizontal antenna radiates little power at the low, *best*, angles. Anything that will give us more low angle radiation at the expense of the higher angles looks attractive. It generally is known that greater height for a horizontal antenna gives more low angle radiation. If the half-wavelength high antenna is raised to ¾ wavelength, we no longer will have a nice single lobe, but vertical radiation plus a somewhat lower and thinner lobe nearer the horizontal. To some, this does not look attractive because of the vertical radiation. Yet the power at low angles has been increased. This continues to be true at a greater height. Figure 3 shows 5° and 10° angle radiation as the antenna is raised.[4]

Not all of us can put our antenna up one or two wavelengths high, particularly above houses, trees, power lines, etc. But even those who can should not be satisfied to neglect the possibilities for improvement.

No matter what kind of an antenna you have, you may be able to string up another identical one below it, to be fed in phase. Any spacing below will help, though about ¾ wavelength separation will give the best gain. Any spacing up to this figure on the highest frequency used, or the most important frequency, will be an improvement, other things remaining equal. Connect the old upper antenna and the new lower antenna with a spaced two-wire feeder and feed the whole thing from the center of this connecting feeder. See figure 5. It might even work using single wire feed, but we haven't measured one yet.

The result is a slightly *higher* angle above the horizontal for the lowest maximum, *but* there will be more power at every useful angle. We have calculated the patterns for one case, a horizontal antenna a full wavelength high, with another one-half wavelength lower, fed in phase. Figure 4A shows the pattern with just the high antenna, figure 4B gives the pattern for the new stacked antenna. In figure 4 we show both, so that a direct comparison of power for each angle can be made. There is no change in the horizontal pattern, so the improvement is at the expense of the signal on the Moon, not the Earth.

When this simple array is used on the next lower band, it becomes a half-wavelength high antenna with another ¼ wavelength below.

Even on the next lowest band, there will be a slight gain, but the ⅛ wave spacing would not, of course, have as much effect as the larger spacing in terms of wavelength on the higher frequencies.

If ¾ instead of ½ wavelength spacing had been used, the improvement would have been somewhat better. It is apparent that a height of at least sixty feet is advisable for practically any antenna. This would permit using a second antenna ¾ wavelength below on 14 Mc. if the path is reasonably clear under the upper antenna, and surely the lower one could have been placed ¾ wave under on 28 Mc. if the latter band is used. The lower wire need not be *exactly* under the upper one, though any substantial displacement will alter the pattern somewhat.

The usual tuned feeders can be used for this antenna system, though because of the parallel impedances presented by the antennas, matching on one or two bands is entirely possible simply by selecting the feeder spacing to give an approximate match, without the complication of stubs or other devices. If the connecting feeder is a half wavelength long, it will act as a pair of quarter-wave matching sections as seen from the center where the line to the transmitter hooks on. The Hawkins system[5] of obtaining a match can therefore be used on two bands if the antennas are center fed (which of course gives broadside directivity on the frequency at which the antennas are a full wavelength long) and if the bands selected are such that the antennas are one-half wavelength long on the lower frequency band.

If the antennas are operated at higher harmonics, then the match may be obtained on any one band on which one-half of the connecting feeder is an odd number of quarter waves long, simply by building the connecting feeder for the geometric mean impedance between that presented by the antenna and that of the line attached to its center.

Also, if half the connecting feeder is one-half wave long or any multiple, the antenna impedances will be paralleled and reflected to the line to the transmitter, so that regardless of the spacing of the connecting feeder, the line can be built for an automatic match on all bands. The method of doing this is very simple and does not involve anything more than a proper selection of wire size and spacing for the line leading to the transmitter.

A similar approach may be used if the antennas are end-fed (in which case it will not be a broad-side beam when the antennas are a full wavelength long), though in this case only one antenna is attached to each end of the connecting feeder and the transmission line impedance must be twice as high.

[4] P. S. Carter, "Current Relations in Radiating Systems", *Proceedings I.R.E.*, June, 1932.

[5] J. N. A. Hawkins, "A Simple Two-Band Directive Antenna", RADIO, November, 1936; see also the *Radio Antenna Handbook*, page 54.

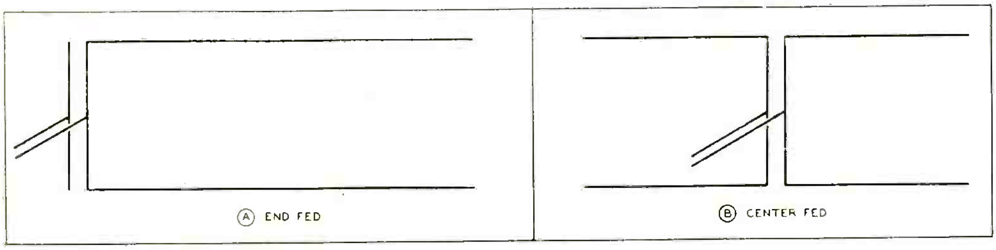


Figure 5: Showing Two Methods of Feed, Giving Different Patterns

For those interested in calculating the various possible patterns, we are giving the equations. The vertical field pattern of a horizontal antenna one wavelength above perfect ground, where Θ is the angle from the vertical and the free space pattern would be unity, is:

$$2 \sin (360 \cos \Theta).$$

Because the 360 represents electrical degrees of height, the same antenna if only ¼ wavelength high would have a pattern described by the equation $2 \sin (90 \cos \Theta)$.

In obtaining the pattern of a stacked system fed in phase it is necessary to write the equation for the pattern of the wires in free space, then to multiply this by the equation for ground effect upon a similar antenna located at the midpoint of the system. The horizontal, stacked antennas, if ½ wave apart, have a vertical pattern described by:

$$2 \cos (90 \cos \Theta)$$

in which 90 represents ½ the electrical degrees of separation between the antennas. The effect of perfect ground upon an antenna as just indicated, would then give this equation for its pattern:

$$4 \cos (90 \cos \Theta) \times \sin (270 \cos \Theta).$$

◆

The Question Box

I hear the term "operating angle" used quite frequently in connection with class B linears, doublers, etc. Could you explain this term and its usage to me?

The term "operating angle" is used to indicate the approximate portion of time over which plate current flows to the tube under consideration. A complete electrical cycle (an oscillation from zero to a maximum, back to zero and down to a minimum, and then back to zero again) is taken as 360 electrical degrees. Then, the portion of the cycle over which current flows is indicated as a certain number of electrical degrees. Thus, in a class B linear biased exactly to cut-off, plate current will flow for each tube over ½ cycle or 180°. In a class C amplifier the plate current pulse is somewhat smaller. In a practical case, the operating angle may vary from 60°-70° to perhaps 100° as a maximum.

•

I noticed in April RADIO *a suggestion whereby a four-wire transmission line could be used to provide the same impedance match as the "Q" bars do in the "Q" antenna system, making a much lighter and cheaper system. I was wondering if the four-wire system will operate as efficiently as the aluminum tubing arrangement, or if the losses will be higher.*

If the same flat-top and the same transmission line were used in two comparisons and nothing but the ¼ wave matching section changed, there would be no discernible difference in the radiated power of the two antennas. If an actual laboratory run were made on the two systems, the insertion loss in both cases would be so small as to be negligible. Either system is very much more efficient than any arrangement whereby rubber is used as the dielectric that separates and insulates the two wires.

•

I noticed that the 100T is made in two different types, the 100TL and the 100TH. I am in doubt as to which one of these two tubes to buy. I intend to use either one or the other in the class C final of my 75 meter phone. Which one would you recommend?

The letters "L" and "H" indicate the amplification factor or μ of the tubes. The μ of the "L" tubes is about 12 under normal operating conditions while that of the "H" tubes is about 32 under its normal conditions. The transconductances of the two types are very nearly the same. Consequently the amount of excitation required for a given output will be very much the same for both types when operating as a class C amplifier. However, there are certain conditions that make the "H" or high-μ type more suitable for ordinary use. First, they require considerably less bias for any type of operation. This means that lower voltage filter condensers can be used in the bias supply for the high-μ tubes. Also, since the r.f. excitation voltage required is somewhat lower, the grid tuning condenser can have a lower voltage rating for the "H's".

The "L" tubes, however, are somewhat better suited for use as class B linears and grid modulated amplifiers. Their μ is just about optimum for this service. They also are preferable for use as high frequency self-excited oscillators.

Let's Look to Linears (Part I)

By Ray L. Dawley,* W6DHG

With the increasing amount of plate dissipation available per tube dollar, it seems a shame that more phone amateurs do not realize how to make the best use of it in their own transmitters. With this inexpensive plate dissipation available, efficiency modulated amplifiers, i.e. class B linears and grid bias modulated final stages, are capable of giving considerably more antenna watts per dollar than many high-level plate-modulated systems. Especially is this true with the amateur who at present has a medium or low power phone rig and wishes to increase its power output. In such a case, if the old rig operates well, has good quality, good frequency stability, and is capable of operating on all the desired bands, by far the least expensive and most satisfactory procedure is to add a modern linear amplifier.

If, however, the old rig was not so satisfactory as far as the r.f. portion was concerned but the speech amplifier and modulator were satisfactory, grid bias modulation of a couple of fairly high power tubes would be best.

At any rate with plate dissipation available in the medium wattage class at about 10 watts per dollar, it is questionable as to whether one should invest in a high level modulator system with its attendant extra power supplies, modulation transformer, etc., for the power range from 100 to 300 watts in the antenna.

Of course it must be admitted there are arguments against efficiency modulated finals as well as for them. One of these is that they are difficult to adjust. This is not true if the proper tuning procedure is followed. As a matter of fact it is at least as difficult a problem to adjust *properly* a class C amplifier, especially at higher power levels (so that it is strictly linear over its operating range). Another argument is that they draw a lot of useless power from the line only to radiate it as heat. This most certainly is not true. If the additional power drawn by the modulator filaments and plates, the modulator supply rectifiers and bleeder, and the power lost due to the inefficiencies of the additional transformers is considered, the class B linear will almost always be found to be at least as efficient as the plate modulated system. In other words, if the total drain of the entire transmitter from the line is compared as a ratio to the power output in first a transmitter with high level plate modulation and then one with low level or grid modulation, the overall efficiency of the low level modulated job usually will be as good and sometimes better. Consider the case of the broadcasters. How many of them with powers over 100 watts or so use high level plate modulation? An unusually small percentage will be found.

More Advantages

A few other advantages of class B linears will be cited. Despite the low cost per watt of antenna power, efficiency modulated amplifiers have the advantage that they require a much smaller number of small parts. This of course is offset by the fact that a few more expensive large parts are needed. But since in almost every case a better grade of materials will be purchased, their life will be proportionately longer.

Another thing is the fact that the power drain of a rig using either the bias or excitation systems of modulation remains constant under modulation. This eliminates the ducking lights and grunting and groaning power supplies so commonly associated with high level class B modulation. And, to mention one more point that may interest the amateur interested in high quality transmission, it is very much simpler and less expensive to obtain *good* audio quality with low audio-level modulation.

Power Output

The amount of power available from a properly operating linear amplifier is primarily determined by the plate dissipation available in that stage. The secondary consideration is the amount of distortion that can be tolerated. Under ordinary conditions (with reasonable distortion) and assuming an average efficiency of 33% and modulation capability of 100%, the power output of a linear amplifier stage is equal to 50% of the maximum power the tubes are capable of dissipating. This value can be increased, but the distortion goes up rapidly. For example, a pair of "fifty watters" (203-A's, 211's, etc.) with a total plate dissipation of 200 watts would be capable of putting out a carrier of approximately 100 watts under rated operating conditions.

The same tubes when modulated class C

*Technical Editor, Radio.

would take care of an input of about 350 watts, which would result in a carrier of about 225 watts (assuming 65% fundamental efficiency and rated operating conditions). Thus we have a power ratio of 2.25/1 or a db ratio of 3.5. Since an increase of one R (or S) generally is taken to be a ratio of 6 db, we see that by plate modulating the final instead of running it as a linear we have gained only slightly more than ½ R in signal strength. This increase of course is negligible.

Tubes

The best type of tube for use in a class B linear stage should have the following characteristics: high plate dissipation and a clear bulb to help in getting rid of this heat, low or medium amplification factor, low plate impedance, and high transconductance. The reasons for these requisites are obvious. The plate dissipation should be high because the power output of the stage is dependent primarily upon this factor. The μ should be low so that the cut-off bias will be as high as possible. When this bias is high, the grid voltage excursions can be higher without drawing excessive grid current. For the same reason the plate voltage on the tubes should be as high as they will comfortably stand to reduce the danger of running into the so-called "diode-bend" in the tube's characteristic. This bend occurs when the instantaneous positive grid voltage approaches the minimum plate voltage. The high transconductance enables the tubes to operate on a minimum of excitation and at highest efficiency.

Other considerations in the design of an efficient class B linear or grid modulated final are: proper design of the grid and plate tank circuits, good grid bias supply regulation, proper loading on the modulated stage when using a linear and on the exciting stage when using grid bias modulation, and lastly, proper loading of the plate circuit of the final stage. All these are important and must be given proper consideration.

Tank Condensers

The plate tank capacity must be somewhat larger than that commonly used for plate modulation because the tubes must work into quite a low value of load impedance. The circulating current will not be materially increased by this large tank capacity because there is necessarily such a large amount of external inductance coupled into the circuit. Similarly, the r.f. voltage appearing across the tank is very much less than with plate modulation, even though the plate voltage on the linear may be much higher to begin with. As a matter of fact the voltage rating of the tank condenser need be only about half that required for the same carrier power with high level modulation of the same tubes.

The grid tank also should be quite high-C in design. Due to the variations in grid current drawn by the tubes under modulation, this circuit must be designed to have good regulation with a varying load. This is accomplished by the use of high-C and through the use of a so-called "swamping resistor". The actual capacity across the tank coil should be about 2 μμfd. per meter at the operating frequency. The swamping resistor will be of the order of 2000 to 10,000 ohms and is best connected from grid to grid on the tubes. It can be made up conveniently from a bank of series paralleled 3 or 5 watt carbon resistors. The total number of resistors should be capable of dissipating about 50% or 60% of the input to the modulated stage. Thus, if the modulated amplifier has 30 watts input, the resistors should be able to dissipate about 18 watts and should have a total resistance that will cause the aforementioned 18 watts to be dissipated.

Bias

The source of bias used should have good negative-current regulation. Batteries (when new) and m.g.'s really make the best supply, but as they are too bulky for ordinary use some sort of a stabilized power supply is most commonly applied to the job. The circuit shown on page 25 of RADIO for January is very well suited. The arrangement shown at the top of the circuit diagram labeled "for class B modulator" could very well be used to supply the grids of the linear. At any rate it is important that a large value audio by-pass condenser be placed across the leads from the bias supply.

Loading of the preceding stage must be done carefully. In this operation three conditions must be met. First, the modulated amplifier must be loaded to its proper operating conditions; second, the coupling between the two circuits concerned must be fairly tight; and third, the amount of voltage appearing at the grids of the linear must be held within fairly close limits.

This latter adjustment together with the loading of the plate circuit of the linear stage will be taken up in detail in the practical examples and constructional details to be described in the next issue.

Postscripts and Announcements

Broadcast Program for Amateurs

Beginning Saturday night, April 3, at 12 midnight over WMAQ (670 kc.), Chicago NBC station, a weekly program for the radio amateur entitled "200 Meters and Down" will be broadcast. This program, sponsored by Wm. J. Halligan, president of the Hallicrafters, Inc., will dramatize the outstanding events in the development of amateur radio and other dramatic incidents in amateur radio history. The material upon which these programs are based is taken from the files of the A.R.R.L. and from the book "200 Meters and Down" by Clinton De Soto.

At the conclusion of each broadcast, Lt. Com. R. H. G. Mathews, W9ZN, Central Division Director of the A.R.R.L. will address the amateurs on subjects pertinent to their avocation and the operations of the League.

◆

Let's Take Vanilla

A number of amateurs recently have remarked on RADIO's "western—or W6—flavor". We doubt if it has any more of a western flavor than its chief contemporary has an eastern one. Any magazine of this sort must rely upon its own staff as its principal source of material, and naturally the staff members have calls of the area in which its offices are located. Furthermore, we secure a larger proportion of outside articles from those whom we can contact in person, rather than by mail; in other words, competent western writers.

But, as inspection of recent issues will show, articles are welcomed equally from all parts of the country, and, for that matter, from Canada and foreign countries, too. And our checks bring just as many dollars in one place as another.

After all, isn't a good technical article still a good technical article whether its author lives in Los Angeles, New York, or Timbuctoo?

◆

Trade Publicity Discontinued

In response to an insistent demand on the part of many of our readers, RADIO will no longer run general manufacturers' publicity in the editorial section except perhaps in the special enlarged yearbook number (January). This policy refers only to the type of apparatus announcement that is usually a duplication of data found in catalogs and advertisements.

For the time being, at least, we will continue to carry announcements of the availability of free literature (catalogs, technical reprints and the like offered gratis or for a nominal sum to cover cost of handling and mailing), such announcements not to run over about 50 words.

Regular texts of a nature of interest to our readers will be reviewed by our book review editor if he considers the book of sufficient merit.

The mere fact that a good technical or constructional article may have had its origin in some commercial plant will not interfere with its use.

◆

Modulating the Bi-Push

Numerous requests have been received for a suitable combination to use for a modulator for the Bi-Push exciter-transmitter described last month. Any audio system delivering from 35 to 45 watts of undistorted audio will do the trick if a modulation transformer with a 3000 or 3500 ohm secondary is used. The transformer secondary should be designed to carry 175 ma. without wire heating or core saturation. One of the new variable impedance ratio modulation transformers of suitable wattage rating would be highly satisfactory. The following combinations are suggestions for the output tubes. Circuits may be found in most of the manuals offered by transformer manufacturers.

46's in class B; 525 volts
210's in class B; 550 volts
T-20's in class B; 550 volts
50's in class AB; fixed bias; 550 volts
6L6's in class AB; fixed bias; 400 volts
Four 45's in AB; fixed bias; 350 volts

The power supply for the modulator tubes should have very good regulation, especially in the case of the class B tubes.

A suitable modulator will be described in an early issue.

◆

Stamp Collector Hams

We have been asked to run a list of calls of hams throughout the world who are stamp collectors. Send in your calls and the calls of any philatelic hams who are known to you, and we'll be glad to print the list.

Several have sent in their names, but we want a few more before starting the list.

Duralumin Mast

Some of our readers have complained bitterly about the difficulty of getting the aluminum alloys and sizes given in the January article about W8ZY's duralumin mast. To help clear this up, we talked with Aluminum Company of America (main office is in Pittsburgh, Pa.) and with others, and present here an up-to-date summary of the situation.

In the first place, an item in the February issue of RADIO suggested using outside diameter dimensions rather than inside diameters, but in the same sizes (0.120 inch wall). Practically none of these alloys is stocked in sizes that will telescope; so don't be startled if you are told that the material must be made up special—though the price still should be close to $25.00 for a 60 foot mast. Outside diameters in quarter inch sizes with 0.120 inch wall are "standard" and are listed in the literature of the Aluminum Company, even though available on special order only.

There are a number of alloys available. 2S is commercially pure aluminum and has the lowest tensile strength for a given temper. It is suitable for only the smallest masts unless well guyed. 2S and 3S are used in drawn cooking utensils and many other articles. 4S is an alloy with fairly high tensile strength and fatigue endurance limit. It was used by W8ZY. A high endurance limit (based on withstanding a half billion cycles of completely reversed stress) is advisable for a swaying mast using only two sets of guys in 60 feet. The Aluminum Company recommended the 52SH alloy to us because of its high fatigue factor, but recently filled orders with the "weaker" alloy, 53SH, for use in 200 and 300 foot police and broadcast antennas. 17ST is more commonly known as "duralumin". Compared with 52SH it costs about twice as much as the others, has a very high tensile strength but a more moderate fatigue.

So much for the sizes and available alloys. Now for the worst part—getting it. When the article was written last November, the delivery time was four weeks. Now it is ten or twelve weeks—*if* your order is accepted. There exists a severe shortage of the metal just now, according to the company. Because of the war in Europe (aluminum being a war material) there are no shipments being made to this country. The drouth reduced the domestic production last summer when a large supply should have been produced. In addition, the Tennessee Valley Authority curtailed power and thus production (Mr. Mellon is said to be a Republican). Result: the company refuses new customers, supplying old ones on a quota based on last year's consumption. It hopes to catch up this summer or fall, but in the meantime you must "know someone" if you want any aluminum.

The thin wall galvanized steel conduit called "Steeltube" can be purchased at electrical supply houses. This is about twice as heavy as duralumin for the same strength, has lower conductivity and poorer weather resisting properties. It is only 1/3 as expensive. It can be used if you want your mast in a hurry, and want to save money.

◆

QSL Contest Winners

Bill Perry, W2KCY, was adjudged winner of the recent QSL contest sponsored by this magazine, and received the HF-100 first prize.

Second prize was awarded W. McGowan, VK2MQ, Sydney, Australia.

◆

ELECTRONICS INSTITUTE

University of Michigan

An Electronics Institute, consisting of a special lecture and conference program in electronics, will be held in Ann Harbor, Michigan, as a part of the 1937 Summer Session of the University of Michigan, with the cooperation of members of the technical staffs of the General Electric Company, the Westinghouse Electric and Manufacturing Company, and the Bell Telephone Laboratories.

The Institute lectures will be given by Dr. Saul Dushman and Dr. Lewis Tonks of the General Electric Research Laboratories, Dr. H. E. Mendenhall and Dr. F. B. Llewellyn of the Bell Telephone Laboratories, Dr. Joseph Slepian and Dr. R. C. Mason of the Westinghouse Research Laboratories, Professor L. B. Loeb of the University of California, and Professor W. G. Dow of the University of Michigan.

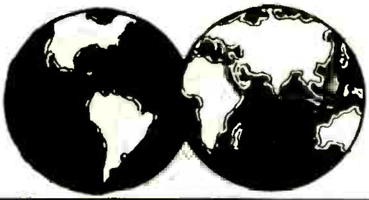
The lecture program will consist of two independent four-weeks' lecture sequences, dealing respectively with high-vacuum (June 28 to July 24) and gaseous-conduction (July 26 to Aug. 20) electronic principles. In parallel problem laboratory and conference courses the lecture material will be worked into illustrative engineering problems, and teaching methods will be demonstrated and discussed. Opportunities for informal conferences will be provided.

Courses in various cognate branches of electrical engineering physics, and mathematics will be included in the Institute program. Selection from among the various elements of the program will permit individual needs to be met.

The primary objective of the Electronics Institute will be to provide an opportunity for teachers and prospective teachers of electronics, also engineers

[*Continued on Page 85*]

DX



By HERB. BECKER, W6QD
Readers are invited to send monthly contributions for publication in these columns direct to Mr. Becker, 1117 West 45th Street, Los Angeles, California.

Well, here we are together again and I hope all of you fellows have recovered from those sleepless nights of the contest, especially you who entered both the c.w. and phone tests. As far as I am concerned I didn't lose a great deal of sleep, but I did get a big kick out of listening in. Anyway, I guess everyone had a lot of fun, and if interest was as as high in other parts of the country and other countries as it was around this neck of the woods, I would say it was a huge success. I understand that the A.R.R.L. has a battery of adding machines that if placed end to end would reach from West Hartford over to Rodimon's farm. I don't doubt that this really is true after glancing over the scores running into six figures. Without wasting more of your time let's take a glance at some of the high scores of the contest. The score of W6QD will not be mentioned again as it was announced exclusively in RADIO of last month . . . ahem! W6CXW, 115,446; W2AIW, 105,-400; W5EHM, 104,742; W3EMM, 104,280; W6GRL, 94,464; W9ARL, 73,302; W8BTI, 91,900.

That, my friends, is most of the high ones. I haven't forgotten W1SZ, who I understand has betweeen 114,000 and 120,000 points. But he never "officially" enters the contest so we won't worry about a few odd thousand points. W6CUH on a recent visit to W1SZ brings back the information that Rod has a swell QRA. Here are some other U.S.A. scores just as they come to me: W8LEC, 57,120; W3EVT, 70,180; W1TW, 84,000; W6FZL, 75,000; W6JBO, 72,000; W6GRX, 66,000; W8MAH, 32,900; W8NV, 27,000; W1ME, 56,300; W2BJ, 21,300; W8OQF, 35,000; W8HWE, 29,350; W6BAM, 26,000; W1ZB, 42,780; W6BYB, 26,700; W8FJN, 69,000; W6KRI, 37,000; W9CIS, 28,000.

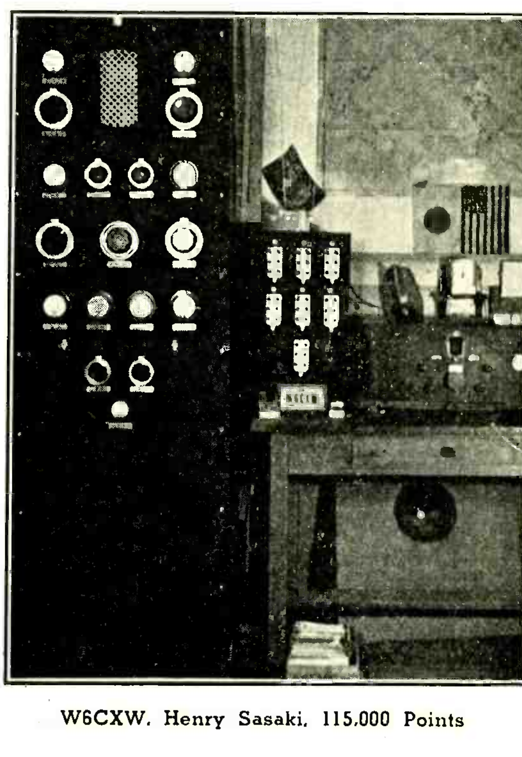
Now some of the boys in other countries come forth with the following: K5AY, 256,000; F8EO, 150,000; K7PQ, 155,000; EI8B, 109,000; EI4J, 78,000; PA0AZ, 90,285; PA0UN, 79,600; PA0PN, 74,500; ON4FE, 29,900; OH2NG, 17,000; OH3NP, 13,700; G6NF, 79,300; G2PL, 74,900; F3KH, 100,000; F8TQ, 35,000; FM8AD, 91,000; G6RB, 37,400; OZ3X, 67,000; ZU6P, 30,000; ZS2A, 52,000; G6WY, 35,000.

That just about winds up the scores, and please don't shoot me if the above totals turn out to be different. That is the way they come to me, and of course I haven't their logs to check.

•

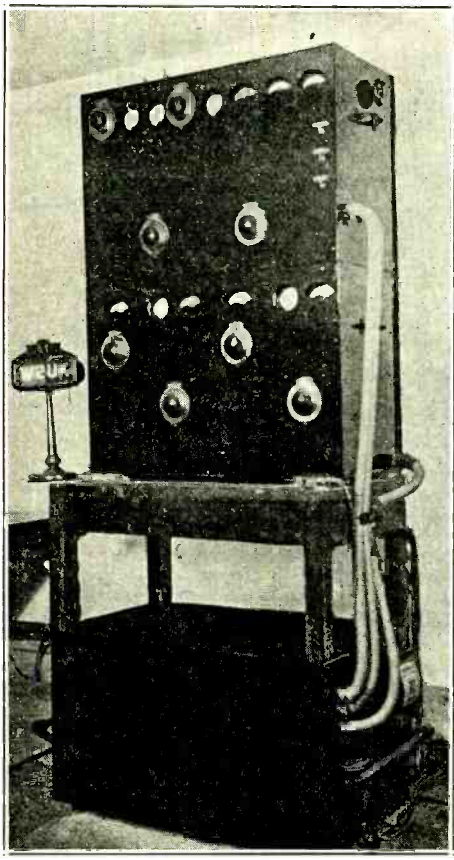
There are many outstanding scores and incidents in this contest. First take a look at W6CXW, Henry Sasaki. Every year he has been absolutely denying that he'll enter the contest. In these same years as far as the Pacific Coast is concerned he has been second in point totals. However, this was his year, and he really did it right. Henry planned for months, putting up all sorts of antennas with plenty of time to give them a thorough trial. 115,000 points is not to be sneezed at, especially for a west-coast station. Take a look at the photograph of CXW, showing his well-designed transmitter which uses two 250TH's in the final. For his receiver it's the same old Comet Pro. The panel of white switches on his operating desk is for changing to different antennas, and by simply throwing any one of the switches it automatically puts that antenna onto the transmitter and receiver. The antenna setup of Henry's consists of four Johnson "Q" antennas, a diamond beam, and another general purpose sky wire of some kind. CXW had 271 contacts with a multiplier of 142, and contacts on each of the bands are divided as follows: 43 on 10, 62 on 20, 32 on 40, and 5 on 80.

At the rate Henry was working the stuff we figured that he surely must have a staff of at least 40 operators; so in order to satisfy our curiosity one evening CUH and I hopped into his car and went out to see what we could see. When we walked in upon CXW, instead of seeing the 40 operators we saw little Henry almost hiding behind the Comet



W6CXW. Henry Sasaki. 115,000 Points

W2UK, Tommy Thomas, 129,000 Points



W2UK, Tommy Thomas, 129,000 Points

Pro. So I guess he carried the burden alone, which I think was quite an achievement. Anyway, Charlie and I chewed the rag with him for about an hour thinking that Henry would be thoroughly griped at keeping him off the air. But no, instead he merely said "I'm glad you fellows stuck around because there is nothing coming in now that's worth while."

•

W5EHM, J. C. Patterson in Dallas, Texas, ran up 104,742 points using four bands . . . 253 QSO's with 138 his multiplier and divided into the bands as follows: 37 on 10, 58 on 20, 39 on 40, and 4 on 80. . . . His transmitter consists of a 53 osc. with 8 crystals, 802 doubler, 801 buffer, 276A second buffer, and a pair of 150T's in the final with one kw. A National 101X receiver with two stages of pre-selection ahead of it. The antenna situation at 5EHM's is really swell: three rhombics with 3¼ waves on each leg without terminating resistors. He says that signals from a dx station would jump from 2 to 3 R's when he would change from ordinary double-doublet to the right diamond. A glance at the photo of Pat's rig will show the neatness with which it is laid out in breadboard style.

W3EMM, Fenton Priest, Norfolk, Va., 104,280 points . . . used four bands. 264 contacts and a multiplier of 132. He made w.a.c. 8 times in the test, one of them being the first 10 meter w.a.c. for him. The transmitter lineup is 6A6-6A6-808 and with a pair of 805's in the final . . . 800 watts. His receiver is a National HRO and the photo of his station presents a neat looking setup.

I guess Fenton didn't have enough operating in the c.w. contest so he immediately booms into the phone contest and with about 40 hours operating time he ran up 34,000 points involving 200 contacts. What happened after the fortieth hour nobody seems to know . . . either he gave out or he ran out of log sheets.

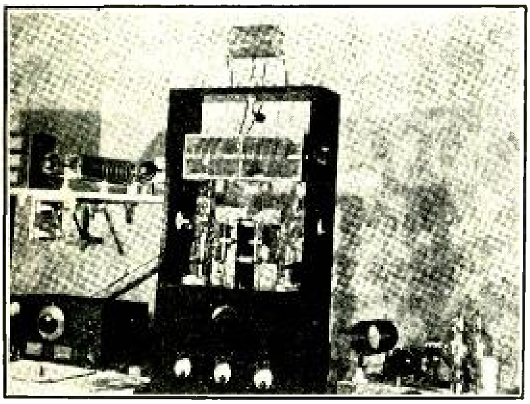
W2AIW, Charles W. Rogers, Manasquan, N.J. . . . 105,400 points and 255 contacts. His transmitter consists of a 53 osc. and RK-20 buffer; an 860 buffer driving a pair of 860's with 900 watts input. The rig used for 10 meters is not shown in the photo but he uses a pair of 50T's also with 900 watts. Two antennas are used; one of them is four half-waves in phase firing about 30 degrees east of north, this one being used on 20 meters while on 10, 40, and 80, Chas. uses a 132-foot zepp. The receiver is an RME-69 and DB-20 with noise silencer.

"WAZ" HONOR ROLL

ON4AU	40	W6EGH	35	W7AYO	30
G6VP	39	W2BJ	35	W9PGS	30
W8BTI	39	W3BBB	35	W6KWA	30
W7BB	39	W9EF	35	W4MR	30
G2ZQ	39	ZG1Z	35	W8DED	30
W3SI	39	W9KA	34	W9IWE	30
W6CXW	39	W8JK	34	W6FKZ	30
W4DHZ	39	W3EMM	34	W6DIO	30
W8CRA	39	W2BJ	34	W1APU	30
W6GRL	39	W3EJO	34	W3AWH	29
W6ADP	39	W2FAR	34	W9LW	29
W3PC	39	W9PK	34	W6HJT	29
W3ANH	39	W6LYM	34	W8FJN	29
W9TJ	38	W1AQT	34	VE5HC	29
G5YH	38	W7BYW	34	W3CDG	29
G6WY	38	W6ENV	34	G6ZU	28
W6CUH	38	W6FKC	34	W3TR	28
W8HWE	38	W8AAT	34	W8DOD	28
VE4RO	37	W3AYS	33	ZU1T	28
W2BSR	37	W6GHU	33	W6CGQ	28
W2GW	37	W6DOB	33	W6GNZ	28
W8DFH	37	W6LDJ	33	W5EOW	28
W6QD	37	W9LBB	33	W9JNB	28
W8BKP	37	W5AFX	33	W6HJT	28
W2GWE	37	G6QX	33	W3EYS	28
W8OSL	37	W9AFN	33	W6CEM	28
W6FZY	37	W9ALV	33	W6JBO	28
G6NJ	37	G6CL	33	W9VBB	28
W2DTB	37	W6VB	33	W6GK	28
LY1J	37	W6BAM	32	W3CDG	28
W8LEC	37	W6KIP	32	W6KEV	28
W6HX	37	W8BTK	32	VU2LJ	28
W7AMX	37	W5EHM	32	W9DEI	28
W8KPB	36	W9EF	32	W8HGA	28
W8KKG	36	VE2EE	32	W6LHN	28
G6RB	36	G6GH	32	W3CZO	28
W9ARL	36	W3EVW	32		
W1ZB	36	W8OQF	32	Phone:	
W1CC	36	W2AAL	31	W5BDB	27
W9PTC	36	W6FZL	31	VE2EE	26
W6GAL	36	W3DCG	31	W3SI	25
W6AM	36	W5CUJ	31	W8JK	24
W9KG	36	W9CWW	31	W3EMM	24
W2HHF	36	W8DWV	31	W6ITH	24
W3EDP	36	W3CIC	31	W6AM	23
W2OA	36	W8LDR	31	VE5OT	23
W6KBD	36	W6HXU	31	W6BAY	23
W3EXB	35	W6KRM	31	W6LLQ	22
W6NHC	35	W6HEW	30	W6OCH	21
W6GRX	35	W2BXA	30	W9QI	21
W8CJJ	35	W8MAH	30	W6MLG	21
W2AIW	35	W7AVL	30	W6NNR	21

If you have worked 28 or more zones and are willing to produce confirmation on demand, send in your score on a postcard.

Phone stations need work but 20 zones, but stations must be raised on phone. Stations worked may be either c.w. or phone.



W9ARL, John Marshall, 73,300 Points

Station dx is 95 countries and 35 zones, over 2600 contacts with foreign stations not including VE or CM. Rogers has been active since 1922, his call then being 2CXY.

•

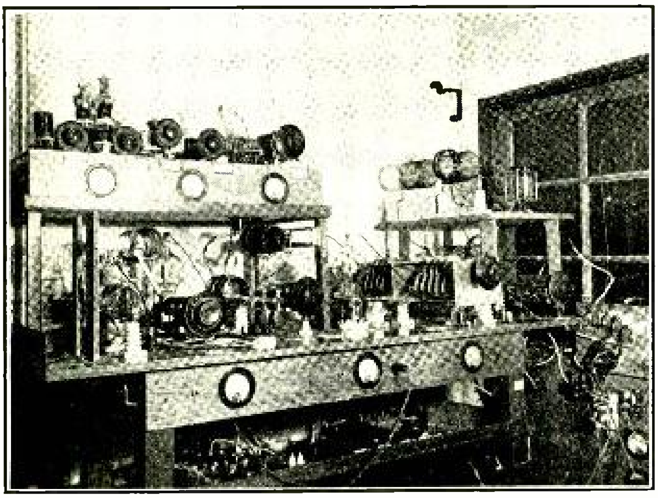
W6GRL, Dr. Charles E. Stuart, Ventura, California, 94,460 points with 246 contacts on four bands. Speaking of Doc calls for a laugh, and the reason . . . the first week-end of the contest, Saturday night to be exact, the XYL and myself, in the snooping mood, decided to journey up the coast to Ventura to see if Doc was pulling teeth or working dx. What we saw upon walking in on him will long be remembered. . . . Yes, he was at his receiver, all right; in fact he was so much at it that he had his pet FBXA apart and spread all over his bed and Doc himself took up a good portion of the same bed "rassling" with it trying to locate the trouble. Imagine, the first week-end of the contest and Doc's receiver going haywire . . . He finally got it perking again about noon the next day, and in the meantime he had to be content with a spare blooper he had around. Guess he must have lost a few points due to that grief. In his anxiety to get going again Doc hooked the four-foot lead from his receiver to the wrong point on his change-over switch, and for half a day he thought he had his diamond beam coming into it, but in reality he had been using that four-foot chunk of wire for an antenna. By that time he was ready to give up; so we got Doc into a huddle and gave him one of these "die for alma mater" pep talks which got him so fired up that he immediately sat down and burned out his keying relay. But don't go away . . . that isn't all . . . laugh no. 4 was had that day when one of Doc's prize patients phoned and said one of his teeth was giving him the devil . . . so good ol' Doc had to take time out and yank out the guy's tooth. The transmitter at W6GRL has changed slightly in that he now is using two Eimac 250TH's. For antennas, it is about the same set-up, five V beams 70 feet high, spreading out like the spokes in a wheel. He added a diamond headed for Europe, which seemed to work out quite well.

•

W9ARL, John Marshall, Kansas City, Kansas . . . 73,302 points, with 215 contacts on three bands. The multiplier was 114, divided as follows: 20 on 40, 55 on 20, and 39 on 10. Johnny runs a kw. on all bands and I think you will agree that his station is very neat when you look at the photograph. He is using a pair of 150T's in the final, and the receiver is an HRO.

W3EVT in E. Falls Church, Va., ran up 70,180 points with 214 QSO's and a multiplier of 108 . . . 37 on 10, 47 on 20, 15 on 40, and 9 on 80. He uses two rigs . . . the one for 3.5 and 7 Mc. has a 50T in the final and the other one for 14 and 28 Mc. has a pair of 35T's running with 400 watts. Clem is 17 years of age, in high school, and has worked 87 countries. Nice going, EVT.

One of the most outstanding highlights in the tests I think was done by W6GRX, Henry Luitwieler. During the first few days of the battle Henry worked K7PQ on 10 meters, a little later that day he worked him on 20 . . . the next day he QSO'd K7PQ on 40 and made a sked with him for midnight on 80. Well, they clicked (you know most skeds don't) and after a brief chat wondered if they might not attempt a contact on 160. The sked was set for 20 minutes later . . . but the joke was, Henry didn't have any coils for his transmitter for that band so he hurriedly wound up some wire and threw it into the rig. After a few minor adjustments he was rarin' to go on 160. Well, to get along with the story, Henry gave K7PQ a buzz and he came right back. Summary: W6GRX and K7PQ worked each other on *five* bands in 36 hours. Henry is an old timer from the spark days, having been back on the air for about five years now, I think. Single-handed he ran up 66,000 points with never more than 600 watts input to his HK-354. Several antennas are used, including a diamond beam.



W6GRL, Charles Stuart, 95,000 Points

General Contest Chatter

It looks like G6NF is tops for England with 79,288 points; 565 stations were worked on four bands with a multiplier of 47. G6NF says that W6's and W7's were two for a penny during the contest but not a single one of them was in Nevada. He adds it must be an awfully dead spot. YL2BB had 294 QSO's . . . G6RB with 37,000 points had 320 contacts, his multiplier being 39. Says that where W4's seem very scarce this year the W9's made up for it as he worked 70 of them. (That beats me.)

Another high W6 is Harry Gross, W6FZL, who did noble work in making a score of 75,000. It is especially good because Harry is located in a thickly populated neighborhood, making it impossible to have one of those super dx locations where he could put up miles of wire. W8MAH, who has a score of 32,976 points, did very well with his 100 watts to a single 841 in the final. He sends through a few notes: Says that EI8B, K5AY, K5AC, FA8IH are all four-band performers. Some good ones heard by MAH are VR6AA, on Pitcairn Island; T8X, on 14,360 kc.; HH5PA, 14,060 kc.; CN8MI, 14,350 kc.; CN8MQ, 14,000 kc., CN8MU, usually around 14,280 T6.

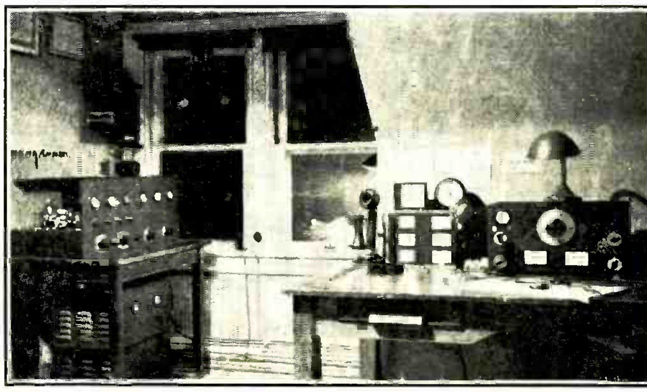
W8BTI, Carl Luhn, got 91,900 points. W1ME with his 56,304 points worked 184 stations with a multiplier of a 102. On 80 meters he had 19 QSO's in 13 countries on five continents, and he uses two 852's in the final, 500 watts input. The receiver is an NC-101X. My friend, Dick Merrick, W6JBO, who like W6FZL is located in the thick of Los Angeles, also ran up a good score, 72,000 points. He says 10 meters was as hot as fire crackers and I guess it was, because Dick was sure getting the reports. His rig uses two 150T's in the final and receiver is an NC-101X.

•

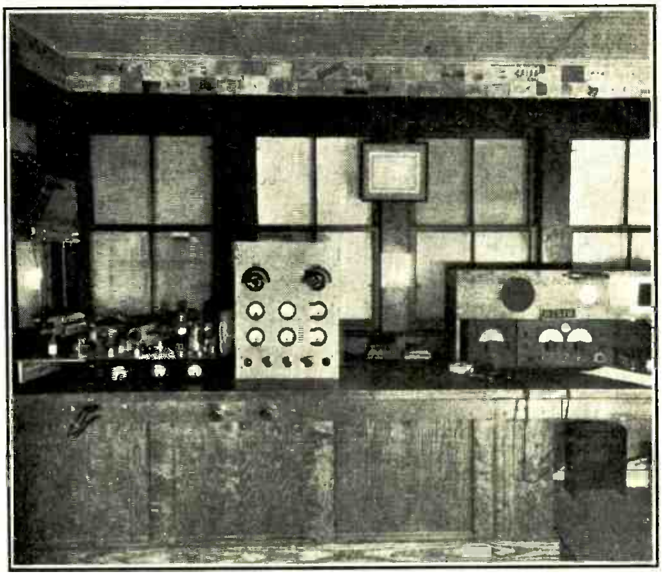
F8EO with his 150,000 points really needed a bookkeeper . . . Had 1050 QSO's and 50 districts, and that, my friends, is going some. G2PL did all right with 74,900 points, but I think he would have done better if he hadn't been thinking of Ginger Rogers!

OH2NG apparently had it over OH3NP by scoring 17,000 points against 13,700 for the latter. U2NE was going to town and had 956 QSO's, but don't know how many points. Rumor has it that W4CBY, ol' Fat Benning, scored 87,000 points . . . . Fat couldn't be located to confirm or deny it so it's all in your hands. W8LEC had 57,150 points with a kw. on all bands using a single Taylor T-200 in the final. W8FJN made 69,000 points and added 8 new countries to his list. K5AY with his 256,000 points seems to be tops for the world and he must have had them lined up ten deep waiting for his QRZ.

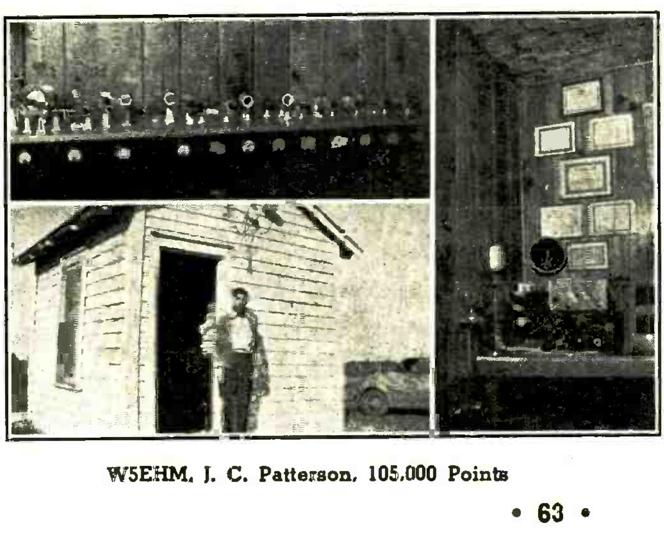
[*Continued on Page 86*]



W3EMM, Fenton Priest, 105,000 Points



W2AIW, Charles Rogers, 105,000 Points



W5EHM, J. C. Patterson, 105,000 Points

A DeLuxe Version of the Bi-Push Exciter

By Faust Gonsett,* W6VR

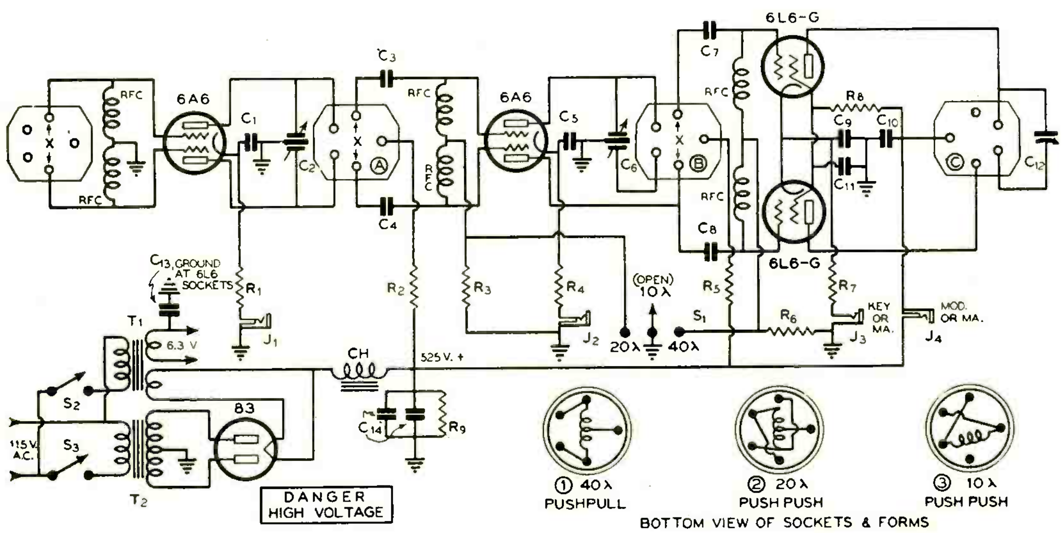
The original "Bi-Push" exciter described last month was built with economy and performance the main considerations. As some amateurs are willing to spend a little extra money for the sake of appearance or convenience, the accompanying de luxe version of the exciter was constructed. It should appeal to those amateurs who take especial pride in the appearance of their equipment. It should be pointed out however, that the performance and operation are no different than that of the simpler unit shown last month. Amateurs who have to watch their pennies can realize all the practical advantages at less cost by constructing the earlier model.

The circuit is exactly the same as for the original exciter, which is reproduced herewith for reference. However, the values of the cathode and plate dropping resistors for the 6A6 stages were altered slightly, with a further reduction in crystal current. These values are not especially critical, however, and either the old or new values of these constants may be used with little difference in results. Further experimenting on the original exciter showed that there was a slight advantage in increasing the 4000 ohm dropping resistors to 5000 ohms, and lowering the cathode resistors from 400 ohms to 300 ohms. These newer values were therefore incorporated in the de luxe model when it was built.

As the only startling difference between this unit and the one described last month is in the mechanical construction, and as this is best shown pictorially, this description will be rather short. Complete data on the exciter may be had by referring to the original article by W. W. Smith in the April issue, page 8.

The complete exciter (or transmitter) and power supply in the de luxe model are mounted on a standard-width relay rack panel and

*Laboratorian, Radio



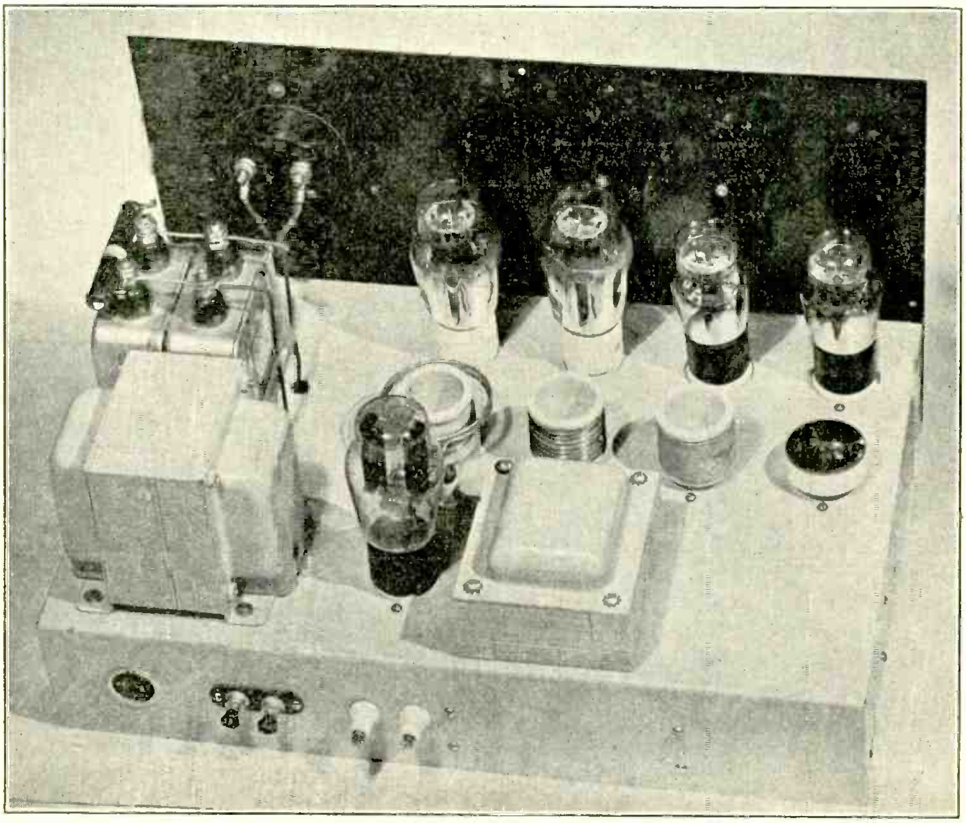
The General Wiring Diagram

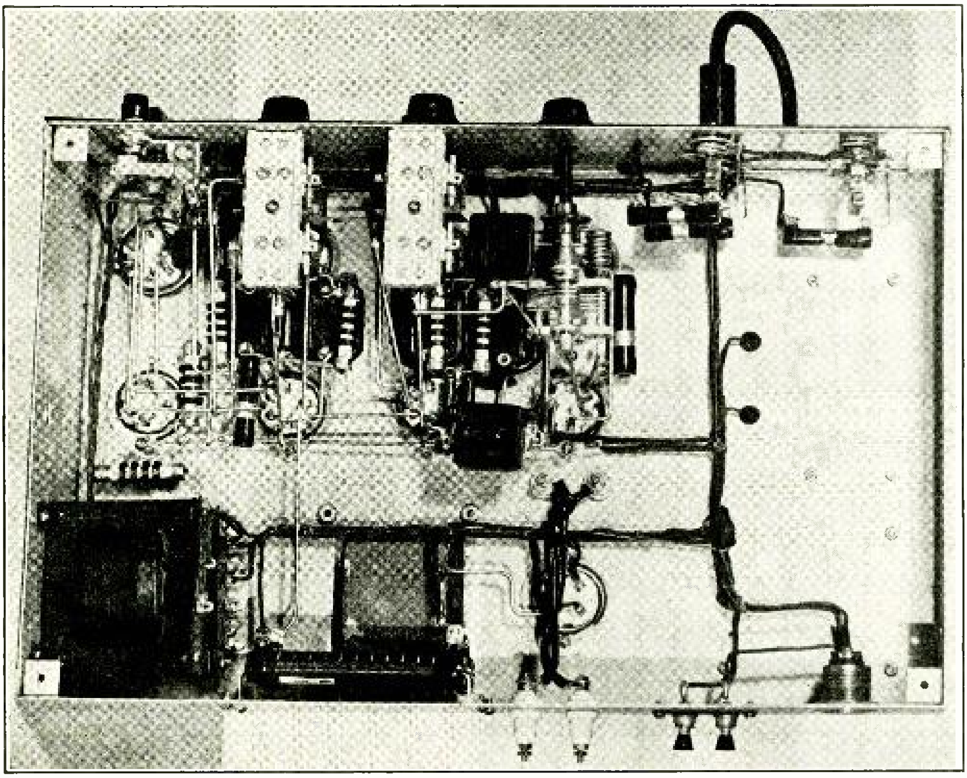
C_1—.004 µfd. mica
C_2—100-100 µµfd. midget split stator
C_3, C_4—150 µµfd. mica
C_5—.004 µfd. mica
C_6—100-100 µµfd. midget split stator
C_7, C_8—500 µµfd. mica
C_9, C_{10}, C_{11}—.004 µfd. mica
C_{12}—50 µµfd. midget, 1000 volt spacing, isolantite insulation
C_{13}—.004 µfd. mica
C_{14}—Either one or two 4 µfd., 600 working volt oil condensers (see text)

NOTE: All mica condensers are 1000 volt test. C_{10} should be 2500 volt test if telephony is to be used.

R_1—300 ohms, 10 watts
R_2—5000 ohms, 50 watts, wire-wound
R_3—10,000 ohms, 10 watts
R_4—300 ohms, 10 watts
R_5—5000 ohms, 50 watts, wire-wound
R_6—Two 100,000 ohm, 2 watt carbon resistors in parallel (50,000 ohms)
R_7—200 ohms, 10 watts
R_8—15,000 ohms, 10 watts
R_9—40,000 ohms, 20 watts
T_1—6.3 v. at 4 amp. and 5 v. at 3 amp.
T_2—700 v. each side c.t., 150 watts
CH—5-25 hy., 300 ma. swinging choke


"BI-PUSH" EXCITER UNIT
RADIO MAGAZINE
MILLIAMPERES





sub-chassis. A receiver dust cover houses the whole works, giving protection from dust and hands besides adding to the appearance.

In winding the coils, one thing was noticed: When using a metal chassis, the extra capacity to ground from the tuning condenser and wiring necessitates a smaller 10 meter coil. The 20 and 40 meter coils are not affected, but it will be necessary to use a half turn or so less on the 10 meter coil than specified in the coil table.

A number of amateurs have written in regarding difficulty in purchasing the XR-20-5 coil forms specified in the original article. Type CF-5-M coil forms will serve well, but they cost twice as much and their smaller diameter makes the jumpering process more difficult unless one has a soldering iron with a very small tip. When using these forms it will be necessary to use more turns on the coils, due to the smaller form diameter. One amateur we know wound his 10 and 20 meter coils on CF-5-M midget isolantite forms and his 40 meter coil on a standard CF-5 form.

Isolantite base 6L6's were used in the de luxe version. Besides having better insulation, the bases have their pins spaced further than is the case with regular octal base 6L6-G's.

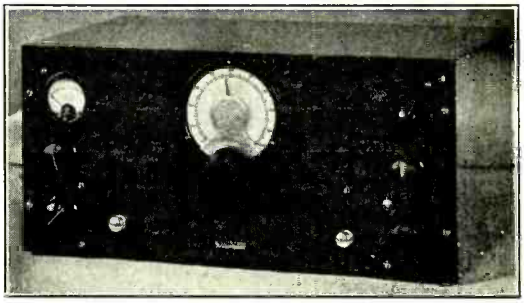
We have heard of two or three scattered cases of amateurs popping their 40 meter crystals in the Bi-Push circuit. However, in each case it was found that the trouble was caused by failure to throw the band switch. If you are afraid to trust yourself with this little chore, the best bet is to get an "A" cut crystal. With such a crystal, failure to throw the switch merely results in reduced output.

Not *all* X cut crystals will blow when the switch is not thrown; approximately 3 out of 4 40 meter X cut crystals will stand the crystal current, which will run around 110 or 115 ma. when the switch is in the wrong position. However, it is not a good idea to take a chance on your X cut crystal being a "tough" one. The best thing to do is to mark the band switch very prominently and not attempt to change bands when in too much of a hurry or just after the excitement of working your first VK6.

With the switch in the correct position the maximum crystal current runs between 70 and 80 ma., depending upon the particular crystal and exact plate voltage used.

A Lazy Man's Dx Receiver

By J. D. Ryder,* W8DQZ



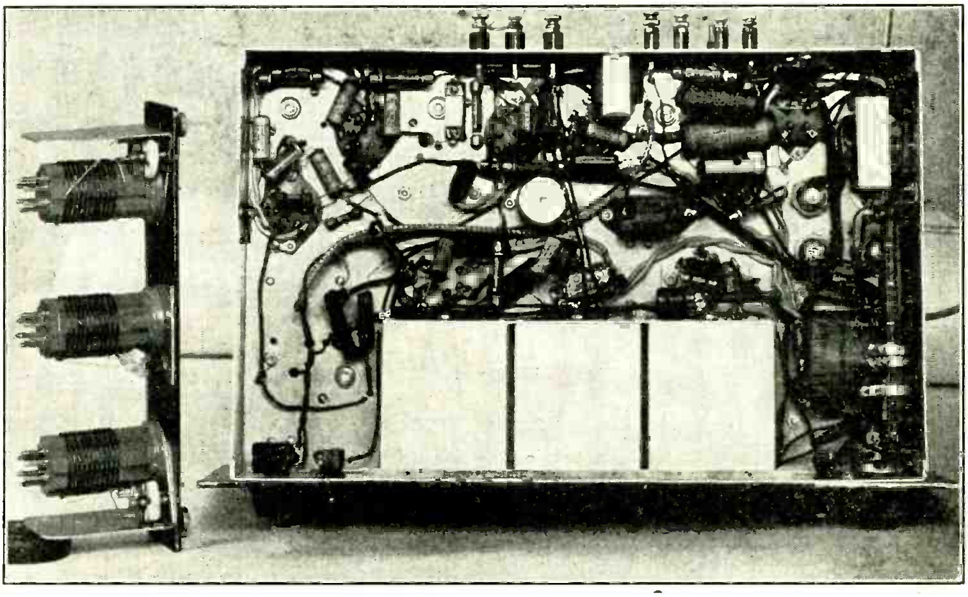
As I am no less lazy or dx crazy than the average amateur, before I can call a receiver "ideal" it must meet an exacting set of specifications. Band-changing must be easily and quickly accomplished, logging of stations must be exact and permanent, the set must operate with maximum efficiency on the various dx bands, and the inherent noise must be at a minimum.

The receiver herein described answers these requirements. Actually it is a nine tube superheterodyne with a 6D6 regenerative r.f. stage, 6C6's as first detector and high-frequency oscillator, a variable band-width crystal filter, two 6D6 i.f. stages, followed by a 6C6 second detector and a 42 audio amplifier. An 80 rectifier and a 6C6 beat oscillator complete the line-up.

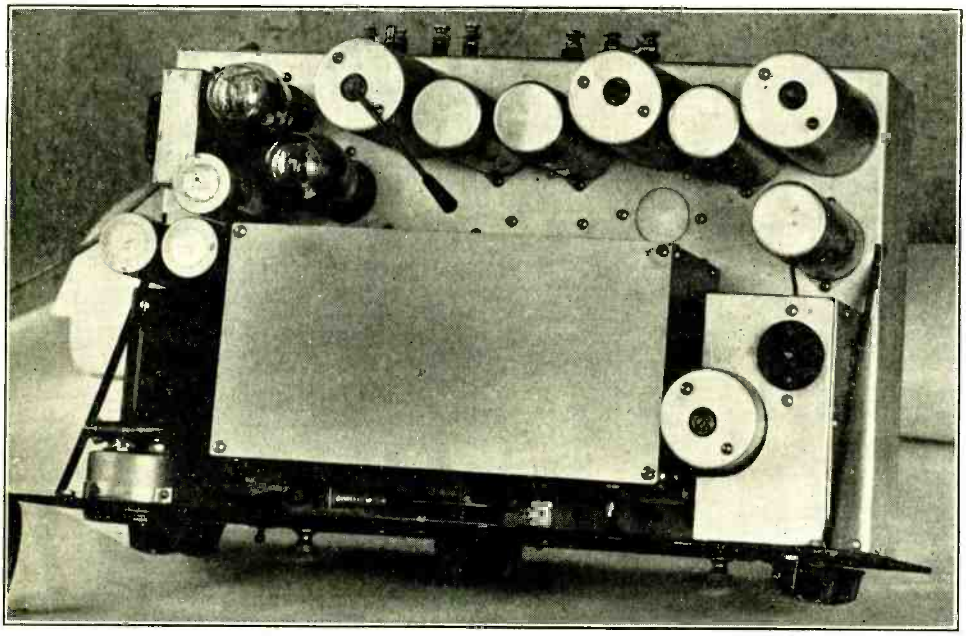
*5084 Oakmont Drive, South Euclid, Ohio.

While no credit is claimed for the originality of the idea of ganging the plug-in coils as incorporated in this receiver, it is through the use of this arrangement that much of the operating convenience and efficiency is obtained.

Since the plug-in coil design is the heart of this receiver as far as mechanical construction and "dx pulling" ability is concerned, it had best be described first. The assembly of one of the coil units is shown in the illustration and consists of three Hammarlund forms, with the oscillator coil at the left, followed by the r.f. amplifier and detector coil forms. These are assembled on an aluminum plate by small screws tapped into the ends of the forms. The holes in the aluminum plate which pass these screws had best be drilled "sloppy" so that the coils can later be accurately lined up to fit their sockets. The padding condensers C_a are



Showing the Ganged Coil Assembly and Under-Chassis View of the Receiver



A Peek Behind the Panel Discloses the Above Layout

mounted on the aluminum plate close to their respective coils. Aluminum wings are provided at each end to protect the coils when they are removed from the set and to serve as guides when inserting the coil set into the receiver. Holes are provided through the aluminum plate for the adjustment of the padding condensers from the front of the set. This whole assembly slides into a large hole cut out of the front panel. The aluminum plate on which the coils are mounted is cut to fit the large panel hole and is later finished to match the front pane of the set. Two nickel plated knobs are mounted on the plate to assist in removing the coils.

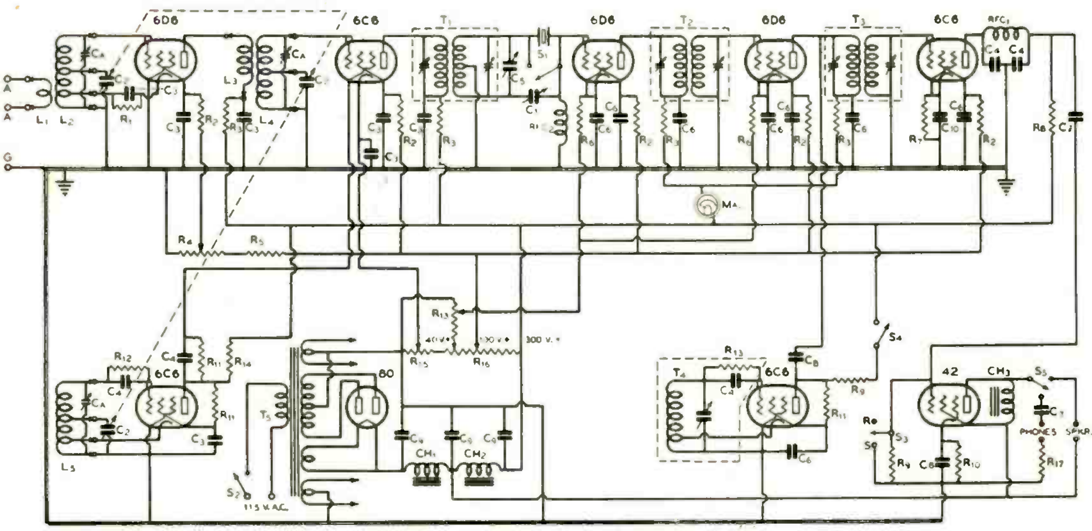
In the design of these coil units due consideration was given to individual shielding of the coils. But, not being a member of the sheet metal benders union and realizing that twelve shield cans would be required for four bands, we took the mountain to Mohammet and built the shields into the receiver so that when the coils are plugged in they are all separately shielded.

Isolantite sockets are mounted on spacers in the back end of each shield can and the guides and coil forms are so positioned that a good push on the nickel plated knobs inserts all three coils into their sockets at once. This method of coil assembly with standard forms cuts down the mechanical work of construction and at the same time leads to a highly efficient shielded coil unit.

By means of the individual air padding condensers and tapped coil band spreading each band is made to cover the middle sixty per cent of the divisions on the dial. Also, when changing bands, stations will always be found at the same point on the dial as when previously heard without resetting any auxiliary dials. This is of particular value in dx work as the location of some elusive station may be spotted on the dial and checked upon over a period of time until he is finally hooked.

The general front panel view is shown on page 67. The panel is standard rack size, 19″ x 8¾″ x ⅛″ aluminum with wrinkle finish for professional appearance. The left side controls are: r.f. regeneration control above, i.f. volume control and on-off switch below, and the phone-speaker switch just to the right. In the center is the main tuning dial and below it is the 12″ x 2½″ coil unit. On the right side are the crystal on-off switch at top, crystal band-width control in center, and beat oscillator switch at bottom, with the send-receive or receiver silencing switch alongside.

The main dial is a home made friction drive product having a reduction ratio of 13:1 for 180° condenser travel. The pointer is made to rotate through 270° by means of fine pitch



The General Wiring Diagram

C_a—Hammarlund APC. See coil table
C_b—See text
C_1—25 μμfd. air padder condenser
C_2—100 μμfd. midget
C_3—.002 μfd. mica
C_4—.0001 μfd. mica
C_5—35 μμfd. midget
C_6—.01 μfd., 400 volt tubular
C_7—.01 μfd. mica
C_8—25 μfd., 25 volt electrolytic
C_9—8 μfd., 450 volt electrolytic
C_{10}—.05 μfd., 400 volt tubular
R_1—1000 ohms, ½ watt
R_2—10,000 ohms, ½ watt
R_3—2000 ohms, 1 watt
R_4—50,000 ohm regeneration potentiometer
R_5—50,000 ohms, ½ watt
R_6—500 ohms, ½ watt
R_7—40,000 ohms, 1 watt
R_8—250,000 ohms, 1 watt
R_9—500,000 ohms, 1 watt
R_{10}—400 ohms, 5 watts
R_{11}—50,000 ohms, ½ watt
R_{12}—100,000 ohms, ½ watt
R_{13}—10,000 ohm volume potentiometer
R_{14}—10,000 ohms, 1 watt
R_{15}—1000 ohm wire-wound potentiometer
R_{16}—15,000 ohm, 75 watt bleeder
R_{17}—10,000 ohms, 2 watts
Ma.—0-1 ma. 2" meter
RFC_1—10 mh. shielded r.f. choke
RFC_2—80 mh. r.f. choke
T_1—465 kc. c.t. i.f. transformer
T_2, T_3—465 kc. air-tuned i.f.
T_1—465 kc. beat osc. coil
T_5—700 volts c.t., 70 ma.; 5 volts, 2 amp.; 6.3 volts, 3 amp. power transformer
CH_1—75 ma., 180 ohm filter choke
CH_2—50 ma., 200 ohm filter choke
CH_3—15 hy., 50 ma. choke
S_1—Crystal filter switch
S_2—Power switch. On back of R_{13}
S_3—SPDT send-receive switch
S_4—Beat oscillator on-off switch
S_5—SPDT phones-speaker switch

gears. A manufactured dial of approximately the same ratio would be as satisfactory; the home made job is used here because of the desire for medium ratio combined with full vision. The latter is of especial importance as it allows instant estimation of the portion of the band covered without mental mathematics (an aid to the lazy man).

The dial drives the first r.f. condenser directly and the oscillator and detector condensers by means of a long gear rack and large gears on the three condenser shafts. This rack is pressed into the gear teeth by pieces of spring bronze so that all back lash is eliminated.

The top view of the receiver shows the space for this rack and gear construction between the panel and the aluminum shields housing the tuning condensers and h.f. tubes. At the left of the receiver is the conventional power supply and at the right of the shield can is the crystal input transformer and a shield housing the crystal and crystal switch and wiring. The crystal phasing condenser can be adjusted by a screw driver through a hole in the right side of this can. To the rear of the crystal is the first i.f. tube followed by the second transformer, and then in a line to the left are the second i.f. tube, third i.f. transformer, detector, beat oscillator tube and coil assembly, and the audio tube.

This equipment is all mounted on a 14 gauge half-hard aluminum chassis 17" x 11" x 3¼" deep. The under chassis view, figure 3, shows the individual coil shields, the layout of tube sockets, and the general wiring.

The electrical circuits are fairly conventional, although quite low "C" is used in the r.f. tuned circuits. The antenna circuit is arranged for either doublet or grounded antennas. The cathode-tap method of regeneration is used and is controlled by a screen voltage potentiometer. This tap is experimentally located so that oscillation occurs with about 25 to 35 volts on the screen.

COIL DATA			
Band	*28 Mc.*	*14 Mc.*	*7 Mc.*
L_1	4	6	8
L_2 Tuning tap Cathode tap	4.8 1.5 0.4	10.8 2.3 0.9	21.8 5.2 0.8
L_3	3.2	8.0	16.
L_4 Tuning tap	4.8 1.5	10.8 2.3	21.8 5.2
L_5 Tuning tap	4.8 1.0	10.8 2.2	18.8 4.0
Secondary wire size	No. 12	No. 14	No. 18
Primary wire size	No. 36	No. 36	No. 36
C_A	25 μμfd.	25 μμfd.	50 μμfd.
Turns per inch	4	8	16

Antenna winding L_1 is wound in a bunch 1/8" below bottom of L_2.
All secondary windings spaced to fill approximately 1 3/8".

The primary L_3 is wound with fine wire between the turns of L_4, starting at the ground end and winding up the required number of turns. Since the secondaries are wound of wire of optimum size for their respective frequencies, and since their shields are quite large, 3" x 3 1/4" x 4" deep, the coils are quite high in efficiency, or Q.

The first detector, instead of having cathode resistor bias, has its cathode tapped to a point on the power supply voltage divider which may be adjusted a few volts positive. This gives an adjustable bias on the first detector, eliminates the usual degenerative effects of detector cathode resistor bias, and allows adjustment of this bias for maximum signal-to-noise ratio.

A conventional electron coupled oscillator circuit is used but the oscillator voltage is fed into the detector suppressor grid through R_{11} and C_4 in a manner suggested by Frank Jones. This leaves a positive voltage on this grid which considerably raises the conversion efficiency of the tube. Due to this higher conversion efficiency the noise level is considerably reduced.

The first i.f. transformer feeds the balanced crystal circuit in which the 35 μμfd. condenser C_5 is brought out to the panel to serve as a band width control for the crystal. Personal preference dictates that the phasing condenser should be once set and left instead of having it easily adjustable and therefore always out of adjustment. It is accordingly mounted inside and is adjustable by a screw driver.

The gain of the i.f. amplifier is controlled by cathode voltage variation and is usually operated very far down to help in cutting down tube noise. Since a screen grid second detector is used, only a small output voltage is required from the i.f. stages.

The audio beat oscillator is operated at low plate voltage to avoid strong output which might find its way into circuits where it is not wanted. The output is fed through a shielded wire to condenser C_b, which consists of two 3/8" square brass plates separated 1/8", and then to the plate terminal of the last i.f. transformer. All wiring in the beat oscillator is shielded carefully. The beat oscillator may be turned on or off by a switch in its plate supply lead.

The grid of the audio amplifier may be grounded by the send-receive switch or by a relay to silence the receiver while transmitting. The power supply is mounted well away from most of the receiver circuits. While a meter was incorporated in the panel layout, no desire has ever arisen to go the rest of the way and apply a.v.c. to the set. However, it could be done in several ways as there is room for an extra tube on the chassis.

The operation of the set is very satisfactory. Coil changing is now no deterrent to frequent band changes and it is no longer necessary to dig to the bottom of the junk box to find a full set of coils. Another very important operating advantage, as mentioned before, is that day after day a station can always be located at the same point on the dial without recourse to hair splitting in the setting of a main tuning dial (band setting condenser). Also of advantage to the lazy man is the fact that all bands come in over the same portion of the dial so that on a 0-100 dial, the edges of the bands are at 20 and 80 and the middle is approximately 50.

The crystal is consistently used and even though no matching of the crystal impedance was attempted, there is no noticeable drop in volume when the crystal is switched in.

◆

In Singapore, the faithful are now called to prayer with a huge p.a. system. Formerly, the Temple biggy shouted his call without benefit of microphone from the top of a tall spire.

More GRID-MODULATED POWER OUTPUT from the HK-154

than any other tube in its class

Here are the facts

Twice as much grid-modulated power output from the Type 154 GAMMATRON as from any other comparable tube! The "154" GAMMATRON is particularly adapted to grid modulation because of its low mu and capability of overload. It is the only tube available that has the characteristics capable of giving high efficiency grid modulation with good linearity. It stands alone in the field; there is no comparable tube on the market.

The "154" GAMMATRON is a low-cost tube! It gives you such GAMMATRON features as: Tantalum plate, Tantalum grid, Nonex glass envelope, extremely high vacuum, no "getter," tungsten supports, more than ample filament and many others. Its ultra-conservative rating is 50 watts plate dissipation.

Investigate the possibilities of this GAMMATRON for use in your phone transmitter. See how easy it is to put a 65-75 watt carrier on the air. Retain your present low power equipment. Simply add a "154" GAMMATRON as grid modulated final amplifier. Here is real phone economy that has never before been possible: low cost audio equipment, inexpensive power supply, minimum of parts.

Send for article by Frank C. Jones describing the HK-154 10-80 Meter Grid-Modulated Phone Transmitter.

HEINTZ AND KAUFMAN LTD

SOUTH SAN FRANCISCO — CALIFORNIA U.S.A.

The Congo Calls

[Continued from Page 25]

painted and bolted together with ½ x 8″ bolts, the assembly being done on the ground. When it came to erecting this 52-foot mast I was up against another problem. The drawing will make clear the method used. Two posts for each mast were set well in the ground, projecting some 14 feet. They were set eight inches apart. Two feet from the top of each of these posts I bored a 1¼″ hole in line with each other. These were to receive a 1″ iron rod which was to act as the pivot on which to swing the entire mast. A similar hole had been bored in the mast 12 feet from the lower and heavier end. By use of a block and tackle this lower end was then hoisted up between the two posts until the hole in the mast lined up with those of the upright posts. The iron rod was shot through and the mast was ready for erecting. This was also done by use of the block and tackle and was simplicity itself. Attaching one block to the lower end of the mast (now suspended high in the air) and another to the base of the two posts, four men hauled away on the rope. To their infinite amazement, down came the lower end of the mast and up went the other, to which the pulley and halyard had already been attached, until the now upright mast was standing its full 52 feet in the air.

This last operation was most spectacular to all the natives and great crowds gathered to see the white man put a stick up in the air higher than a palm tree. But it actually took less than five minutes to elevate the mast. Four such masts were erected, the long axis pointing about 37 degrees north of west, which I calculated would hit a lot of W's right on the nose. In this I have not been disappointed. I frequently have had my low-power signal reported in the States as R6 to 8 and recently W8JK assured me that I was easily R9, which is not so bad for a single 210 with hand power. By use of a d.p.d.t. switch I use the same antenna for both transmitting and receiving and it works both going and coming with equal effectiveness.

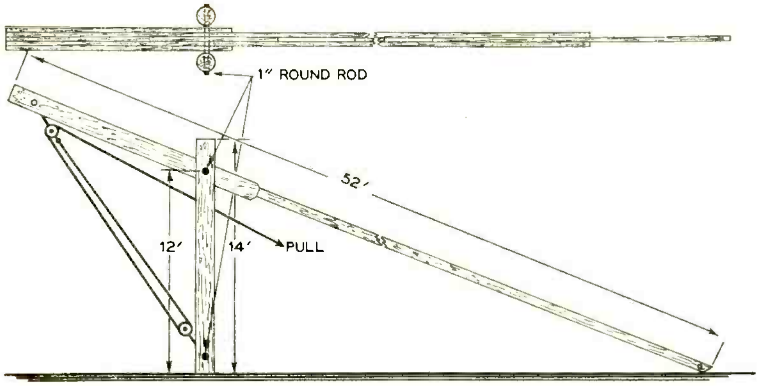
And now ON4CSL has a new receiver, one which pulls a speaker, and my ears have returned to normal. It is only honest to state that without friends ON4CSL would not exist. The finest present I ever received was the National FB-7 which the Georgia Tech Club of New York presented to me for Christmas, 1935. Those fellows can never know the amount of profit and pleasure they have afforded not only me, but the other members of the American colony here as well. There are ten of us now. We followed the latest World's Series play by play with as much eagerness as any fan at home. And football? I constructed a gridiron on my drawing board and by using a thumb tack to represent the ball we had grandstand seats at every game broadcast this season, although we had to stay up till midnight to do it!

I sometimes have had to QRT in such haste that I was unable to say even SK, let alone 73's. Several times I have had to leave thus unceremoniously on account of storms coming suddenly upon me. Electric storms are frequent in this latitude and sometimes appalling in intensity. Annually many natives are killed by lightning. Only a few days ago one was brought into the hospital badly cooked and stinking to high heaven. A number of times as storms have approached while I was at the key I have had severe shocks and once I was about knocked out. I always complete the QSO if possible. But I don't care to have any part of my anatomy cooked.

On one occasion I was in the midst of a QSO when my native "boy" popped wild-eyed into the room and gasped, "Mama says come quickly! The drivers have attacked the house!" Needless to say, I went quickly. The driver ants were all over the house but had concentrated on my wife's bedroom. And since it was late at night, she had retired and was marooned in bed and could neither stay in bed or get out of bed! A sad plight, indeed! I rescued her with the use of a gasoline blow torch. When drivers attack a house the only course of action possible is to vacate. We followed the usual course. But that has nothing to do with lightning.

When I erected my diamond antenna my friends asked me concernedly if I did not think it would "draw" lightning since it was so high and covered so much area. Lightning had had a habit of playing all about the Post, striking houses and palm trees at random. I replied that I thought it would draw lightning—in fact I *hoped* it would. But I went on to explain that my grounding system was about perfect and that by simply throwing a switch I could immediately ground the whole antenna system. The antenna would "draw" the lightning from the air in driblets, dissipating it into the ground before it could collect sufficiently for a destructive discharge. I can vouch for the fact that this is what it does, for several times when I have been a little slow in throwing the switch those driblets have passed right through my body! Anyway no destructive discharge has taken place in this immediate vicinity since the high antenna was erected.

In trying to analyze the various emotions which have come through my experiences with my radio, my mind goes back to the second World's Series game which I heard in 1926. The preliminaries of the game were being announced and then suddenly the announcer (McNamee, I think it was) stated, "There's the National Anthem." Through the phones came the familiar strains. I was alone in my shack at the time but I stood at attention and my eyes



Method of Raising the Four Poles

used his phone, which was very fine. One night my wife and I were sitting in the station when 4CRE said, "I have a surprise for you." Then from the speaker came our daughter's familiar yet long-unheard voice, "Hello, mother and dad." I'm not saying what I did, but my wife just wept. Again, you will have to be separated from your oldest child for some years to know just what that contact meant to the parents. We shall be eternally grateful to 4CRE as

filled with tears. Sounds silly, doesn't it? But you will have to be an American, many years far from home in a wild country to understand. Then it won't be silly. It will be very real.

Another instance: Eight years ago my wife and I sent our older daughter (we have three kids, all born in Congo) back to the States for schooling. A year ago I was holding regular skeds with W4CRE in Nashville. He always

well as to 4AHH and 2BSD who staged similar hookups at later dates.

Then there was W4AM in Chattanooga, Tennessee (my home town), who kept me posted daily on my father's recent last illness. It's hard to be so far away from home at such a time. No one can know the depth of my feeling as W4AM told me daily of my father's failing condition. He even went out to see him and brought me last messages from him. I have never seen W4AM or W4CRE or W8JK face to face; still I know them and hold them in high affection as brothers of the air.

The final chapter of ON4CSL has not been written. Our wagon is indeed hitched to a star. Through the fine cooperation of hams and friends in Chattanooga and elsewhere in the States I have just received a new transmitter, crystal controlled, with an output of 100 watts, powered by a gasoline-driven 110-volt a.c. generator. It is equipped with speech amplifier. Unfortunately the outfit was badly damaged in transit and new parts have not yet arrived. But perhaps even before you read this you will have heard "The Voice of the Cannibal".

And now the call ON4CSL is no more! The station remains, but instructions have been received from the Government authorities that henceforth ON4CSL is to be known as OQ5AE. So voila!

◆

A hardware store has applied for a broadcast station license, requesting 56,000 kc. Already they are gunning for our five-meter band!

Calls Heard

[*Continued from Page 35*]

January, 1937

(28 Mc. code)

CN8MQ; D4KPJ; D4MDN; F3KH; F80B; F8QW; F8ZZ; FA8IH; FA8J0; FM8AA; FT4AB; G2PL; G5BJ; G5QY; G5VU; G6DH; G6QB; HB9A0; HB9J. — OH 1NR; 2NM; 20T; 3NK; 3NP; 30D; 30I; 5NG; 50A; 50D; 7NC; 7ND; 7NF; 7NJ. — ON4CH; PA0AZ; SP1LM; SU1KG; SU1SG; U1CN; U2A0; VE3KF; VK2GU; VS6AH; YL2BB; YL2CD; YL2CM; YR5AV; YR5IG; ZE1JJ; ZE1JR; ZS2X; ZS6AJ; ZT1R; ZT2Q; ZU6P. — W 1BJE; 1BUX; 1HI0; 1IWC; 1QP; 1SZ; 2AIF; 2BUX; 2CK0; 2DVM; 2JME; 2JXZ; 3EXB; 3JM; 3PC; 4AGI; 4EDQ; 8AAJ; 8CJM; 8CKY; 8HRD; 8KYY; 8MFB; 80KG; 9BBU; 9DM; 9MTN; 9PK; 9PZI; 9UIT; 9UYD; 9VJD; 9VWW.

(28 Mc. phone)

C02AU; VE2KX; VS6AH; YL2BB. — W 1CHG; 1DSV; 1FH; 1JDV; 1SZ; 1WV; 2AIF; 2BAA; 2DKJ; 2HTG; 2INX; 2JUJ; 3AIR; 3AKX 3AUC; 3FMQ; 3FPL; 3FXU; 3GIZ; 4DRZ; 4EC; 4EDD; 8JFC.

February, 1937

(28 Mc. code)

D3CSC; F3KH; F8E0; F8WK; FB8AB; FM8AA; FM8AD; FQ3AA; G2PL; G5QY; G6DH; G6WY; HK1JB; J2CB; 0E3AH; 0H1NF; 0H2NB; 0H20G; 0H6NS; 0N4FE; 0N4FT; 0N4JB; PY1BR; SP1KZ; SU1R0; U2NC; U3BH; U3BM; U3CL; U3FB; U3QK; U3QT; U3VG; U9ML; UK3AH; VE2JQ; VE3KF; VE5HR; VK2BK; VK2GU; VK3CP; V03X; ZE1JU; ZL3DJ. — W 1CSR; 1EZL; 1FAU; 1HI0; 1IBT; 1RY; 2ACY; 2CKN; 2DAG; 2D0Z; 2DVM; 2ENY; 2EQQ; 2GFY; 2INS; 2JME; 2JVU; 2MB; 3ASW; 3FGW; 5DQD; 6BAM; 6GRX; 6HB; 6IDF; 6IRD; 6JJU; 6JN; 7DSZ; 8IFD; 8MWY; 8MZE; 9DGL; 9DN; 9DXX; 9NNZ; 9PXS; 9SII.

(28 Mc. phone)

G6DH; HK1JB; PY2AC; SU1R0; VE2JK; YL2BB. — W 1AAK; 1DNL; 1HTP; 1IPV; 2BAA; 2DJX; 2DKJ; 2FGV; 2FL0; 2GAH; 2HYT; 2IJD; 2JKR; 2JME; 2JXZ; 2TP; 3AKX; 3FMQ; 3FV0; 3GIZ; 3PC; 4DRZ; 4YC; 5WG; 6JJU; 7CKZ; 8CJM; 8EBS; 80AA; 9DDF; 9FAA.

E. H. Swain, G2HG, 31 Woodbastwick Rd., Sydenham, London, S.E. 26

Feb. 23 to March 16

(28 Mc.)

W 1ANU; 1AV; 1BFT; 1CUY; 1DA; 1GLF; 1HKY; 1I0B; 1JPE; 1RY; 2AIF; 2AMM; 2AYB; 2AYJ; 2BHD; 2BQK; 2CPA; 2DL0; 2DNG; 2DPA; 2GFH; 2GFY; 2GUM; 2HSL; 2IBP; 2I0N; 2JXZ; 2LW; 2MB; 2TP; 3AFC; 3ATR; 3BPY; 3BWA; 3BWB; 3BVE; 3CGR; 3CLC; 3CZ0; 3EBK; 3EDP; 3EE; 3EEB; 3EVT; 3FDJ; 3FV0; 3HC; 3JM; 3RL; 4AUU; 4CDE; 4DXM; 5AM0; 5BXN; 5ENZ; 5E0F; 5E0J; 5LW; 5WG; 6BYD; 6D0B; 6DUC; 6HB; 6FZQ; 6JB0; KBD; 6RH; 7AVL; 8ANB; 8BIQ; 8BTR; 8CYT; 8DML; 8FVU; 8HGW; 8HRD; 8JIN; 8JJY; 8KYY; 8LVH; 8MCC; 8MKZ; 8MVG; 8MYF; 8NAB; 80LX; 80UK; 80UT; 9ABE; 9AEH; 9AKJ; 9AUH; 9AWP; 9ELK; 9HFF; 9IQM; 9JU; 9LWG; 9MUX; 9PXS; 9SSI; 9SXV; 9TGN; 9TPI. — VE 1AU; 1CI; 2HP; 3ADM; 3KF; 3WA; 3XU; 4PH; 5HR; 5QP; V03X; VK2GU; VK3BQ; VK3YP; ZS2N; ZU6P; SU1R0; 0A4J.

◆

Cooling the Rig

[*Continued from Page 41*]

(just above the base, below the baffle shield) with normal load runs at least 10 or 15 degrees C above surrounding air, we see that we must not let the temperature inside the cabinet rise much above 110 degrees Farenheit. This may sound like rather a high value to reach under ordinary conditions. That conclusion is not true. With the surrounding air temperature from 85 to 100 degrees F, the various transformers, bleeders, and tubes can easily raise the temperature in a closed cabinet well above the danger point.

The way to cure all this is so simple and inexpensive that it seems a wonder that more hams do not avail themselves of it. A quiet 8 inch fan can be obtained for three or four dollars and when placed at the bottom of the rack will circulate cool air throughout the rig. The fan preferably should be placed so that its stream of air plays directly upon the rectifier tubes, as they are the ones to whom cooling is most important.

If the rack is completely enclosed, a hole can be placed in the back for the cool air to enter and a number of smaller holes cut in the top for the heated air to leave. If the tubes in the final stage are operating at high plate dissipation (especially in the case of a class B linear) cooling them by means of another small fan will greatly reduce the danger of releasing occluded gas from the glass envelope. As a matter of fact, certain tubes (Eimacs and Gammatrons) are rated at a considerably higher plate dissipation with forced draft on the envelopes. At any rate the useful life of almost all the components of an enclosed transmitter can be lengthened by the use of forced ventilation.

The average 8 inch fan draws about 35 watts, and most types are very quiet.

The Open Forum

[Continued from Page 50]

The antenna shown will produce horizontally, circularly, and elliptically polarized waves, and there is nothing against supporting it in a different plane than here shown. The arrangement makes the ideal "splatter system".

The transmitter was placed in operation in the spring of 1934 after considerable work on the oscillator unit during the fall of 1933. It was rebuilt with slight modifications in 1935. Powered by a navy generator, its i.c.w. note was familiar to many hams in this vicinity.

At present the system has been removed to make room for a 28 Mc. rig of the same type. It was thought that the latter frequency would indicate more peculiar effects than are apparent at 56 Mc.

It staggers the imagination to contemplate the possibilities of the three phase system: more steady signals, directive effects, "secret" modulation, etc.

The system is tricky to adjust, enough so to make one prematurely grey. But with the experience gained from the previous work it is hoped that the ten meter rig will settle the question. More will be heard of this system in the future. For the past year, audio frequency high selectivity has taken my time, as the pages of RADIO for October '36 and February '37 will indicate.

F. MALCOLM GAGER.

LEG PULLING?

Los Angeles, Calif.

Sirs:

Hoorah for that Los Angeles city council which had gumption enough to tell its citizenry that the erection or maintenance of a tower as a part of an antenna system within a residential district is unlawful! (I refer to W6MJK's letter in the March RADIO.)

Of all the god-awful things that mar the modern city, these towers so loved by the "hams" are about the worst. I shudder every time I see one of the things, with all of its

Taylor HEAVY CUSTOM BUILT DUTY Tubes

Put zip in those sick rigs
Use Taylor Tubes for R9 sigs!!

"Ol' Doc Common Sense" prescribes–

For Low Power
T-20 — Price $2.45

For Medium Power
T-55 — Price $8.00

For High Power
T-200 — Price $21.50

Taylor Tubes operate at reasonable voltages. Make a double saving. Slash operating and construction costs. Stay on the air by eliminating breakdowns resulting from excessive and unnecessary voltages.

YOUR FAVORITE DISTRIBUTOR RECOMMENDS TAYLOR TUBES

"More Watts Per Dollar"

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

attendant wires, draped across an otherwise perfectly decent landscape. Talk about oil wells in one's backyard . . . they at least represent an income.

If more city councils would be a bit more strict and turn thumbs down at these towers, more residential districts would look less like a section of Long Beach's Signal Hill oilfields and more like the realtor's dream.

It's too bad that W6MJK had to be the goat, but someone always has to be the first to pay the price.

Incidentally I'd like to take on that ham who lives next door and has one of these things on his portion of California real estate. Or now that they are illegal perhaps I won't have to.

RALPH JOHNSON, B.C.L.

•

TO THE RESCUE

Los Angeles, Calif.

Sirs:

Some time prior to the 16th of March, I was called by Richard S. Lyon, radio amateur, and was informed by him that the City Prosecutor of the City of Los Angeles had directed him to remove his transmitting antenna tower within a certain period of time or if it was not removed, that he would be prosecuted for a crime and compelled to remove it. He stated to me that some time ago he had considered, and as a result of such consideration, had purchased a residence property—a hillside lot, from a tract owner named Willett. That prior to the purchase of this lot, and while considering the advisability thereof, he had inquired as to the cost of construction of a radio transmitting tower, appurtenant to his residence, feeling that there was a possibility that because of the geographical condition, the expense of placing a tower such as he was then using might be too great.

The agent for the owner of the tract, as I understand, secured a contractor and an architect for Mr. Lyon and the plans and figures were gone into and after consideration, it was ascertained that the expense would not be prohibitive and Mr. Lyon agreed to purchase this lot through the tract owner's agent, with full knowledge on the part of the agent as to the use to which Mr. Lyon was intending to put it.

Mr. Lyon built his residence and tower, installing his transmitter, and was going merrily on his way when he was rudely interrupted by the authorities of the City of Los Angeles directing him to take down his antenna and tower, inasmuch as the City Planning Commission of the City of Los Angeles had cautioned him that the district in which his residence and tower were located was an R-1 zone, in which

district only single family residences and their usual accessories could be built. Mr. Lyon immediately inquired as to why he was required to move his antenna and tower and was told that this particular antenna and tower was not a usual accessory. Mr. Lyon was also using this particular antenna for receiving purposes.

Mr. Lyon did not believe that he could be required to remove this transmitting tower. In other words, he felt that this was a usual accessory and took issue, as a result of which he was ordered to appear before the City Prosecutor on the 16th day of March at 10:00 a.m. He consulted with me and asked me if I would appear with him, to which I agreed and which I did.

On arriving at the City Prosecutor's office, Deputy Prosecutor Kelly took charge of the matter and with Mr. Grimes, Mr. Lyon, myself, and a gentleman whose name I cannot recall, we went into a huddle. We asked Mr. Kelly just how he could decide that an antenna was not a usual accessory to property in the City of Los Angeles. I also advised Mr. Kelly that within the City of Los Angeles there were probably between 3500 and 5000 "hams", all of whom would be exceedingly interested in a proposition where one of them might be required to remove his antenna. I pointed out to Mr. Kelly that the Navy net and the Army net, the major disaster relief and emergency net, as well as the ordinary amateurs would be affected by any such ruling and that in the place and stead of having one amateur, Mr. Lyon, to contend with, he probably would have several thousand to consider. I also pointed out to Mr. Kelly that there was at that time and still is an ordinance in the City of Los Angeles requiring any antenna to be at least twenty feet high and forty feet long in a straight line. This was applicable of course to receiving antennas, and I requested of Mr. Kelly information as to just how an antenna twenty feet high and at least forty feet long could be held aloft without a tower or some similar support under it or sky hooks above it, and that it seemed to me that unless some such provision were made there would be no way to maintain an antenna in the sky in that position unless the City Prosecutor's office could provide a Hindu magician who could throw the antenna in the air and make it stay there without visible means of support.

I also pointed out to Mr. Kelly that all of the broadcast listeners, the number of whom was incalculable, would be affected, and I requested information from Mr. Kelly as to whether or not an ordinary receiver in an ordinary residence was a usual accessory. Mr. Kelly felt that it was and is an accessory. I then pointed out to Mr. Kelly that an antenna is a part of a receiver and a necessary part of the receiver under present conditions in order to obtain proper reception, without interference, and as necessary as the power supply to the receiver, to which Mr. Kelly agreed. I then asked him how to maintain an antenna in the proper position in accord-

ANNOUNCEMENT

FROM AND AFTER MAY 15, 1937

RADIO, Ltd.

publishers of "Radio"

will be publishers and distributors of

- JONES RADIO HANDBOOK
- JONES ANTENNA HANDBOOK
- AMATEUR RADIOTELEPHONY
- RADIO AMATEUR NEWCOMER
- JONES ULTRA HIGH FREQUENCY HANDBOOK
- SUPPLEMENT TO JONES RADIO HANDBOOK (in preparation)
- RADIO NOISE SUPPRESSION (in preparation)

heretofore distributed by the Pacific Radio Publishing Company of San Francisco.

Until May 15, 1937, all trade orders should, as heretofore, be sent to Pacific Radio Publishing Co., Box 3278, San Francisco. Orders to be filled on and after May 15, 1937, should be sent to Radio, Ltd., 7460 Beverly Boulevard, Los Angeles.

Until that date retail orders may be sent to either address, and after May 15th to Los Angeles only.

San Francisco
April 9, 1937

Pacific Radio Publishing Co.
Radio, Limited

ance with the ordinance of the City of Los Angeles, without maintaining a pole or tower for that purpose, and Mr. Kelly felt that there was a great deal of room for argument concerning the construction of the words "usual accessory". He stated, however, that the matter had been placed with the Civil Department of the City Attorney's office for an opinion, which opinion had been forthcoming, and which decided that the antenna tower was *not* a usual accessory, under the rules and regulations of the City Planning Commission. He did say, however, that perhaps someone had passed on the matter without due consideration, and continued the matter for thirty days for the purpose of allowing me to file a brief with him. All of this was done March 16th, 1937.

On the 19th of March, 1937, during the evening I was in a QSO with W6FJ, in which I stated in full the matters as they had been reported to me and the results of my conference with the City Attorney's office as above set forth. I also stated the proposition as it had been put up to Mr. Lyon by the City Prosecutor's office. I probably was in QSO with W6FJ for an hour and a half. The situation was fully gone into and all manner of questions asked by W6FJ and the answers given by me as to what the situation was, and of course not only W6FJ but many others who were listening became interested as to whether or not they might be required to move their antennae. I later learned through W6NXW that one of his very good friends, a short-wave listener, had been listening to my conversation with W6FJ. This friend of NXW's made copious notes of the matter and within the next day or two went down to the City Hall. I do not know what he did, but I do know that within two or three days the report was that the City Planning Commission had passed a resolution that an antenna and tower *is* a usual accessory within the meaning of their rules and regulations; so "that's that".

I put in considerable time, both on the air and in the office at the City Hall attempting to obtain a proper ruling on this matter and I understand the results are as above.

PERRY F. BACKUS, W6HUX.

◆

ACTION

Sirs:

Apparently my suggestion relative to extending the class A amateur operator license restrictions to include c.w. as well as phone, has stirred some genuine interest in an attempt to clean up the bands.

I am gratified to note that without exception all comments received have been enthusiastically in favor of the proposal which I made in your February number.

Several commentators have suggested, however, that another opportunity has only been presented through which to unburden ourselves, without any further action being taken. In this connection, I realize full well that merely expressing opinions through the columns of your magazine will not secure the necessary official action which we desire, and accordingly, I am willing to undertake the task of carrying the matter further, with the cooperation of the fraternity.

Accordingly, may I suggest that all amateurs who are in favor of extending the restrictions of the class A license to cover c.w. operation as well as phone, write me direct, over their call letters, expressing themselves in favor of such a move. Thirty days after appearance of this suggestion in your columns, to allow sufficient time for such correspondence to reach me, I will assemble all such support received, and present it to the Federal Communications Commission with a request for consideration by that body.

This may, or may not, result in action being taken, but appears to be the most logical first step to be taken. In order for such a request to carry weight, it should be backed by a large number of supporters; therefore I urge every amateur who is favorable to this project to express himself in writing.

Such correspondence should be addressed to me at 801 Fourth Ave., Seattle, Wash.

HOWARD S. PYLE, W7ASL.

•

LOW POWER HOLIDAY

Plainfield, N.J.

Sirs:

RADIO has, in the past, brought out editorially very good reasons why amateurs should not impose on themselves a so-called "high-power holiday". I believe that majority sentiment is rightfully against such a move.

Yet, just ten minutes ago I listened in on a 20-meter c.w. rag-chew which certainly sets one wondering how well we can keep our own house. The rag-chew involved a W9 and a W6 who were comparing notes on the merits of their final amplifier tubes which were of the same manufacture. The W9 broadcast that he was running the equivalent of 1320 watts input and our law-abiding W6 asserted that his only limitation was his 220-volt line made up of number 4 gauge wire. His tubes, he figured, were dissipating about 1000 or 1500 watts. I, for one, should like to believe this to be an isolated case.

Stations guilty of such operation can hardly point to dx contacts as achievements; and it certainly does not radiate a true sense of fairness.

JOHN H. GULLANS, W2AWU.

With the Editors

[*Continued from Page 9*]

not mean purchase of many more crystals, later to be thrown away if another change becomes advisable. Here is our suggestion for a plan to go into effect now, pending any further adjustment which might later prove to be necessary:

28,000—28,300	code only.
28,300—28,500	phone band — code please stay out.
28,500—28,800	code—and phone, at least for the present.
28,800—29,200	code and phone (using 7 Mc. crystals falling outside the 14 Mc. band).
29,200—30,000	code and phone, but as only some 3.5 Mc. band crystals fall here, stabilized self-excited oscillators *might* be permitted.

In this plan, 300 kc. go to code and the next 200 kc. to phone, exclusively. The balance of 1,500 kc. is wide open.

This is an increase in phone frequencies of 700 kc., or more than on all lower frequency bands put together. The phone stations would be moved from the edge, but that may be no disadvantage, for the foreign stations can indicate a desire to work one or the other. The phones will be relieved of the effect of code on their a.v.c., while code stations will be free of phone QRM.

Interference on frequencies used by dx stations will largely be eliminated.

Although the harmonic relationship calls for a code band again at 28,500 to 28,800, it is not yet necessary to make any such restriction, and the range is good for those with code crystals for the high frequency end of 14 Mc. who want to try ten meter phone.

From 28,800 to 29,200, only crystals falling in the 7 Mc. band but out of the 14 Mc. band probably will be used. Beyond 29,200 where only a few 80 meter band crystals will fall, we badly need "population" to reduce congestion elsewhere. Opening it to phone—possibly even with self-excited oscillators—will help to get the gang to move there. Crystal control could come when necessary.

You may not agree with this suggestion, but it may provide a basis for a letter to your director. Let's see that the directors know how we feel *before* the meeting, not after.

—E. H. C.

Postscripts and Announcements

[Continued from Page 59]

and physicists engaged in electronic development work in industry, to broaden and unify their grasp of fundamental electronic principles. It is believed that this opportunity for association between electronics teachers and the men who have been and are the leaders in electronic research and development in industrial laboratories, will help greatly to clarify methods and policies in the teaching of electronics in engineering schools.

A special bulletin describing the details of the Institute program is being prepared, and will be mailed to anyone interested on request. Address Professor W. G. Dow, Electrical Engineering Department, University of Michigan, Ann Arbor, Michigan.

◆

HAMFESTS AND CONVENTIONS

Alberta, Canada

Northern Alberta Radio Club will stage the Alberta hamfest in Edmonton, Alberta, Canada, on July 10 and 11. All interested in attending should communicate with A. Stollery, 10608 - 73d Avenue, Edmonton, Alberta, Canada.

Cleveland, Ohio

Shut-in friends of Cleveland Radio amateurs, broadcast station engineers, police radio operators, and radio service men will be entertained at an outing in Puritas Springs Park, Cleveland, Ohio, on August 1. Arrangements for the affair are in the hands of a committee headed by John "Pop" Garvey, 2141 West 67th Street, Cleveland.

St. Paul, Minn.

Mid-American Dakota division of the A.R.R.L. convention, to be held in Hotel Lowry, St. Paul, on May 21, 22, and 23, will have among its speakers Dr. John Reinartz and Boyd Phelps. Fine modern technical exhibits will be contrasted with radio antiques combed from the ham shacks of old timers. Highlights of the entertainment program will be army net, navy net, and phone association luncheons, a mammoth stag, and the convention banquet at which 1500 hams and friends will be in attendance.

Special entertainment has been provided for the y.l.'s and ex-y.l.'s.

Tickets are $2.75 and advance registration may be secured by sending check or money order to W9JIE, 1200 Fauquier Street, St. Paul, Minn.

Through the cooperation of C. W. Loeber, federal radio inspector, the convention committee has arranged to hold examinations for class A and B amateur radio licenses during the convention period. Any "ham" desiring to take his examination at the time has been asked to write Mr. Loeber for forms 610 and 611.

Detroit, Mich.

Dr. E. C. Woodruff, president of the American Radio Relay League, will be guest speaker at the ninth hamfest of the Detroit Amateur Radio Association in the National Guard Armory of Ypsilanti, Mich., on May 16. R. H. G. Mathews, central division director, also is expected to be among the honored guests present.

◆

F.C.C. Notes

The Inspector-in-Charge at Norfolk, Virginia, advises that for the balance of the calendar year, examinations in Winston-Salem, N.C., will be held in the Civil Service Room, Post Office Building, instead of Reynolds High School.

Dx Department

[*Continued from Page 63*]

W6BYB got on the air with a 300TH in the final, all set to go when it seems that all the b.c.l.'s within a radius of a mile turned in QRM reports . . . so not much of a contest for BYB. W8HWE worked HS1RJ for his 100th country the last afternoon of the contest.

W9TB, E. E. Schroeder, Chicago . . . 76,000 points scored on four bands, with a multiplier of 119. His rig uses four 860's in p.p. par. with a kw. on all bands from 80 down to 10. The antenna situation is well taken care of in having 7, one for 80 and two each for 40, 20, and 10. The 20 and 10 meter antennas are half waves in phase, horizontal, while the 40 and 80 meter ones are half waves, also horizontal. All antennas are fed with non-resonant 600 ohm lines exactly matched so that no retuning of the final tank is necessary, and are operated by DPDT a.c. relays just outside the shack, thus enabling him to select any one of them from the operating table. In the contest Schroeder made w.a.c. 6 times on 20 and 4 times on 10, and worked 5 continents each on the 80 and 40 meter bands. Four-band contacts were had with EI8B, FA8IH, K5AY, XE2N, K6CGK, K7PQ.

It looks like W7EK is the highest W7, as he scored 37,146 points, 152 contacts with a multiplier of 82. W7AMX had 30,800 points to his credit in 73 hours of operating time, while his neighbor W7BD came out with 14,000 using two bands. 7BD blew his bottle the first day of the contest so couldn't get on 10 meters the rest of the test . . . In its place he used two 6L6's in p.p. with 200 watts input . . . ouch!

All in all, it looks like there has been more activity and interest in this year's contest than in any previous year's. Conditions over the nine-day period were also far better than any contest that I can remember. Now that the big push is over we have only to wait until next year for one that will even outdo the one just finished. You birds better start planning now on those multi-frequency rigs and practice sending with a key in each hand, because that's what it's coming to.

W9CWW is back in the running again. He worked a few new Zones and now has 31. W3EDP says that a certain VE4 has been signing NX1UU at times and made the mistake of signing his real call during a QSO . . . . humph!

Are You Insured?

For the small sum of $2.50 we will insure any amateur in the U.S.A. against missing any of the important developments in radio for a period of one year. We will guarantee that at the end of the year he will be endowed with an invaluable store of ideas obtainable nowhere except in RADIO.

●

No physical examination is required; this endowment policy will be issued to any wide-awake amateur who realizes the importance of keeping step with the rapid strides being taken by amateur radio.

●

In this unusual policy the insured is also the beneficiary, and the premiums amount to less than three quarters of a cent a day. An application blank will be found on page 93. Remember, this company is a "mutual" organization; it is just what the policy-holders make it. The larger the number of policy-holders, the larger the dividends. Don't delay; insure today.

Ah, here's something from North Dakota. W9UBB has worked into 28 zones and a few of the good stations include TF5C, U9AL, U9MI, FA8DA, FB8AB, ZU1T, ZS5Z, ZS6A, ZS1H, ZS6AJ, ZU6AF, ZS2X, ZE1JS, ZS2D, ZT6N, PY1BR, CX1CX, LU7AZ, OA4AQ, and quite a few J's and VK's, ZL's.

W3EMM has 24 zones on phone, including PK1MX. EMM has worked 82 countries on c.w., and uses p.p. 805's in the final. W3UVA has had a devil of a time getting on the air in the last two years but it looks as though it will soon happen . . . . . gonna use p.p. 100-TH's. However, he did work HB9Y on 80. W7ALZ has been doing alright by working G6WY, G5IS, F8EO, F3KH, D3DLC, PA0TSK, LY1J, OZ2M, OZ7O, OZ3FL, OZ3J, OH5OA, OH3NP, U1AD, U9MF, OK1ZB . . . . 25 zones and 56 countries.

W6ITH has now boosted his zone total on phone to 24. VE5TV is the latest and he was about 14120 kc. Reg has also been working a number of South African phone stations: ZU6P, 14120; ZS6AJ, 14050. W9KG is hard at it and reports that W9LBB is still a traveling salesman and dx is nil with him.

W1APU got his 30th zone by snagging K7FYI . . . . and that was his 68th country. W8HGA lives in a deep valley in Hinton, West Virginia, and has a little trouble getting his sig out of it, but I think he does quite well with his p.p. 210's . . . . 29 zones.

W7AYO writes that he doesn't get much of a chance to be on the air these days, since he is a student in University of Washington. However, during the spring vacation he managed to get on the air a few days and found that conditions were pretty good. He made a w.a.c. in about eight hours. A few of the new countries for him include FB8AE, OE3, U9, XU8. He uses a pair of 203A's in the final with about 500 watts. Antenna is a 400-foot zepp.

Congrats to W1HX, "Norm" Young, and Mrs. Young. There is a new baby girl in their house.

Charlie Pine, W9CWW, who is still in Leavenworth, has boosted his power to 120 watts which resulted in working a couple of new countries. W2GW worked a station signing LS2D on Jan. 28. Does anyone know anything about his QRA?

W2GTZ says that VK6SA has been trying to connect with stations in South Carolina, Nebraska, and Nevada, for his w.a.s. Any of you fellows in those states who would like to oblige please get in touch with W2GTZ. W1AQT changed his QRA a month ago and has been rebuilding, using a pair of RK-18's in the final. He says that W1FH has also moved and will be on the air as soon as he gets the shack built to put the stuff in.

BI-PUSH EXCITER
AND POWER SUPPLY

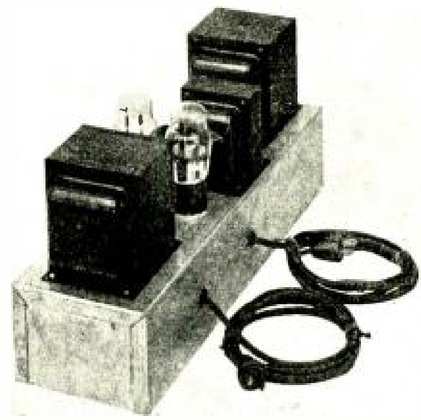
This tri-bond exciter or transmitter is fully described in April "RADIO" on Page 8. The original model was designed by W. W. Smith, W6BCX.

The RF kit, pictured assembled, includes all high quality parts, such as Hammarlund, National, IRC, Amphenol; the tubes are RCA 6A6's and Raytheon Isolantite base 6L6G's. Punched out chassis, etc. (Less Crystal) .... **$23.75** net

(The price of the individual parts totals $25.37.)

POWER SUPPLY

This is a real husky supply capable of handling 300 ma. If you want a good "all around" supply to be used for a Bi-Push, modulators, or any other setup calling for 550 volts d.c., this is it. The transformers are special, and include a plate transformer, a filament transformer with 5 V. and 6.3 V. windings, and a 300 ma. choke. Rectifiers are 83V's . . plates in parallel. The two filter condensers (mounted under chassis) are Cornell-Dubilier oil-filled, 4 mfd. each. Power supply kit .. .. .. **$18.75** net



ORDER BY MAIL

Any of the following hams will be glad to give your order his personal attention:

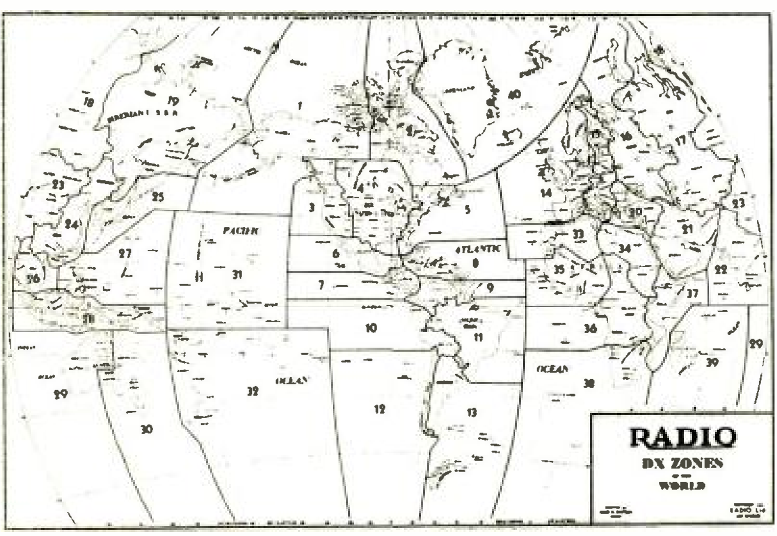
W6CUH, W6QD, W6LFC, W6NOF, W6DUX, W6JWQ, W6FMK

RADIO-TELEVISION SUPPLY COMPANY

"Where Ham Spirit Prevails"

1701 So. Grand Ave. Los Angeles, Calif.

A map of the world for 25c!



Size: 34" x 28"
Heavy white paper

This is a reproduction of the WAZ map which appeared in the DX Department of January "RADIO". List of countries within each zone is also included.

Price 25c, postpaid, anywhere.

(Canadian postal notes [25c] and British postal orders [1/-] accepted. Five international reply coupons accepted as 25c.)

[Dealers and jobbers: Unexpected demand has enabled us to offer this map to the trade; write for prices.]

RADIO, Ltd., 7460 Beverly Boulevard, Los Angeles, California

W8AAT added a couple of zones by working HS1RJ and U9ML. This makes his 85th country. W3AYS has worked a few new ones which include ZC6AQ, 14,400; U6SC, 14,410. W8HWE has worked some good ones lately, including YM4AA, U9ML, U9AF, and 4 VU's and a bunch of KA's, VS's, J's, PK's, XU's, and MX2B. W8HWE worked his 100th country and 38th zone by snagging HS1RJ.

Bob gives the QRA of VU2FH for those who want it:

> Terry Adams, C.I.D.
> Foreign Branch, Head Police Office
> Bombay, India.

W7AVL wants to know what happened to the ZL's on 40 meters.

Otto Miller, W6NHC of San Diego, has had to fold up his old rig. He is now on the Paradise Islands for a few months while his ship is being overhauled in the Navy Yard at Pearl Harbor. Before leaving however, he was able to boost his zones to 35 and his countries to 75.

Correction: In the March dx columns there appeared the following, "W2BRS works TF3C for his 36th zone". It should have been "W2BSR works TF5C". There is really nothing wrong with this except the two calls involved, and anyway the writer was in the usual trance.

W9NTW-W9OHK and W9SCW have combined their stations for the summer with operation to be under the call of SCW. Three separate transmitters will be used and with this combination they naturally expect to work more than W stations.

Here's Something

W8DWV has worked 13 countries on the South American continent, including the "Territoire de l' Ininni", which is the penal colony south of French Guiana. He has the OSL card to vouch for the QSO and the call is FS3FQH. The colony is ruled by a separate government from French Guiana. W8DWV is looking forward to working FY8C in French Guiana and when he does so he expects to be the first station to work all countries on any continent. At least it looks like a good chance to be the first W to do it. (Of course, he means with the exception of Australia.) 8DWV has 31 zones and 97 countries to his credit.

Last month this department mentioned the fact that effective March 1, the Belgian Congo stations were changed from ON4 to OQ5. Our old friend, the Rev. Carroll Stegall of ON4CSL, now becomes OQ5AE. Another Congo station, formerly ON4CGW, is now OQ5AA. Still another new one is OQ5AQ on 14360 kc.; he comes in about 1500 g.m.t.

"Ham Humor"

Some time ago, RADIO inadvertently started something when an article mentioned that W9HP had the highest-powered call. Since then, many others have

sent in letters stating that W9KW was the highest-powered call; then someone said W6CKW had "six California kilowatts" and must be the strongest. Now, W6KW says that while he himself has a high-powered call (and darned expensive to live up to), he thinks W6MKW has him beat, with "six million kilowatts!" What then, of W9OKW—"nine octillion kilowatts!" Beat that, if you can!

W6OAN says he is tired of hearing these fellows on fone say they're going to "look over the band." Sez W6OAN: "I'm going to get even with those guys by building a new rig—a binocular circuit—using two 6E5's (magic eyes) in a push-pull final. Then, I'll *really* look over the band!"

Down San Diego way, W6BZE (named Dick Shanks) has always been considered a regular "ham". Hence, he is getting to be well-known as "Ham Shanks"! Does anyone know another "ham" by the name of Hocks?

(Thanks to W6KW for the above).

What! . . . . another W7? This time W7AOL. He says for six long years he has been chasing Africa, and just recently, one morning, he hooked three in a row, ZT5P, ZS1B and ZS1AL. Thought he was doing pretty good until that afternoon when he dropped over to see Art Bean, W7AMX, and after he saw the mess of dx that that guy has worked he began to wonder all over again. Anyway I think 7AOL does very well, considering his top power of 30 watts.

New Station in Liberia

Thanks to the many fellows who have sent in the information about the new Liberian station EL2M. EL2M is almost a shadow of old EL2A . . . . just as loud and just as consistent. Frequency is generally between 14100 and 14150 k.c., self-excited T7. QRA is Henry Grimes, P.O. Box 72, Monrovia, Liberia.

F8EO sends in some info covering the past few months. He said that 28 Mc. has been very good, having heard W6GRL on fone several times. (GRL's fone . . . . hi). ZS1H was probably the most consistent on 10 meters and FB8AB was heard very often but hard to copy, due to bad note. F8EO says that 14 Mc. has been very remarkable in that it has stayed open so long, in fact it was so wide open that the local F stations were too loud for comfort. Ordinarily the band would fold up around 1730 G.m.t., but, up until a short time ago, he was able to work W2's until 2000 G.m.t. LU7AZ and PY2AJ come in very well about 2100 G.m.t. The Pacific coast boys have been coming through most all day . . . . . and while we're on the subject, 8EO has had over 150 QSO's with W7AMX. W7EK is very regular. Both F8EO and F8EX have worked K7EVM who comes in quite well. That's good dx for the F8 gang. The best time for them to work the K6 gang is in the evening, although they are sometimes heard in the mornings. K6MXM, K6COG, K6AKP are the best.

On 7 Mc. F8EO has hooked up with numerous W6-W7 stations, the most consistent being W7BD and the loudest W6CXW.

Both G2PL and F8EO were on night after night around 0730 G.m.t. on 7030 kc. for QSO's with the Pacific coast. F8EO says that conditions on 80 meters were fair and that many F stations are putting little rigs together to use on this band. F8FC is throwing on some power, however, and will use 300 watts on fone on 3.5 Mc. G2PL was QSO ZL1DI on this band and was trying to hook up with VK3EG, but met with little success.

•

A note from the old timer, Alan Smith of G6VP, states that he has 39 zones and the one lacking is zone 23.

Might mention a couple of other laughs I had in the contest. Heard ZL4AO, who was knocking 'em off a mile a minute, hook up with a certain W9. This W9, apparently not used to contest procedure, gave him a number like this: 000323. ZL4AO came back to him with a "hi, hi" and thanked him for swell report "000", then took 15 minutes explaining the rules of the test. Got a real rise out of "Shrimp" right afterward when I hooked him and gave him the same number as the W9 did. The other laugh was when W6KRI was lucky enough to hook ZK1RG on Cook Island. The ZK came back and gave number and then said, "QRA here, Caroline Green, Cook Island." Then when KRI went back and kept calling her "OM" every now and then during the QSO. He probably thought Caroline Green was the name of a golf course or something. Oh yes, he finally got it straight.

•

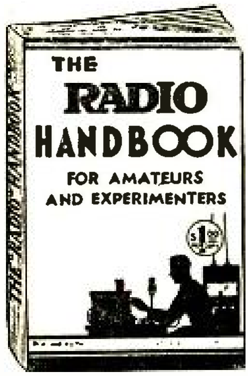
Tell the W9's to look for me, as I sure lost out during the test. In answer to inquiries as to when QD is on the air: Spasmodically throughout the week between 8:30 and midnight, P.s.t., the frequency 14,396 kc., I hope!

Flash: Just as we go to press we receive a letter from Tommy "Dark Horse" Thomas, W2UK, to the effect that he rolled up 128,898 points. Four bands were used and 72 different countries worked with the same rig he used last year.

◆

Interference Elimination Booklet

A condensed summary of the subject of eliminating man-made interference in domestic and auto radio installations is contained in a handy little booklet just released by Continental Carbon Inc., of Cleveland, Ohio. Each form of interference is discussed briefly and methods of attacking it are disclosed. The booklet is of vest pocket size, 24 pages, and well illustrated. It may be obtained from Continental Carbon distributors or direct from the factory, 13900 Lorain Ave., Cleveland, Ohio. Price 10c, postpaid.



The "Radio Handbook"

1936 EDITION

For Only 50c!

We have on hand an oversupply of the **1936** "Radio Handbook". There is no need to tell you about this greatest of handbooks on high frequency radio. 360 pages, profusely illustrated, paper bound.

Begins where others leave off.

While they last

50c In **continental** U. S. A. express collect. (Averages 10c) (C.O.D. averages 28c)

By mail, prepaid, anywhere 75c or 3/2
(Canadial postal notes and British postal orders accepted.)

RADIO, Ltd.

7460 Beverly Boulevard — Los Angeles, California

We Invite You to try **Mid-West Service**

YES—the LARGEST EXCLUSIVE amateur supply house in the WORLD INVITES YOU to try its many features and departments. OUR catalog is the "HAM" guide to quality products at FAIR prices. OUR advisory staff headed by W9ETP will be glad to solve your many technical problems. YOUR special needs will be given immediate attention. WE will gladly quote you on ANY items or apparatus.
FOR your convenience we list below a few of the many "HOT ITEMS" which we now have ready for quick delivery. WHY DELAY?—Order TODAY either prepaid or C.O.D.

● ● ● ●

1. **National NC101X** . . . "hot on 10 meters" . . . Complete .... **net $129.00**
2. **Hallicrafters' Sky Challenger** . . . "best value in the country" . . . terms **$13.50** down and $5.00 per month or........ **net $69.50**
3. **CRM Cathode Ray Oscilloscope** . . . "low cost modulation monitor using RCA 913 tube" . . . without tubes........ **net $11.10**
4. **Raytheon 6L6G** with isolantite base . . . "low loss on high frequencies"........ **net $1.91**
5. **RCA Aerodynamic Microphone** . . . "streamlined for the ham"........ **net $15.90**

LIMITED space prevents the showing of our UNLIMITED STOCK—If you do not see what you want or WANT what you see—WRITE in and ASK FOR IT.

6. **Cornell-Dubilier Capacitors** Dykanol impregnated and filled "neat, compact, dependable for high voltage."

	Cap. Mfd.	Wrk. Volts	Cat. No.	**Net Price**
A.	2	600	TL-6020	**$1.32**
B.	4	600	TL-6040	**1.76**
C.	1	1000	TL-10010	**1.32**
D.	2	1000	TL-10020	**1.62**
E.	1	1500	TL-15010	**2.06**

7. **Thordarson's Multi-Match Modulation Transformers**—"will match any tubes to R.F. load."

	Type	Cap. Watts	**Net Price**
A.	T11M74	40	**$ 4.70**
B.	T11M75	75	**7.35**
C.	T11M76	125	**11.47**
D.	T11M77	300	**17.64**
E.	T11M78	500	**35.28**

A NEW KIND of CATALOG

WRITE FOR YOUR COPY TODAY!

MIDWEST RADIO MART
520 South State Street,
Chicago, Illinois
Dept. R67 — **RUSH ORDER**

☐ Please send me your 1937 "Red Book".
☐ Find enclosed $........ for item number........ or
☐ Send C.O.D. immediately item ....
Name........ Call ....
Address........
City........ State........

BUYER'S GUIDE

Where to Buy It

PARTS REQUIRED FOR BUILDING EQUIPMENT SHOWN IN THIS ISSUE

The parts listed are the components of the models built by the author or by "Radio's" Laboratory staff. Other parts of equal merit and equivalent electrical characteristics usually may be substituted without materially affecting the performance of the unit.

●

Jones 56 Mc. Superhet

IFT—Miller types 212X-2, 212X-2, and 212X-4
T—Peerless no. 406
CH—Inca type D-1
Tuning condensers—National type UM-15 (revamped)
C_{11}—Aerovox type GM-5

●

The DeLuxe Bi-Push Exciter

Coil forms — National XR-20-5
Isolantite Base 6L6-G's—Raytheon
All sockets — Amphenol isolantite
Meter—Hoyt type 573, 0-300 ma.
RFC—National R-100
C_2 C_6—Hammarlund MCD-100-S
C_{12}— Hammarlund MC-50-S
T_1—UTC type LM-4
T_2—Inca type B-15
CH—Inca type D-42

INDEX OF ADVERTISERS

The Marketplace

(a) Commercial rate: 10c per word, cash with order; minimum, $1.00. Capitals: 13c per word. For consecutive advertising, 15% discount for 3d, 4th, and 5th insertions; 25%, thereafter. Break in continuity restores full rate. Copy may be changed often as desired.

(b) Non-commercial rate: 5c per word, cash with order; minimum, 50c. Available only to licensed amateurs not trading for profit; our judgment as to character of advertisement must be accepted as final.

(c) Closing date (for classified forms only): 25th of month; e.g., forms for March issue, published in February, close January 25th.

(d) No display permitted except capitals.

(e) Used, reclaimed, defective, surplus, and like material must be so described.

(f) Ads not relating to radio or radiomen are acceptable but will be grouped separately.

(g) No commissions nor further discounts allowed. No proofs, free copies, nor reprints sent.

(h) Send all Marketplace ads direct to Los Angeles accompanied by remittance in full payable to the order of Radio, Ltd.

(i) We reserve the right to reject part or all of any ad without assigning reasons therefor. Rates and conditions are subject to change without notice.

BETTER QSL's—SWL's! Samples! FRITZ, 203 Mason Avenue, Joliet, Illinois.

FOR SALE: RCA ACR-136, $35.00. Practically new. W6FZL, 6115 Eileen, Los Angeles.

OVER $200 has been paid for articles from contributors not on our staff in each of several recent issues of RADIO. For full details on writing articles, send 3c stamp for reprint.

QSL's. 300 one-color cards, $1.00 SAMPLES. 2143 Indiana Avenue, Columbus, Ohio.

BRETING 14 for sale. Complete with speaker. 3 months old. Perfect condition. $80.00. Guy H. Dennis, W6NNR, 1195 Crenshaw Blvd., Los Angeles.

USED Western Electric Amplifiers and Equipment: 8 a, $25; 8 B, $35; 17 B, $35; Volume Indicators, $20; 10A, $35; Rectifier panels, 1B, $59; 6000A, $75; 514A Meter Panels, $17.50; 57AF Condensers, 2 Mfd., 59c; 95D, 1 Mfd., 75c. Assorted transformers, chokes, resistances, condensers, and Weston meters. List available. Hass Radio, 26 Willoughby Street, Brooklyn, N.Y.

ATTENTION—Selling out. Receivers, transmitters, large assortment. Make offer. W2DBF.

MOVING—must sacrifice RK20, 802, 204, tubes, condensers, coils, transformers. W6BEJ McCullough, 3817 Girard, Culver City, Calif.

CONSULT us with your shield can, cabinet, and rack problems. We have built hundreds of them. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

PLATE transformers, 2½ kw. Hilet, 160 lb. Any voltages. Two-year guarantee. $39.00. Send for circular. For heavy duty chokes see January RADIO. Leitch, Park Drive, West Orange, N. J.

SELL: Brand new Hallicrafter Sky Chief. Best offer gets. William Martin, 13 Prince Street, Marblehead, Mass.

FOR SALE: RCA 40-C Amplifier, like new. G.R. Oscilloscope. W.E. carbon microphone, announce stand. New and used WE 5 kw. water-cooled tubes. Direct inquiries to Box No. 10, RADIO, 7460 Beverly Blvd., Los Angeles.

CRYSTALS: . . . . For limited time only, 80 and 160 meter crystals mounted in new type shielded dustproof holder, $1.25. Highest quality and fully guaranteed. Stock up now. WHITE RADIO LABORATORY, SANDPOINT, IDAHO.

"T9" CRYSTALS: Eidson's high activity, fracture resisting 40 and 80 meters only, $1.60 postpaid. Powerful—dependable X-cut, fully guaranteed. Close frequency always supplied. Unsolicited testimonials and repeat orders tell the real story—they're unbeatable! "T9" superlapped ceramic plugin holders, $1.10 postpaid. COD orders accepted. Commercial crystal users inquire prices. "Eidson's", Temple, Texas.

PEAK Pre-Selector—first $10 takes it. W6NHL, 210 - 22nd Street, Santa Monica, Calif.

STEEL shield cans, chassis, panels, racks, cabinets. Send sketch for estimate on your layout. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

THOUSANDS of crystals for the 160 and 80 meter bands, 75c each postpaid, FABERADIO, Sandwich, Illinois.

COPY 20 w.p.m.? 450 jobs open soon. 60c to 70c per hour. Twelve months yearly. Full information, $1.00. Money-back guarantee. TELEGRAPHERS' SERVICE BUREAU, 6703 Dunham Ave., Cleveland, Ohio.

SPECIAL 866B's—$3.75. 866's—$1.65. Guaranteed six months. F. B. Condenser mike heads $10.00. 100 watt Universal Class "B" transformers $8.00 pair. Langrick Radio Engineering Service. W6PT. 626 Maltman Ave., Los Angeles, Calif.

WRITE us for trade-in price on your old receiver. We buy meters. Walter Ashe Radio Co., St. Louis, Mo.

THERMOCOUPLE ammeters repaired, $2.50, W9GIN, 412 Argyle Bldg., Kansas City, Mo.

WRITE us for trade-in price on your old receiver. We buy meters. Walter Ashe Radio Co., St. Louis, Mo.

AMATEUR Radio, Commercial Radiotelephone and Radiotelegraph licenses, complete training. Resident and correspondence courses. Every graduate a licensed operator. N. Y. Wireless School, 1123 Broadway, New York.

SELLING out—Write for List—W2HTP.

QSL's. 300 one-color cards, $1.00. Samples. 2143 Indiana Avenue, Columbus, Ohio.

QSL's—Introductory offer continued. Highest quality, lowest prices. Radio Headquarters, Ft. Wayne, Indiana.

OUR 75c crystals for 160 and 80 meters are fine. Letters of praise arrive daily. Faberadio, Sandwich, Illinois.

METER REPAIR SERVICE. Complete repair and replacement service on all types of meters. Reasonable prices. Braden Engineering Co., 305 Park Dr., Dayton, Ohio.

BAKED CRACKLE FINISHED TEMPERED MASONITE PANELS. State sizes and thickness for estimate. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

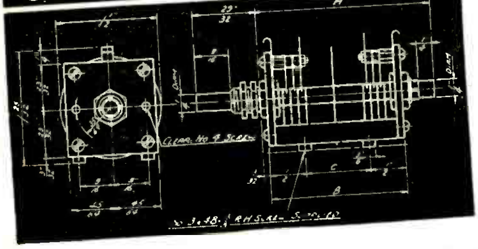
---

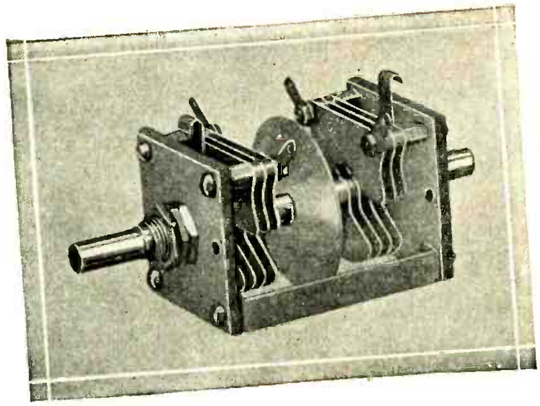
ex-W6FEW, W. E. McNatt Jr., now W7GEZ, Lewiston, Idaho.

METER REPAIR SERVICE. Complete repair and replacement service on all types of meters. Reasonable prices. Braden Engineering Co., 305 Park Dr., Dayton, Ohio.

New

CARDWELL DUAL TRIM-AIR LINE OF DOUBLE MIDGET CONDENSERS





- Isolantite insulation.
- Double end plates.
- Sturdy heavy duty double bearings.
- Solid nickel plated brass shafts.
- New "TYANGLE" tie rods for maximum frame strength, yet simple construction.
- 1/4 inch shaft extended at rear for ganging to other units.
- Four convenient mounting methods:
  - A. Single hole.
  - B. Tapped holes in "Tyangle" rods.
  - C. Regular Trim-air mounting brackets.
  - D. Regular Trim-air mounting posts.
- Plenty of space between sections with shield optional.
- Five compact balancing types, similar except single bearing only.
- All types have exclusive Trim-air cup type blue steel "take up" washers, insuring one hundred percent permanent shoulder bearing tension.
- Light weight and small size makes these units ideal for portable gear.

NEW DUAL TRIM-AIR MIDGETS

Type	"A" Dim. (Depth Behind Panel)	"B" Dim.	"C" Dim.	Airgap ins.	List Price
ER-10-AD	2 11/16"	2 3/32"	1 3/32"	.030"	$2.60
ER-15-AD	2 11/16"	2 3/32"	1 3/32"	.030"	2.60
ER-25-AD	2 11/16"	2 3/32"	1 3/32"	.030"	2.70
ER-35-AD	3 17/32"	2 15/16"	1 15/16"	.030"	2.90
ER-50-AD	3 17/32"	2 15/16"	1 15/16"	.030"	3.10
EU-75-AD	3 17/32"	2 15/16"	1 15/16"	.020"	3.30
EU-100-AD	3 17/32"	2 15/16"	1 15/16"	.020"	3.40
EU-140-AD	4 3/16"	3 19/32"	2 19/32"	.020"	6.00
ET-30-AD	5"	4 3/8"	3 3/8"	.070"	3.60
ET-30-AD (with insulated coupling)	5 9/16"	4 3/8"	3 3/8"	.070"	4.10
ES- 4-SS	3 17/32"	2 15/16"	1 15/16"	.140"	3.60
ES- 4-SS (with insulated coupling)	4 3/32"	2 15/16"	1 15/16"	.140"	4.10

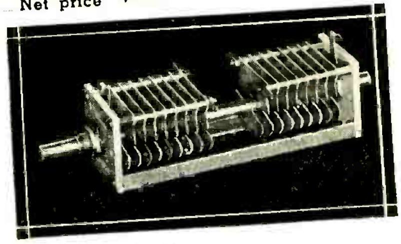
New Balancing Type Trim-Air Midgets

ER-25-AB	1 1/32"	....	....	.030"	1.90
ER-50-AB	1 5/16"	....	....	.030"	2.30
EU-75-AB	1 5/16"	....	....	.020"	2.50
EU-100-AB	1 13/32"	....	....	.020"	2.60
EU-140-AB	1 7/8"	....	....	.020"	5.30

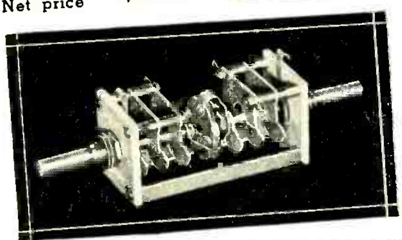
See this new line at all CARDWELL distributors and get free bulletin.

40% DISCOUNT on LIST PRICES SHOWN.
Prices subject to change without notice.

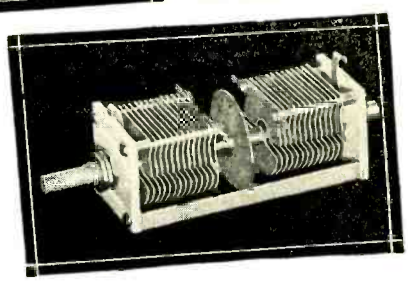
ER-25-AD For push pull 5 and 10 meter buffer amplifiers, phasing controls on S.S. supers, and for portable gear of any type. Cap. 25-25 Mmfds. 1000 volts .... Net price **$1.62**



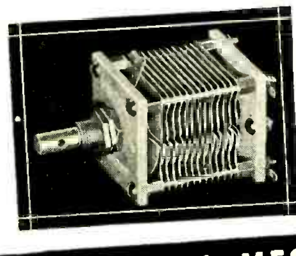
ET-30-AD
A fine unit for ultra high frequency final amplifiers, filling your insistent demand. Cap. 30-30 Mmfds. 2500 volts. Net price **$2.16**



ES-4-SS
Used as shown, with Isolantite coupling, as single control neutralizer for push pull 35-T's etc. Available also with solid shaft. Net price **$2.46**



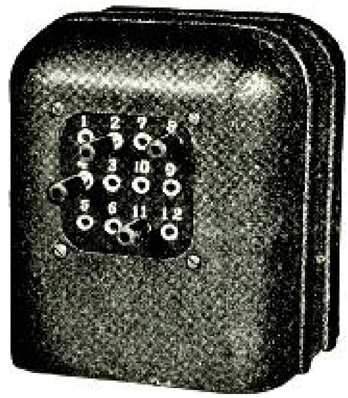
EU-140-AD
For receivers of high "C" P.P. low voltage tank circuits. Cap. 140-140 Mmfds. Net price **$3.60**

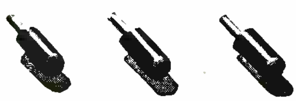


EU-140-AB Illustrates one of five sizes of new balancing capacitors. Very useful in bridge work. Max. Cap. either side, 140 Mmfds. .... Net price **$3.18**

THE ALLEN D. CARDWELL MFG. CORP.
83 PROSPECT STREET • BROOKLYN, NEW YORK

Multi-Match

MODULATION  TRANSFORMERS




BY

THORDARSON

WITH THE NEW FEATURE "PLUG-IN-TERMINAL BOARD"

The only Modulation Transformer built with "Plug-in-Jack Terminal Board." Match any tube to any load instantly with simple plug and jack connection. A sensational departure from soldered terminals and connecting posts. New graceful space saving streamline case design. Absolute moisture and humidity proof construction throughout. Will safely withstand tropical climates.

COMPARE THESE FEATURES

1. "Plug in Jack Terminals" for input and output.
2. Complete variable matching.
3. New modernistic case design.
4. Moisture proofed.
5. Minimum space factor permits easy chassis mounting.
6. Completely compound filled.
7. Double varnished and baked.
8. Moderate price.

FURNISHED IN FIVE SIZES AS FOLLOWS

	Connected Series	Connected Parallel
T-11M74 For up to 40 watts		
Max. Pri. M.A.D.C. per side...	100	...
Max. Sec. M.A.D.C...........	80	160
T-11M75 For up to 75 watts		
Max. Pri. M.A.D.C. per side...	145	...
Max. Sec. M.A.D.C...........	145	290
T-11M76 For up to 125 watts		
Max. Pri. M.A.D.C. per side...	210	...
Max. Sec. M.A.D.C...........	160	320
T-11M77 For up to 300 watts		
Max. Pri. M.A.D.C. per side...	250	...
Max. Sec. M.A.D.C...........	250	500
T-11M78 For up to 500 watts		
Max. Pri. M.A.D.C. per side...	320	...
Max. Sec. M.A.D.C...........	320	640

FREE Write Dept. R75 today for Bulletin SD-275 or see your parts distributor. **FREE**

THORDARSON ELECTRIC MFG. CO.
500 W. HURON ST., CHICAGO, ILL.
Demand "Power by Thordarson"