RADIO

ESTABLISHED 1917

November, 1936 — 30c in U.S.A. and Canada — No. 213

1/8 in the United Kingdom; 2/- in Australasia

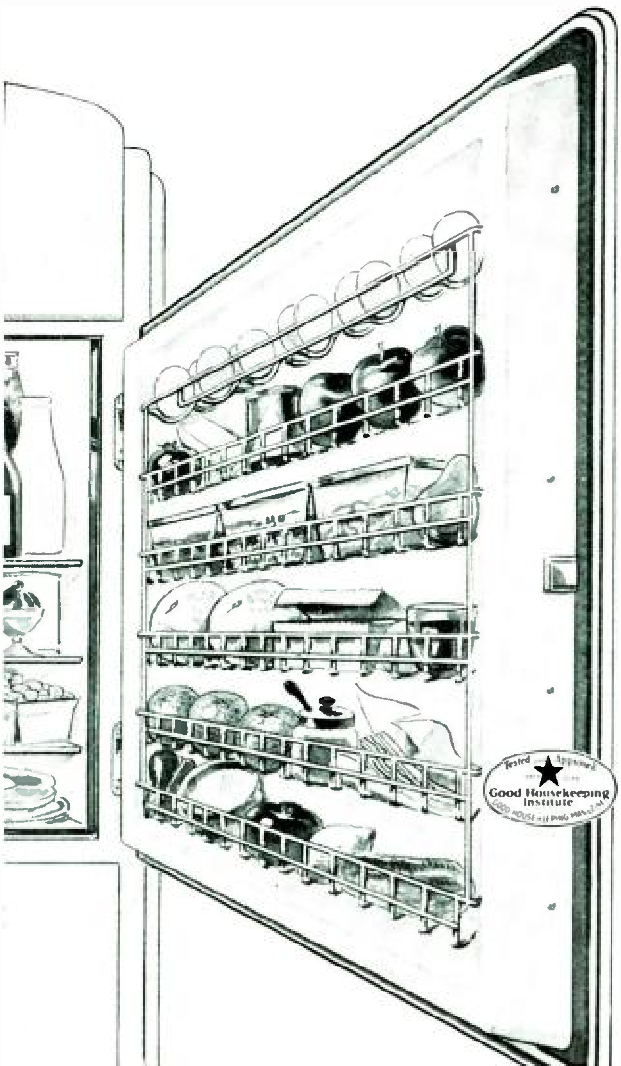
THE WORLDWIDE TECHNICAL AUTHORITY • OF AMATEUR • SHORT WAVE AND EXPERIMENTAL RADIO •

This Month

www.americanradiohistory.com

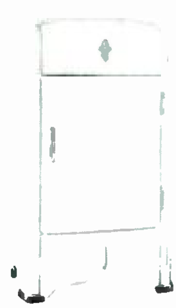
The Open door

TO GREATER SALES VOLUME *is the* CROSLEY SHELVADOR



The nation's housewives are stampeding to the Shelvador . . . Crosley Dealers everywhere are reporting new "highs" in sales volume . . . wide-awake dealers are clamoring for the Crosley franchise — what's causing all this excitement? Is it the advanced Shelvador features or Crosley's dominant position in electrical refrigeration? It's both of these PLUS . . .

this much more in a **SHELVADOR**



THE WORLD'S MOST BEAUTIFUL REFRIGERATOR

DEALERS: Line up with the Crosley Line and Profit! The Crosley Shelvador is priced for quick sales action—from $99.50 to $241.95, including delivery, installation and FIVE-YEAR PROTECTION PLAN.

(All prices slightly higher in Florida, Texas, Rocky Mountain States and west.)

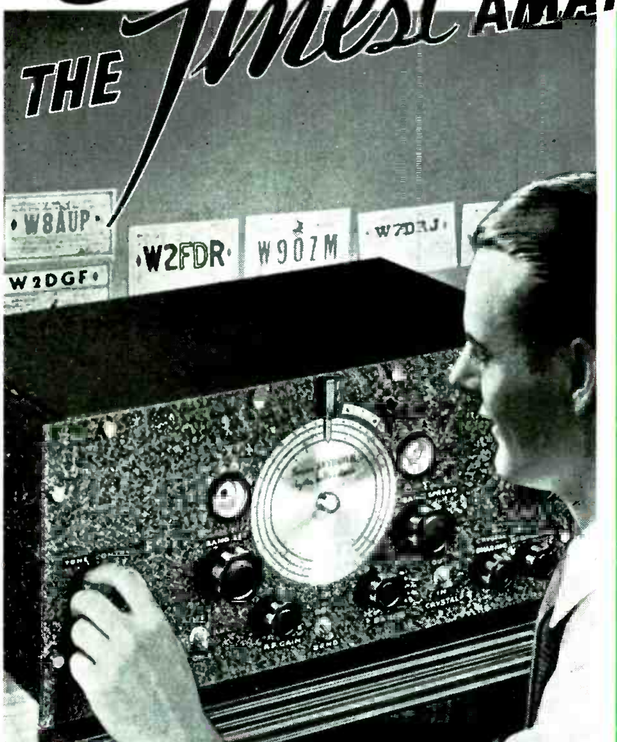
THE CROSLEY RADIO CORPORATION • CINCINNATI

POWEL CROSLEY, Jr., *President*

www.americanradiohistory.com

NEW 1937 hallicrafter SUPER SKYRIDER

THE *Finest* AMATEUR RECEIVER BUILT *at any Price!*



THE NEW 1937 11-tube Super Skyrider is outstanding! There are many exclusive new features of engineering — design — construction, not to be found on any other communication receivers.

No charts or graphs are needed to read the new Super Skyrider Dial — station frequencies at a glance! That is only one feature of this most conveniently operated set. Higher sensitivity—new and improved phone reception — and 30 other features. And, best of all, you can buy it on TIME PAYMENTS from your radio jobber.

There Are Many Other New Hallicrafters Communication Receivers to Choose From!

THE SKY BUDDY—A real 5-tube Hallicrafters engineered communication receiver at an astonishingly low price. **THE SKY CHIEF**—This new 7-tube superheterodyne is designed with all the latest features usually found only on much higher priced sets. **THE ULTRA SKYRIDER**—The receiver for the Ultra-High Frequency operator. **THE SKYRIDER COMMERCIAL**—An 11-tube superheterodyne especially fitted for commercial service.

HERE ARE A FEW OF THE MANY NEW 1937 SUPER SKYRIDER FEATURES:

- 11 Tubes, 10 of them metal.
- 40 M.C. to 535 K.C. in 5 bands.
- 338 Degrees main tuning dial.
- Electro-Mechanical Band Spread.
- 14 Watts Undistorted Output.
- Direct Calibration Tuning—No Charts or Tables.
- Field Strength Indicator.
- Improved 10 meter performance.
- Single Signal Crystal Action.
- 465 K.C. Iron Core I.F. for improved selectivity.
- Ceramic Insulation.

the hallicrafters inc.

Laboratories and Communications Division

2609 Indiana Ave. Chicago, U. S. A.

NOW YOU CAN BUY ANY NEW 1937 HALLICRAFTERS COMMUNICATION RECEIVER ON *TIME PAYMENTS* FROM YOUR LOCAL RADIO JOBBER

RADIO, November, 1936, no. 213. 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.

www.americanradiohistory.com

Phone: WHitney 9615
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	**$3.50**	**$6.00**

**In California, add 3% sales tax*

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

†FREQUENCY

Published monthly under date as of the following month; ten issues yearly including special annual number; the August and September issues (which would normally appear in July and August) are omitted. Short-term subscriptions are accepted pro-rata, but no special numbers will be included. 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 are acceptable. 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.)

◆

Advertising

For advertising rates, consult our nearest office. For classified advertising, see *Marketplace* in any issue.

◆

PRINCIPAL FOREIGN AGENTS

Canada: J. A. Holmes, 615 W. Hastings St., Vancouver.
Europe: N. E. Read, 37, Willow Street, Oswestry, Shropshire, England.
Australasia: "The Bulletin," Box 2521BB, Sydney.
McGills, 183 Elizabeth St., Melbourne.
Swain & Co., Ltd., Pitts St., Sydney.
Te Aro, 94 Courtenay Place, Wellington.
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
Engineering Editors
ROBERT S. KRUSE,[1] W1FG
J. N. A. HAWKINS, W6AAR
Associate Editors
K. V. R. LANSINGH, W6QX
B. A. ONTIVEROS, W6FFF
Assistant Editors
HERBERT BECKER, W6QD
GEORGE D. WALKER,[2] W4CTO
E. H. CONKLIN,[4] W9FM
CHARLES A. HILL, W6BRO
RUFUS P. TURNER,[3] W1AY
Technical Consultants
RALPH O. GORDON, W6CLH
JAMES M. SHARP, JR., W6DMY
CHARLES D. PERRINE, JR., W6CUH
Laboratorians
RAYMOND DAWLEY, W6DHG
FAUST GONSETT, W6VR
Laboratory Assistants
MARTIN A. BROWN, W6ABF
JACK HARWOOD, W6DJZ
Technical Draftsmen
M. S. DAVIS
WILLIAM ROBERTS, W3BOI
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
Eastern General Manager
V. R. LANSINGH
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[2]; 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.

◆

Copyright, 1936. All rights reserved.
Reproduction without permission is forbidden; permission is usually granted amateur radio papers on request.

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

[1]Box 115, Guilford, Connecticut.
[2]Box 355, Winston-Salem, North Carolina.
[3]159 W. Springfield Street, Boston, Massachusetts.
[4]512 N. Main St., Wheaton, Illinois.

www.americanradiohistory.com

SAVE $2.40

Buying individual copies of "Radio"
for two years costs you:

18 issues* at 30c =	$5.40
2 issues* at 50c =	1.00
Total	$6.40
A 2-year subscription costs	$4.00
You save (in U.S.A. or Canada)	$2.40

(For foreign rates, see opposite page)

*RADIO *is published ten times annually including special enlarged annual number.*

www.americanradiohistory.com

SAVE MONEY WITH THIS NEW 1937 RADIO CATALOG

THOUSANDS of Hams "shop in their slippers". It's easier on the feet and temper. It saves Money—it saves TIME. Send for this Big Radio Catalog and see for yourself what great savings are possible. You'll be amazed at the completeness of the "Ham" section—the low prices quoted on everything you need in radio. S. W. receivers—matched kits, transmitters, tubes, tools, parts, testing equipment.

WORLD'S LARGEST DISTRIBUTOR

Only the overwhelming purchasing power of the world's largest distributor of radio parts makes possible the tremendous values shown in the new 1937 catalog. On its more than 150 pages you'll find over 50,000 radio items listed. Everything that is NEW in radio is here first.

AT YOUR SERVICE

The largest Ham staff is always at your service. Twenty-five licensed radio amateurs to help you solve your problems—to give you the understanding coopera-tion which only a fellow Ham can give.

HOOT MON! 'TIS SMARRT TO BE THR-RIFTY! SEND FOR THIS BRAW-BONNY BOOK-'TWILL SAVE YE MONEY

EVERYTHING YOU NEED IN RADIO

SWIFT DELIVERY

Five strategically located branches and a modern teletype system are your assurance of TWENTY-FOUR HOUR shipments. You get the finest quality radio products WHEN you want them — no matter where you may be situated. Avail yourself of this Super-Service.

10 THOUSAND BARGAINS

Within this catalog you will find more bargains than you ever heard of. Bargains in all brands of parts—bargains in every type of test equipment—bargains in every type of tube, transmitting and receiving—bargains in tools—bargains in all "Ham" equipment. And REMEMBER—no product is listed in the Blue Ribbon Catalog until it has passed the exacting standards laid down by our laboratories.

That Is YOUR ASSURANCE of Quality

SEND IN THIS COUPON NOW

Wholesale Radio Service Co., Inc.
901 W. Jackson Blvd., Chicago, Ill.
Please RUSH your FREE Blue Ribbon Catalog 65-M6.

NAME ....

STREET ....

CITY .... STATE ....

WHOLESALE RADIO SERVICE CO. INC.

CHICAGO, ILL. 901 W. JACKSON BLVD. • NEW YORK, N.Y. 100 SIXTH AVENUE • ATLANTA, GA. 430 W. PEACHTREE ST. N.W.
BRONX, N.Y. 542 E. FORDHAM RD. • NEWARK, N.J. 219 CENTRAL AVE.

www.americanradiohistory.com

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. 213 November, 1936

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.

www.americanradiohistory.com

Taylor HEAVY CUSTOM BUILT DUTY Tubes

MORE WATTS PER DOLLAR in Audio-FREQUENCY TUBES as well as in R.F.

756

100 Watts Audio Output
(Per Pair)
in Class "B"

$4.95 Ea.

T-55

250 Watts Audio Output
(Per Pair)
in Class "B"

$8.00 Ea.

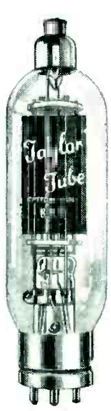
Class "B" Audio Characteristics
Push Pull Operation

Filament, Volts	7.5
Filament Current, amps	2
D.C. Plate Voltage, volts	850
Mutual Conductance, umhos	1600
Amplification Factor	25
Grid. Voltage, appr. volts	30
Load Resistance (Plt. to plt.) ohms	6750
Av. D.C. Plate Current (2 tubes), mils	225
Static Plate Current (per tube), mils	10
Power Output (2 tubes), watts	100

Thordarson, Jefferson, United and other leading transformer manufacturers have new Class "B" units available for these Taylor Tubes.

Class "B" Audio Characteristics
Push Pull Operation

Fil. Voltage	7.5
Fil. Current, amps	2.0
Mutual Conductance, umhos	2200
Amp. Factor	20
AT 1000 VOLTS	
Grid. Voltage, appr.	45
Load Resistance (Plt. to Plt.) ohms	10000
Av. D.C. Plate Current (2 tubes), mils	300
Static Plate Current (per tube) mils. appr.	20
Power Output (2 tubes)	175 watts
AT 1250 VOLTS	
Grid. Voltage, appr.	67.5
Load Resistance, (Plt. to Plt.) ohms	12000
Av. D.C. Plate Current (2 tubes) mils	250
Static plate current (per tube) mils, appr.	25
Power Output (2 tubes)	250 watts



822

500 Watts Audio Output
(Per Pair)
in Class "B"

$18.50 Ea.

CLASS "B" AUDIO CHARACTERISTICS
Push Pull Operation

Filament, volts	10
Filament Current, amps	4
Mutual Conductance, umhos	5400
Amplification Factor	27
D.C. Plate Voltage, volts	2000
Grid. Voltage, appr. volts	–90
Load Resistance (plt. to plt.), ohms	9000
Av. D.C. Plate Current (2 tubes), mils	450
Static Plate Current (per tube), mils	25
Power Output, (2 Tubes), watts	500

BUY TAYLOR TUBES and SPEND the SAVINGS on Other Parts!

All Leading Radio Parts Distributors Recommend Taylor Tubes

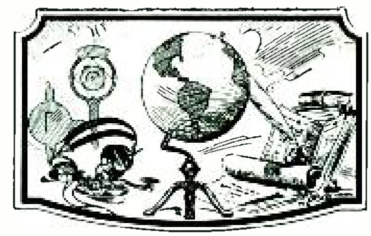
Get your copy of the New Taylor Tubes Combined Catalog and Handbook No. RM from your favorite Distributor or write to us . . . *FREE*

TAYLOR TUBES, INC.

2341-B WABANSIA AVE. CHICAGO, ILLINOIS

www.americanradiohistory.com

R/9 with the EDITORS



Directors or Representatives?

It will be encouraging for those interested in democracy in the affairs of amateur radio to note that no recent pronouncement of the Secretary-General Manager of the League has provoked a wider criticism, even among those who usually support him, than his recent statement that Directors were in no wise obligated to voice the wishes of their constituents, but are solely expected to exercise their own best judgment in casting their votes.

In conversation he is said to have compared the League "with best corporate practice". It would seem self-evident even to the youngest League member that there is a wide gulf in character between a corporation whose sole object is to make money and one such as the League, the primary object of which is *not* the making of profits but the protection of amateur radio from further encroachments and the regaining of lost ground—though this primary object has been treated at times in a very secondary manner by the current League administration.

It is the duty of the Board of Directors of the League to reflect to the best of its ability the wishes of the membership; to this proposition nearly all those who have been raised in a democracy will agree, despite the contrary statements from our leading oracle.

Let the Directors direct the League officials, not their constituents. It might also be a good idea to call them *representatives* as more nearly indicative of their true function.

In practice it is sometimes difficult to determine the wishes of the membership; in such instances, the directors must of course use their own best judgment. Fortunately a number of directors have taken more than a perfunctory interest in their duties and have made real efforts to discover what their constituents are thinking. Divisional conventions are likely to represent a pretty fair cross section of the membership of the division. The managers of many of these conventions have arranged and conducted open forums for the express purpose of giving the divisional director an insight into the members' opinions. Some open forums have been called expressly for the purpose of "instructing" the director; some directors have honored the instructions even when contrary to their own opinions; others have pointedly ignored them.

At the recent Central Division Convention a platform committee was appointed which drew up a set of resolutions for presentation to the open forum session of the convention. A new height in the administration's practice of stifling all criticism was reached when Director Roberts, as chairman of the meeting, refused flatly to recognize the committees' spokesman or even to allow the platform to be presented. Even the administration's staunchest supporters could not stomach such a denial of the right of free speech, and the comment from the floor became caustic to the point of downright insult, followed by a nearly unanimous demand for a new chairman. Finally Mr. Bailey was appointed and Mr. Roberts forced to take a back seat.

Though he has been a staunch administration supporter and it was generally anticipated that hte resolutions to be offered would be anti-administration in character, Mr. Bailey is to be commended upon conducting the remainder of the forum in an orderly and impartial manner.

Central's Resolutions

The resolutions presented by a platform committee to the open forum of the recent Central Division Convention were passed by large votes.

They first recommended that the Central Division be split, Illinois and Wisconsin to form a new division. This brings to mind a suggestion made some time ago by one of the editors of the former *R/9*: that the territory includes in the various divisions should be so divided that the Director could contact in person the greatest numbers of his constituents and thus be able most accurately to reflect their opinions, and that the inequalities in the numbers of members represented by the various Directors be in part compensated for by requiring that every action of the Board of Directors, to be effective, must be approved both by a majority of the Directors present *and* by Directors representing a majority of the membership.

It was resolved that A.R.R.L. headquarters be moved to Chicago. While heartily approving removal of League headquarters to the central portion of the country, it appears to us that some smaller town might be more suitable for the League's employees, less expensive

[*Continued on Page 86*]

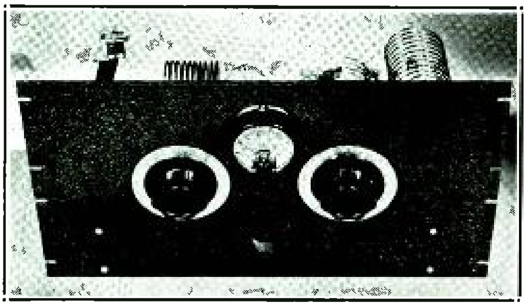
www.americanradiohistory.com

The New 154 in a 200 Watt Amplifier

By Ray Dawley, W6DHG

For years amateurs waited patiently for a "half-pint" 211 or 203-A. It finally came, and then another long wait for a "low C" version of the same. But recently new tubes of this group have been released so fast and furiously that we find it difficult to keep up with them and describe them all in detail. One of the more unusual ones is the new HK-154. It has quite a low μ and unique construction.

Heintz and Kaufman, Ltd. have just favored us with a new addition to the ever increasing transmitting tube list. This one, however, seems to have something apart from the rest of the group. The first thing to strike the eye is the unusually low amplification factor for a tube of this type (6.5). On closer examination it will be immediately noticed that the low μ is just one



Front View of the HK-154 Amplifier

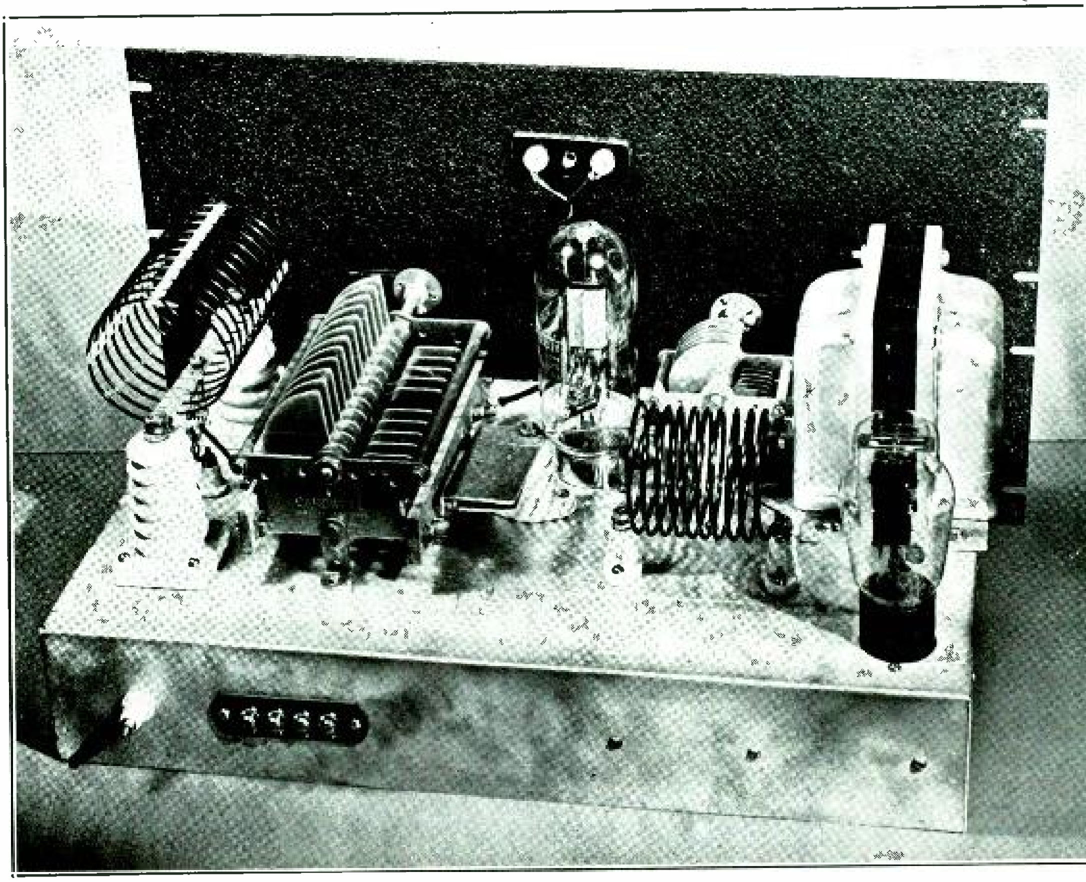
of a number of unusual features to be found in the new tube. The filament power is very high for such a low plate dissipation. This would be almost mandatory if a spiral or other cylindrical filament were used. The Gammatron 154, however, has a modified M-type of emitter, having no space charge zone down through the center to waste valuable emission. This fact, coupled with the low plate impedance, close element spacing, and high mutual conductance, makes a really low-voltage, medium power tube that is easy to excite. Low interelectrode capacities, tantalum plate, and extremely short grid and plate leads promise unusually good ultra-high frequency operation. These elements are each supported by a very heavy single-lead wire. These wires are fused directly into opposite sides of the glass envelope and thereby serve as the connections to the elements.

In designing a stage around this tube especial consideration should most certainly be given to these unusual features. Extremely short connecting leads from the neutralizing condenser to the grid and from the tank to the plate should be used, inasmuch as the manufacturer has taken such care to make the internal tube leads themselves short and direct. The tube requires unusually high bias. For example: at 1500 plate volts, 2½ times cutoff (class C bias) would be about 675 volts. However, as the grid current required is quite small, (25 ma. seems perfectly adequate) the excitation power needed is still quite small. Also, as the grid impedance of the tube is very high, especial attention should be given to the grid tank. A quite low C one is best, one that will develop as high an r.f. voltage as possible with a given amount of driving power.

It is almost necessary to use some form of fixed minimum bias voltage to limit the plate current in case the excitation fails. Without some sort of safeguard the low R_p would allow such a high value of plate current to flow as to almost surely endanger the tube. Some sort of bias power supply is most economical and as the normal grid current of the tube is small the regulation requirements are much less stringent than usual. A bleeder current of 50 to 80 ma. on a b.c.l. power transformer supply is adequate. With as many of these thoughts in mind as possible, along with a few other ideas, a design was evolved for a 154 amplifier stage.

First, the stage is rack mounting. Present day practice in transmitter design almost demands this. The unit is built up on a standard 10" by 17" by 3" metal subpanel, with a "6 panel" unit steel panel (10½" x 19" x ⅛"). On this one subpanel is built the complete stage with the exception of the plate power supply. That is, the tube with its associated grid and plate circuits, the bias supply, grid and plate metering circuits, and the filament supply for the 154 are all integral with the unit. All the power is obtained from one heavy duty power transformer. It is rated at 425 volts each side of c.t. at 200 ma. and has two 2½ volt filament windings, one at 14 amp. and one at 7 amp, besides the usual 5 volt rectifier

www.americanradiohistory.com

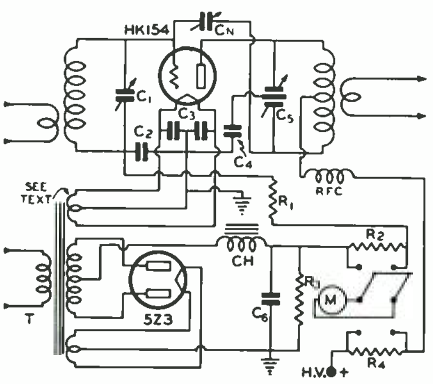


The HK-154 10-160 Meter 200 Watt Amplifier Unit, Back View

winding. These two heavy 2½ volt windings are connected in series (with careful attention to the polarity) to produce one 5 volt winding, and the junction of the two is grounded as a center tap. Inasmuch as both windings have a rating in excess of the required 6.5 amperes, this connection is perfectly feasible. Actually, the measured voltage under load is 5.15 volts, which is just about right. This transformer cost but little more than a suitable 5 volt filament transformer. The bias supply filter consists of an input choke and a 16 µfd. condenser with a 4000 ohm bleeder resistor across the output. While this does not appear to be very much filter, it is quite ample, as the stage is primarily designed to be run class "C", a mode of operation more or less insensitive to bias variations when sufficient excitation is used. In addition, only about 325 of the 600-800 volts bias is supplied by the power supply. The rest is developed by the grid current of the tube flowing through the 10,000 ohm grid leak. As this rectified grid current is naturally pure d.c., the percentage of ripple voltage in the bias pack is greatly reduced when expressed as a percentage of the whole bias voltage. Actual tests have proven the above to be true. The hum modulation in the carrier from this or any other source was undetectable to the ear.

The grid tank is made as low C as practicable. Starting out with a coil known to be too large, turns are removed until the tuning condenser will just pass through resonance before the plates are unmeshed to minimum capacity. This procedure should be followed on all bands. The coils for the high frequency bands, 14 mc. up, are wound with no. 10 wire and are self-supporting. Lower frequency coils should be strengthened with strips of celluloid and coil dope to prevent vibration. The plate tank uses a wire wound, celluloid supported coil of standard manufacture designed to tune with about 25 µµfd. The tank circuit leads were all made as short as possible, no lead being longer than

www.americanradiohistory.com



The 154 Amplifier and Integral Bias Supply

C_n—Neutralizing condenser. See text.
C_1—50 μμfd.. 3000 volt spacing
C_2—.01 μfd. mica. 2500 volts
C_3—.006 μfd. mica. 500 volts
C_4—.002 μfd. mica. 5000 volts
C_5—50 μμfd. per section. 6000 volt spacing
C_6—16 μfd. electrolytic. 450 volts
RFC—2.5 m.h. pie wound transmitting type
R_1—10,000 ohms. 25 watts
R_2—100 ohms. 2 watts
R_3—4000 ohms. 50 watts
R_4—Plate current shunt (see text)
M—0-50 ma. d.c.
T—425 v. each side c.t.. 100 ma.. 5 v. 3 amp. and two 2.5 volt windings that will each carry 6.5 amps

2". The neutralizing condenser leads, however, are really short. There is no lead from the tank to the neutralizing condenser, one plate being mounted directly on the tank condenser. The other plate, mounted on a standoff insulator, has a connection only ¾" long to the grid of the tube. In addition to decreasing lead length, this arrangement saves the cost of a "store-boughten" neutralizing condenser. The plate tank condenser is mounted on small isolantite bushings to insulate it from the chassis in case of flashover. The r.f. return is obtained by a .002 μfd. 5000 volt mica condenser mounted under the chassis. The tank used (a 6000 volt per section, double spaced one) proved ample for high level modulation at 1500 volts. There is no output system shown as the unit was primarily designed for link coupling of the input and output.

Metering of both grid and plate currents is done by one milliammeter. Through the use of a tap switch and separate shunts in each circuit, either grid or plate current indication is instantly available. A 100 ohm resistor is connected across the grid current contacts of the switch and inasmuch as the meter resistance is of the order of one ohm, the error introduced by this resistor's presence is only about one per cent. The shunt across the plate current contacts is of such a value that the 0-50 ma. calibration becomes 0-250 ma. or five times scale. This value is easily determined experimentally by causing 50 ma. to flow through the meter with a battery and an external variable resistor, and then switching the meter across the plate current shunt and adjusting the length of the shunt wire until the meter reads 10 ma. In this particular case it took about 1½" of no. 30 constantin wire. The wire from an old rheostat or open-wound resistor will work equally well. In this way the meter has its normal 50 ma. range on grid current and a 250 ma. range on plate current. The switch is a six-position two-circuit affair and the first and fourth positions are used. The two sets of contacts that lie between these positions are removed to reduce the chance of insulation breakdown. No difficulty need be experienced with this arrangement if proper precautions are taken with regard to insulation and spacing of the parts carrying high voltage.

The amplifier operates equally well on 14 and 28 mc. and no doubt could be made to operate reasonably well on 56 mc. No difficulty at all was experienced in running the full rated input of 175 ma. at 1500 volts with only 20 to 30 ma. of grid current. The plate heating was still not objectionable at 200 ma., or 300 watts input. One thing, however, was noticed, and that is that unusually high bias is required —500 volts being about the minimum for 1500 plate volts if good efficiency is desired. This, of course, is to be expected with a low μ and was explained at the first of the article. The small driving power required makes the unit well suited as an amplifier to increase the power output of a low-powered rig at a minimum of expense. An 801, '10, pair of 802's or 46's, or any other stage capable of delivering 20 to 30 watts of actual r.f. output would furnish adequate excitation.

◆

The following information supplied by the R.C.A. will be of interest to hams in d.c. districts who have found the type 48 receiver tube fb as crystal oscillator, doubler, or class C amplifier with 110 volts on the plate:

Interelectrode Capacitances, Type 48 Tube

Triode Connection (screen tied to plate)

Grid-plate	11 μμfds.
Input	7.6 μμfds.
Output	5 μμfds.

Tetrode Connection

Grid-plate	1.5 μμfds.
Input	17 μμfds.
Output	9.5 μμfds.

www.americanradiohistory.com

An Experimental, Dynamic-Shift Linear Amplifier

By J. N. A. Hawkins, W6AAR and Ray Dawley, W6DHG

The theory of dynamic shift linear amplification as applied to both grid excitation and grid bias modulated radio frequency amplifiers has been discussed in detail in past issues of RADIO*. Briefly, the dynamic shift amplifier is one whose modulation capability is varied, or expanded, at a syllabic rate in order to allow high unmodulated plate efficiency.

Several months of operating experience with a 150 watt phone transmitter using a dynamic shift class B linear amplifier in the final stage has enabled us to identify most of the "bugs", which are apt to occur in tuning and operating this type of amplifier.

One experimental transmitter is shown herewith and the circuit diagram of the complete transmitter is shown in figure 1.

The radio frequency portion of the transmitter uses a 53 as a high μ triode oscillator, crystal controlled, driving an 865 buffer which in turn drives the 801 plate-modulated class C amplifier which is modulated by class A 250's. The modulated output of the 801 class C stage drives the grids of the two 50T's in the 150 watt final amplifier. The bias and plate voltage on the final amplifier stage is varied at a syllabic rate by the control circuit, which utilizes a variactor in the primary side of the power line feeding the plate and bias rectifier transformers.

The speech amplifier used to drive the grids of the 250 modulators was conventional and is not shown.

The audio output of the 250 modulators is fed by capacity coupling to the upper end of the Heising modulation choke (CH_1) in order to minimize d.c. saturation of the modulation transformer.

An extra 15 ohm monitoring winding on the modulation transformer (T_1) is used to feed part of the audio output of the modulators to the control circuit through an isolating transformer consisting of a 200 ohm to push-pull grids audio transformer (T_2).

The audio in the secondary of this transformer goes to the 84 full wave rectifier which rectifies the audio, leaving only the syllabic envelope of the speech waves across the rectifier load resistor R_1. This syllabic current is a pulsating direct current whose a.c. components consist of frequencies below 20 cycles per second. The syllabic voltage across R_1 is used to oppose or buck out the battery bias which normally keeps the 6A3's biased to practically cut-off. Thus the d.c. plate current on the 6A3 control tubes increases as the syllabic voltage across R_1 increases. The plate current of the 6A3's is supplied by a 250 volt power pack and is used to saturate the d.c. winding of the Variactor CH_2. When the core of CH_2 becomes saturated, the a.c. reactance of its a.c. windings becomes quite low and thus the a.c. voltage drop across those windings drops to a low value. This effects a similar rise in the voltage applied to the primaries of the plate and bias transformers T_3 and T_4. Thus the d.c. plate and bias voltages applied to the 50T tubes in the final linear amplifier rises as the syllabic amplitude of the audio modulating signal rises. The resistor R_2 consists of a 600 watt electric heater across part of the a.c. winding of CH_2 and is used to reduce the control range of the Variactor CH_2 as well as to increase the current carrying capacity of that saturable choke. The Variactor was originally designed by the United Transformer Corporation to be used in a controlled carrier transmitter and to have a control range of 10 to 1 or greater. In the dynamic shift amplifier the control range of the variactor needs only to be 1.5 to 1, so that only part of the useful control range of the Variactor is needed.

The swamping resistor connected from grid to grid of the final amplifier consists of a 15-

The Variactor-Controlled "Axis Shifter"

*RADIO, May, 1936, page 8; June, 1936, page 63; July, 1936, page 22.

www.americanradiohistory.com

watt, 7500-ohm carbon resistor. A group of smaller resistors connected in series-parallel may be used in place of the one shown to give the same resistance and heat dissipating capacity. The purpose of this resistor is to stabilize the load on the 801 modulated stage, which varies with the grid current drawn by the final amplifier during modulation.

The Variactor used as CH_2 is the U.T.C. type CV5, and the a.c. line and shunt resistor were connected as shown in order to enable it to operate properly in this circuit. The resistor was connected across the two outside terminals and the a.c. line was connected across the two inside terminals.

The 200 ohm input to the control unit was connected across the 15 ohm monitoring winding of the output transformer T_1 instead of the 200 ohm input line from the speech amplifier in order to eliminate some low frequency hash which otherwise leaked into the modulators from the control circuit. This precaution may not be necessary with a shielded control unit.

Adjustment

The radio frequency portion of the transmitter is tuned up and neutralized in the conventional manner. With the final amplifier operated without plate voltage but with normal resting bias the modulated stage and the modulators are adjusted for best quality. The modulated stage runs with about 30 watts input and about 20 watts of output.

After the modulated stage is working properly the plate voltage is applied to the linear amplifier with the control potentiometer on R_7 in the full "off" position so that the plate and bias voltages on the linear stage remain at the low or resting position. The 801 class C stage should be tone modulated about 50% and then the antenna loading on the linear can be adjusted for maximum output. This value of antenna loading may have to be slightly readjusted later but will be very close to the optimum value. The loading on this amplifier, as with all linear amplifiers, is closer than for ordinary class C operation and is quite critical for good efficiency and modulation capability. It is therefore preferable to line the transmitter up by the aid of a cathode ray oscilloscope if available.

After the preliminary adjustment of the linear stage, the control potentiometer can be turned up and the tone modulation of the 801 stage increased to 95%. By means of any good overmodulation indicator, including a 'scope, adjust the control potentiometer R_1 until the percentage modulation of the output is 95% when the 801 stage is modulated 95%. Then if the control circuit "tracks" properly the expansion of the modulation capability will be essentially linear. Note that if there is not enough control the linear amplifier will not have 100% modulation capability. If there is too much control the linear amplifier will be inefficient and will run hotter than it should. Metal plate tubes allow the plate loss to be estimated and help in tuning the rig.

In this transmitter the resting plate input is 1500 volts at 175 ma. and with 100% sine wave modulation the plate input to the linear is 2000 volts at 175 ma. This represents an axis shift of 25% and the plate loss completely modulated is slightly greater than the plate loss resting. The resting modulation capability is 50%. The plate current does not vary during modulation, although a *small* change in plate current does not necessarily indicate non-symmetrical modulation and splatter. It may be that the plate and bias voltages on the linear do not exactly track so that some controlled carrier effect is present. However the carrier power (exclusive of sidebands) will never change more than 10% or so even with the worst tracking obtainable and no controlled carrier effects will be perceptible at the distant receiver.

The audio quality from this transmitter is extremely good, in fact much better than with any controlled carrier transmitter we have worked or played with, which is as we expected it should be. There is nothing that should cause any distortion at either the receiver or transmitter with this amplifier. The efficiency and output are about the same as are obtainable with a controlled carrier linear stage, and by running the linear class BC this output and efficiency should be increased somewhat over the best controlled carrier linear amplifiers, which cannot be operated class BC but must stick to pure class B operation. Class BC operation was not used in this transmitter in order to simplify adjustment and to minimize possible troubles during the experimental work.

It was also found that, due to the very close and critical antenna coupling, the final amplifier tank circuit must be fairly "high C" if trouble is to be avoided. It is impossible to get close enough antenna coupling if low C tank circuits are used, and the linearity also suffers with too low a ratio of C/L.

www.americanradiohistory.com

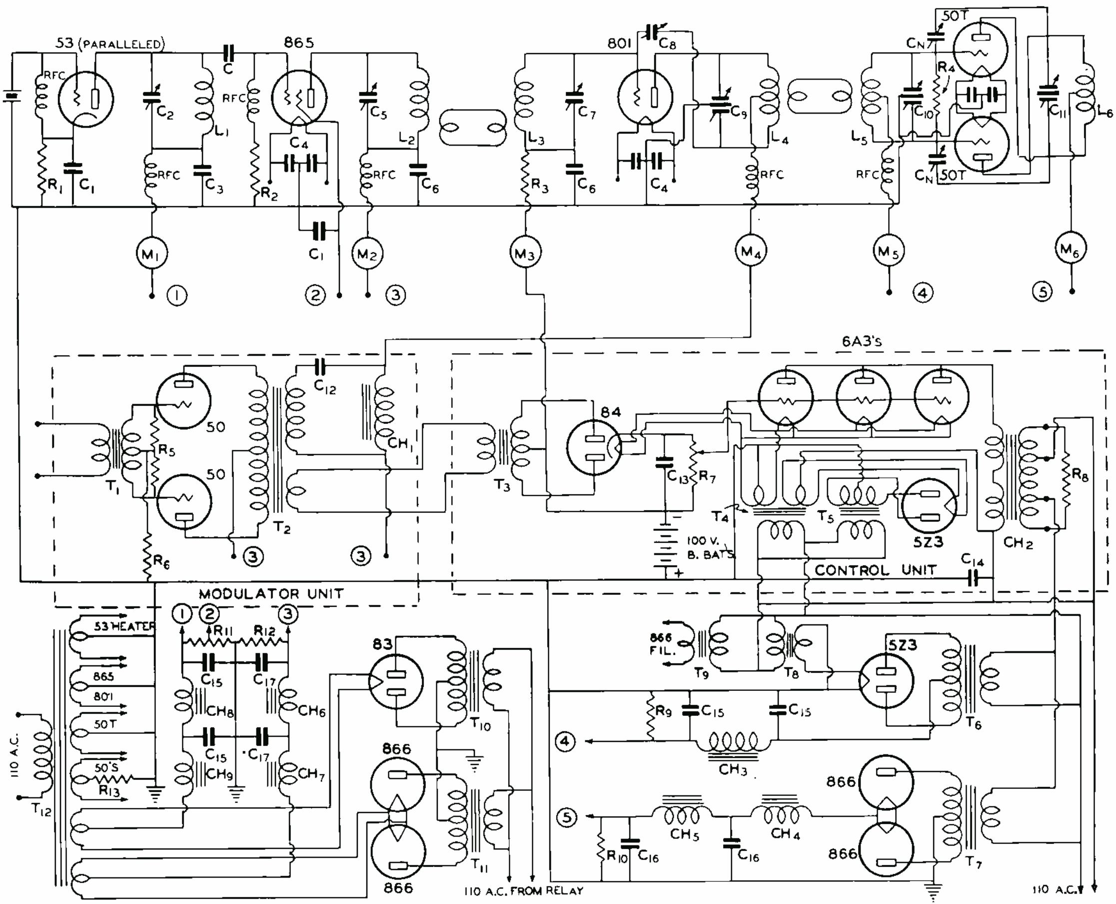


Figure 1. General Wiring Diagram of the Experimental Axis-Shift Transmitter

R_1—500 ohm, 5 watt
R_2—10,000 ohm, 2 watt
R_3—5,000 ohm, 5 watt
R_4—"Swamping" resistor
R_5—50,000 ohm, 1 watt
R_6—25,000 ohm, 1 watt
R_7—100,000 ohm potentiometer
R_8—110 v., 600 watt electric heater element
R_9—3,000 ohm, 50 watt
R_{10}—50,000 ohm, 50 watt
R_{11}—15,000 ohm, 50 watt
R_{12}—20,000 ohm, 100 watt
R_{13}—1,000 ohm, 20 watt
C—.00025 μfd. mica
C_1—.01 μfd. tubular paper or mica
C_2—50 μμfd. midget variable
C_3—.006 μfd. mica
C_4—.002 μfd. mica
C_5—.0001 μfd. variable, 1000 v. spacing
C_6—.002 μfd. mica
C_7—50 μμfd. variable, 3000 v. spacing
C_8—25 μμfd. variable, 3000 v. spacing
C_9—75 μμfd. per section, 3000 v.
C_{10}—50 μμfd. per section, 3000 v.
C_{11}—50 μμfd. per section, 6000 v.
C_n—5 μμfd., 7500 v.
C_{12}—8 μfd., paper
C_{13}—0.5 μfd., paper
C_{14}—2 μfd. 600 volt paper
C_{15}—8 μfd. electrolytics
C_{16}—2 μfd., 3000 v.
C_{17}—2 μfd., 1000 v.
T_1—200 ohm to P.P. grid trans.
T_2—Special trans.—P.P. 50's to 10,000 and 15 ohms
T_3—Small line to P.P. grids
T_4—Fil. trans.
T_5—375 v. each side c.t., 60 ma.
T_6—375 v. each side c.t., 60 ma.
T_7—2500 v. each side c.t., 250 ma.
T_8—Fil. trans., 5 v. at 3 amps.
T_9—Fil. trans., 2½ v. at 10 amps.
T_{10}—375 v. each side c.t., 60 ma.
T_{11}—750 v. each side c.t., 125 ma.
T_{12}—Fil. trans. bank
CH_1—50 hy., 100 ma. mod. choke
CH_2—CV5 variactor
CH_3—20 hy., 50 ma.
CH_4—Swinging choke, 250 ma.
CH_5—16 hy., 250 ma.
CH_6—20 hy., 250 ma.
CH_7—Swinging choke 250 ma.
CH_8—20 hy., 100 ma.
CH_9—20 hy., 100 ma.

Another point that deserves mention is the fact that the plates of the linear amplifier tubes heat briefly at the end of each sentence. The explanation is that the modulation ceases, yet the lag in the control circuit leaves the plate voltage up for an instant before control is eliminated, so that the plate efficiency drops to a low value while the plate input is high. These periods of high plate loss last for about a tenth of a second at the end of each sentence.

The actual measured carrier output of this transmitter is between 150 and 175 watts, which is not bad for a pair of 50T's running as a class B linear amplifier.

Whether this transmitter is economically desirable is debatable, due to the fact that the control equipment is big enough for a transmitter of several times the power output. It is thought that there is very little advantage in using

[*Continued on Page 90*]

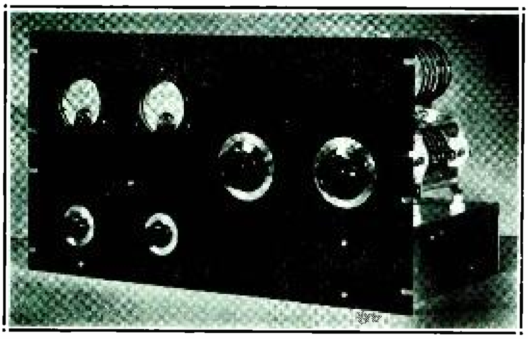
www.americanradiohistory.com

An HF-100 Multi-Band Exciter Unit

By Ray Dawley, W6DHG

Although designed particularly for use in conjunction with the HK-154 amplifier on page 10, this exciter unit makes a very nifty driver for any final stage requiring up to 60 watts grid drive. If desired, the exciter may be used as a 10 to 80 meter transmitter, feeding an antenna directly. The use of the high-μ, high-transconductance HF-100 in a special circuit does the trick.

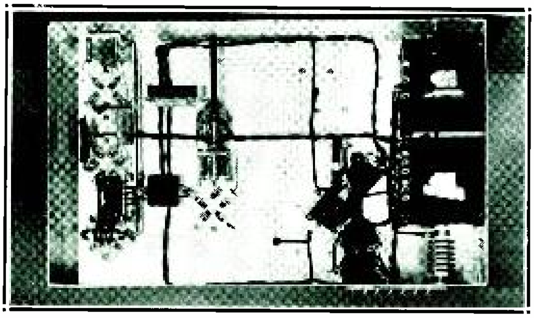
In the design of a multi-band transmitter, especially one for the higher frequency bands, the most frequent procedure is to make use of a number of small tubes or sections of tubes to get down to the output frequency, followed by a number of cascaded power amplifiers. This arrangement is fine if a number of bands are to be operated in harmonic relation to one crystal. However, if a reasonable number of crystals in different bands are available, this procedure is wasteful of both tubes and equipment, and complicates tuning. With the recent advent of a number of high μ, high transconductance, inexpensive tubes of medium plate dissipation, a new design suggests itself: namely, the use of a high-level crystal oscillator (low drift crystal) followed by one or more power doublers to reach the output frequency. There has recently been described a new method of approach to the doubling problem* whereby the same order of output is obtainable from a tube either as a doubler or a straight amplifier. By the application of this system, quite high second harmonic power output is available with small tubes.



60 Watts Excitation. No Neutralization. When Used as a Companion Unit to the Amplifier on Page 10, They May Be Run from a Common Power Supply.

The exciter to be described was designed to supply adequate excitation to the 154 Gammatron amplifier described elsewhere in this issue on the ham bands from 80 down through 10 meters. About 50 watts of power is obtained by the use of a 42 crystal oscillator, 6L6G doubler, and HF100 power doubler in the final. The 6L6G stage is only necessary when the output is to be on the fourth harmonic of the crystal, such as 10 meters on a 40 crystal, 20 on an 80 crystal, etc. Sufficient driving power is obtainable by link coupling the HF100 directly to the 42 oscillator for operation on twice the crystal frequency.

The unit is mounted on a 10/17/3" chassis with a 10½" standard panel the same as the 154 stage. A 500 ohm cathode resistor with an r.f. choke across the crystal is used in the 42 oscillator. This method of connection minimizes the r.f. crystal current and holds down the non-oscillating plate current on the 42. The tuning of an oscillator of this type is a little different from the conventional pentode connection with a grid leak for bias. As the plate condenser is tuned through resonance from the high frequency side there is at first a drop in plate current when the crystal breaks into oscillation. Then as the capacity is increased the plate current and output increase to a maximum; past this point oscillations stop and the plate current returns to the non-oscillating value. The best point of operation is where the plate current is about half way between the non-oscillating and maximum value.

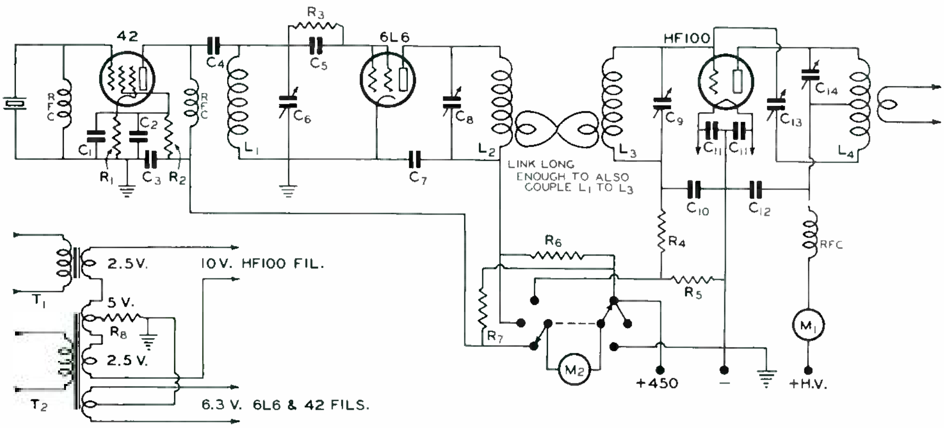


Bottom View of the Chassis, Showing Position of Parts

[Continued on Page 84]

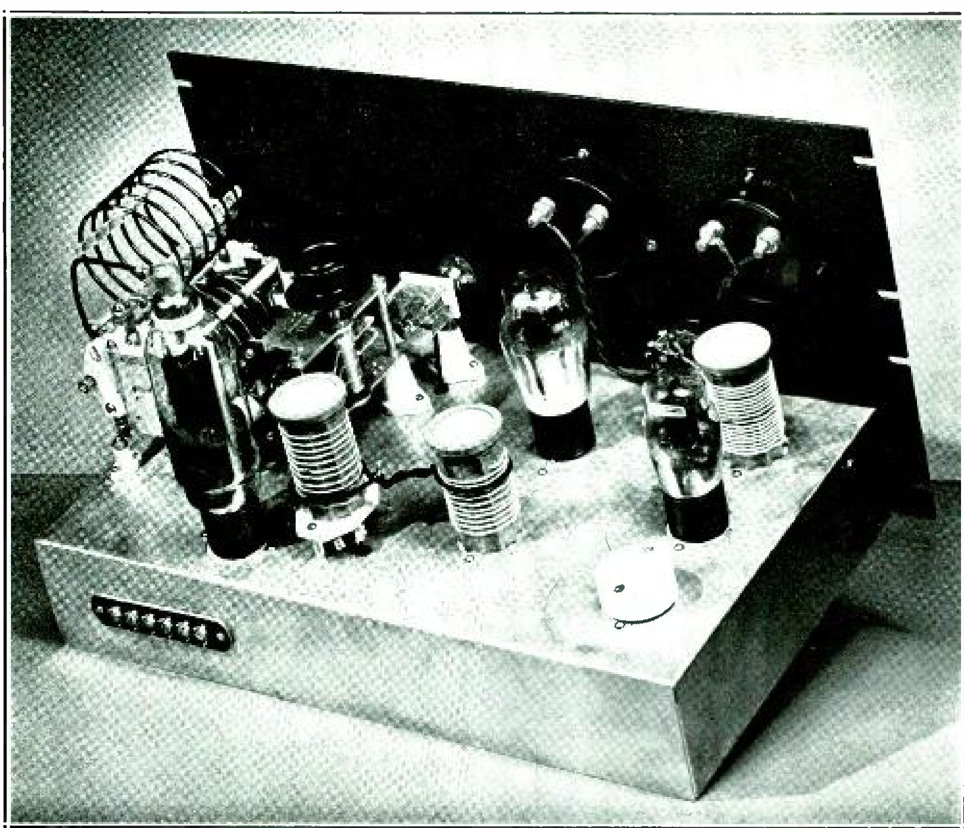
*E. M. Dowling—High Efficiency Frequency Doublers—Radio, April, 1936.

www.americanradiohistory.com



General Wiring Diagram of the Multi-Band Exciter

C_1—.01 µfd., 400 v. tubular
C_2, C_3, C_4, C_5—.006 µfd., 600 v. mica
C_6—100 µµfd. midget
C_7—.002 µfd., 600 v. mica
C_8—100 µµfd. midget
C_9—50 µµfd. midget
C_{10}—.01 µfd. mica, 2500 v.
C_{11}—.002 µfd., mica
C_{12}—.004 µfd., 2500 v. mica
C_{13}—25 µµfd., 6000 v. spacing
C_{14}—50 µµfd., 6000 v. spacing
R_1—500 ohms, 5 watts
R_2, R_3—50,000 ohms, 3 watt carbon
R_4—10,000 ohms, 10 watts
R_5—100 ohm, ½ watt carbon
R_6—100 ohms, ½ watt
R_7—100 ohms, ½ watt
R_8—1500 ohms, 30 watts
M_1—0-200 or 0-250 ma. d.c.
M_2—0-100 ma. d.c.



Back-Panel View of the Multi-Band Exciter, Showing Mechanical Construction

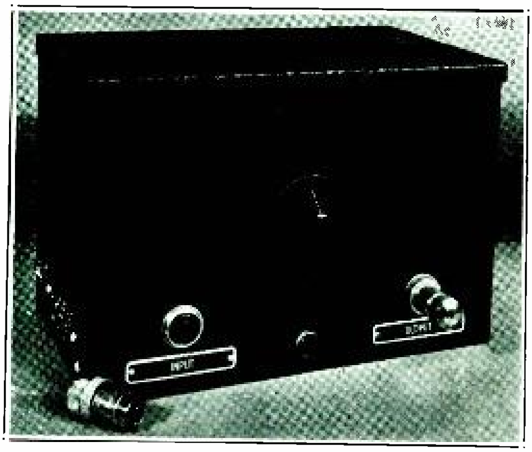
www.americanradiohistory.com

A Multi-Purpose Voltage Amplifier

By Raymond P. Adams*

A simple, low cost two-stage amplifier with universal power supply and universal input and output connections, having high gain and good frequency response. Its versatility makes it a very useful amplifier for the amateur station. It also makes a very good low-level amplifier for public address applications.

Many voltage amplifiers applicable to line, microphone, and similar services have been developed and have been described in this and other magazines. Some have been really excellent designs—those engineered for humless a.c. operation with high gain and high fidelity in particular—but because of the cost



Front View of the Amplifier Unit

of the component parts, particularly transformers, most of these developments have been beyond the reach of the amateur with limited funds.

In designing a construction which might approximate as much as possible the average ham's "ideal", with the cost factor taken definitely into consideration, an amplifier using inexpensive audio components and having as many desirable features as possible was called for, including moderately high gain, a good fidelity characteristic, universality of application, transformer coupling, parallel plate feed, and humless a.c. power. To all practical extents, the model described becomes a sensible expression of that objective.

If the amplifier itself hits the mark, the power unit becomes equally efficient and universal in application. Designed primarily as an A and B supply for the amplifier, it retains features permitting its use in various other services. It will supply 20 ma. for the amplifier, well filtered, and an extra 40 ma. for a pentode power stage or a triode class B driver stage. Or it will supply up to 18 ma. for a high frequency autodyne, with an additional 40 available for audio amplification. Or its total 60 ma. capacity may be utilized at one terminal, where such service is desired of it.

General Design

The author first worked out an "ideal" trial circuit—calling for the use of inexpensive components, small in physical size, reasonably similar in appearance.

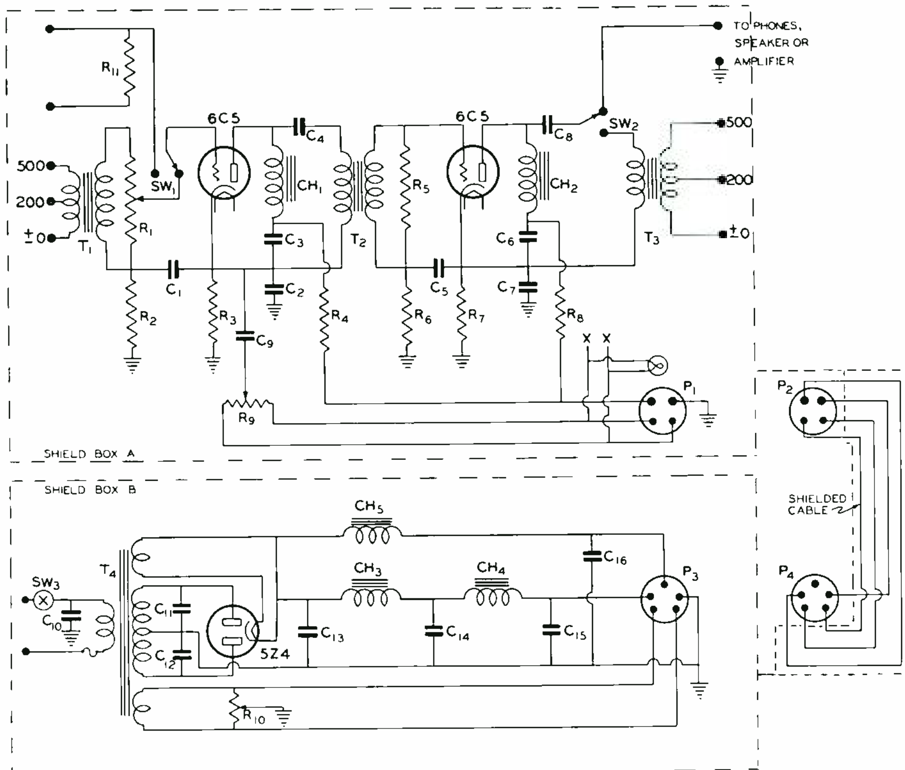
Cast iron encased units and high-permeability space savers were out from the start; they were both too costly for the design. It was necessary to find cheaper components, even if they were to be no more than electro-statically shielded by ordinary materials.

A breadboard set-up was developed using several inexpensive components. The a.f. parts consisted of two high inductance 5000 ohm 18 ma. chokes for parallel plate feed, an input transformer with primary for 200 and 500 ohm connection, an audio intermediate transformer with a 1-4 turns ratio and an output transformer matching 200 or 500 ohm lines. Two similar 5000 ohm chokes were acquired for the power supply, together with a 60 ma. choke for filtering high output, and a power transformer with 60 ma. capacity and an output voltage of 320 volts d.c. into 8 μfd. input filter capacity. The relatively husky transformer was called for for reasons above mentioned and because it cost little more than an independable midget.

Breadboard experiment proved that a well-shielded final model using these components in our original circuit might meet requirements, and two suitable shield cans were secured. The final model was constructed, with every care taken in arranging and wiring all components, and a very satisfactory amplifier-power supply combination resulted.

*1717 No. Bronson Ave., Hollywood, Calif.

www.americanradiohistory.com



General Wiring Diagram of the Amplifier

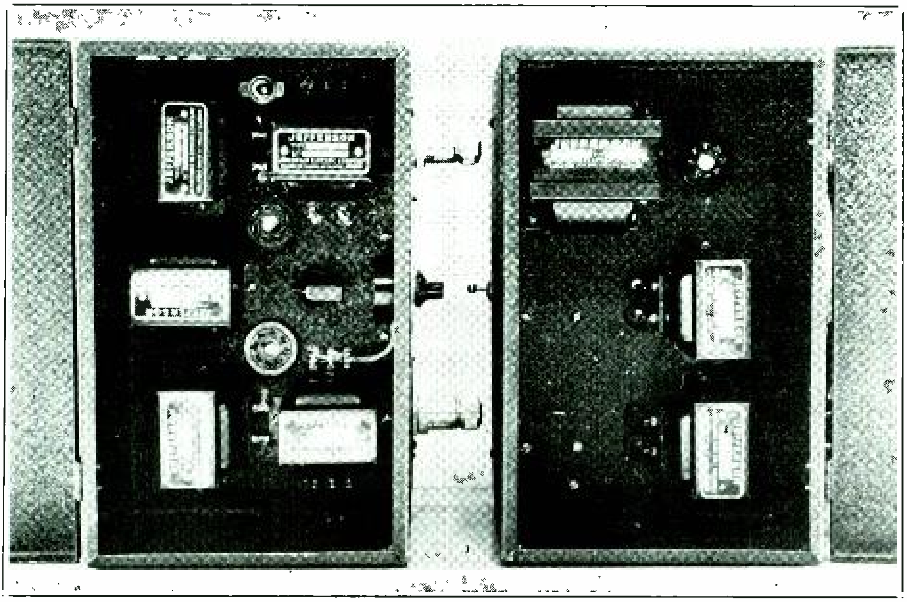
T_1—200 and 500 ohm line to grid
T_2—3 or 4 to 1 ratio interstage
T_3—Plate to 200 and 500 ohms
T_4—Midget b. c. l. power transformer, 60 ma. rating; 5 v. and 6.3 v. filament windings
CH_1, CH_2, CH_3, CH_4 High inductance, 10 to 15 ma. audio chokes
CH_5—30 hy., 50 ma.
R_1—500 M. potentiometer, tapered
R_2—50,000 ohms, ½ watt
R_3—10,000 ohms, adjustable slider, 10 watts
R_4—30,000 ohms, 1 watt
R_5—500 M., ½ watt
R_6—50 M., ½ watt
R_7—10,000 ohms, 10 watts, adjustable slider
R_8—15,000 ohms, 1 watt
R_9—400 ohms, potentiometer
R_{10}—50 ohms, potentiometer
C_1, C_5—1 µfd., 200 volt paper
C_2, C_6—1 µfd., 400 volt paper
C_3, C_7—10 µfd., 25 volt electrolytic
C_4, C_8—0.25 µfd., 400 volt paper
C_9—0.5 µfd., 200 volts
C_{10}—0.1 µfd., 400 volt tubular
C_{11}, C_{12} — .002 µfd. mica (optional)
C_{13}, C_{14}, C_{15}—16 µfd. midget electrolytics, 450 volts
C_{16}—8 µfd. midget electrolytic (optional with CH_5) for separate supply if wanted
SW_1, SW_2—S. p. d. t. toggle switches
SW_3—S. p. s. t. toggle switch
P_1—Male chassis receptacle
P_2—Female cable plug
P_3—Female chassis receptacle
P_4—Male cable plug

The Circuit

Let's begin with the power supply, which suggests the usual arrangement of power transformer, chokes, and filter condensers—with the refinement of an input-to-filter terminal for a 60 ma. connection. The rectifier is a 5Z4, supplying 320 volts (and more) into 16 µfd. input capacity. The filter, consisting of the two 5000 ohm chokes and three 16 (or 8-8) µfd. electrolytics, effectively eliminates ripple. The filter drop at 10 ma. is 100 volts and at 15 ma. 150 volts, with the output 220 and 170 respectively. One terminal of the output receptacle is wired directly to filter input (with installation of a 1400 ohm choke and an additional 8 µfd. capacity recommended where inherently filtered high current d.c. is desired) to permit additional 40 ma. connection, with simultaneous low current amplifier drain through CH_3 and CH_4, or to permit any drain up to 60 ma. to be taken from that terminal alone. The power transformer, remember, supplies 60 ma., and dual service output in various current values may be had, the available "high" at the free terminal being something like the difference between full power rating of the transformer and the value of current (up to 18 ma.) drawn through CH_3 and CH_4.

R_{10} may be eliminated, if desired, by chassis-grounding the center-tap wire for the 6.3 volt filament supply. Potentiometer center-tapping was featured in the experimental model simply

www.americanradiohistory.com



Looking Down Into the Amplifier and Associated Power Supply

to assure exact centering—an unnecessary precaution when an accurate center tap is used.

There are two 6C5's in the amplifier, parallel-plate fed through 5000 ohm chokes, and transformer coupled. The drop through the individual choke depends, of course, upon the value of current drawn by the tube which it feeds, with the current for the tube in turn determined by the value of the adjustable bias resistor. This resistor, by the way, is a single unit for both tubes, with three sliders: one at center-tap for chassis-grounding and two variables for obtaining separate tube bias. The total resistance is 10,000 ohms, and any value of bias resistance up to 5000 ohms may be had for either tube, optimum value being determined with the amplifier in operation in a particular service.

The retards or parallel chokes accomplish three things: they keep d.c. out of both intermediate and output transformer primary windings; they increase the overall gain of the amplifier; and, in conjunction with the 0.25 μfd. coupling condensers C_4 and C_8, serve to level out over-all frequency response. Transformer coupling, with inexpensive components, suggests low frequency attenuation; but with these parallel feed jobs in the circuit, really good fidelity is obtained.

Cathode resistors are by-passed by 10 μfd. electrolytics. Plate and grid circuits are properly by-passed and de-coupled, and grid circuit coil windings are paralleled with 0.5 megohm resistors for reasons which are quite obvious. The 0.5 megohm resistor across the secondary of T_1 is a potentiometer, whose variable contact determines the amount of voltage input to V_1 and whose control varies, in effect, the amplifier gain.

The hum circuit (C_9-R_9) permits a bucking voltage to be supplied V_1, a nice refinement where the amplifier is used at full gain, to balance out any possible hum which may develop.

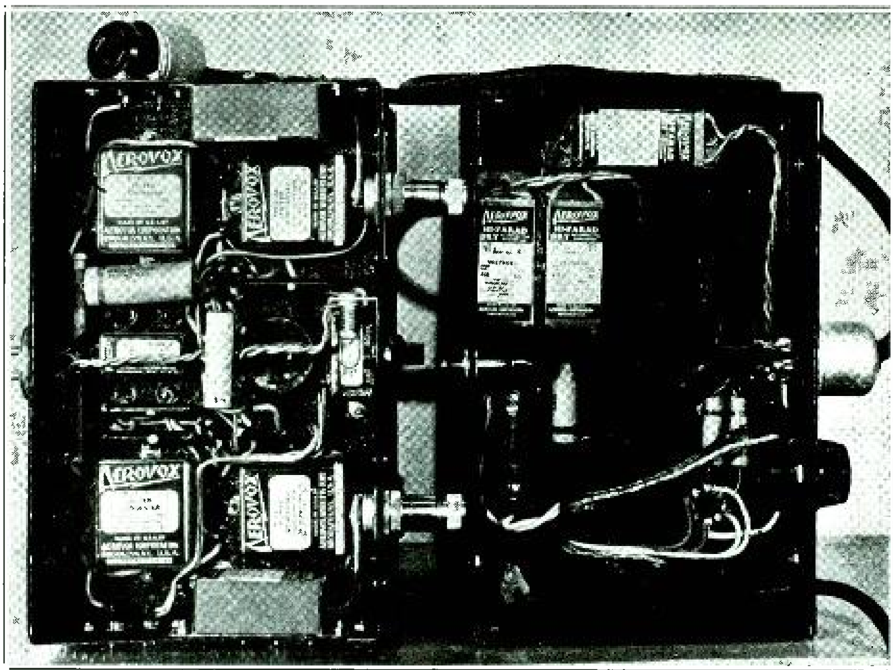
Both input V_1 grid and output V_2 plate circuits may be switched from transformer connection to free terminal connection. In the grid circuit, the convenience affords direct connection to V_1 for crystal microphone feed. In the plate circuit, it provides for phone, magnetic speaker, or power-speech amplifier output.

Construction

Simply those bits of information which the author feels are necessary to facilitate construction will be mentioned here. The photos clearly show the layout. SW_1 was not installed at the time of photographing and does not show. By-pass condensers are mounted wherever possible on audio component mounting bolts.

Input and output toggle switches are mounted on the amplifier chassis, inside the cabinet. Input and output three-connection circuits are wired both to three-terminal assembly plates

www.americanradiohistory.com



Bottom View of the Amplifier (Left) and Power Supply (Right)

on the side walls of the box and to chassis receptacles for three-point matching mike-cable plugs. The plugs, by the way, come with one terminal grounded to the shell, and unless ground connection at this point is desired, the tie should be changed by loosening an insert screw in the plug assembly, shifting the casing, and tightening the screw at another and insulated point.

In the laboratory model, the power cable has male and female plugs at the respective ends for connection to both amplifier and power pack receptacles. Threaded covers are used with both plugs, and they screw into threaded joiners mounted with the receptacles on the rear wall of chassis and cabinets. Use of this joiner arrangement insures against pull-apart.

In mounting joiners and receptacles, it will be first necessary to widen the receptacle retainer ring groove. The groove is spaced for installation through a single average chassis thickness, with some leeway, and we have two such thicknesses to consider—that of the chassis itself and that of the cabinet wall.

The transformer has a multi-tap filament winding, and leads are selected for 6.3 volt operation and brought to two points on the power pack cable receptacle. Others may be rolled up and taped, cut back, or brought to a separate terminal plate for various filament voltage connections in other services.

No shielding of leads, grid or otherwise, was found necessary within the amplifier box, and should not be required where wiring has been carefully done and components properly arranged.

Operation

In the laboratory model, with the gain on full, and with filament supply and bucking voltage potentiometers properly adjusted, the hum level was found to be to all practical extents inaudible. No audio degenerative or regenerative effects were noticed, and overall fidelity seemed excellent.

Of course this little job won't approach in performance expensive commercial affairs. Nobody ever expected it to. But it does work and work well, and it meets a very definite demand. It proves conclusively that a combination line and microphone amplifier, transformer-coupled and using inexpensive audio components throughout, a.c. operated, and hitting reasonably true on fidelity, will give surprisingly efficient service when properly designed, built, and operated.

◆

442 persons are employed by the F.C.C.; 329 at Washington and 113 throughout the country.

www.americanradiohistory.com

A Simple Two-Band Directive Antenna

By J. N. A. Hawkins, W6AAR

Outside of the diamond antenna system, which is too large for most of us, directive antennas have always been one-band affairs. The new array described here is directive broadside on two bands and may even be used on three bands, although when operated at the fourth harmonic some parasitic lobes appear, which give radiation at about 35 degrees above the horizon. However, the antenna is not only quite directive on its fundamental and second harmonic but all impedances are matched and it can be fed with an untuned transmission line.

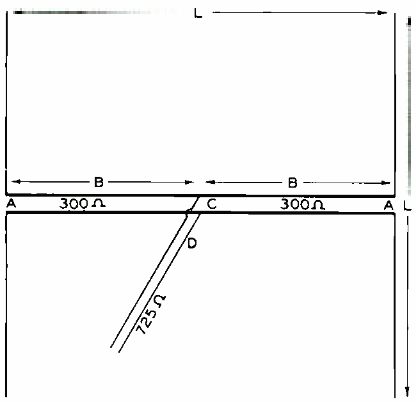


Figure 1
The Hawkins Two-Band Directive Antenna System

The "H" type of directional antenna is quite old and has given good results in many ham stations for years. Although an American development, it has found wide commercial use only in Europe, where it is used for both transmission and reception on the high frequencies. The arrangement shown differs from the common H-array in the spacing between the vertical elements, which is twice as great as in the ordinary H-system.

Figure 1 shows the principal dimensions and feeder arrangement. The length L should be a half wavelength at the lowest or fundamental frequency. For 20 meters L is about 34 feet. The construction of the phasing section is quite important in order to allow proper impedance matching on both the fundamental frequency and the second harmonic.

The phasing section is made of quarter-inch aluminum tubing spaced an inch and a half. This gives the phasing section a characteristic surge impedance of 300 ohms, which is right when the main transmission line from the transmitter has a characteristic impedance of 725 ohms. (A common 725 ohm line consists of no. 16 wire spaced 10 inches.)

The matching of impedances is shown as follows. On the lowest or fundamental frequency the length L is a half wavelength so that there is high current at points A. (See figure 2.) An assumption of 60 ohms as the impedance at points A will not be far off. Each half of the phasing section B is a quarter wavelength long and acts as a Q type matching transformer with a 300 ohm surge impedance. Considering just one half or side of the array at a time it is found that the quarter wave phasing section changes the 60 ohm load at A to a 1,450 ohm load at C. The relationship is 60:300::300:X and therefore X equals 1,450 ohms. The other half of the array acts in the same manner so that the impedance at C consists of two 1,450 impedances in parallel or 725 ohms. Thus C matches perfectly the 725 ohm line and there will be no standing waves on the line from the transmitter.

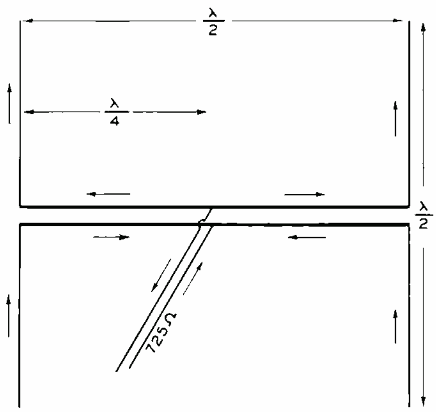


Figure 2
The Antenna System of Figure 1 Operating on the Lower (Fundamental) Frequency

Second Harmonic Operation

When the array works at twice the fundamental frequency the length L becomes a full wavelength as shown in figure 3. Thus there are two half waves in phase at each side of the

www.americanradiohistory.com

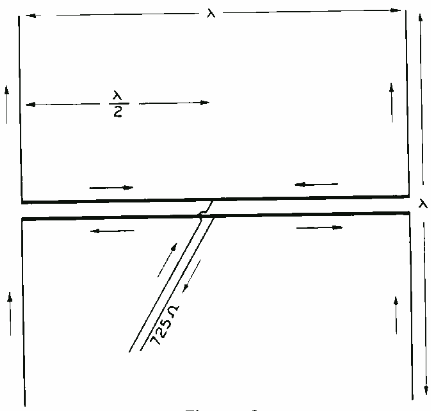


Figure 3
The Same Directive System Operating at Its Higher Frequency (Twice Fundamental)

antenna array. There is high voltage at points A and the impedance at those points is approximately 1,450 ohms. Each half of the phasing section B is now a half wavelength long and each half acts as a one-to-one matching transformer regardless of its characteristic surge impedance, which naturally remains at 300 ohms. Thus the 1,450 ohm load at points A is reflected through the half-wave sections as 1,450 ohms at point C. However, remember that at point C there will be two 1,450 ohm impedances in parallel due to the load from each half of the array so that the load on the line from the transmitter is again 725 ohms and again there will be no standing waves on the line.

Directive Gain

On the lower or fundamental frequency, the array consists of two half waves in phase spaced a half wavelength.

The flow of electrons through the array, at any instant, is indicated by the direction of the arrows in figure 2. The power gain of this array is two times, or three decibels. Practically all of the radiation is confined broadside to the plane of the array.

On twice the lowest frequency (second harmonic) the array consists of two pairs of in-phase half waves spaced a full wavelength. The total power gain is approximately 3.2 times or 5 decibels over a reference vertical half-wave doublet. The radiation pattern has four lobes, two broadside and two end fire.

Third and Fourth Harmonic Operation

This array can be operated on the third and fourth harmonics with some useful directivity although the parasitic lobes become rather large. Also the impedances are not perfectly matched, so that zepp. tuning of the main feed line will be desirable to minimize the effects of the standing waves which form on the line. However, the mismatch between the line and phasing section never is as much as two-to-one; so the small amplitude of the standing waves on the main line from the transmitter will not be very large.

◆

A basis for the intelligent selection of full-scale reading of the meters used in a transmitter is the F.C.C. regulation in this regard. As a definite regulation it applies strictly to commercial stations, but it is based upon good practise and can be followed to advantage by amateurs.

The full-scale reading of a direct current instrument should not exceed five times the normal reading, and the full-scale reading of an antenna ammeter should not exceed three times the normal reading. It should be possible to estimate readings with an accuracy of 2% plus or minus, and the function of each instrument should be marked on its face or directly beneath on the panel.

RECEIVER CONTEST

For the best receiver article submitted to "RADIO" before November 30, we are offering the winner his choice of the following transmitting tubes: One HK-354, one Taylor T-200, one Amperex HF-300, two Eimac 50-T's, two Raytheon RK-35's, or one RCA-805.

RULES:

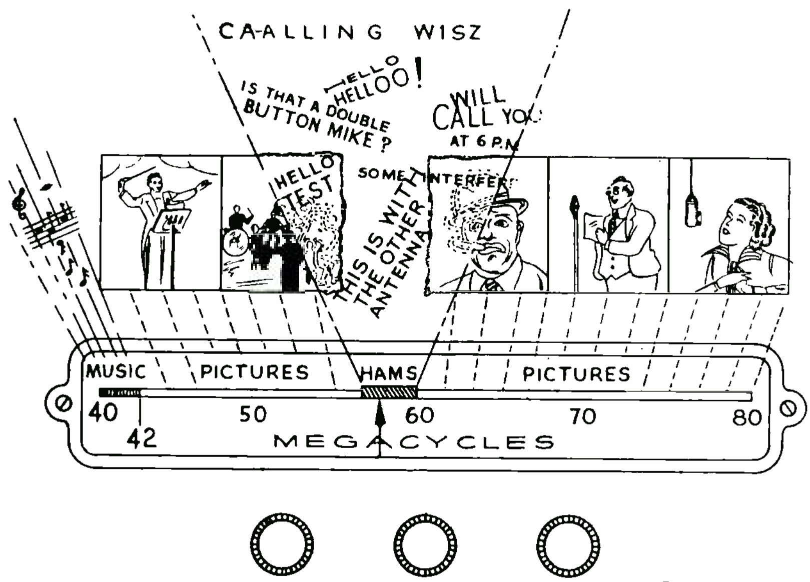
1) *The story must be original and must not have appeared elsewhere.*
2) *All articles accepted for publication will be paid for at our regular rates without regard to the contest. The winner, in addition to the usual cash payment for his manuscript, will receive his choice of the above prizes.*
3) *No rejected manuscripts will be returned unless accompanied by a stamped, self-addressed envelope.*
4) *The members of the* RADIO *technical staff will act as judges.*
5) *Manuscripts must be postmarked by November 30, 1936.*

The receiver does not have to be elaborate to win, may have as few as three tubes. Originality, performance, unique features, and mechanical construction will determine the winner, not the number of tubes. Diagrams may be rough pencil sketches, and the article does not have to be written in flowery language, as the diagrams are redrawn anyhow and the manuscript can be rewritten by us if necessary. However, *good clear photographs* will be a deciding factor in choosing the winning manuscript. Also, be sure to list the components *both* by value (ohms, etc.) and manufacturer's type number. Before announcing the winning receiver, it will be duplicated in our laboratory to confirm the author's performance claims.

www.americanradiohistory.com

Our 5-Meter Band: What Is Its Destiny?

By Robert S. Kruse



WILL JOHN CITIZEN SEE IT LIKE THIS ?

The receiver dial shown in the drawing herewith is by no means purely fanciful. In the 40-42 megacycle range there are at present some "local broadcasting" transmitters, and a considerable number of additional ones are contemplated. The receiver manufacturers are for next year extending many of their household receivers down to 5 meters and lower. As for the "pictures", there is a strong opinion among engineers concerned with such matters that they should occupy the 42-80 megacycle region or thereabouts.

Now it has been the custom to "talk down" television in certain amateur radio magazines, to make believe that it is so far off that no planning for it is necessary. However, if this country has a boom anything like the European mess (or in spite of it) television will be no dream; it will be right here with no time left for planning.

Seeing the Bridge Ahead of Time

Thus commercial radio *has already planned,* while amateur radio as a whole cannot conceivably have united on a plan under any leadership determined enough to make a plan useful.

It is not intended to suggest that amateur radio should make a fight for the 5 meter band if the result is that it sticks in the midst of a television dial where it may be resented by a large number of citizens. In that case these broadcast-listening citizens might well ask why so many amateur 5 meter voice transmitters have reverted to the ancient "wobbulated" oscillator, capable of much interference with a broad-tuning television receiver. The reply to that question would be embarrassing, at least. Or these listeners might simply invoke the "greatest good of the greatest number" and be reasonably sure of getting action as desired. The interest of the manufacturer, the broadcaster, and the listener would seem in such a case to be more convincing to our federal government than the tale of services alleged to have been performed in a war which is even now overshadowed by the coming war.

An opposition based on permitting the situation of the sketch to arise, and then trying to defend it, does not promise success. It seems more rational to follow other procedures, as:

(a) To make a determined effort under competent engineering (not political) guidance to determine whether there exists any real need of so broad a future television band as 38,000,000 cycles.

(b) To make an earnest study of the possible wisdom of trading the present 4 megacycles known as the "5 meter band" for other territory slightly higher in frequency.

www.americanradiohistory.com

Neither of these may be the best suggestion, but we may look them over briefly.

How Broad Is Television?

Considering the type of pictures which present television equipment can transmit, and the probable range of the transmitters, it is apparent that this 38,000,000 plan pre-supposes that 5 or 6 stations are to operate at once in the same city, with "guard" bands between them. There exists a good, healthy doubt whether any such set-up is at all justified by the "public convenience and necessity". To look at a picture requires a person to look in one direction, therefore hampers household activity or conversation much more than casual listening to the present sound-broadcasts. Psychologists argue from this that one is sure to spend much less time in "tele-looking" than in "tele-listening". In one series of experiments it was concluded that an average person would "look in" less than twelve minutes per day. It assuredly does not require six stations to serve one city for twelve minutes out of each 24 hours. Neither is there much promise in running six stations when roughly 59/60 of the possible audience is ignoring all six pictures at any given moment. For any one station this means that the audience averages 1/360 of the city's radio-equipped population, *at best*. Of course the twelve minute result may be wrong; perhaps people can be persuaded to "look in" for thirty minutes a day, thus justifying one television channel which then averages as much as 1/6 of the radio audience by not following any one audio broadcaster through thick and thin, but by working with whatever station is at that moment sending something worth looking at, or falling back on a Mickey Mouse film.

The need of 38,000,000 cycles remains *highly* unconvincing.

Should it be found that for some not-yet-visible reason, there is an actual "public convenience and necessity" which may be served by removal of the amateur 5 meter band, then the actuality of such a "convenience and necessity" should first be established by sober discussion among the engineering friends of amateur radio, and as a second topic the desirable new locations established. The suggestion that in yielding up a band, amateur radio should in turn obtain something else for it, may seem childishly obvious. It is offered here as a small tonic for the nerves of "strategic retreaters".

This country has gotten itself into needless difficulties through international radio conferences which settled some things that are our own affairs. The Editors of this magazine have suggested that it is a good time to advise other nations that we propose to run our (very large) share of the world's radio stations more nearly in a manner calculated to make them produce their greatest useful result. It is a good suggestion, especially as regards this 40-80 megacycle region *which the western world can settle in any way that pleases it without in the slightest degree influencing the radio affairs of other continents*. Thus as a suggestion for discussion by our readers there is offered this:

If television requires the major portion of that 42-80 mc. band—(does it even need a third of it??)—then is it desirable to move our 5 meter band to one end of that range to avoid the situation of the sketch? If so, it is surely unwise to move it toward 42 mc. where it interferes no less with pictures and is nearer the music, not to speak of the larger antennas needed there. To move it toward 80 mc. looks more promising. Transmission there is acceptable, one is not too close to the 2½ meter band, the interference is now at one end of the dial, and the receiver manufacturer may miss it if he chooses. Amateur transmitters may need rebuilding, but that offers a good chance to junk the modulated oscillator.

◆

How Are Your Antenna Halyards?

Just before winter puts an added strain on your antenna, you might look at the halyards on your mast. Rope may show wear at the pulley, at the cleat where it is fastened, or anywhere that it has been flapping against the mast, a guy wire, etc. If your mast is near a chimney, a galvanized iron pulley may have become corroded due to the action of smoke, so that the wheel does not turn but wears the rope. Some rope may rot and be weak even without showing wear on the surface. Inspect the halyards now and avoid trouble later.

You may wonder at the reason for all this caution. A member of our staff recently returned from a vacation to find that both masts were without halyards, and the antenna was lying in the yard.

And threading a pulley atop a 50-foot pole by remote control is still the tough job it was ten years ago.

◆

The power developed in the plate circuit of a pair of class C tens is sufficient to lift a hundred-pound weight through a distance of twenty-seven and a half feet in a single minute.

www.americanradiohistory.com

Room Acoustics for Phone Amateurs

By Guy C. Omer, Jr.

Some amateurs are interested only in what the other fellow has to say and in making themselves understood; they are concerned only with intelligibility, not fidelity. Other amateurs take much pride in the quality of their phone signals; they get much satisfaction out of "sounding like a broadcast station". If you belong to the second group, you will be interested in knowing a little about the "how" and "why" of room acoustics.

A hard plastered wall reflects sound more efficiently than a mirror reflects light. Sound in a room is reflected back and forth from walls, ceiling, and floor, mixing, changing, and gradually dying out after the source of sound has stopped. This is reverberation and is measured in units of time[1]. Reverberation is not the pure nuisance you might think. Because we have grown accustomed to it a proper amount of reverberation is necessary to give speech and music proper fullness. Too much reverberation makes the room seem "echoey" and too little makes it seem dead. The proper times have been found by pure experiment and have to do with the volume of the room and also the frequency. The references at the end of this article will provide more information, but since the requirements are not precise for the amateur, it will do to place the reverberation of his transmitting room between 0.5 and 0.7 seconds. Only about 1/6 of the sound reaching an amateur microphone arrives as echos; hence the room correction need be only approximate. A human head is fortunately smaller than an orchestra and may be placed nearer the microphone so that the walls and ceiling are relatively distant and hence not in need of the drastic and expensive treatment required in broadcasting studios. Another fortunate thing is that one does not encounter very strong deep tones in the human voice (except perhaps in the case of Bill Earle of W7CAL). However the remarks about getting close to the microphone do not indicate that good speech in a bad room can be obtained by simply crawling into the microphone. It is better to back off a little, use a little more amplifier gain (or a little more voice), and correct the room to give a normal sound to the voice.

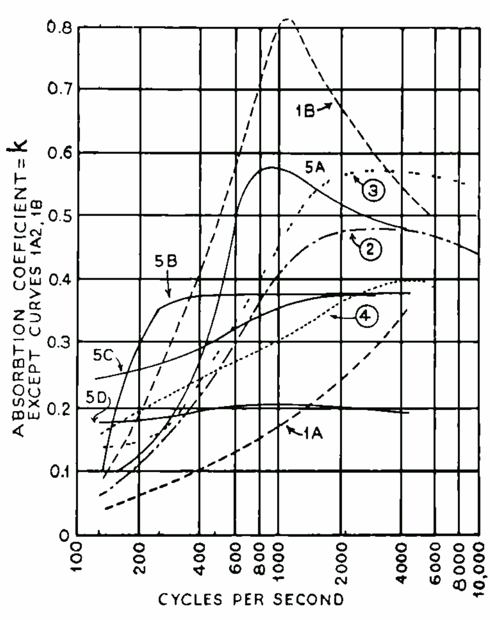


Figure 1
Curves showing the absorption of different materials.
1A—10 oz. cloth flat against the wall.
1B—The same draped to ½ area.
2—½" soft hair felt.
3—Average of several acoustic tiles.
4—Average of several acoustic plasters ½" thick.
5A—½" flax-linum semi-stiff sheet.
5B—½" Acoustolic sheet.
5C—½" Insulite sheet.
5D—7/16" Celotex sheet.
All are for the unpainted material. Tints or dyes may be used.

Choosing the Room

Many broadcasting studios have been built with height, width and length in a 2-3-5 ratio. Try to choose a room about like that and particularly avoid a square or cubic room or one with curved walls or ceilings, as these tend to have strong resonance frequencies or focal points. Rooms not usually being what the rules call for, let us outline what can be done to correct them. All sorts of queer corrections have been used in the past, from the early velvet tents with a ten-layer wall, to recent European studios with stalactites hanging from the ceiling and zigzag screens set around all the walls. While barricading all bad features of

*Box 141, Haskell Institute, Lawrence, Kansas.

[1]Reverberation time is the time in seconds required for a tone to attenuate 60 db after the source of sound has stopped.

www.americanradiohistory.com

TABLE I—RANGE OF PROPER REVERBERATION TIMES, IN SECONDS

Room volume in cubic feet	*Time at 128 cycles (158%)*	*at 256 cycles (120%)*	*at 512 cycles (100%)*	*at 1024, 2048 & 4096 cycles (95%)*	*at 8192 cycles (115%)*
500	.73-.96	.55-.73	.46-.61	.44-.58	.53-.70
600	.74-.98	.56-.74	.47-.62	.45-.59	.54-.71
700	.75-1.0	.58-.75	.48-.63	.45-.60	.55-.72
800	.77-1.01	.59-.78	.49-.64	.46-.61	.56-.74
900	.79-1.02	.60-.79	.50-.66	.47-.63	.58-.76
1000	.80-1.07	.61-.81	.51-.68	.48-.65	.59-.79
1200	.82-1.10	.62-.85	.52-.71	.49-.68	.60-.82
1400	.84-1.16	.63-.89	.53-.74	.50-.70	.61-.85
1600	.85-1.20	.65-.91	.54-.76	.52-.72	.62-.88
1800	.87-1.22	.66-.92	.55-.77	.53-.73	.63-.89
2000	.88-1.23	.67-.93	.56-.78	.54-.74	.65-.90
2200	.92-1.23	.70-.94	.58-.78	.55-.74	.67-.90
2400	.94-1.24	.71-.95	.59-.79	.56-.75	.68-.91

the radio room may seem like a good idea there is usually no space to spare and amateur treatment fortunately or unfortunately boils down to simple absorption treatment, which means nothing but placing against walls, and perhaps floor and ceiling, some kind of sound absorbing material.

It saves money and improves results to do this with some thought, rather than haphazardly. No two large flat surfaces should be left facing each other without treating at least one of them. About the cheapest, reasonably good, treatment is to put most of the absorbing material near the microphone, though it is better to have moderately absorbent material spread over the whole room rather than a little bit of high absorption material in one place only. Try to cover at least two *adjacent* walls and also either the floor or the ceiling. However, remember that acoustical materials are soft and easily damaged, because it is necessary to allow sound to enter them and be dissipated by friction.

Possible Materials

For the wealthy amateur there is acoustic tile placed by a professional firm for $500 and up —mainly up. Acoustical plasters are also best left to the professional. Drapes, once used in broadcasting, are in disfavor today because their action is irregular with respect to frequency and because they cause a fire hazard. However, where a door or window must be covered but accessible, heavy burlap or loosely knit material may be hung in folds two or three inches out from the surface. Rugs also were great favorites once and for the amateur are still a useful substitute for ceiling treatment. They should be soft and preferably backed with a rug pad. Wall treatment, once we get below the expensive materials first mentioned, consists either of porous sheet material or else of loose fluffy material held in place by metal cloth. For an amateur it is rather expensive to face the wall with the loose fibrous materials as this requires first the application of firing strips, then filling two or three inches of mineral wool, rock wool, thermo fill or the like between these strips, and finally the application of a wire cloth covering. The cheapest and most widely available material is the familiar insulation board obtainable in thicknesses up to 1 inch, and it is these materials which are listed in the table. These wood fibre boards have fairly uniform performance and are not too costly when bought in big sheets. If you care to pay much more for them you can buy them in the form of beveled tiles. They may be nailed on, though a better scheme is to use the accoustical cement which the lumberyard can supply. It is meant to be used on a plaster wall and sets in about twelve hours.

Practical Example[2]

The room shown in figure 2 has a volume of 1200 cubic feet. We now require a few figures to determine what correction this room shall have with the wallboard we propose to use, which is 7/16 inch Celotex. Looking at the table of range of proper reverberation times we find that for a room of 1200 cubic feet this time should be from 0.5 to 0.7 second as stated earlier in this article (this figure is for 512 cy-

[2]Most of the theory originally found in this paper has been omitted in favor of an example of the acoustic treatment of the room shown in one of the drawings.

www.americanradiohistory.com

cles). For the lower end of the human voice it can be about 20% longer, which is lucky. It should be a little shorter from about 1000 cycles to 4000 or 5000 cycles.

Our room is not large. It will probably resonate at a low speech frequency; therefore

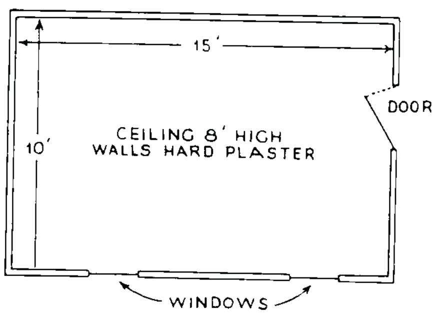


Figure 2
The sample room which is analyzed as to necessary acoustic treatment.

we need absorbing material which will use up bass notes. Our 7/16 inch Celotex is good, perhaps too good, for this, as may be seen by looking at the curves of the absorption performance of various materials in which curve 5D is the Celotex we are talking about.

From here on the story can be followed in two ways. Either you can look at the result in the next paragraph and simply guess at the manner in which it must be modified to fit your particular room or else you can follow through the ensuing simple calculation which will make the result actually fit your room.

We will work at 1024 cycles because this is the "center of gravity" of the human voice. From the table of proper reverberation times we decide not to go above 0.65 second if we can afford enough insulation board to keep down to that time. Now if:

V = 1200 cu. ft. volume.
T = 0.65 second reverberation time
S = 700 sq. ft. of wall and ceiling area.
$A = -\log_e (1 - k)$
k = absorption coefficient of material as shown in table.

then we can write the reverberation time equation:[3]

$$0.65 = \frac{0.05 \times 1200}{700 \times A}$$

and if this is solved we find that the average coefficient of absorption must be made 0.13 to get such a reverberation time for this room. The question now is how much Celotex we must use to get this result. Looking at the curve sheet we see from curve 5D that the material has a coefficient of 0.2 so that we need to cover 0.13/0.20 of the wall area to get the desired result at 1024 cycles. This works out at 455 square feet of Celotex needed. If this much board is put up the results are those shown by the curve A in the graph labeled "acoustical correction of a room with volume of 1200 cubic feet". This is the curve labeled "trial calculation." As was prophesied, the room is dead enough at the low pitches, for the curve below 1000 cycles is well inside of the two solid curves. These solid curves are the upper and lower limits of proper reverberation time for a room of this size, the figures, of course, being

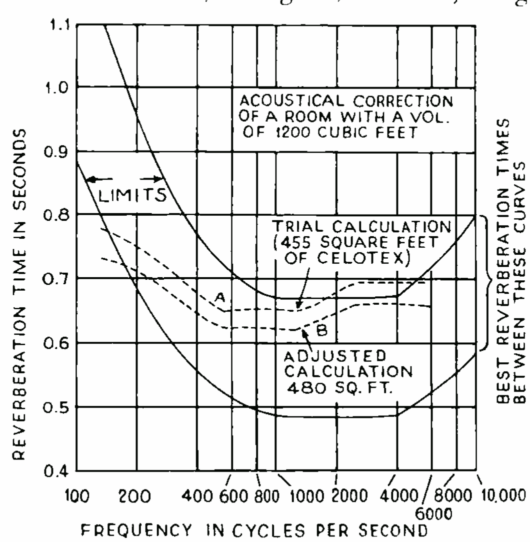


Figure 3
Effect of applying acoustic correction to a room of 1200 cubic feet. The solid curves show the limits of "proper" reverberation time as taken from the accompanying table. The purpose is to correct the room so that its actual time falls within these curves. Curve A is the first attempt, curve B the final correction.

taken from the table of proper times. Thus we find that to get the high pitch reverberation time down we need more board than we thought, even though 455 sq. ft. was all right for the lower pitches.

If we increase the area to 480 sq. ft. we will be able to use up complete sheets of the material and will obtain the results shown by the curve B marked "adjusted calculation". This looks to be a little bit too good at the low frequencies but a great deal of absorption there is useful to overcome resonances. This amount of ma-

[3]To avoid logarithmic calculations see the table of values of A.

www.americanradiohistory.com

TABLE II—VALUES OF A FOR USE IN CALCULATIONS

k	.01	.06	.1	.2	.3	.5	.6	.7	.8	.9	.95	1
A	.01	.06	.105	.22	.35	.66	.92	1.3	1.7	2.4	3	10

terial will cover the entire ceiling and after the windows have been subtracted it will cover the wall also. 15 sheets 4 x 8 ft. and about a gallon of cement (acoustical) cost about $25. This room is now acoustically corrected and the station is one step nearer "real broadcast quality".

Care should be taken in coloring acoustical material. Only a few perforated materials can be painted with ordinary paint. Some materials, especially commercial tiles, may be painted with a special paint which does not fill the pores. Most acoustical materials may be colored with water colors, washes, or dyes. It is better to leave the material in the natural color or to purchase the material integrally colored.

This short paper can do no more toward covering a large subject but the following references will be found useful if you are interested further. In the *Proceedings of the Institute of Radio Engineers,* Vol. 19, pages 17-34; Vol. 20, pages 1296-1309; Vol. 21, pages 655-673. In the *Journal of the Acoustical Society of America,* Vol. 1, pages 217-241; Vol. 3, pages 14-43; Vol. 4, pages 20-37, also 44-55. In the *Bell System Technical Journal,* Vol. 9, pages 390-407. Several books on acoustics are available from such publishers as McGraw Hill, Van Nostrand, John Wiley, and the Harvard University Press.

TO THE WIVES OF HAMS

I cannot but give my heartfelt sympathy to Mrs. W7APU* and other Mrs. Hams for I understand their point of view and can see it very clearly. It is sad if one isn't in accord. One doesn't feel that Mrs. W7APU is exactly in discord, in as much as she is possessed with a f.b. (fine business to you) sense of humor. One may lose patience with the o.m. and his wires and cards and apparent insane gibberings, but oh! Mrs. Ham, Mother, or others: isn't it a grand feeling to know he is there in body if not in spirit and not out chasing some butterfly of the night or playing poker?

I realize that few of you would care to investigate the why's and wherefore's of radio, but if you would like to make the o.m. gnash his hair and tear his teeth, just you settle down and learn the difference between a condenser and resistor, get the feel of that soldering iron, and shout with glee as you make the wires stick together with an unsightly gob of solder. Make the acquaintance of another ham, swear him to secrecy, and get him to give you the dope on learning the code. After a week or so you will be surprised (and so will the o.m.!!) to find you know twice as much as he does. If you don't you're not a true female of the species!

The Bug will get you if you don't watch out, and then the o.m. will come home finding you monopolizing his pet "side winder", as you have forgotten the hour, the dinner, and everything as you are intent on practicing the code.

And then the day arrives and you have a nice little ticket from Uncle Sam and it is your turn to do your stuff and you get results the o.m. will never get. You, too, acquire that "queer look" in your eye and the next time he shows symptoms of calling at strange places and ringing doorbells you are one jump ahead of him.

You are no longer an x.y.l. but a y.l. at the key. Nothing but! Not even an o.w. (old woman). I am still trying to find out when y.l. becomes an o.w. Apparently never in Hamdom as long as you are at the key.

—*Y.L. (or o.w.?) K6MZK.*

*See Radio for May, 1936, page 17; and June, 1936, page 34.

Radio men with testers which require external 45-volt batteries for reading megohms will find a long-sought aid in the new pint-sized 45-volt transceiver batteries. These tiny units may be housed permanently and comfortably in the accessories tray of the set analyzer.

The F.C.C. has discontinued issuance of the commercial extra first class operator's license, since the privileges granted under that ticket are duplicated by those extended under the regular radiotelegraph first class license bearing a radiotelephone first class endorsement. Like the old amateur extra first ticket, only a few of the commercial extras were issued during the long life of the license.

www.americanradiohistory.com

An Inexpensive Homemade A.C. Ammeter

By Guy Forest

Most every amateur, serviceman, and experimenter has a good a.c. voltmeter of 10 or 15 volt scale for measuring filament voltages. The meter can be made to do double duty by means of an auxiliary unit comprised of a small transformer (even a burned out one can be used) and a few resistors. A multi-scale a.c. ammeter is the result, a very handy instrument to have in any shop or "shack".

In numerous instances of service work on radio, electric refrigeration, or household appliances there is occasion to measure 60-cycle alternating currents, but the usual run of instruments or testers makes no provision for such measurements. Not only in the above instances, but also in the experimental laboratory or home workshop some gadget which would give a.c. current readings would be a boon. With no more than an old b.c.l. power transformer and some small resistors it is easily possible to make the gadget, to work with one of the common types of a.c. voltmeters.

The idea is to use the 60-cycle core and windings as a current transformer. The current to be measured is passed through the low side and the a.c. voltmeter or milliammeter is connected to the high side. The usual current-transformer relations are true whether the meter is of the rectifier type, dynamometer type, or iron-vane type, milliammeter or voltmeter. For instance, if a power-transformer primary is wound for 115 volts, with a 2.5-volt filament secondary, the ratio between the windings is 115/2.5, or 46 to 1. A 0-1 rectifier-type a.c. milliammeter connected to the high side would read full scale with 46 milliamperes flowing in the low side, and smaller current values would be proportional to other scale readings.

Because the internal resistance of the rectifier-type milliammeter is not constant the meter cannot very well be shunted to increase the range. The internal resistance varies depending on the magnitude of current, and if a shunt were connected the current would not divide the same at high and low ends of the scale. The best way to change the range is to change the ratio of the current transformer. The possibilities on most transformers are limited, and in addition it is hard to make the current ranges direct reading on the meter scale. For these reasons two other types of a.c. meters offer greater convenience and flexibility.

One such type of meter is the ordinary a.c. filament voltmeter, commonly the iron-vane type. Most of these meters have ranges from 0-8 up to 0-15 volts, nearly all take a current of around 60 or 100 milliamperes at full scale. For instance, the old Jewell Pattern 74 0-15 a.c. voltmeter has a current rating of 88 ma. full scale; the Weston Model 476 0-15 a.c. meter takes about 72 ma. maximum; and a similar Triplett model some 62 ma. When these types of meters are connected as indicators on a current transformer, they function as milliammeters and the measured current equals the winding ratio times the meter current. It is entirely satisfactory to shunt the meter so as to obtain different current ranges, and the value of the shunt may be fixed so as to make the voltmeter scale true for reading current. For example, a 110/10-volt filament transformer has a winding ratio of 11 to 1. A 0-10 voltmeter requiring 75 ma. for full scale, in combination with the transformer would be a 0.825 ammeter; and, if a shunt of approximately 650 ohms were adjusted across the meter the scale could be made to come out an even 0-1 ampere and be read from the 0-10 voltage scale nicely.

The other type meter well suited for these methods is the rectifier-type a.c. voltmeter. It is necessary to shunt the secondary of the current transformer with a resistance that is 1/5, or less, the total resistance of the rectifier voltmeter. Under this condition the shunt is the effective load for the transformer, and the meter acts only to measure the voltage on this load. There are then no complications concerned with the variation of the meter resistance at various scale positions. The same flexibility as regards ranges and direct-reading scales, outlined for the iron-vane meter, obtains with the rectifier voltmeter. There is a further advantage, due to the inherent sensitivity of the latter instrument, that less energy is absorbed from the circuit to operate the meter.

In figure 1 is shown a typical diagram of connections and elements, which holds true for any of the types of a.c. meters, and from which

www.americanradiohistory.com

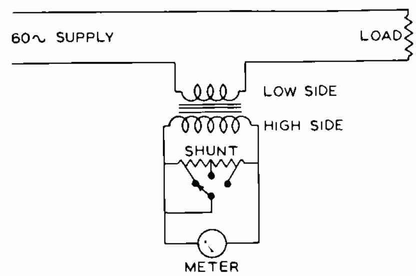


Figure 1
Current Transformer Connections for Homemade A.C. Ammeter

R_s—Ohms resistance of shunt
R_m—Ohms resistance of meter
N_1—Turns on low side
N_2—Turns on high side
E_1—Low side voltage rating
E_2—High side voltage rating

then

Amperes through meter =

$$\text{amperes in low side} \times \frac{E_1}{E_2} \times \frac{R_s}{R_s + R_m}$$

and

Voltage on meter =

$$\text{amperes in low side} \times \frac{E_1}{E_2} \times \frac{R_s \times R_m}{R_s + R_m}$$

can be figured rather closely the important facts about any of the setups.

One gadget that was made up used a little filament transformer, rated at 115 volts on the primary winding and 2.5 volts, 4 amperes, on the secondary. The meter was a Weston Model 301 rectifier-type voltmeter, range 0-3 volts, resistance approximately 3,000 ohms. The shunt resistor was two Yaxley wire-wound fiber strip type units connected in series, one 250 ohms and one 500 ohms. They were tapped into the switch to give three overlapping ranges of current; 0-300 milliamperes, 0-.9 ampere, and 0-3 amperes. The voltmeter scale on the Model 301 meter reads the current on the first and last ranges, by properly placing the decimal point. On the middle range the scale reading is multiplied by 0.3 to get the current in amperes.

The best way to set the taps on the resistors is to borrow an a.c. ammeter, measure the current flowing through the low side of the current transformer, and adjust the tap to get the same reading on the indicator meter. If the a.c. ammeter cannot be obtained, then use the following scheme.

Connect the low side of the transformer in series with the a.c. light supply and a lamp socket. Screw a fairly new 25 or 30-watt lamp of one of the better grades into the socket, and figure the current from the ratings etched on the bulb. That is, a 30-watt, 115-volt lamp will draw 30/115 = .26 amperes. If the voltage is different from 115, the current will be different in the same proportion, roughly. For instance, on 110 volts it would be 110/115 × .26 = .25 amperes. Set the switch on the unit to the 300-milliampere range and adjust the resistance tap to get the correct reading on the scale. Then screw in a 75- or 100-watt lamp and adjust the tap for the next range. For the highest range two or more 100-watt lamps may run at the same time, in parallel, and their currents added. Make sure that the tap wire makes contact with the resistance winding before passing current in the primary of the transformer, then slide the tap along till the right spot is found and twist it tight. Put a coat of shellac or insulating varnish on the resistance for mechanical protection, after the taps are on.

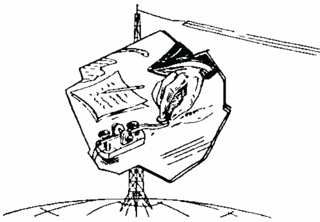
Any old filament or radio set transformer can be used in this scheme, so long as either the 115-volt or high-voltage winding is good, likewise one filament or low-voltage secondary winding. The maximum current that can be passed is determined by the current rating on the secondary winding. A 1.5-volt, 10-ampere filament winding could be used to measure up to 10 amperes. For the larger current ranges it is comparatively simple to wind a few turns of heavy wire on the core, space permitting. By selecting the ratio between the two windings which are used, and the value of the shunt resistance across the meter, any current from 50 millamperes to 30 amperes can be measured with one inexpensive meter.

◆

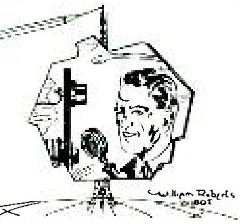
There are at this writing 44,000 valid amateur station licenses issued by the U. S. Government. Amateur stations in all of the other countries together total only approximately 25,000. In the United States and her possessions, there are 60,000 valid operator licenses, amateur and commercial.

Of the 44,000 U. S. hams, 334 are women. The largest number of Y.L.'s and O.W.'s, a collection of 80, is in the sixth district. The third district has the smallest number of woman hams.

www.americanradiohistory.com



CALLS HEARD AND DX DEPARTMENTS



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

Frank A. Adams, W6HQM, 2930 Walnut Street, Walnut Park, Calif.

These stations were heard at the Marquesas Islands by W6HQM while aboard the tuna clipper *Cabrillo*. List received via W6GTM.

(14 Mc. c.w.)

W 1AFO-6; 1DZE-5; 2ALO-7; 2AXZ-7; 2AY-6; 2BNX-8; 2HL-7; 3CVK-7; 3JX-7; 4AJY-7; 4CBZ-5; 4CQR-6; 4CYC-5; 4TR-7; 5BB-8; 6BVS-9; 6CUL-6; 6HFB-9; 6KWA-9; 6VF-6; 7AYO-8; 7AVL-8; 8BTK-7; 8CWY-7; 9BPU-6; 9BWT-7; 9DBJ-7; 9GCH-8; 9HUZ-8; 9LQU-7; 9RXL-7. — CH2AZ-7; UE3EL-6; VE4HU-7; VE4RO-8; XE2V-8.

H. E. J. Smith, CP1AA, ex CT2BK, c/o Southern Radio Corp., La Paz, Bolivia
May 1 to July 1

(14 Mc. c.w.)

W 1ADA-4; 1BBT-5; 1BDW-5; 1CC-7; 1CLX-6; 1CQR-5; 1SCR-5; 1DLD-6; 1DMA-5; 1FFK-5; 1FPP-5; 1FTR-5; 1GCX-7; 1GF-6; 1GNE-5; 1HE-6; 1HTR-5; 1ICA-6; 1IFZ-6; 1IKB-6; 1IOG-5; 1JNL-6; 1KA-7; 1SN-5; 1SZ-7; 1TS-5; 1WV-5; 1ZB-5; 1ZI-5; 2AAL-6; 2ADQ-6; 2AHC-5; 2AWF-6; 2AYJ-6; 2BHW-7; 2CBI-6; 2CBO-6; 2CKR-6; 2CMY-5; 2CPA-5; 2CQX-6; 2CTN-8; 2CVJ-5; 2CZV-6; 2DFN-6; 2DLO-5; 2DSH-7; 2DYU-5; 2EQQ-6; 2FAR-6; 2FBA-7; 2FVT-8; 2GIZ-5; 2GKR-5; 2GOM-6; 2GRG-6; 2GVZ-6; 2GWE-5; 2HFP-5; 2IFX-6; 2IFZ-5; 2KL-6; 2KU-6; 3AFW-5; 3ANH-5; 3ANS-5; 3AVJ-5; 3AWH-6; 3YU-6; 3BES-6; 3BFH-5; 3BPF-5; 3BQP-5; 3BQU-6; 3BVN-5; 3BWA-6; 3CDG-6; 3CHH-6; 3DAJ-5; 3DGP-6; 3DLY-5; 3EDP-6; 3EJO-6; 3EMM-5; 3ENX-7; 3EO-6; 3EPJ-5; 3EPR-5; 3EPV-4; 3ERD-6; 3ERJ-5; 3EVT-6; 3EXB-5; 3EXW-5; 3FGO-6; 3FLH-7; 3FQG-5; 3FVS-5; 3JM-6; 3NE-5; 4AH-7; 4AIJ-6; 4AIT-6; 4ATS-6; 4BBR-6; 4BER-5; 4CEN-6; 4CUO-6; 4CYU-7; 4DCK-5; 4DIQ-6; 4DQH-6; 4DRD-5; 4EF-5; 4EG-5; 4OG-7; 4RU-6; 4ZH-7; 5AFX-5; 5AQE-6; 5ATY-6; 5BIQ-5; 5BXC-6; 5CPB-5; 5CUJ-6; 5DQB-6; 5DXG-6; 5DYF-5; 5DZM-7; 5EBT-6; 5EDY-5; 5EGA-7; 5EIP-5; 5EKV-6; 5ERS-6; 5EUL-5; 5FAL-6; 5FIO-5; 5FIX-7; 5FSE-8; 5IF-5; 5JC-6; 5JM-5; 5QL-5; 5SL-6; 5VQ-6; 6ADP-6; 6AET-6; 6AHZ-5; 6BAG-5; 6BAW-6; 6BXL-6; 6CNO-6; 6CQG-5; 6CSI-6; 6CUC-6; 6DOB-5; 6DPJ-7; 6DRE-6; 6EPZ-6; 6EUL-6; 6EYC-6; 6FOZ-5; 6FQY-6; 6FXZ-6; 6FZL-7; 6FZY-5; 6GAL-5; 6GCX-6; 6GIC-6; 6GNZ-7; 6GRE-6; 6GRL-7; 6HJT-5; 6HX-6; 6IDW-6; 6IIG-5; 6IOJ-6; 6JBO-4; 6FJF-6; 6JJA-6; 6JJS-5; 6JMR-5; 6KBD-6; 6KNF-5; 6KRC-5; 6KRI-5; 6KWA-5; 6KWC-6; 6KWH-5; 6KZH-6; 6LCA-6; 6LCF-6; 6LDJ-5; 6LFL-6; 6MFX-5; 6MHB-5; 6MJK-5; 6RH-6; 6SN-5; 6UF-6; 6ZZ-6; 7AFS-5; 7AIS-5; 7BQX-6; 7BYW-6; 7DL-5; 7DXZ-4; 7EOR-5; 7ERA-4; 8ANB-5; 8AVH-6; 8AYD-6; 8AZD-5; 8BJH-6; 8BKP-6; 8BTI-4; 8CED-6; 8CGI-6; 8CTE-5; 8CYT-5; 8DAE-6; 8DFH-5; 8DGB-7; 8DHC-6; 8DJW-5; 8DNE-6; 8DPS-7; 8EMW-6; 8FCV-6; 8FJN-6; 8HUD-4; 8HUS-5; 8HZR-5; 8IPF-6; 8IRH-5; 8JIN-5; 8JMP-5; 8KO-5; 8KPB-6; 8KWI-6; 8LAV-6; 8LCI-5; 8LEC-7; 8LEH-8; 8LRR-5; 8MEE-5; 8MZE-5; 8OSL-6; 9ABE-5; 9AJA-6; 9ALV-6; 9ARL-6; 9ARH-4; 9AUH-6; 9AUJ-5; 9BDX-5; 9BIY-6; 9BU-7; 9CJI-9; 9COH-8; 9CPQ-5; 9CUH-6; 9DEF-7; 9DHT-6; 9DLO-5; 9DMA-6; 9ELA-6; 9FDL-5; 9FS-6; 9FZY-5; 9GDH-5; 9HCO-5; 9HQQ-6; 9HUV-7; 9IJN-6; 9IML-5; 9IWE-5; 9IWY-5; 9IYA-6; 9JDP-6; 9JIE-6; 9JO-8; 9KA-6; 9KFY-5; 9YU-6; 9LB-5; 9LBB-5; 9MUY-5; 9NEV-5; 9NFA-6; 9NNZ-6; 9OKZ-8; 9OPU-7; 9OUD-7; 9PK-6; 9PAT-5; 9PTC-5; 9PXZ-5; 9RAY-5; 9RGR-5; 9RME-5; 9RQM-6; 9RXL-6; 9RZP-7; 9SJ-6; 9SKF-7; 9SPB-5; 9TEX-6; 9TXG-5; 9UAZ-5; 9UOX-4; 9VAT-7; 9VPF-6; 9VQJ-6; 9WAT-7.

Ichiro Terumichi, J2LK, 344-6 Kitashinagawa, Tokyo, Japan
April 1 to May 10

(14 Mc. phone)

KA1AK-8; KA1ME-9; K6LJF-7; NY2AE-8; OA4R-7; VK2BQ-7; VK2NI-6; VS6AQ-8; W6LLQ-9; XE2AE-8; XU8MI-8.

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

(14 Mc. c.w.)

CE3AC-6; HAF7G-4; I1TKM-5; CE1ER-4; OH5NF-7; VQ4CRE-6; XE2C-7; ZD8A-8.

Robert Douglas Everard, Westgate House, Gransden, Sandy Beds, England
April 25 to May 25

(14 Mc. phone)

W 6AH; 6AM; 6ABF; 6AQK; 6AVU; 6BAY; 6BGH; 6BYW; 6CLS; 6CNE; 6CQG; 6DEP; 6DMN; 6DTE; 6EIP; 6EQA; 6ESX; 6FFN; 6FQY; 6FTU; 6GAL; 6GAT; 6GOY; 6GYO; 6HEG; 6ISH; 6IRX; 6ITH; 6JZH; 6KM; 6KMO; 6KSE; 6KSO; 6LFU; 6LLQ; 6LR; 6LY; 7AMQ; 7AQO; 7APD; 7AWY; 7BUH; 7CHT; 7DNP; 7OXT; 7EAF; 7EGV; 7EPU; 7ETN; 7FL; 7FP; 7IF; 7MD; 7QC; 9AA; 9AAN; 9ANZ; 9AR; 9AUH; 9AWO; 9BBU; 9BEZ; 9BHO; 9BQG; 9CCU; 9CG; 9CVN; 9DDF; 9DGY; 9DUM; 9ELK; 9ELS; 9EYW; 9FJ; 9GEG; 9GIM; 9HCD; 9HCR; 9HWJ; 9IEW; 9JNG; 9KFA; 9LGT; 9LVG; 9MVM; 9MEL; 9NGZ; 9OLY; 9PEI; 9QI; 9RA; 9RGH; 9RUK; 9RUW; 9TDI; 9TDJ; 9UVC; 9VOO; 9WVR.— CX1AA; CX2AK; EA8AF; EA8AL; EA8LW; FA3LY; HH2B; HI1C; HI1W; HI2K; HI4F; HI5X; HI6O; HI7G; HJ1ABM; HP1A; K6JLV; K6KKP; LY1J; NY2AE; SU1AG; SU1OH; SU2NE; SU5NG; SU8MA. — VK 2AP; 2BQ; 2BW; 2GO; 2HF; 2NO; 2RH; 2TC; 2UC; 3MR. — VP2CD; VP2KM; VV4AC; XE1CS; XE1G; XE1H; XE2H; XE2N; XE3AG.

Petr. Jastrembskas, LY1J, Hipodromo 14, Kaunas 1, Lithuania

(14 Mc. c.w.)

W 1AHI-5; 1AIH-4; 1AQH-6; 1AVG-5; 1AXA-6; 1BFT-4; 1BHQ-5; 1BJP-4; 1BKL-5; 1BPX-4; 1BUK-5; 1CAB-4; 1CC-4; 1CCA-5; 1CJP-5; 1CNE-5; 1CNU-6; 1DA-4; 1DHE-4; 1DLD-6; 1DOS-4; 1DUK-4; 1DZE-7; 1EWD-5; 1EYP-4; 1FET-4; 1FH-6; 1FID-4; 1FTR-6; 1FUP-4; 1GCX-4; 1GF-7; 1GSH-4; 1GVH-6; 1HWP-5; 1HX-6; 1HXW-4; 1IAS-4; 1IBD-4; 1ICA-4; 1IED-4; 1IIB-4; 1IOB-5; 1IOF-4; 1IQZ-5; 1JLE-4; 1NI-5; 1QV-7; 1RY-5; 1SZ-4; 1TE-4; 1TS-6; 1ZB-5; 1ZD-7; 1ZI-6; 2AAL-6; 2ALB-4; 2ALO-6; 2AXZ-5; 2AYJ-5; 2AZL-6; 2BEF-6; 2BJ-5; 2BVJ-4; 2CGJ-6; 2CMJ-4; 2CLM-4; 2CMY-4; 2CUQ-4; 2CWC-6; 2DIJ-4; 2DLO-6; 2DPA-5; 2DSB-4; 2FL-4; 2FVT-6; 2GFR-4; 2GIZ-4; 2GKR-4; 2GMZ-4; 2GVZ-4; 2ICO-6; 2JME-6; 3AFW-3; 3AGC-4; 3AOJ-4; 3AYS-4; 3BPT-5; 3BSY-5; 3BWA-4; 3BZB-4; 3BZE-5; 3CHH-4; 3CRK-4; 3DAV-5; 3DBD-4; 3DCG-5; 3DNQ-4; 3DVE-5; 3DZX-4; 3EAX-4; 3EHW-5; 3EIG-5; 3EJO-4; 3EJM-4; 3EMM-6; 3ENS-5; 3EPR-4; 3EYS-6; 3FKK-5; 3FYR-4; 3JM-5; 3KF-4; 3KU-5; 3NK-5; 3PC-6; 3SI-6; 3YC-7; 3ZU-5; 4AGP-4; 4AJX-5; 4BBP-3; 4BSJ-4; 4BVD-4; 4CEN-4; 4CYJ-5; 4BHZ-4; 4FT-5; 4TR-5; 5LW-4; 6BAG-5; 6FHY-4; 6HX-4; 6KBD-6; 6LW-4; 7APG-5; 7DL-6; 7DVY-3; 8AAT-4; 8AIE-5; 8AON-4; 8AU-4; 8AYD-4; 8BFG-5; 8BTI-3; 8CBC-4; 8CKY-4; 8CTE-4; 8CYT-4; 8DOD-4; 8EIS-5; 8EMW-4; 8EUY-4; 8FIP-5; 8HCL-4; 8HXK-4; 8JIN-3; 8JK-5; 8KKG-4; 8KKR-4; 8KPL-3; 8KWI-4; 8LEA-5; 8LKT-4; 9AFN-4; 9CIA-4; 9GDH-4; 9IJ-5; 9JFB-4; 9KG-4; 9POV-5; 9PD-4.

Eugenio Alves de Moura, CT1ZZ, Rua das Antas, 472, Porto, Portugal
June 21 to July 18

(14 Mc. c.w.)

W 1AEP-6; 1BLO-6; 1BUK-6; 1BWJ-5; 1CSR-6; 1CUX-2; 1ELR-6; 1FDN-5; 1FOJ-8; 1FPP-7; 1GOR-7; 1GRV-9; 1IGX-6; 1ILY-6; 1ISL-9; 1IVE-4; 1JUG-6; 2ARK-5; 2BDZ-6; 2CAY-6; 2CCI-6; 2CIL-6; 2CS-6; 2DI-5; 2DMN-6; 2DRJ-6; 2DYU; 2EGG-6; 2ET-8; 2FFG-6; 2FIM-7; 2FPM-7; 2GHT-6; 2GKE-6; 2HEA-7; 2HGB-5; 2HJL-5; 2HMJ-7; 2HZP-6; 2IPZ-5; 2IUV-7; 2JME-6; 2LYZ-6; 3AGV-7; 3AHS-5; 3AXD-6; 3BKZ-6; 3BXG-6; 3BYI-6; 3DGP-5; 3DI-7; 3DOT-6; 3EDP-9; 3ENX-8; 3EPF-6; 3ERD-5; 3FLL-5; 3FSP-6; 3GEB-6; 3GHD-5; 3QT-7; 3ZF-6; 4DO-5; 4DRD-7; 4DTR-4; 4EAK-5; 4RU-6; 4ZG-5; 5CUJ-4; 8BTI-9; 8BZD-6; 8DAE-6; 8DM-7; 8DZC-5; 8ERJ-5; 8FHM-4; 8HSC-7; 8HUS-6; 8IMR-6; 8IRH-6; 8KDO-7; 8KTW-7; 8LCI-6; 8LHC-4; 8MFW-8; 8MHO-6; 8NBK-5; 8NPR-4; 8NSC-7; 8OQF-7; 9ALV-6; 9BVI-6; 9CH-6; 9DHT-6; 9JDP-7; 9NKO-6; 9OXD-4; 9PST-7; 9RKP-6; 9SII-4; 9SYJ-7; 9THH-7; 9UNZ-6; 9VJI-6; 9VWL-4.

www.americanradiohistory.com

Robert Mele, W8EMW, 142 Roney Road, Syracuse, N.Y.
June 1 to July 1

(14 Mc. c.w.)
CE1AR; CE3EN; CM2AG; CM2AO; CM2BA; CM2EA; CM2OP; CM8GF; CN8MU; CP1AA; CP3ANE; CT1GD; CT1KR; CT1ZZ; CT2BC; CT3AN; CX1BG; CX1CX; CX2AK. — D 3CFH; 3DXU; 3FXI; 4CSA; 4HCF; 4IZI; 4JTK; 4JUB; 4JZI; 4KMG; 4KRJ; 4NIC; 4OAR; 4ORT; 4PIU; 4QNM; 4TJH; 4TKP; 4TPJ; 4VRR; 4YBF; 4ZPI. — EA 0AA; 1BA; 2AD; 2BH; 3BV; 3CZ; 3DL; 3EG; 3ER; 4AP; 4AV; 4AW; 5BS; 8AN. — EI 5B; 5F; 5G; 6G; 6F; 7J; 8B; 8F; 8J. — F 3AJ; 3AU; 3DN; 3EY; 3JR; 3KR; 8AI; 8CP; 8DC; 8EF; 8EX; 8IG; 8NJ; 8PZ; 8RC; 8SK; 8SN; 8WQ; 8XH. — FB8AG; FM8AD; FT4AB; FT4AG; FT4BB. — G 2CL; 2DC; 2FH; 2HQ; 2IU; 2KB; 2KX; 2LB; 2MV; 2NH; 2TX; 2BV; 2WQ; 2WW; 2ZQ; 2ZY; 5BI; 5BJ; 5BP; 5CV; 5GI; 5GR; 5JF; 5JO; 5JX; 5ML; 5MS; 5RI; 5RS; 5SS; 5WY; 5XQ; 5YH; 6AG; 6BQ; 6DL; 6JC; 6GN; 6IJ; 6MH; 6MS; 6MY; 6NB; 6NX; 6OX; 6QN; 6RT; 6UW; 6VQ; 6YK. — GI2CN; HAF2I; HAF3B; HAF3D; HAF4H; HAF5C; HAF8C; HAF8I; HB9AK; HB9AL; HB9AW; HB9AZ; HB9BD; HC2MO; HH3L; HH5PA; HI6O; HJD7A; HJ3AJH; HS1PJ; I1IR; I1RRA. — J 2CL; 2HQ; 2JJ; 2KJ; 2LU; 2ME; 3FJ; 6DO; 8CA. — K 4BU; 5AA; 5AC; 5AG; 5AH; 5AV; 5AY; 5BF; 6AKP; 6KSI; 6LEJ; 6MXM; 6MRF; 7IL; 7UA. — LA5S; LA7R; LU1CM; LU2AM; LU3DH; LU5AQ; LU6AD; LU6DG; LU8EN; LX1AO; LY1HB; LZ1A; OA4Z; OA4M; OE3WB; OE7EJ; OE7JH; OH2OD; OH2RJ; OK1CX; OK2HX; OK2PL; OK2PN; OK3VA; ON4AU; ON4GW; ON4LZ; ON4MS; ON4OU; ON4PA. — OZ 1WP; 2EI; 3J; 3NN; 4H; 4LM; 5M; 7CC; 7SS; 8JB. — PA 0AD; 0AZ; 0DZ; 0FLX; 0GN; 0HG; 0IDW; 0IR; 0JJ; 0JMW; 0KA; 0MT; 0MW; 0SD; 0OK; 0YQ. — PJ4A; PK1MO; PK1PK; PK6AK. — PY 1AW; 1DC; 2BB; 2BX; 2CN; 2CW; 2DO; 2GJ; 2QD; 3CJ; 7AA; 7BB. — PZ1PA; SM5UU; SM6UR; SM6WL; SM7WS; SM7YA; SP1DA; SU1AB; SU1CH; SU1SG; SU1TM; SU5NK; SXAD; TI2AP; TI2TAO; TI3WD. — U 1BU; 1DB; 2NE; 3BC; 3DI; 3QT. — VK 2AP; 2BX; 2DG; 2EG; 2EI; 2EL; 2HP; 2HV; 2KS; 2MC; 2MY; 2NY; 2OW; 2PX; 2QE; 2TD; 2TI; 2UB; 2UN; 2VA; 2VG; 2WQ; 2XU; 2ZC; 3CX; 3DF; 3DP; 3FO; 3HK; 3KR; 3KX; 3ZZ; 4DO; 4EL; 4FJ; 4HR; 4WJ; 5FM; 5GL; 5WG; 5ZC; 6FO; 7AV; 7JB; 7KV. — VQ3FAR; VQ4CRH; VQ4KSL; VQ4KTA; VQ7AA; VS1AA; VS1AF; VS2AG; VS4MT; XE1AA; XE1DA; XE1H; XE2N; XE3AC; XOH3NQ; YL2BB; YL2BH; YM4AA; YM4AG; YR5OR; YT7KP; YV5AA; ZK1AA; ZL1EV; ZL1JY; ZL2QA; ZL2QM; ZL2QT; ZL2QU; ZS2L; ZT2Q; ZS6Q; ZU9A.

J. Vincent McMinn, 12 Edge Hill, Wellington, C-3, New Zealand
May 1 to June 1

(14 Mc. phone)
W 1AXA-6; 1BQQ-6; 1CND-6; 1CNV-7; 1DAH-5; 1DNL-7; 1FVO-7; 1SZ-8; 2AIH-8; 2AIO-6; 2BYM-7; 2EDW-7; 2ELO-6; 2FHI-6; 2FHJ-6; 2FLG-6; 2GMG-6; 2GOQ-8; 2HUQ-6; 2IHW-7; 2ZC-7; 3AHR-7; 3AHS-7; 3APO-7; 3BNC-6; 3BWW-7; 3DQ-7; 3SI-7; 4CFD-6; 4OC-6; 5ACF-7; 5AOT-7; 5BEE-8; 5BFS-7; 5BMM-6; 5CSR-7; 5DSV-7; 5DUK-7; 5EEH-6; 5FHM-7; 5MT-7; 5SJ-7; 6AH-6; 6AM-7; 6ANU-6; 6AQK-7; 6AVU-6; 6BGH-6; 6BHO-7; 6BIV-7; 6BWE-6; 6CFJ-7; 6CIF-7; 6CNE-6; 6CQG-7; 6EQA-7; 6EQK-7; 6ETX-7; 6GNP-7; 6GOT-6; 6HQK-7; 6HZO-6; 6ISH-7; 6JYH-7; 6JZH-8; 6KSE-6; 6KW-6; 6MIT-6; 6MVR-8; 6NIT-7; 6PB-5; 7ALZ-7; 7APD-7; 7AQO-6; 7BUH-7; 7FU-6; 7IF-7; 7QC-7; 8CRA-6; 8EPC-6; 8HAF-7; 8JSY-6; 8JVF-6; 8LPI-6; 8LQI-7; 9AKO-6; 9ANZ-6; 9BBU-7; 9BEZ-7; 9BPM-7; 9EOZ-7; 9GJY-7; 9HLG-6; 9JIY-6; 9JLR-6; 9JUX-5; 9LD-9; 9QC-6; 9RUK-6; 9SZY-7. — CO2KY-6; CO2WZ-8; CO7CX-6; D4AGR-5; EA5BE-6; EA7AI-8; F8II-6; K7FCR-6; KA1AK-6; NY2AE-6; OM2RX-6; SU1CH-7; TI2FG-6; VE3DF-6; VE3HC-7; VE3NF-6; VE4CW-6; XE2AH-7.

(14 Mc. c.w.)
CE1AQ-6; CM2AZ-7; CM2DO-5; D4HCF-7; D4KMG-6; D4MNL-5; D4RYM-5; D4TKP-4; D4VRR-7; D4XCG-6. — EA 1AT-5; 1AZ-6; 1VA-5; 3BP-6; 3CZ-5; 3DL-6; 4AP-7; 4AV-6; 4BM-5; 4BW-6. — F 3BR-5; 8AI-3; 8BS-6; 8ED-7; 8LG-4; 8NV-5; 8PK-6; 8PZ-6; 8OK-5; 8VP-4; 8WK-5. — HAF3D-5; HAF8C-6; I1TKM-7; J6DG-5; K5AM-5; LA1G-5; LY1J-6; OA4AT-5; OE1EK-5; OK1BC-4; OK2AK-6; ON4AU-5; ON4SS-5; OM2RX-6; PAOAZ-4; PAOKG-4; PY2DO-5; SP1GZ-7; SV1KE-6; U3AG-6; U5AE-6; U9MF-6; VE2HN-5; VP5AA-5; XZN3D-7; YT7MT-6; YT7VN-5.

(7 Mc. c.w.)
CT3AN-5; D3BFN-5; D4CSA-6; D4IJD-5; D4UYD-5; D4WYG-5; EA1AW-6; EA5AQ-5; EA5CG-5; F8DC-7; F8PX-6; K7ANZ-6; K7CHP-6; LU8DJQ-6; OE3AH-6; OK1BB-4; ON4DN-4; PAOOX-5; PAOYS-5; SP1IH-5; U2AV-6; U2ED-5; U3BI-5; XE1BA-6; XE1DY-6; XE1HG-5; XE3Y-5; XU8RR-7; XU8TT-6.

E. L. Walker, W8DFH, 2717 Connecticut Ave., Pittsburgh, Pa.
June 8 to July 8

(14 Mc. phone)
CE1BC-7; EA5BR-8; EA7AI-9; G2NH-8; G5ML-9; G5SV-9; G5VO-9; G6LK-8; G6XR-9; HH5PA-8; HI2K-7; HI4F-8; HI5X-9; HI7G-8; K6CMC-9; K6LJB-9; LU4BH-8; NY2AE-9; OA4R-7; TI2RC-8; TI3AV-8; TI5JJ-8; VK4JX-8; VO1I-8; VO4Y-8 VP9R-7.

(14 Mc. c.w.)
B4UP-8; CE3EN-8; CN8MN-7; CP1AA-7; CP3ANE-8; CT1KR-7; CX1BG-7; CX1CC-6; CX1CG-6; CX2AK-7; CZ2G-7. — D 3CFH-7; 3DXU-7; 3FDF-6; 3GKR-6; 4ARR-6; 4CSA-7; 4NPR-6; 4OUT-6; 4SLD-7; 4SXR-6; 4XCG-8; 4ZPI-6. — EA4AP-7; EA4BW-8; EA5BS-7; EI5F-6; EI6F-6; EI8B-7; EI9F-7; ES5C-6. — F 3AU-7; 3DN-6; 3DC-7; 8EF-6; 8GG-6; 8JD-6; 8LG-7; 8NP-5; 8RC-7; 8RR-5; 8PQ-7; 8WK-7; 8XH-7. — FA3JY-7; FB8AB-8; FB8AD-7; FB8AG-7; F24AE-6. — G 2DC-7; 2OH-7; 2FP-6; 2IM-6; 2KB-7; 2LA-6; 2LB-7; 2MV-6; 2UL-7; 2VU-6; 2XY-7; 2YY-7; 5BU-7; 5BP-7; 5HB-6; 6KT-7; 5KX-7; 5LI-6; 5OQ-6; 5QA-6; 5QY-7; 5YH-7; 6CJ-6; 6CL-7; 6DB-7; 6DL-7; 6OP-6; 6GN-6; 6JF-6; 6KO-6; 6KP-6; 6NJ-8; 6NX-6; 6OX-7; 6PY-6; 6QB-7; 6TD-6; 6VP-8; 6WO-5; 6WU-7. — GI5QX-7; GI5UR-6; HAF3D-8; HAF5C-8; HB9AK-7; HB9AZ-7; HB9B-7; HB9BL-7; HC2JM-8; HC2MO-6; HH3L-7; HI4F-7; I1TKM-6. — J 2CB-7; 2CL-8; 2JJ-7; 2KJ-9; 2LU-8; 2ME-6; 3FK-7; 5CE-6. — K 4UG-7; 5AA-8; 5AC-7; 5AG-7; 5AH-8; 5AM-6; 5AV-8; 5AY-7; 6AKP-7; 6KCN-9; 6LBH-7; 6LEJ-7; 6LHK-7; 7ENA-7; 7FCR-7; 7LW-9; 7UA-9. — KA1AN-6; KA1LB-7; LL2A-8; LU1MC-7; LU4BA-7; LU5BZ-6; LU6AD-7; LY1J-7; NY1AA-7; NY1AB-7; NY1AD-7; NY2AD-7; OA4AM-7; OA4J-8; OA4M-7; OH2OV-6; OH3NP-8; OH5NR-6; OK1LM-6; OK2HX-6; OK2LU-6; OK2PN-6. — ON 4AS-8; 4AU-9; 4FX-7; 4GG-8; 4GW-8; 4HC-7; 4LB-7; 4RAY-6; 4VW-8. — OZ2H16; OZ3O-6; OZ7SS-7; OZ9P-7. — PA 0AZ-7; 0FD-7; 0HC-7; 0HG-7; 0JB-6; 0JMW-8; 0LR-7; 0MDW-7; 0MW-6; 0NW-6; 0QZ-7; 0XF-9. — PK1MO-6. — PY 1AJ-6; 1DC-7; 2AP-7; 2EA-7; 2GJ-7; 2GS-6; 2JO-6; 2QD-7; 3CF-6; 5AA-6; 7AA-9; 7BB-7; 9AD-6. — PZ1PZ-6; SM5RS-6; SM5UL-5; SM5WZ-7; SM5YQ-6; SM7UC-6; SM7WS-7; SP1CM-7; SX3A-9; TI2DB-6. — U 1AD-6; 1AE-6; 1CN-5; 2NE-7; 3AG-6; 3DI-7; 9MF-7; 9MI-7; 9MJ-7. — VK 6AA-8; 6CA-7; 6FO-7; 6KB-6; 6MO-7; 6MW-7; 6SA-6. — VO1N-8. — VP 1JR-7; 1WB-8; 2AT-8; 2BX-7; 2DF-7; 4TA-7; 5AB-8; 5AG-7; 5JB-8; 5PZ-7; 7AA-9; 9YR-8. — VQ8AB-6; VQ8AG-6; VR4BA-7; VU2CQ-6; YM4AA-8; YN1AA-9; ZB1H-7; ZD8A-8; ZE1JJ-6; ZE1JS-7; ZP2AC-6; ZS1AX-7; ZS4J-7; ZS4U-7; ZT6AQ-6; ZU1T-7; ZZ2A-8.

John Videberg, W1IYX, 41 Rosemount Avenue, Waterbury, Connecticut

(56 Mc. dx heard)
W 1AOZ; 1BBK; 1BCR; 1BJE; 1BPH; 1BSI; 1CDR; 1CK; 1CPU; 1DBE; 1DQ; 1DVK; 1ECM; 1ETA; 1EWM; 1FMC; 1FQV; 1FWK; 1FZU; 1GEA; 1GKU; 1GMF; 1GUJ; 1GZM; 1HBT; 1HDJ; 1HM; 1HMA; 1HMM; 1HMV; 1HOM; 1HPV; 1HRX; 1HRZ; 1HSV; 1HUD; 1HUZ; 1HVM; 1IFO; 1IHY; 1IKN; 1IWG; 1IXO; 1JGN; 1JIQ; 1JPW; 1JQT; 1JWN; 1OM; 1VW; 1WH; 1WT; 1XAV; 1XW; 1ZAC; 1ZK; 2AG; 2AHX; 2AIT; 2AMN; 2ASY; 2AXM; 2AYC; 2AZB; 2BBM; 2BJ; 2CBN; 2CEL; 2CFY; 2CJJ; 2DCP; 2DFI; 2DKJ; 2DX; 2EWL; 2FUW; 2GEC; 2GIK; 2GKY; 2GYM; 2HCK; 2HFX; 2HG; 2HMB; 2HNW; 2HPZ; 2HUT; 2IAG; 2IAR; 2ICA; 2IFU; 2IFV; 2IGH; 2IGK; 2IHR; 2IJU; 2IMF; 2IPY; 2IRY; 2ISY; 2ITE; 2ITY; 2IVO; 2JCJ; 2JDB; 2JKM; 2JLR; 2JNO; 2JOQ; 2JZ; 2LI; 2MO; 2NF; 2YK; 2YP; 3AC; 3AUY; 3AZN; 3CNI; 3DRA; 3DX; 3FHT; 3LIK; 9LBP.

◆

In 1906, Poulsen made much of his feat—transmitting radio signals over a distance of 190 miles "with only half a horsepower".

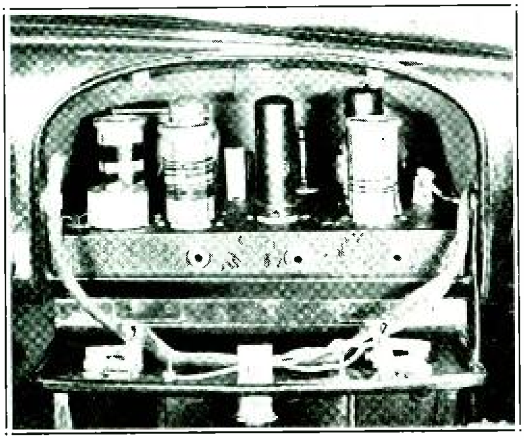
◆

Americana—A Lynn, Mass. publisher in 1906 advertised a book which told how to repair one's telephone "when the blamed thing won't work". Sounds like some of the phone hams now on the air are using the book as a reference.

www.americanradiohistory.com

A 28-33 Mc. Crystal Controlled Mobile Unit

By Louis R. Padberg, Jr.,* W9FPA



The 9 Meter Crystal Controlled 6L6 Mobile Transmitter, Installed in a Glove Compartment

Frequency stabilization of a transmitter operating on the high and ultra-high frequencies has been highly desirable, but due to the difficulties involved in the several doubler stages usually needed to give sufficient power to drive a modulated amplifier, too many of the rigs operating in our crowded bands have been of the self-excited or m.o.p.a. (non-crystal) type. With the present interest being shown in the ultra-high frequency spectrum by commercial and governmental interests, it would be well to improve the stability and quality of the signals which we are emitting in the more popular high frequency bands. Needless to say, this will also improve the pleasure of operating in those bands, besides aiding in retaining these frequency assignments and the chance of getting more in those regions.

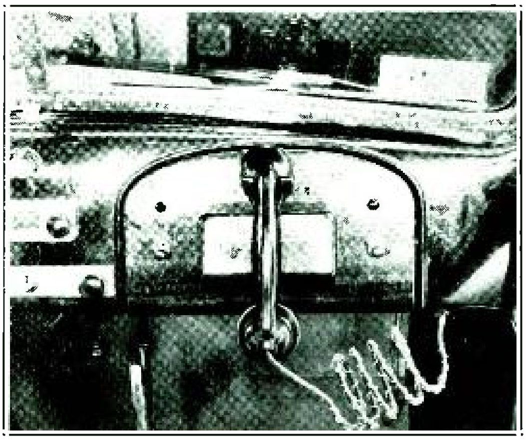
Two years work with various types of modulated oscillators, m.p.o.a., and crystal controlled layouts led to the development of the unusually simple yet satisfactory transmitter which is described in this article. Small and simple, it can be installed in the glove compartment of most any car, and has frequency stability and quality of output which compares favorably with the better rigs on the lower frequency bands. Although designed for the police mobile communication frequency of 33,100 kcs. (nine meters) the design is such that with a few changes in tank coil dimensions and a suitable crystal frequency, it is ideal for low-powered home use on ten or five meters, or as a mobile rig for the five meter amateur band. The measured output is between 10 and 15 watts, depending on the input voltage.

*Chief Operator KGPC, St. Louis Metropolitan Police

In the first setup, the tubes were of the all-metal type, but tests showed that in the case of the crystal oscillator tube, somewhat greater output was secured when using the glass 6A6. So the present rig uses a combination of both types of tubes, glass and metal.

As used on the police transmitter, the 6A6 crystal oscillator is tuned to a frequency of 8,275 kc. and the output is quadrupled in the second triode section of the 6A6 to 33,100 kc. and fed to the grid of the 6L6 r.f. amplifier. This arrangement, the "Gordon Exciter", gives better output than any of the others tried, but due to the abundant harmonic output, some simple type of absorption wavemeter should be used to note definitely the frequency of the harmonic being used.

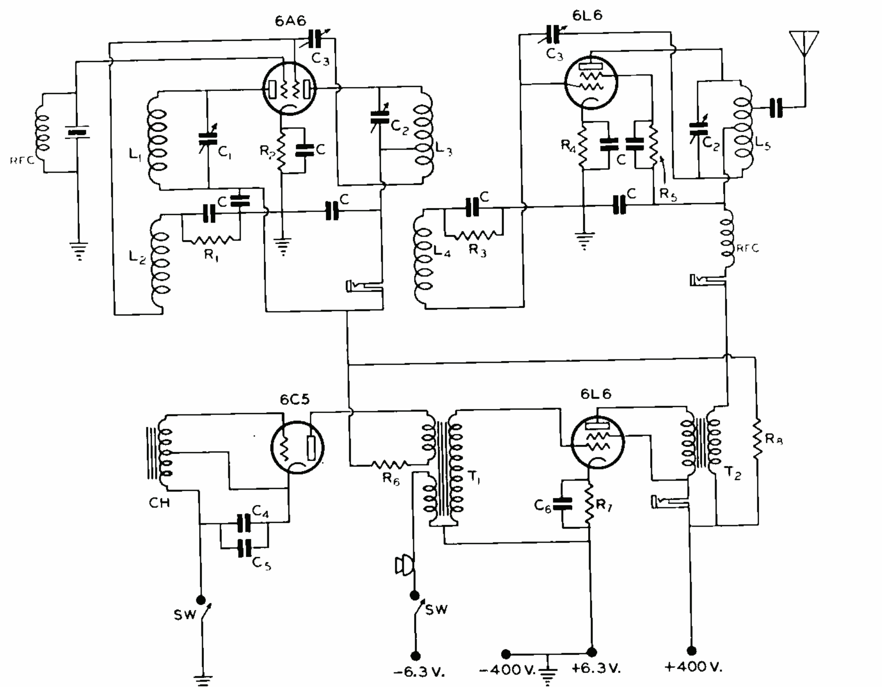
The 6L6 as an r.f. amplifier is exceedingly easy to excite but care should be used in the placement of parts, because due to the high transconductance of this tube, some weird effects may be noted, particularly in regard to self-oscillation.



Neat Arrangement of Handset and Controls, Compartment Closed

In the original plan, modulation was to be accomplished by a pair of 6L6 tubes, but it was

www.americanradiohistory.com



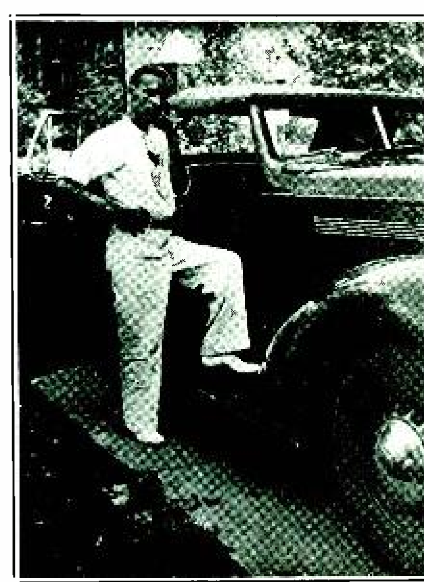
Wiring Diagram of the 9-10 Meter Mobile Unit

C—0.1 µfd. mica or tubular paper
C_1—100 µµfd. midget
C_2—50 µµfd. midget
C_3—5 µµfd. midget
C_4—.05 µfd. paper
C_5—.003 µfd.
C_6—10 µfd. 50 volt electrolytic
CH—Primary of universal output transformer; choose taps to give tone desired
T_1—Dual purpose midget transceiver transformer, 100 ohms and plate of tube to grid
T_2—Transceiver modulation transformer
R_1—20,000 ohms, 2 watts
R_2—400 ohms, 10 watts
R_3—10,000 ohms, 2 watts
R_4—100 ohms, 2 watts
R_5—10,000 ohms, 10 watts
R_6—20,000 ohms, 10 watts
R_7—1000 ohms, 10 watts
R_8—500 ohms, 10 watts
L_1—12 turns no. 18 E.
L_2—19 turns no. 24 E.
L_3—6 turns no. 18 E.
L_4—7 turns no. 18 E.
L_5—3 turns no. 18 E.
Note: Coils are all wound on standard 1½" plug-in forms, low loss material. Turns are for 9 meters. For 10 meter amateur band, increase a slight amount for best results. L_3, L_4, L_5 spaced diameter of wire. L_3 tapped at approximate center.

found that a single 6L6 working without any driver stage and directly from the output of a high grade single-button microphone modulated the "almost-thirty-watts" input very satisfactorily. This was surprising but everything about this tube is remarkable. The 6L6 was also tested as a harmonic oscillator and gave outputs greater than had been obtained with any other arrangement using a single tube. Care should be taken when using the familiar "tritet" circuit with fairly high input, as the crystal current may be higher than the crystal can stand. The author, after waiting two months for a specially ground crystal, had the misfortune to break it into several pieces due to too-high crystal current under these circumstances.

The described transmitter was installed in the glove compartment of a car and a vertical "fish-pole" antenna was fed by means of a concentric feeder. The first test produced consistent signals over a three-mile area. A high point was then tried and signals from the car were readable over a distance of 15 miles right through the heart of the city. This had never been done with any transmitter previously tried. At this

[*Continued on Page 74*]



The Author Calling the Home Station for a "Test One to Ten"

www.americanradiohistory.com

A Portable Audio Oscillator of Many Uses

By Ray Dawley, W6DHG

In the course of tuning up a ham phone transmitter, especially one using a class "B" linear or grid modulated stage, a source of constant tone becomes almost essential. One of pure waveform and constant output is especially useful. Whistling and prolonged "oh"s are both poor and highly irksome substitutes. How many times have you wished that you could be both in front of the mike emitting more or less of a sine wave in the form of a whistle, and over at the rig watching that meter or the plate of some tube? A small portable audio oscillator can easily and inexpensively be made that will soon make itself indispensable in the performance of these and similar tasks.

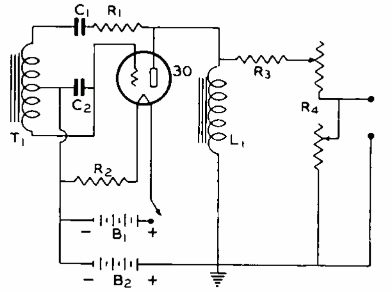


Figure 1
Actual Hookup of the Audio Oscillator

T_1—Small p.p. output to v.c. transformer
L_1—12 hy. 20 ma. choke
C_1—.02 µfd., paper
C_2—.02 µfd., paper
R_1—75,000 ohms, 1 watt
R_2—20 ohm filament resistor
R_3—250,000 ohms, 1 watt
R_4—Dual 250,000 ohm pot., connected as L pad

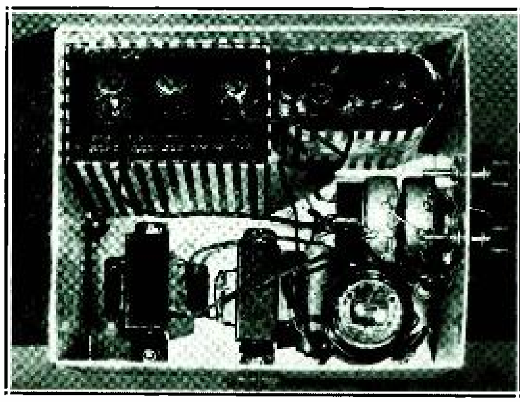
The units to be described are simply small, battery-operated, single-frequency audio oscillators with resistance stabilization. A type 30 tube is used as the generator, operating with 45 volts on the plate. Through the use of the new, ultra compact Burgess types F2BP for filament and Z30P for plate, the units are comfortably housed in a standard 5/5½/6" shield can. The original idea of using a pilot lamp to indicate if the gadget were inadvertently left on was discarded, the reason being that the smallest lamps ordinarily available draw no less than 60 ma. This doubling of the battery drain makes the economy of the safeguard very doubtful. These batteries will undoubtedly give long life in the intermittent type of service ordinarily required of a unit such as one of these. The first one to be built up has been in more or less continuous usage for the past four months without any apparent ageing of the components, either batteries or tubes.

It will be noticed from the circuit diagram that choke feed instead of the more usual resistor parallel feed is used. This greatly reduces the IR drop in the plate circuit, allowing practically the full battery voltage to appear at the tube. Greater output with less harmonic content is obtained through this expedient. The components listed with the first diagram gave an oscillator with the following output characteristics:

Frequency of oscillation........................720 c.p.s.
Harmonic content..........Undetectable on 'scope
Maximum r.m.s. output (500M ohm ext. load)..4.1 volts
Minimum output.........Just detectable on input to high gain amplifier

Manufacturers' tolerances in components will undoubtedly introduce variations, but the above gives an idea of what can be expected.

The output system shown, used with a half megohm external load, gives a useful variation from a maximum of 4.1 volts r.m.s. (5.75 peak) down to the approximate level of a crystal mike. Consequently the output can be connected directly to the high impedance input of almost any conventional amplifier without fear of overload. Of course it can be fed also to the grid of some higher level audio stage as long as a peak voltage of about six volts is adequate.



The Unit with Lid Removed, Showing Construction

www.americanradiohistory.com

Figure 2 shows a somewhat different arrangement with an output impedance of approximately 200 ohms. This arrangement would be more adaptable to a speech amplifier designed for double button, condenser mike, line, or other low impedance input. A pad of about 10 db loss is put between the plate circuit and the load to reduce the effect of external variations on the oscillator itself. This reduces the output level to about -30 db or .03 volts across the terminals.

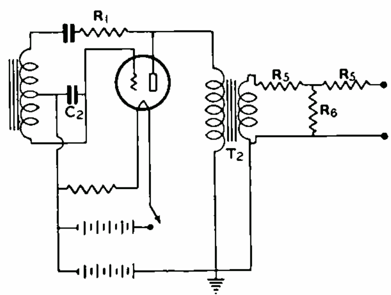


Figure 2
Alternative hookup for 400 cycle tone, 200 ohm output

T_2—Same as T_1, with 8 ohm voice coil winding to T pad
R_1—50,000 ohms, 1 watt
C_2—.07 µfd., paper
R_5—100 ohms
R_6—150 ohms

If a different frequency is desired it is easily obtained by using a different condenser value for C_2. A .01 µfd. gives about 1000 cycles; .07 µfd., 400 c.p.s.; and 0.1 µfd., about 250 c.p.s. Any other frequency in this range may be obtained by taking the value of inductance of one side of the transformer as 2.5 henries and figuring the appropriate capacity to give the frequency desired. In any case if the value of C_2 is changed, the resistor R_1 should be changed also. This resistor should be adjusted experimentally to the largest value that will just allow stable oscillation. Higher capacities will require a somewhat lower resistance than given, and conversely with lower capacities. This procedure must be carefully carried out if a minimum of harmonics in the output waveform is required.

◆

It is regrettable that a larger number of hams did not hear the nation-wide *Stoopnagle and Bud* broadcast early in September, when the comic pair mimicked the first evening with an all-wave receiver. A dopey ham QSO was tuned in and it was a riot from start to finish—everything from "class-B crystals" to "K-Please".

◆

The F.C.C. states that it has no intention at present of resuming publication of the official amateur call-book.

OPEN FORUM

License Fees?

Fresno, Calif.

Sirs:

Inasmuch as the hams have gone about legislating themselves out of a lot of frequencies, why can't they go a step further and try to talk Uncle Sam into requiring a license fee, based on the amount of power used, etc.? This fee could also be applied to commercials, and might result in fewer "V wheels".

If we were paying for our operating privileges, perhaps the government would take notice of the number of shekels they could take in by encouraging amateur operation. The crowded conditions would cut down the number of amateur stations, and as a result it would be to the interest of the government to relieve the crowded conditions to increase its revenue. Besides, if we paid for our privileges, we would have more of a right to air our grievances than now, and more of a chance of having something done about them.

Of course a terrific howl would go up from a lot of amateurs, but when one has from $100 to $5000 tied up in amateur gear, wouldn't it be wise to loosen up a few extra dollars a year to enable us to enjoy our investment to the fullest extent, and get the most returns per dollar spent on our hobby?

CLYDE C. ANDERSON, W6FFP.

●

"All Right, All Right"

Perth Amboy, N.J.

Sirs:

. . . . This business of the general public's getting the wrong impression of us who are radio amateurs or "hams" as compared with the general public's idea of those "radio amateurs" who try to enter the entertainment field, seems to need further clarification, I think. In speaking with people not familiar with amateur radio, I find that the phrase "amateur radio communication" seems to give those people the correct impression the first time that mention is made of amateur radio. My experience has been that they usually want to know what instrument I play or do I sing. And then follows a short educational course in proper interpretation of the words used during the conversation! This is just another thought to keep our spirits up and going . . . .

WILLIAM L. HAAS, W2GMY.

www.americanradiohistory.com

A Medium Power Band Switching Transmitter

By R. C. Henning,* W6CBN

Being able to switch bands in a hurry with but little effort is sometimes of more advantage than kilowatts of power. Here is a versatile transmitter that puts out 300 watts on c.w. and about 65 watts on phone. It can be switched from one band to another in very short order. No innovations; just a transmitter that really works plus the incorporation of band switching.

After building many transmitters, ranging from a 210 in a Hartley circuit to the popular multi-stage crystal control transmitter of today, it was decided that the job of winding the coils for the different stages was the most oppressive job of all. In fact, seldom it was that enough ambition was mustered to wind coils for more than two bands, and even at that it required some good rumors about European dx to rouse me into winding those 20-meter coils. Invariably after changing about six plug-in coils and re-neutralizing all stages, which is no little job in itself, I would find the elusive dx coming in on the band I had just deserted. Now after this disagreeable task of plugging and unplugging coils had been done many times and I began to realize that I was deriving absolutely no enjoyment from it at all, and that it robbed me of time that could be spent usefully on the air, I decided that band switching was the only way out.

As the aforementioned events took place about a year ago, the next transmitter built was not a band switching model simply because some authors were still condemning the principles of tapping coils or shorting out portions. Since this time considerable progress has been made in this line. Coil switching in receivers is an accepted matter now and at one time it was called bad practice; so this enheartened me to make my next transmitter one incorporating coil switching. I entertained some fears as to the outcome of this venture but in the end it was discovered they were entirely unfounded.

The previous transmitter was of table style, built on a wooden chassis; so being of a changeable mind, rack and panel design was decided upon. Breaking all precedent, phone equipment would also be included (a microphone won at a convention simply had to be used) and operation on the three popular bands, 80, 40, and 20 meters, would be possible. Having never operated any more power than is capable of two 210's in push-pull in the final stage, the trend is naturally to higher power. So a final stage possessing the qualities of being able to take between 200 and 400 watts input with ease and at no time being under any strain or overload was desired. The tube lineup or the number of stages is of considerable importance, especially so in a coil switching transmitter; for if one has to set a dozen or so switches to change bands it will soon get tiresome and the main purpose of the switches will be defeated. With all these ideas in mind some definite plans were made for the transmitter.

The Rack and Chassis

Being quite familiar with standard relay construction from commercial work, the building of a rack presented no difficulties. The following materials bought from a local iron and steel works constitute all that is required to build a rack of 36 units (63" of panel space): 2 pieces of 3" channel steel 5' 9" long; 2 pieces angle steel 3/8" x 4" x 6"; and 2 pieces of soft steel 1/4" x 2" x 20 1/2". All pieces were cut to exact length by the steel works and the total cost amounted to $4.50. Now it was my good fortune to be acquainted with a machinist who possessed a template which had been used to drill the holes for other standard relay racks; so it only required, with the aid of a high speed drill and drill press plus an automatic tapper, a couple of hours to drill and tap the 144 holes (72 to a side).

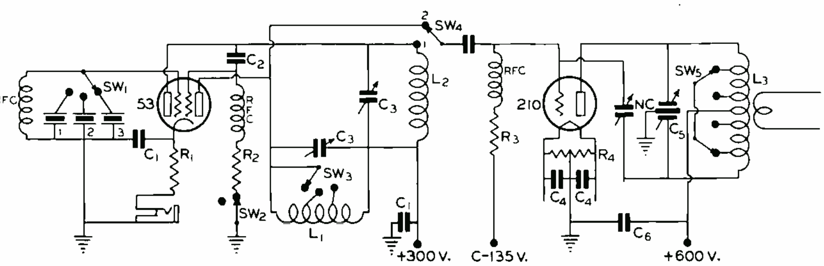
A 12-24 machine thread was chosen for the mounting holes, the sometimes-used 10-32 thread appearing entirely inadequate for the weight which is placed on the power supply chassis. For the specifications of drilling a standard rack I would refer you to any General Radio catalog, in which full particulars appear.* The two steel angles which constitute the base are also drilled for permanent mounting with lag screws or possibly for casters.

With the channels laying on the floor parallel to each other and with the correct spacing, which can be determined by placing the two 20 1/2" strips at the extremities of the channel

*3737 Irving St., San Francisco, Calif.

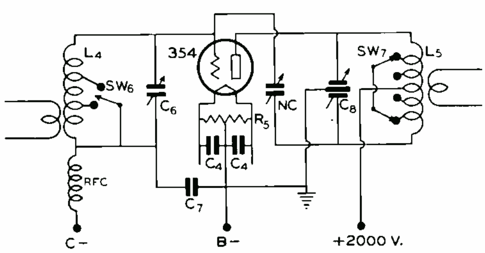
*Also April 1936 Radio, page 38.

www.americanradiohistory.com



The Exciter and Buffer Unit

C_1—.01 µfd., mica or tubular paper
C_2—.0001 µfd., mica
C_3—100 µµfd. midget
C_4—.002 µfd. mica
C_5—Split stator, 100 µµfd. per section, 1000 volt spacing
C_6—.002 µfd. mica, 2500 volts
NC—15 µµfd., 3000 volt spacing
R_1—500 ohms, 10 watts
R_2—20,000 ohms, 10 watts
R_3—5,000 ohms, 10 watts
R_4—20 ohm c.t. resistor



The Output Stage

C_6—70 µµfd., 2,000 volt spacing
C_7—.002 µfd., mica
C_8—65 µµfd. per section, 5,000 volt spacing
R_5—20 ohm c.t. resistor, 10 watts

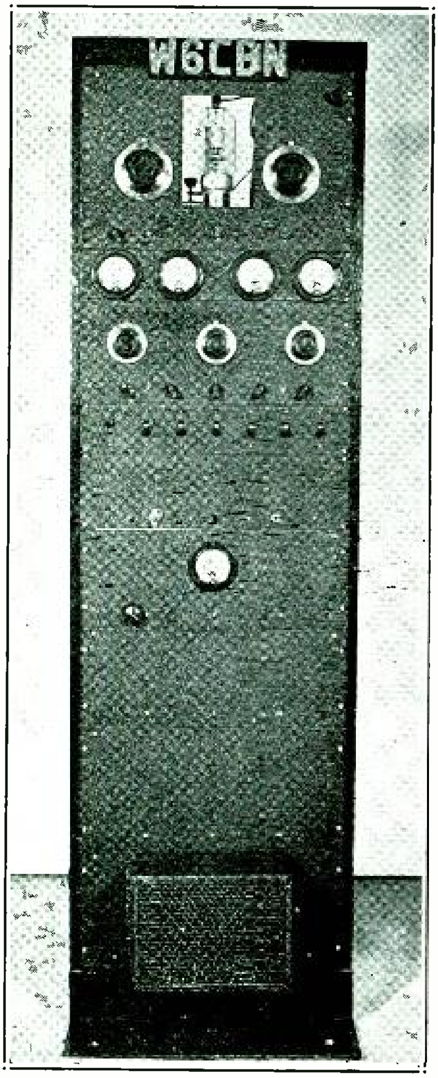
iron, a Z-framework made from soft iron or wood is bolted to the channels. The framework can be bolted with 12-24 M.S. to the mounting holes. Making sure that everything is parallel and in the same plane, the rack is ready for welding. They can be bolted together but in most cases it is never so rigid as welding, and since the cost of welding all joints was only $2.00 there was no hesitation on that score. All surfaces were then sandpapered and painted with aluminum paint, which as a rust inhibitor seems to be replacing red lead. A final coat of black enamel was applied and the rack proper finished. All panels in the rack were made from no. 12 gauge furniture steel which was cut to exact dimensions by a sheet metal company.

The panels are all 19″ in length and the widths are in multiples of 1¾″ (standard rack units). Slotting the panels for the mounting screws is accomplished by drilling holes and cutting into them with a hack saw. The chassis, except that of the pre-amplifier, measure 17″ x 9″ x 2″ and were made from no. 16 gauge galvanized iron. The heavy gauge iron used in the chassis makes them exceptionally strong, the heaviest of chokes and transformers making no sags or depressions. The chassis, after all holes had been drilled in them for apparatus, were given a coat of aluminum paint. Aluminum paint won out over black paint because of the fact that it does not show dust and it also affords better lighting to work by behind the rack. The panels were taken to a plating company and were "crinkle" finished. The chassis were fastened to the panels with three 8-32 machine screws.

Instead of the usual triangular plates on each end of the panel to support the chassis, I chose to use straps of 5/16″ x 1/16″ cold rolled steel strip. Regardless of the height of the panel the strips were run from the top edge of the panel to the back corner of the chassis. This, in my opinion, is an improvement over the triangle plates since it makes all parts much more accessible and also provides more light. Brackets so used on this transmitter seem capable of holding unlimited weight, and as can be seen in the photograph they have a pleasing appearance.

Protruding through the back face of the chassis are tube sockets through which all power connections are made by means of tube base plugs. The wires leading to the chassis are laced with number 12 lacing twine, and running to the right enter the Curtis Strip. The use of Curtis Strip in connection with racks is not ordinarily seen in commercial installations, but being acquainted with its effective use at the HB office of Mackay Radio, it was decided that nothing else would do. Over thirty wires transverse the Curtis Strip, many of which are heavy wires carrying filament voltages. The front side of the Curtis Strip "peels" right off thus exposing all the wires. The front replaces by simply snapping it back into its slides. An

www.americanradiohistory.com



The Relay Rack Construction Presents a Pleasant Commercial Appearance

X-ray a.c. socket manufactured to mount in a Curtis Strip is the a.c. terminus for the whole transmitter. This wire conveyor is supported by two 7" spacers of conduit pipe through which ¼-20 bolts pass. It might be said that I consider this means of running cables the most convenient system yet seen.

Viewing the front photograph of the transmitter, proceeding from bottom to top, the first panel contains the final amplifier power supply. The box with the grill work face contains the two 866's. It acts as an electrical shield as well as a protection against shock. This scheme also gained needed room on the chassis behind the panel. Directly above this panel is the oscillator-buffer power supply and above it is located the deck containing the speech amplifier-modulator and bias power supplies. Next in order is the modulator unit, the pre-amplifier, switch panel, oscillator-buffer amplifier unit, meter panel, and final amplifier stage. By looking at the rear and side views practically all components can be clearly seen.

The Power Supplies

The final power supply is of the conventional type using two 866's as rectifiers. A swinging choke and a filter choke rated at 300 m.a. current capacity are located directly behind the two 2 µfd. 2000 volt filter condensers. The transformers supplying filament voltages for the 866's and for the HK-354 are mounted to the right. The clear space left on the chassis is in anticipation of the time when a compact high voltage transformer will be bought, a pole transformer remotely fed now being in use. The filament and positive high voltage leads are brought through the chassis with feed-through insulators. A 200,000 ohm 50 watt bleeder resistor, while not intended to provide any regulation on the supply, serves to discharge the filter condensers after the power supply is shut off.

In the oscillator-buffer power supply two 83's acting individually as half-wave rectifiers supply 700 volts to a 50,000 ohm high wattage bleeder resistor with very good regulation. A voltage of about 300 volts is tapped on the bleeder to supply the crystal oscillator. Four electrolytic condensers are hooked in series parallel to provide filter capacity.

One 83 tube capably serves as rectifier in the speech amplifier-modulator power supply. A husky swinging and filter choke of 200 ma. current rating plus a bleeder resistor give this supply good regulation. On this same chassis is the bias power supply in which an 83 tube is also used. This supply is quite conventional except for the bleeder resistor. The bleeder must consume all the current the power transformer is capable of supplying and all this loss is dissipated in the form of heat. So obviously this resistor must be of low resistance and of high wattage. In this case I used a 7500 ohm 80 watt resistor and in connection with a power transformer putting out 400 volts each side of the center tap it gave sufficient voltage and regulation to bias the HK-354 as well as the 210 buffer stage. A relay is in series with the bleeder circuit, the contacts of which must close

www.americanradiohistory.com

before the a.c. voltage will be applied to the primary of the high voltage transformer; hence if no bleeder current should flow in the bias supply the relay will not close and no voltage will be applied to the final amplifier. Any bias supply should be equipped with this precaution.

Modulation

The modulator-speech amplifier unit consists of a type 56 tube fed from a 500 ohm line-to-grid transformer. This tube in turn is transformer-coupled to a 46 tube which drives two 46 tubes in a class B modulator stage. The modulator is supplied at 400 volts potential under load and modulates the 210 buffer stage with no difficulty. Since c.w. is more frequently used than phone it was decided to modulate the buffer stage, thus saving the cost and outlay of a high power modulator. When modulating the buffer stage the final amplifier is operated as a class B amplifier. Provision is also made for grid modulating the final amplifier, but it is thought that the present scheme offers several advantages.

The pre-amplifier is situated directly above the modulator. It contains two stages of resistance-coupled amplification using type 37 tubes. A velocity microphone feeds into this pre-amplifier.

Regular toggle switches were used in preference to the smaller radio switches because they are much more rugged in construction. The type of switches used are made in a bakelite shell and have the terminals on the sides, differing from the usual porcelain switch with its terminals in the front which made it unsuitable for use on panels. Incidentally, a switch panel is a mighty handy place for fuses, which in most cases are in series with the switches.

The R.F. Section

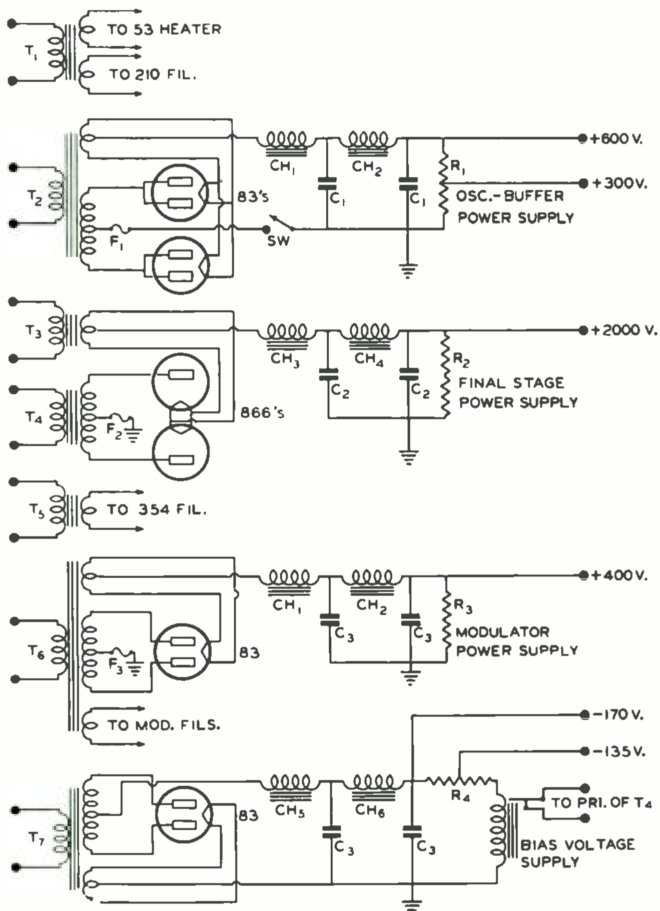
The oscillator-buffer unit with band switching, the main impetus for building this transmitter, consists of a type 53 tube in a conventional Jones circuit followed by a 210 buffer stage. Looking at the front view of this panel the first of a row of small pointer knobs (left to right) is used to select any of four crystals. The second switch connects the grid of the 210 to either the first or second anode of the 53 tube, and when connecting to the first anode the grid return of the second triode of the 53 is automatically opened. The third switch shorts approximately half of the 7 mc. coil in the plate circuit of the second triode of the 53, thus making it possible when using a 7 mc. crystal

Back View of the Phone-C.W. Transmitter

to double to 14 mc. The fourth knob turns the neutralizing condenser of the buffer stage. The last switch shorts out portions of the 210 plate coil making possible operation on 3.5, 3.9, 7, and 14 mc. The switches used are of the rotary type and are exceptionally strong mechanically and electrically, therefore well suited to radio frequency work. All the switches on this unit are located below deck. The dials on this panel are those tuning oscillator. doubler, and buffer amplifier circuits.

The meters mounted on their own panel read cathode current of the 53 tube, buffer plate current, grid current of the final amplifier, and plate current drawn by the final amplifier re-

www.americanradiohistory.com



The Various Power Supplies

T_1—2.5 volts and 7.5 amps., 5,000 volt insulation
T_2—750 volts each side c.t., 150 ma. 5 volts, 6 amps.
T_3—2.5 volts, 10 amps., 5,000 volt insulation
T_4—2,350 volts each side c.t., 250 ma.
T_5—5 volts, 10 amps.
T_6—525 volts each side c.t., 200 ma., 5 volts, 3 amps., 2.5 volts, 6 amps.
T_7—250 volts each side c.t., 100 ma., 5 volts, 3 amps.

spectively. The meter mounted on the modulator panel reads plate current to the class B 46's. The final amplifier is of the usual circuit design except of course for the band switching feature. The tuned grid circuit of the final amplifier is link coupled to the buffer stage (link couplings were removed for the photograph). This tuned grid tank is switched in the same manner and with the same type of switch as used in the exciter unit. The switch used on the final plate tank, however, required much heavier construction and the only way this could be solved was by making one. This switch is mounted on the coil just above the condenser. The neutralizing condenser seen at the base of the 354 tube is a homemade affair. With a fly-cutter, two discs 3¼" in diameter were cut from heavy aluminum. The hole which is necessarily left in the center of the discs is counter sunk until it is possible to drop a 12-24 flat head machine screw through with its head flush with the face of the disc, or if anything, a bit receded. This size screw was found to fit nicely through a 1½" high Johnson insulator. The other disc was fixed in the same manner to accept a ¼-20 machine screw and threaded through a metal arm which in turn was fastened to a ribbed Johnson insulator of about 3" in height. When finished, both discs were given a coat of clear lacquer. A distance of about ½" between plates was found to give the right capacity to neutralize the HK-354. The final tank coil is wound with no. 14 enameled wire, and the tank condenser on which the coil is mounted is rated at 5000 volts breakdown with a capacity of 65 μμfd. per section. Antenna coupling is accomplished by link coupling the final tank coil to a tuned antenna circuit a short ways removed from the transmitter.

Convenient operating is attained by paralleling those switches which are used in actual transmission and having them located at the operating table. Monitoring of keying is done by the use of a Western Electric 120 ohm line sounder placed in the cathode circuit of the 210 buffer stage, and it has proved to be far more effective in showing what one's "fist" really sounds like than an oscillator or buzzer.

Though very little time has been had to make QSO's on the air or to do much testing since the transmitter was finished, what has been done has been gratifying. The use of split-stator condensers in the two neutralized stages makes it unnecessary to touch the neutralizing condensers except when moving to the 14 mc. band. The 210 buffer stage provides sufficient excitation to the 354 tube to realize an input of 400 watts on c.w. The ability to change bands in a minute or so is alone worth all the work put into the transmitter. By keeping a tuning chart, all tuning condensers can be set to exact points on the scale, thus saving much time that would be otherwise wasted.

www.americanradiohistory.com

THE OPEN FORUM

160 METER JITTERS

Holland, Michigan.

Sirs:

So many complaints of interference from 160 meter phones to broadcast reception have been received by the F.C.C. that there exists a possibility that this band may be taken away from the amateurs unless there is a considerable decrease in QRM to b.c. reception.

Inasmuch as I have operated on this band for some time I have formed definite opinions as to the usefulness of this band to the amateurs. Many fellows like 160 meters and would hate to lose it, particularly so unless a substitute band were given to the amateurs in its place. In case of such a move, if the amateurs who at present use 160 were given a substitute from perhaps 3400 kc. to 3500 kc., or from 3800 kc. to 3900 kc., the amateurs would be about as well off and the interference question would be solved to a considerable extent.

Operating on the 160 meter band is particularly troublesome when using powers of 200 watts or more, as it is practically impossible to eliminate the interference caused by broadcast receiver oscillator harmonics hitting in or close to this band of frequencies. In other words, the 160 meter band is too close to the broadcast band and the only solution is to obtain a band farther away from 1500 kc.

Although many of the well known amateurs on the higher frequencies think that most of the trouble is caused by improperly adjusted transmitters, this is untrue in 90% of the cases. Any amateur who has used any fair amount of power on 160 meter phone can endorse this statement.

At present the operator with a class B license does not have much of a choice of a good phone band. 160 meters has several bad features, its poor daylight distance coverage, the interference problem, and the requirements of a long antenna which is almost an impossibility to erect in a city. The 10 meter band is too erratic to be called a good band and of course at night the signals generally go out with darkness.

A band in the vicinity of 21 mc. would be desirable for this class of dx phone work and the more amateurs that boost for a band in this region the better the chances would be of obtaining it. The A.R.R.L. is now making a survey of the frequencies near 21 mc. and every amateur should help in this work.

Rus Sakkers. W8DED.

•

W9HCC, CAIRO, AND CHICAGO

Minneapolis, Minn.

Sirs:

I am told that at the Chicago Convention a resolution was passed which demanded that I, or "some person of like calibre", be sent to Cairo along with the regular League representatives.

This is all news to me, as my wishes were not consulted, and nobody informed me beforehand that such a resolution would be offered.

Had I been at the Convention, I would have brought to the attention of the persons offering this resolution certain matters which I believe they should have considered before putting it before the Convention:

1. It is extremely doubtful whether any such invitation would be accepted by any conscientious person who has not had a responsible part in the preparations made on this side of the water, particularly in connection with the moulding of the views of the United States delegates. No one cares to be responsible for results unless the methods of achieving success are left to his discretion.

2. Even assuming that the invitee, on reviewing matters in detail, could give complete approval to the preparations that had been made by others, the fact remains that any body of persons representing the interests of the amateurs at Cairo should be composed of persons who can work together in harmony, and with mutual trust and respect. To violate this principle would be most unwise.

3. A delegation that must be accompanied by a "policeman" isn't worth sending at all.

I would consider it a favor if you would bring these views to the attention of the Board of Directors and of the members of the League.

When, if ever, it becomes necessary to apply these principles to concrete cases, the matter can be examined further and definite decisions properly reached.

I'm not seeking this job.

Sumner B. Young.

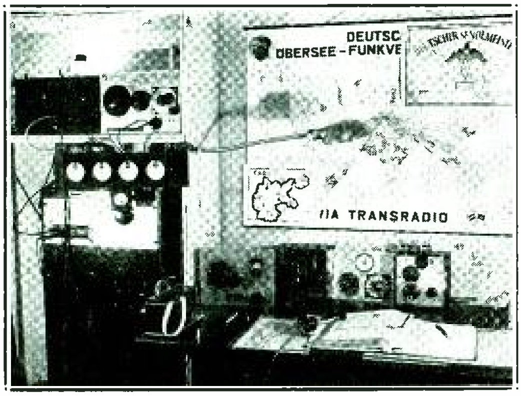
www.americanradiohistory.com

D4BUF, Berlin, Germany

By Herb Becker, W6QD

Southpaw D4BUF at His Operating Desk

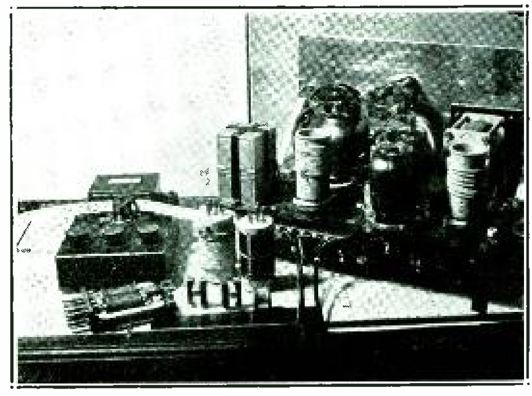
The story of D4BUF is brought to you in a little different manner than most of the others that have been published in this department. Howard Stowitts, a young dentist of Los Angeles who is a friend of the writer, had the good fortune of taking a three-month trip to Europe during the summer. During the Olympic Games his stay was confined to Berlin, and while there he had the pleasure of visiting the station of Werner Slawyk, D4BUF. Most of the information contained on these pages was brought back by Dr. Stowitts.



Transmitter and Operating Position

Mr. Slawyk, D4BUF, is a television engineer and officer of the German Reichspost technical service. In the amateur field he is foreign manager of the D.A.S.D., which is the German section of the I.A.R.U. D4BUF was manager of the D.J.D.C. contest held in August.

The first CQ was sent out from o.m. Slawyk's station on February 16, 1930, and he assures us that "it was a weak one, hi." His small rig at that time was unlicensed and used the call, D4CR. In one of the photographs the operator is seen at his side-swiper key, which was made from a Kellog switch. In another, is shown a view of his transmitter and other equipment on the operating desk. The lineup of his rig is an AF-3 for the ECO, two AL-2's in the doubler stage, and the final is an RS-31 with about 100 watts input. Below the transmitter is the meter panel and then beneath this is the cabinet containing five power supplies. On the desk is a machine key and perforator. The receiver,



Master Oscillator and Machine Tape Perforator

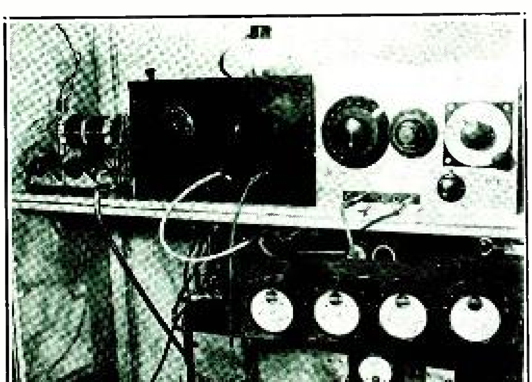
which is an a.c. O-V-1 using pentodes, may be seen at the left. In Werner's own words, "This receiver is the huge ultra sensitive, super quality, de luxe, high fidelity, special vest pocket type . . . O-V-1." (Hi.) The two watches in the panel come in very handy; one is Mean European Time and the other is a stop watch for three-minute CQ's. In another picture may be seen a close-up view of the master oscillator with its interchangeable coils, and to the left is the perforator for the machine key. The frequency meter at D4BUF uses 'H' iron-core coils and they have proven very successful up to 15 Mc. There are just a few turns of wire on them, giving very low copper losses, and with the loss in the iron core being so small, makes these much better than the average coil. Another photograph reveals a closeup view of the

www.americanradiohistory.com

transmitter, and to the left may be seen the Collins coupler, which is inductively coupled to the plate tank of the final amplifier. A special relay-switch changes the antenna over from transmitting to receiving, and the antenna in use is a zepp.-fed type, 40 meter half wave.

Machine Key and Receiver (to the Left)

On the rear wall of the shack is a map of the world, the wording "Transradio" meaning the Transradio lines of the German Reichspost. Mr. Slawyk has been manager of the Nauen station for quite some time. The diploma on the left signifies membership in the "Betriebsdienst", which is similar to the O.R.S. in the U.S.A. (It is for intra-German test and traffic practice work on 3.5 Mc., as the sending of messages is prohibited in Germany and other European countries.) The large diploma is an international one, the "Deutscher Sende Meis-



Transmitter and Collins Antenna Crupler

ter" given for outstanding dx work. Incidentally, if any of you fellows are interested in obtaining one of these you may write the D.A.S.D. in Berlin or to D4BUF for all the rules.

The specialties of D4BUF are dx and intra-German traffic. During the past two years, 80 countries have been worked. In June of this year Werner did some of his best dx; in fact, better than any other similar period. He contacted all six continents, six times on 14 Mc., although his first w.a.c. was made in November 1932, and this on 7 Mc. In the early summer the W6's and W7's start dropping in there like a 'ton of bricks', according to o.m. Slawyk, and especially those using the beam antenna affairs. The odd part of it is that up until 1934, when D4 would contact a W6 or a 7, it was equivalent (almost) to a QSO with Mars. But now it is a different story as the walls of Werner's shack have more cards from these districts than from W3 or W8.

This may all seem very good but Mr. Slawyk assures me that he has his unhappy moments. For example, he lives in a fairly thickly populated section of Berlin, and this prevents him from having the best of a radio QRA. This apparently has no harmful effects in traffic work, but during dx contests he is somewhat handicapped, and this in spite of the fact that D4BUF can really take 40 w.p.m. with ease.

'Doc' Stowitts brings back a very interesting piece of news in the strides that Mr. Slawyk has made with television. During the evening of his visit, the Slawyk family and Stowitts sat around in the living room and viewed a perfect broadcast of some Olympic events, and following that, a complete show.

When any of you QSO D4BUF, just glance at the photographs and you will get a general idea of what goes on in that far-away shack of Werner Slawyk in Berlin.

◆

Since many of the special broadcast stations, not in the 550-1500 kc. range, are received with amateur short wave sets, it is of interest that the F.C.C. has adopted new terms to designate these special services. *Relay broadcast stations* were formerly called "broadcast pickup stations"; *International broadcast stations* were formerly "experimental relay stations", and *special broadcast stations* were formerly "experimental stations" licensed to operate on 1530, 1550, and 1570 kc.

◆

During the last fiscal year, 29 amateur licenses were withheld or suspended, for periods of six months in most cases. Only one ticket was suspended for two years, and another obtained by fraud was ordered cancelled. Five ham station licenses were revoked.

www.americanradiohistory.com

28 Mc. Beams That Made a Phone W.A.C.

By Frank C. South*, W3AIR

At the beginning of 1936 we gave thought to increasing power or building a radiator that would give a decided gain. The conclusion was the opposite of that reached by most—we chose the antenna. A four-in-phase system was decided upon and with the space, wire, ambition and help of W3FMK, we started out.

The Fixed Array

The first array was to be suspended between two light masts, each made of three lengths of 2 x 2. A 100-foot roll of no. 12 soft enameled copper was fastened between a large steam pipe and an auto, and stretched enough to provide

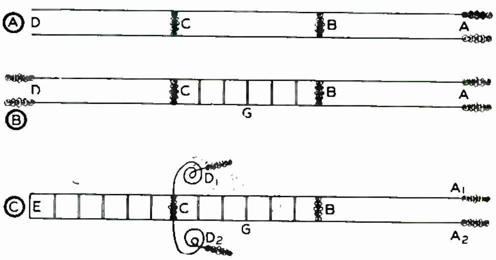


Figure 1
The three preliminary steps in laying out the array. For dimensions see text or refer to figure 3.

two 51 foot lengths. Six-inch insulators were fastened to one end of each wire and the wire was suspended waist-high for convenience. Let us designate these insulators as A_1 and A_2 (see figure 1a). Next, two more insulators were threaded through the wires, designated B and C. B was moved to a position 16′ 18″ from A, while C was placed 17′ from B. To the open ends of the wire were attached two more insulators, D_1 and D_2, placed 16′ 8″ from C. Separator bars of six inch steatite were inserted between B and C. Five will do the trick nicely (see figure 1b). BC now represents a feeder while AB and CD become the four antennas, a pair of "double-zepps", when stretched out.

Next, a 17′ 2″ piece of wire for the quarter-wave matching transformer was cut. This was folded into an elongated U and the ends soldered to each wire at the ends of the insulator C. D_1 and D_2 were folded back so the U-section could be drawn out and four separators fastened to it. A fifth one could be used at its closed end, E, though it is not a necessity (see figure 1c). This is a low potential point and can actually be grounded if there is no unbalance in the array, affording lightning protection.

*2 Nassau Street, Princeton, N.J.

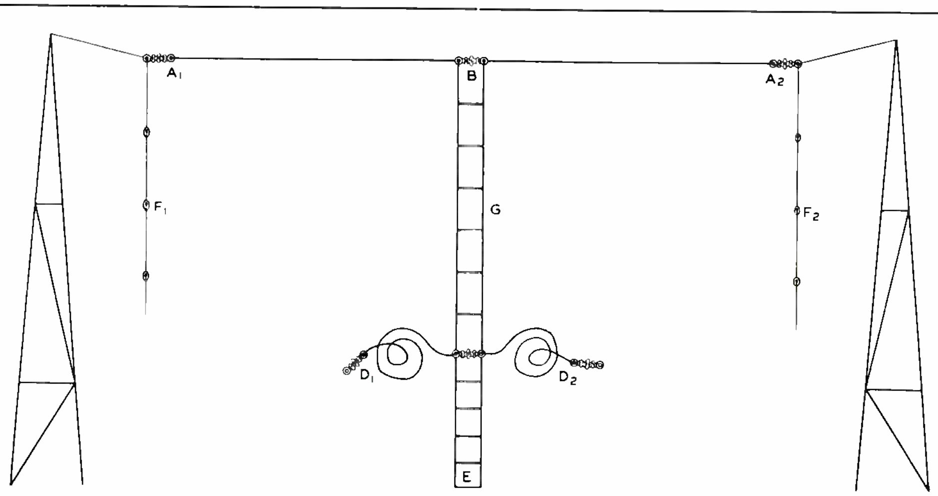


Figure 2
Figure 1-C looks like this when suspended from the supporting masts. The array works better when removed from the earth; therefore make the masts or poles as high as possible.

www.americanradiohistory.com

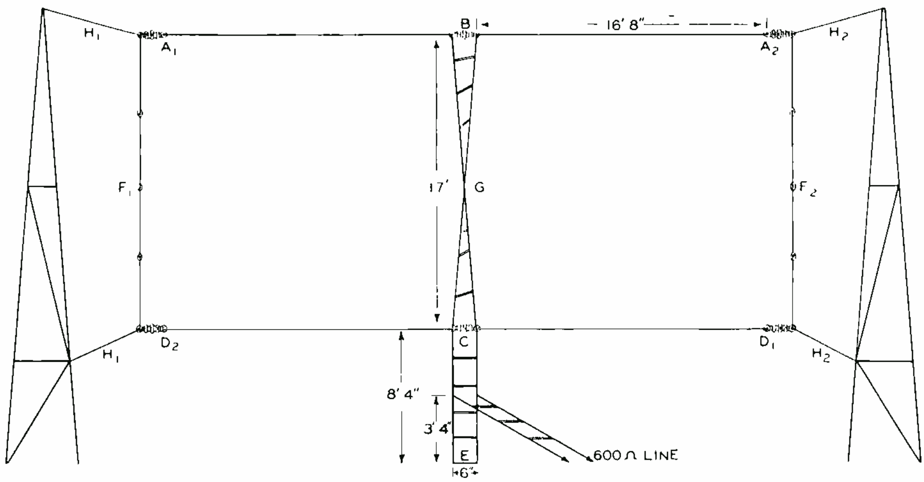


Figure 3
The curtain looks like this when completed. It works well on reception as well as transmission, giving a worthwhile improvement in signal. W3AIR's 28 Mc. phone w.a.c., made with low power, attests to the efficiency of the beams.

At W3AIR, it is fastened to wood without insulation, to hold it in place.

The completed array was then removed to the base of the poles, the halyards fastened to A_1 and A_2 and hauled up. While D_2 and D_1 could have been fastened to the masts so as to be directly under A_1 and A_2, we decided to connect A_1 and D_2, also A_2 and D_1, with 17 foot wires broken with three small insulators each, shown as F_1 and F_2 in figure 2. Because the ends of the feeder G at points B and C are 180° out of phase, being a half wavelength apart, the feeder must be given one transposition so that the antennas will be in phase.[1] D_1 must therefore be placed under A_2, and D_2 under A_1 (see figure 2). The D-insulators are guyed with rope to the lower part of the masts.

The transmission line is attached with clips to the stub. Tuning is similar to the "J" or any similar stub-matched antenna. The line is then soldered permanently. See the handbooks for adjustment details. Tuning the stub itself was dispensed with.

This unit is supported on 35 foot masts above a garage roof. A taller support would be desirable if used above ground. The gain is 6 db,[2] as it stands, and another 3 db can be had using a duplicate system as a reflecting curtain, making the system uni-directional rather than bi-directional as at present.[3]

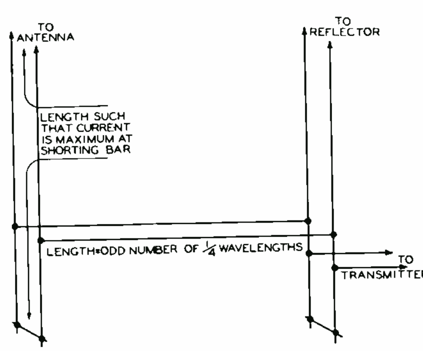


Figure 4
Matching stubs for antenna and driven reflector. To reverse direction of transmission, reverse any one of the following: (1) line termination at antenna; (2) line termination at reflector; (3) connecting line between stubs.

The Rotating Array

For Asian signals—and for South America off the other side—another unit was constructed. It has only one mast, the upper two antennas being supported on a long bamboo spreader. This rig can be moved in an arc of 90 degrees.

The non-resonant lines are coupled directly to the transmitter through a double-pole-double-throw relay which throws the antenna in use in position for receiving. The adage holds true, "If you can hear 'em, you can work 'em."

[Footnotes on Next Page]

www.americanradiohistory.com

[*Continued from Last Page*]

[1]In this method of feeding first one pair of antennas and then the other, any error in spacing or phase slightly disturbs the vertical directivity. Where the feeder or line can conveniently be guyed, the stub or feeder could be coupled to G, at the midpoint between B and C. The feeder G should not, then, be transposed. The stub could be replaced in either case by a tuned feeder, with some loss in efficiency. If such a feeder were connected at the center of G, the antenna could also be used on 14 Mc. The horizontal pattern on 14 Mc. would be the same as for a half-wave horizontal antenna, but the radiation would be lower, particularly helpful at long distances; theoretical gain on 14 mc., 3 db or double the power.

[2]Power gain of four times. Makes 250 watts sound like a kilowatt. The theoretical gain is 2 db for the "double-zepp" pairs, plus 3 db for the second pair broadside to the first. Total, 5 db. The measured gain in the horizontal plane could be greater because of the concentration of power nearer the horizontal—particularly useful above 14 Mc. Southworth (*Proceedings I.R.E.,* September 1930) found measured gains 1 db better than calculated, for simple beams of a similar type. A reflecting curtain would add another 3 db, making the theoretical gain 8 db. If the feeder or stub connects to the center of G, some additional gain can be secured by making G about ¾ wavelength long, 25½ feet, and supporting the upper antennae that distance above the lower ones. The familiar ½ wavelength separation for broadside antennae is a convenience not producing maximum **gain.**

[3]The pattern from W3AIR's array in the horizontal plane is relatively broad and bi-directional, identical with that of a double-zepp. A reflecting curtain, if used, could be supported by being connected, together with insulators A_1 and A_2, to 8½ foot spreaders so that the whole reflecting system would be ¼ wavelength from the antennae. The reflectors might not be driven, in which case there are no feeders. A driven reflector is customarily placed some odd multiple of a quarter wavelength away. R.C.A. uses a spacing of 2¼ wavelengths for the V-type. This larger spacing is to cut down the interlocking tuning between the curtains. A method of driving the two curtains is given in figure 4, showing two stubs ¼ wavelength apart, one leading to the antenna and the other to the reflector. The requirements of a reflector are: 90° space relationship, gained by construction; 90° phase relationship, which results from using an odd number of quarter wavelengths of line between the two stubs; and equal currents, which can be had by adjusting the position of the quarter wavelength feeder ends on the two stubs, after the shorting bars on each stub have been adjusted for resonance. After it is all finished, the feeder is adjusted on one stub for the proper match.

◆

W1ENN tells us about a certain metal roof across the street from a ham phone station acting as a loudspeaker. W6CEH has the same trouble with an electric cooking range downstairs.

A.R.R.L. Withdraws Phone Request

On June 9, 1936, the Federal Communications Commission ordered that a public hearing be held before the Telegraph Division, beginning at 10 a.m. on October 20, 1936, for the purpose of assisting the Commission in determining the action to be taken on the request of the board of directors of the American Radio Relay League that the Commission's Rule 377 be amended to permit class A amateur radiotelephony operation (type A-3 emission) on the band 3850 to 3900 kilocycles in addition to the present 3900 to 4000 kilocycle band (F.C.C. Docket no. 4010).

The Commission has been formally notified that the American Radio Relay League desires to withdraw its request. The Commission does not have pending before it any request of any other party to be heard in this connection. Therefore, the Telegraph Division has directed the cancellation of the hearing and the discontinuance of all proceedings in connection with docket no. 4010.

◆

A very handy and reliable frequency spotter or band-setter can be built around a standard superhet "transformer" which will hit 100 kc. Any standard tetrode or pentode of the type generally employed as a superhet beat oscillator might be employed. The only adjustment is the initial setting of the oscillator on 100 kc. This may be done by bringing the proper harmonic to zero beat with the carrier of some broadcast station operating on a multiple of 100 kc. The accuracy of broadcast stations often is better than a hundredth of one per cent.

Points will be afforded a hundred kc. apart throughout the amateur bands, including the 5-meter range, and the "spotter" will be found to hold its calibration remarkably well over long periods, provided it is first permitted to warm up for half an hour or so before using. It can be trimmed from time to time as necessary to keep it zero beating with the b.c. station.

◆

Hams with a bent for finding new means of amusement will enjoy learning to read the dial phone clicks that slip into most loudspeakers. One ham reports that he has thus learned first-hand how his y.l., a neighbor, has been calling up a fellow-ham (and rival for the lady's hand) as much as a dozen times a week!

◆

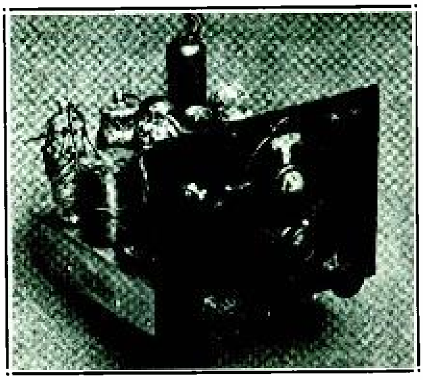
According to the F.C.C., calls are "regularly renewed or reassigned to the last holder of record as often as appropriate."

www.americanradiohistory.com

An Inexpensive Battery Superhet

By JOHN A. G. BUNTING,* VE5CO

The receiver described here was not developed with the idea in mind of building something better than one can buy, but rather to fill the need for a 2-volt ham set that would be more sensitive and selective than the ordinary regenerative detector or t.r.f. Many of the gang asked for dope on a superheterodyne using 2-volt tubes when they found one was in use here, as none is available commercially unless a person has money to burn.



The Battery Super, Front View

The writer has used this little set for about a year, with slight modifications, and can truthfully say that it is away ahead of all amateur sets used before—and they have been many. Without a pre-selector, image response will be a bit troublesome, especially on 20 meters, but not bad. Using the pre-selector, results are very good. Parts used were what were on hand; the average ham can use whatever he has with good results, as the chassis size, etc. need not be conformed to nor exact placement of parts, if he knows enough about set building. If one has not built similar affairs, it would be better to follow everything closely.

The first receiver of this type was built on a piece of old car chassis, which was hard to work with. However, since the writer is like 99 per cent of the hams, it was made to do until a piece of 12″ x 12″ aluminum was obtained. Also the original set used as tube shields, cans which formerly contained tire-patching outfits. On the later chassis, tin foil, about as thick as good writing paper, was doubled and then wrapped around the tube, tied with bare wire, and connected to ground. Thorough shielding must be used, as well as the by-passing, or plenty of "birdies" will be evident and not much gain. The leads from the b.f.o. were run through shield braid stripped from some shielded lead-in wire. No shielding is used around the first detector or h.f. oscillator, the metal cabinet providing shielding. No signals can be heard with antenna and ground off. Although we are in a favorable place as far as freedom from QRM goes, there being only one 10 kw. s.w. transmitter within two hundred miles, a poorer place for h.f. reception would be hard to find. However, the results are excellent, a tribute to the performance of the receiver.

The chassis is a piece of 12″ x 12″ aluminum, with four sides bent down to make a pan 1¾″ deep, leaving the top 8½″ square. The 3 i.f.'s are 4¾″ back from front and from left to right across the deck. Behind them, from left to right, are the first and second i.f. tubes, with the second tube a little to the left of its can. The second detector is almost in between the

COIL TABLE

20 Meter Band

L_1—4 turns no. 30 d.s.c.
L_2—7 turns no. 22 d.s.c., no tap
L_3—7 turns, tap 4 turns from ground
L_4—5 turns no. 30 d.s.c.

40 Meter Band

L_1—5 turns no. 30 d.s.c.
L_2—16 turns no. 24 d.s.c., no tap
L_3—10 turns no. 22 d.s.c., tap 7 turns from ground
L_4—5 turns no. 30 d.s.c.

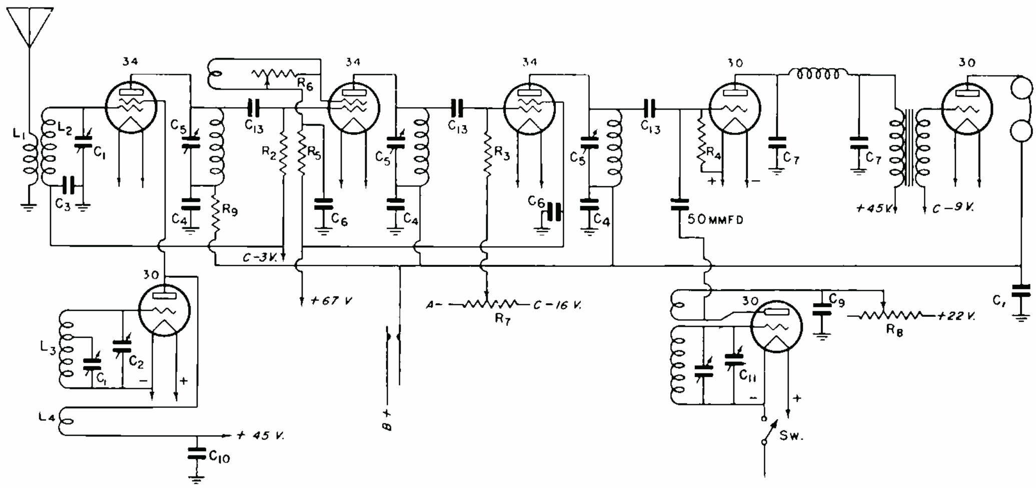
80 Meter Band

L_1—8 turns no. 30 d.s.c.
L_2—33 turns no. 24 d.s.c.
L_3—18 turns no. 22 d.s.c., tap 11 turns from ground
L_4—9 turns no. 30 d.s.c.

Less turns could be used on L_1, but the number was found to be a compromise between using the preselector and not using it.

* Box 102, Golden, B. C., Canada.

www.americanradiohistory.com



Wiring Diagram of the Battery Superheterodyne

C_1—50 µµfd. midget
C_2—100 µµfd. midget, band set
C_3—.01 µfd. paper
C_4—0.5 µfd. paper
C_5—140 µµfd. trimmers
C_6—0.25 µfd. paper
C_7—.00025 µfd.
C_8—.00025 µfd. mica
C_9—0.25 µfd.
C_{10}—0.25 µfd.
C_{11}—2-plate midget to correct for b.f.o. drift, front panel control
C_{12}—4 µfd., 200 volts
C_{13}—250 µµfd.
R_2—2 megohms
R_3—5000 ohms
R_4—3 megohms
R_5—1000 ohms
R_6—5000 ohms
R_7—50,000 ohms
R_8—50,000 ohm pot., optional
R_9—20,000 ohms

second and third i.f. cans, with the audio tube behind it and a bit to the left. The b.f.o. tube is behind the third can and a bit to the right. Behind it and to the left is the 8 µfd. electrolytic condenser. The b.f.o. switch is right behind its tube, opening the filament of that tube. The first detector coil is on the extreme left front of the chassis, 1¼" from the panel, its tube a little to the right and slightly in between the first and second cans. The oscillator coil is on the extreme right, the same distance from the panel, with its tube a bit to the left and partly between the second and third cans. The first detector condenser is about 3" from the left of the panel, 2¾" above the chassis. The oscillator condenser is slightly to the right of the center of the panel, shaft 2¾" above the chassis. Band spread condenser is 3¾" above chassis and 1¼" from right of panel. Main switch is 1¼" from left of panel and 5" above chassis. The ¼ µfd. by-pass for the oscillator is sandwiched between the oscillator coil and the third can, as there was no other place to put it. C_3 is soldered to the first detector coil socket. Knobs are whatever are on hand, and one with a pointer is useful for the first detector tuning, although not critical of adjustment.

The i.f.'s are wound on one-inch diameter bakelite tubing about 2¾" long, 85 turns of no. 36 d.s.c. to a space three quarters of the tubing length. The third i.f. has 80 turns. The cans were made from 1/16" copper, which originally was in an old b.c.l. set. The copper was cut to size and wound around a form slightly smaller than the desired finished diameter, soldered inside and a top soldered on, also from inside. The i.f.'s may be purchased ready-made if one wishes to spend the money.

The coupling condensers are bolted to the top end of the coil forms, away from the coils about ¼". Grid leaks are inside the coils.

One-eighth inch bolts were soldered to the inside of each can on opposite sides, with heads cut off, for holding the cans to the chassis; each coil form has a small brass angle bolted to it and soldered to the inside of the can, holding the coil slightly off-center. Coupling condensers were wrapped in cellophane to prevent shorts.

The b.f.o. is 70 turns of the same wire and on the same size form, but the condenser is about 250 µµfd. with a two-plate homemade variable midget-controlled condenser from panel in parallel. Almost anything can be used for the a.f. transformer if it will go in the space.

All h.f. coils are wound on 5-prong tube bases, the tap going to the "K" prong, "hot" end to "G", and ground to "F". The inside of the antenna coil goes to "P", the outside to "F". The inside of the oscillator plate coil goes to plus and the outside to plate. The tuned winding is the same as the detector coil. The 3500 kc. first detector coil was lengthened by cutting off another tube base close to the prongs

www.americanradiohistory.com

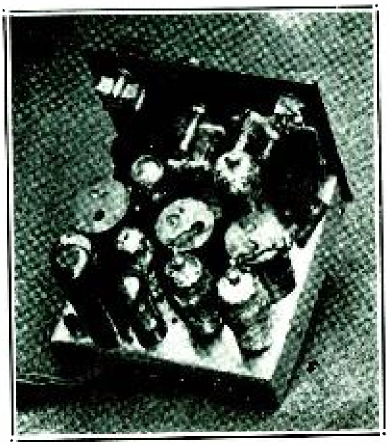
and fastening it to another base, making it about 2" long. The band spread is approximately 95 per cent on 80 and 40, and 85 per cent on 20. A little juggling may have to be done on the higher frequencies, but is worth it, once the spread is ok. The band spread condenser will be about half meshed for 80, almost all in for 40 and all in for 20. The main switch is a 3-pole affair and breaks A-minus, B-minus, and B-plus. A 50,000 ohm rheostat can be placed in the b.f.o. plus lead, externally, to control plate voltage with good results.

In tuning the i.f.'s, the frequency will be in the region between 1350 and 1500 kc.

After the set is wired and tested for shorts, etc., plug in the first detector coil and all tubes but the oscillator tube. Be sure that the b.f.o. switch is open. Connect antenna and ground and, using an insulated screw driver, tune the i.f.'s to some weak station just inside the b.c. band. Do not pick a loud one, unless just to get started. Although the ear is not very sensitive to changes of volume, a fairly good job of alignment can be done if volume is kept low. While the writer is equipped with a service oscillator, output meter, etc., these were *not* used. Since many hams do not have access to this equipment, the above procedure was followed in order to ascertain whether or not a decent job could be done without such facilities.

The first i.f. will tune very sharply; therefore, use a piece of slim bakelite for a screwdriver to reduce capacity effects, as well as the possibility of a short to the can. While electron-coupled oscillators can be used to advantage in both h.f. and b.f.o., the writer was too short of cash when this was first built, as the s.g. tubes are about twice the price of the triodes. The drift of the triode oscillators was not enough to warrant the extra expense. A crystal filter and other refinements could be added, but they all cost a bit more than some amateurs can afford—hence this receiver. For the money spent, the results are better than for any other battery set we have seen. To those who are accustomed to building different types of receivers, parts can be used which will fit in and work together to get equally as good results. The junk pile can be picked over and the actual cash outlay be kept very low, perhaps nil.

Ninety volts of "B" can be used with good results if there does not happen to be a set of three batteries on hand, but 135 volts is better. If an air cell or similar "A" battery is used, a midget rheostat can either be put on the chassis or else on the battery itself.



Looking Down on the Economy Battery Super

◆

Raise You Twenty

Those who had qualms when reading of the "Mayor's" (W6DDS) 75-foot guyless tower in the January, 1936, issue of RADIO will be interested in knowing that he helped W6FNK put up one of the same construction 95 feet into the clouds. It has no guys, no "antennas" holding it up. Ye ed. can vouch for it because he climbed up to the 80-foot level to survey the surrounding landscape, and it looked all of 200 feet to the ground.

W6FNK entertains visiting hams by giving them either the antenna or a halyard and defying them to pull the tower over. One smart boy got off about a hundred yards to get more leverage, but he couldn't move the top more than 6 inches in spite of his 175 pounds and some terrific tugs.

◆

For soldering in those out-of-the-way places, secure from your local metal store a piece of copper rod one foot long and the same diameter as the tip in your soldering copper. Cut into four-inch lengths. If the tips should screw in, instead of being fastened with a set screw, have your local machine shop thread these tips for you. Take the original to the machinist for screw pattern. Bend one of these lengths to form a 90 degree angle; bend one to form an angle of 45 degrees; and leave the third one straight. Shape the tips like the original.

—W6DOB.

www.americanradiohistory.com

Exciters: Past, Present, and Future

By J. N. A. Hawkins, W6AAR

Three years ago the term "exciter" was not known among amateurs. Now it is just about the chief topic of discussion and bone of contention. The history and evolution of the popular exciters now in use is quite interesting and instructive. With pardonable pride we point out what is evident from the following short review of exciters: nearly all the important developments in exciters have been described in "Radio" first.

The first widely used crystal oscillator was the old reliable 210 crystal oscillator as used in the Pierce variation of the Armstrong or tuned grid-tuned plate oscillator. Due to the high interelectrode capacitance and low μ and power gain through the 210 at around 250 volts plate voltage, the safe power output of this oscillator was only a watt or so and the r.f. crystal current was rather high. George Grammer (W1DF) and Clayton Bane (W6WB) discovered at about the same time that the then newly developed "PZ" (later the 47) pentode allowed higher power outputs to be obtained from the same Miller-Connelly-Armstrong circuit with low r.f. crystal current. Refinements in both crystals and 47 pentode tubes ultimately allowed amateurs to get close to 10 watts of r.f. power output with low crystal current by operating the oscillator tube at 500 volts plate voltage and using cathode bias of about 500 ohms in place of the 5000 to 50,000 ohm grid leaks which were originally used with the 47 crystal oscillator. See figure 1. It is not known just who first found that cathode bias represented a great improvement over grid leak bias in a crystal oscillator but it was probably Frank Jones (W6AJF), because he was using it long before he started talking about it in Radio.

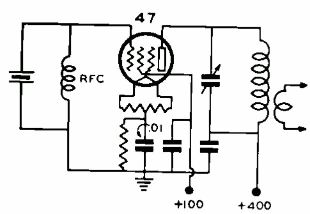


Figure 1
Bane-Jones Pentode Oscillator

The next step in crystal oscillators occurred when James Millen (W1HRX) put a crystal in the grid circuit of an electron coupled Dow-Hartley oscillator and thus added regeneration and second harmonic output. See figure 2.

Thus, in the pages of Radio News, the "tritet" was born, although it was some time later that Jim Lamb changed Jim Millen's inductive coupled feedback circuit into a cathode impedance coupled feedback circuit and actually named it the *tritet*. The circuits were identical except that Millen's circuit tapped the cathode point down on the coupling impedance and Lamb's circuit tapped the cathode directly on the upper end of the coupling impedance. In the Millen arrangement the coupling was varied by moving the cathode tap on the feedback coil while Lamb's arrangement was to vary the impedance of the feedback coil by means of a large variable condenser shunted across the cathode feedback coil. Both owe a lot to Lt. Dow, who originated what is called the *electron-coupled oscillator*. Jim Lamb's main contribution was to show a simple means of varying the feedback without moving a tap on a coil.

Incidentally, while discussing the tritet it is desirable to correct a misconception that has been current for years concerning both the tritet and the electron-coupled oscillator. It has long been thought that these oscillators consisted of a triode oscillator feeding a tetrode or pentode doubler through a common grid circuit. Thus the name tritet came from the idea of a combination triode oscillator tetrode doubler.

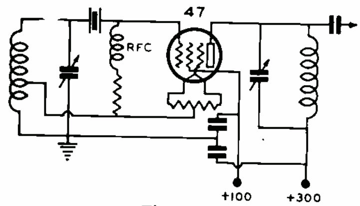


Figure 2
Millen-Dow Oscillator

It is pretty well accepted now that the principal feedback for the triode oscillator portion of the circuit does *not* come from the screen grid but from the plate circuit, even though the

www.americanradiohistory.com

plate is apparently tuned to the second harmonic of the crystal frequency. However, it is obvious that the cathode tank is in the plate circuit and plate current goes through it, thus causing a voltage drop across it at the fundamental crystal frequency. With the plate voltage off the tritet it still can be made to oscillate due to screen feedback alone, but when the plate voltage is applied the screen current, and thus the screen feedback, drops to a very low value, which is usually insufficient to sustain oscillation without additional fundamental feedback from the plate circuit. My own version of the tritet was developed to allow the filament of the tube to be grounded, which is desirable when using large, filament-type pentodes, such as the RK20, 804, RK28 and 803, to avoid heavy current filament r.f. chokes. It is exactly the same in every respect as the standard tritet, although the circuit at first glance looks quite different. This circuit found rather wide use with 47's as combination oscillator-doublers from 1933 on.

The main advantage of the tritet was that, due to the additional feedback, even a poor crystal could be forced to oscillate. However the second harmonic output was low until Goodman, W1JPE, improved it in 1936 in his regenerative tritet. See figure 3. Due to the inherently high r.f. crystal current in the tritet, however, its popularity has been limited.

The most original step in the feedback type of crystal oscillator was the Reinartz arrangement shown in figures 4 and 5 and first shown last March in RADIO. In this circuit the phase of the feedback is reversed from that of the tritet. This tends to reduce the r.f. crystal current instead of increasing it by reason of the feedback. You will hear more of this one.

However, the Reinartz oscillator does not necessarily run with less crystal current than a tritet, as the crystal works into a capacitive reactance and also due to the fact that the object of the Reinartz oscillator is to get high fundamental power output rather than second harmonic output as in the tritet. Thus it might be said that the Reinartz oscillator uses negative feedback of an amount great enough to sustain oscillation. The feedback in the Reinartz oscillator comes from the voltage drop across a cathode tank, which consists of a high C circuit roughly resonant at from one fourth to one half of the frequency of the crystal. It is the *reactance* of this tank that is important, and not its resonant frequency or

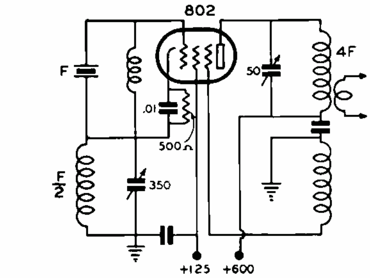


Figure 3
Goodman-Dow "Tritet" Plus Cathode Bias

even its L to C ratio. Thus its resonant point could be varied over a wide range while maintaining its reactance at the crystal frequency constant. Jones has found that any of the common r.f. chokes shunted by the proper fixed condenser works just as well as a tuned tank in the cathode circuit. However, it is obvious that the circuit will be somewhat less flexible as to changes in tubes, crystals and plate voltages when the feedback reactance is non-adjustable.

The main difference between the Reinartz negative feedback oscillator and a tritet working on its fundamental frequency lies in the r.f. grid return from the bottom of the crystal holder and in the reactance of the cathode tank. In the tritet the r.f. grid return is to cathode *above* the feedback coil. In the Reinartz arrangements the r.f. grid return is to ground, or the B minus end of the cathode coil. It is rather surprising that the benefits of negative feedback remained a secret as long as they did when the tritet was so close to the final answer.

The Reinartz oscillator circuit is really a distant cousin of the old Pierce oscillator where the crystal was connected between plate and grid of a triode. In the Pierce and Reinartz oscillators the plate circuit of the oscillator, which includes the cathode tank, must have a net reactance which is capacitive; whereas all the modifications of the Miller-Connelly-Armstrong circuit, including the Tritet, must have a net plate circuit reactance which is inductive.

While on the general subject of multi-grid oscillators a tear should be shed for W6UF and W6CHE who, in the Eimac tube laboratory, did so much development of high powered pentode and tetrode crystal oscillators to run at plate voltages of 1000 to 3000 volts. The vast amount of quartz dust swept out of their laboratory shows that their research largely benefitted the stockholders of the various crystal manufacturers.

www.americanradiohistory.com

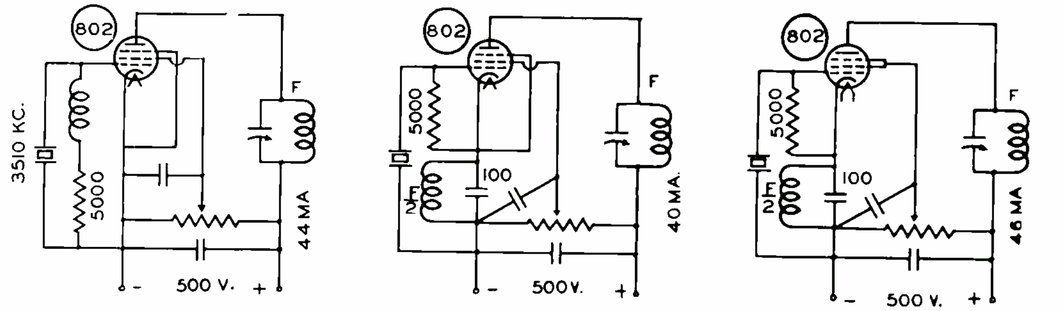


Figure 4
Comparison of various 802 oscillator circuits

	Conventional Pentode Oscillator	Reinartz Pentode Oscillator	Reinartz Tetrode Oscillator
Watts in	22.0	20.0	23.0
Watts out	7.3	11.2	14.0
Efficiency	33.0%	56.0%	61.0%

Triode Oscillators

One of the biggest helps to the amateur exciter problem came when R.C.A. and the other receiving tube manufacturers scratched their respective heads over the bad features of the 46 and then brought forth the 53-6A6-6N7 type of zero bias, high μ-high transconductance triode. This tube is notable mainly for the extremely close spacing between the cathode and the control grid, which allows high transconductance to be obtained at low grid current and low plate voltage.

W. W. Smith (W6BCX) first discovered the tremendous advantages inherent in this tube as a crystal oscillator, single-ended doubler (with and without regeneration) and push-push doubler. He presented his findings in an article in the August 1934 issue of RADIO. See figure 6. He referred to it as the *Siamese* exciter. Two months later Millen showed a transmitter using a 53 exciter in *QST*.

One of the bad features of the 53 exciter was the trouble with primary and secondary emission from the control grid, which made the oscillator "run wild", at higher plate voltages (300 to 400 volts). In order to remedy this condition Jones (W6AJF) early in 1935 added cathode bias to the 53 arrangement of Smith, which not only cured the tendency of the 53 to run away at high voltages but also (surprisingly enough) reduced the r.f. current through the crystal, allowing the power output to be increased at the same time. G. F. Lampkin added a series link arrangement to several cascade 53's, simplifying band changing.

To date, no one has bothered to explain why cathode bias should act any differently than grid leak bias in a crystal oscillator.

My opinion on this phenomenon is as follows:

Why Cathode Bias

It is known that the r.f. crystal current is a function of the r.f. voltage fed back from the plate in the normal phase (180 degrees out of phase with the r.f. plate voltage). It is not necessarily related to the d.c. grid current, d.c. plate current, d.c. plate voltage or r.f. power output. Generally, it is closely related to the r.f. plate voltage, which goes down as the cou-

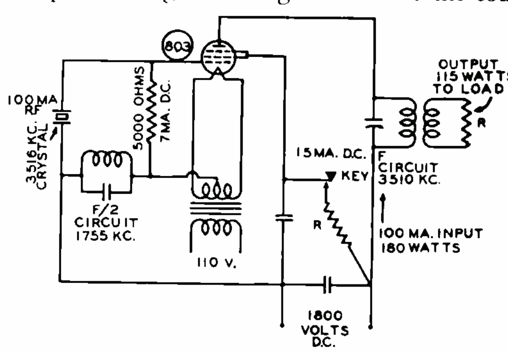


Figure 5
100 watt crystal oscillator using an 803. This is in use at a number of amateur stations with results about as indicated by the figures.

pling to the load is increased. Thus the tighter the coupling to the load, the greater the r.f. power output, the greater is the d.c. plate current, but the less is the r.f. crystal current. Phelps pointed this out in his 250 watt crystal oscillator using push-pull 212D's shown in *Modern Radio* and *R/9*. Thus remember, the tighter the coupling the less the feedback voltage and the lower the crystal current.

This theory disagrees widely with that of some of the manufacturers of high precision crystal oscillators used in broadcast transmit-

www.americanradiohistory.com

ters, but checks in practice. They usually ran the crystal oscillator very lightly loaded "to reduce the strain on the crystal". And by so doing they promptly ran up the crystal current and got more drift and less output than other manufacturers who placed a moderately heavy and stable load on their crystal oscillators.

The next point is that with grid leak bias the bias falls as the excitation falls and thus a crystal oscillator with grid leak bias has least bias when delivering most power output. With cathode bias the opposite occurs and the bias is greatest when the plate current and output is greatest. Let us take a conventional 42 crystal oscillator, for example. Using grid leak bias, a poor crystal takes about 50,000 ohms of grid leak bias to allow it to start quickly when keyed, for example. A good crystal should require only about 5000 ohms of grid leak bias to start fast enough. The lower the grid leak the greater the output and the less the crystal current, *but* the harder the oscillator is to start. In the same oscillator by using perhaps 400 ohms of cathode bias practically any crystal will start quickly, yet when conditions settle down the output and crystal current about correspond to the 5000 ohm grid leak condition. In other words, it is not the *amount* of grid bias which is so important but the way the bias varies with load and the way the bias adjusts itself to d.c. plate current.

If it were not for the difficulty in starting oscillation in an oscillator with a very low resistance grid leak, there would be no difference between grid leak and cathode bias.

There is absolutely no difference in the excitation power lost in any of the different types of bias supply. Thus the whole point is that cathode bias allows the oscillator to get along with less bias and less r.f. grid excitation voltage, which means less r.f. crystal current and more power output.

It is probably desirable to use cathode bias in all crystal oscillators, even the tritet, for these reasons. It also provides "safety bias" when oscillation fails.

The Exciter of the Future

We of RADIO have been working on various exciters for several months and expect to be able to show at least two really good ones that are outstanding from every point of view. We have found out some new things about exciters, but we are not going to show anything radical unless there is a good reason for it. All the really useful advances in r.f. exciters first saw

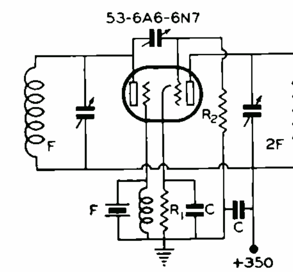


Figure 6
Smith "Siamese" Plus Cathode Bias (Jones)

the light of day in RADIO and we are actively trying everything possible in order to be certain our new one is still the best.

The exciter problem is not simple. There are really two exciter problems. The first type of exciter might be one designed to deliver high output on 10 and perhaps 5 meters regardless of the output on longer wavelengths. The other problem is an exciter which gives approximately equal output on from three to six bands. It is obvious that with the high power gains possible, even when doubling through the newer tubes, an exciter with constant output on several bands will use unnecessarily large tubes in the first and second stages, at least. Therefore, the ideal exciter will probably not be one exciter but two exciters, one having constant output on three to six bands and the other having high output on the two highest frequency bands but materially lower output on the lower frequencies to reduce the cost.

◆

When planning 5-meter crystal control, using a crystal oscillator in one of the lower-frequency bands and a string of doublers, it must not be overlooked that the tiniest crystal drift is magnified to adult size by the time the last doubler is reached. The usual drift due to temperature variation, characteristic of the particular crystal cut used, must be multiplied by 32 when the crystal oscillator is running in the 160-meter band, to show the resultant drift on 5; by 16 when the crystal is on 80 meters; by 8 for 40; and by 4 for 20. Except where all-band excitation is the prime prerequisite, it is simplest to have the crystal stage of the exciter operate in the 40- or 20-meter band and to use zero-cut crystals. No stability is gained by using a 160-meter crystal of the same cut.

◆

Carbon monoxide is one of the undesirables present in a gassy radio tube.

www.americanradiohistory.com

Class C, Grid Bias Modulation

By Raymond C. Olesen*

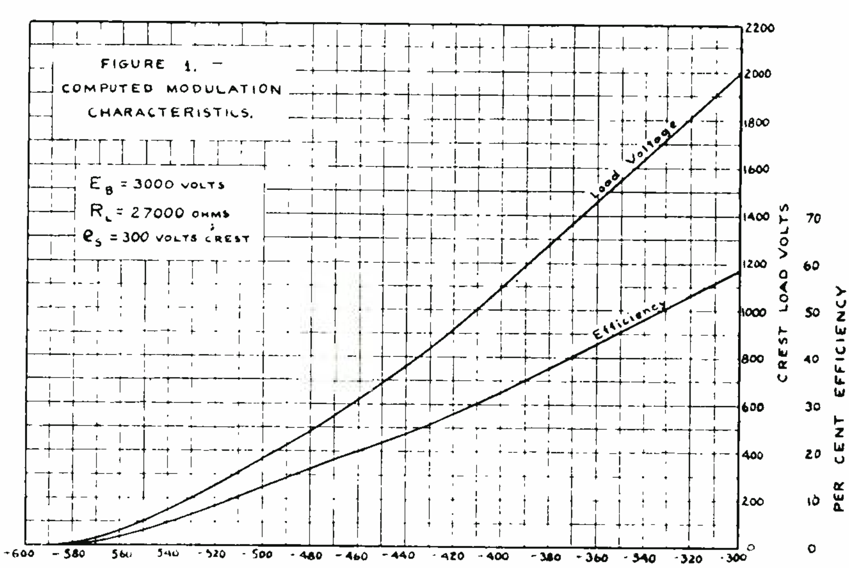
Sixty watts of carrier with only 70 watts of plate loss is really new for a high quality bias-modulated amplifier. Mr. Olesen describes a class C, bias-modulated amplifier whose unmodulated plate efficiency is in excess of 45%. He gets his results by using high bias and grid drive, yet the measured distortion is less than in conventional bias-modulated broadcast transmitters.

Grid modulation is attractive from the standpoint that neither the modulator nor the radio-frequency exciter need deliver appreciable power. Thus the amateur who normally spends most of his time on c.w. may with little cost provide a modulator that is adequate for his purposes. However, some of the aspects of grid modulation are not well understood and it is the purpose of this article to consider these, not with the view of designing a transmitter so one can make a Chinese copy, but rather to offer suggestions to the enterprising amateur who is experimentally inclined.

Both Western Electric and Collins have used class C bias modulation for some time. However, they use fixed bias equal to about 1.5 to 2 times cut-off and do not attempt to drive the grid very positive. Unmodulated plate efficiencies of from 22% to 33% have been the normal efficiencies for this type of bias modulation. Hawkins has obtained around 40% unmodulated plate efficiency in his class BC system but even this value of unmodulated plate efficiency is exceeded in the arrangement shown herewith.

The purpose of driving the grid of a class C amplifier positive is to increase the plate current until the rated plate dissipation of the tube is the factor that limits the power output. However, in conventional grid-modulation systems the grid is seldom driven very far positive and distortion, rather than plate dissipation, limits the power output. This is due to the fact that a large load resistance must be used, since the ideal straight-line curve of load voltage versus grid-bias voltage is approached only as the load resistance approaches infinity and the power output approaches zero. In practice, a compromise must be made between distortion and power output and, when distortion is held within reasonable limits, the rated plate dissipation of the tube cannot be utilized unless the rated plate voltage is exceeded. A comparatively small load resistance may be used, however, and distortion will not be excessive if the grid is driven positive. This principle is utilized in both class B and class AB audio-frequency amplifiers and the improvement in power output is well known to everyone. However, the full possibility of applying the same principle to the grid-modulated radio-frequency amplifier is usually overlooked and this study is designed to show the improvement in power output that may be obtained by reducing the load resistance and driving the grid-positive.

The curves in figure 1 show computed modulation characteristics for a typical grid-modulated amplifier in which the



*Stanford University, Calif.

www.americanradiohistory.com

grid is not driven positive. The d.c. plate voltage in this case is 3000 volts. The load resistance is 27,000 ohms and the crest radio-frequency exciting voltage is 300 volts. In spite of the comparatively large load resistance, the curve of load voltage versus grid-bias voltage is still a poor approximation of the ideal straight-line relation. Figure 2 shows computed modulation characteristics for a modulated amplifier, in which the grid is driven positive and the load resistance is reduced to 7400 ohms. The d.c. plate voltage is reduced to 2000 volts and the crest exciting voltage is increased to 650 volts. In spite of the comparatively small load resistance, the curve of load voltage as a function of grid-bias voltage approximates the ideal straight-line relation over the greater part of its length. It is also apparent that 100 per cent modulation is still not possible without excessive distortion.

Computed modulation characteristics, in which the plate voltage was reduced to 500 volts for the sake of safety, were checked in the laboratory and the agreement in magnitude was found to be within 10 per cent. The measured and computed curves were almost identical in shape and hence the measured and computed distortions agree very closely.

Figure 3 is a comparison of the modulation characteristics for the conditions shown in figure 1 and figure 2. In both cases the tube is an Eimac 50T and the curves were computed using the constant current chart supplied by the manufacturer. See figure 5. The dotted curves are for the operating conditions shown in figure 1 in which the grid is not driven positive and the load resistance is 27,000 ohms. The solid-line curves are for the operating conditions shown in figure 2 in which the grid is driven positive and the load resistance is 7400 ohms. Since the d.c. plate voltages are different for the two cases, load voltages and grid-bias voltages are shown in ratios. In both cases cut-off bias is the d.c. plate voltage divided by the rated amplification factor of the tube.

Inspection of figure 3 shows that the peak power output when the grid is driven positive is nearly three times as great as when the grid is not driven positive. In the former case the design is such that the rated plate dissipation of the tube determines the maximum power output, while in the latter case power output and plate dissipation must be sacrificed to reduce distortion to a reasonable value. Driving the grid positive also reduces power-supply cost since the tube is operated at a lower plate voltage.

Driving the grid positive introduces the factor of grid current, and the grid-driving power varies during the modulation cycle. This means that poor voltage regulation of either the modulator or radio-frequency exciter will introduce distortion, and voltage regulation must therefore be considered in the design of such a grid-modulated transmitter. This problem is not new, however, as the voltage regulation requirements for the modulator are similar to those for the driver stage for a class B audio-frequency amplifier and the requirements for the radio-frequency driver stage are similar to those for the exciter for a class B linear radio-frequency amplifier and also for a plate-modulated class C amplifier.

The design of a modulator with good voltage regulation does not present any serious problems and will therefore be considered only briefly. The modulator should have as low an internal impedance as possible and this means the use of tubes with low plate resistance and, if possible, the use of an output transformer with a step-down ratio.

So many factors are involved in the problem of exciting-voltage regulation that it is difficult to state any hard and fast rules. The best solution seems to be the selection of a driver tube

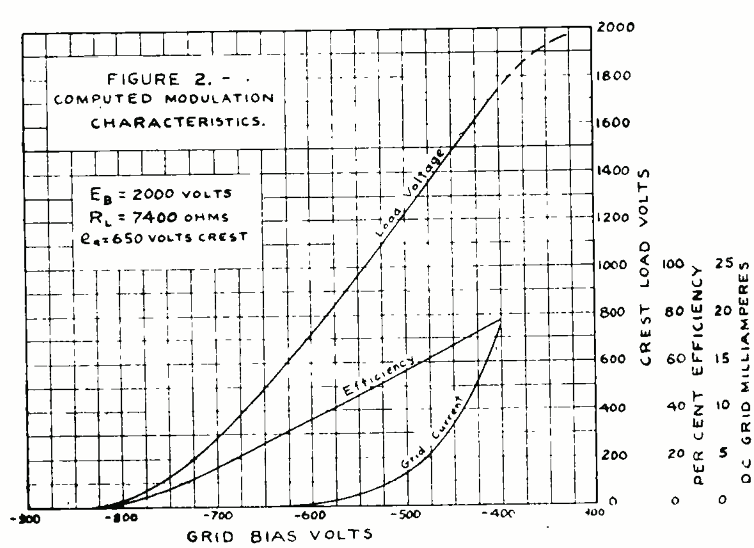


FIGURE 2. - COMPUTED MODULATION CHARACTERISTICS.

www.americanradiohistory.com

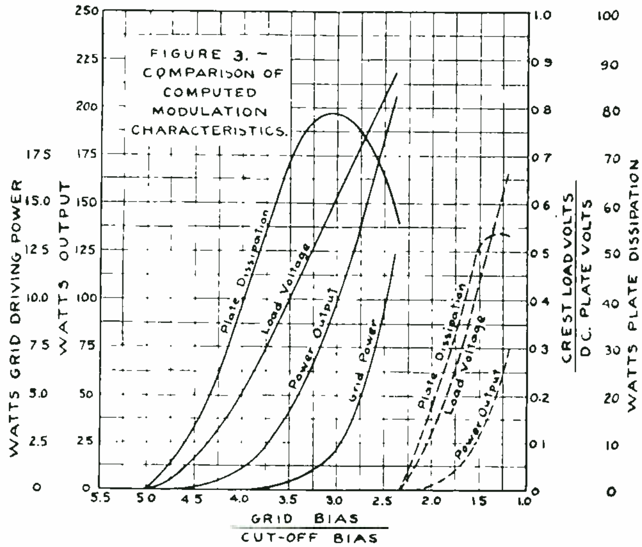


FIGURE 3. — COMPARISON OF COMPUTED MODULATION CHARACTERISTICS.

of approximately 175 volts is required for 90 per cent modulation and laboratory measurements have indicated that the distortion can be less than 5 per cent. A pair of self-biased 2A3's in push-pull class A service provide an excellent modulator capable of modulating one or two 50T's. A transformer with a center-tapped primary and a step-down impedance ratio of approximately two is ideal. A U.T.C. type PA-20, PA-71 or VM-1 with a 6000-ohm primary and 3500-ohm secondary should be a suitable low cost transformer. A 3000-ohm bleeder resistance connected across the secondary will reduce distortion appreciably. The power supply for the modulator should deliver 300 volts at 120 milliamperes and the bias resistor for the 2A3's should have a value of approximately 375 ohms.

having a low plate resistance and capable of delivering several times the required grid-driving power and then the selection of a value of bleeder ("swamping") resistance by trial and error.

Now that the problems involved in designing a high output grid-modulated amplifier are covered in a general way, let us consider more detailed steps in the design of such a transmitter using an Eimac 50T. Referring to figure 2 it may be seen that a grid-bias voltage of -550 volts is a suitable operating point and the crest-load voltage at this grid bias is 970 volts. The carrier power output from one tube is the square of the crest-load voltage divided by twice the load resistance, and this gives a value of 63.5 watts. The efficiency is 47 per cent and hence the power input is 135 watts and the plate dissipation is 71.5 watts compared to the rated value of 75 watts. The power input divided by the d.c. plate voltage gives a plate current of 67.5 milliamperes. When the excitation is properly adjusted, the grid current will be approximately one milliampere with a grid-bias voltage of -550 volts and a plate voltage of 2000 volts.

Reducing the grid-bias voltage to -400 volts produces a c.w. transmitter whose power output is 206 watts. The efficiency is 78 per cent and hence the power input is 264 watts and the plate current is 132 milliamperes. The grid current with proper excitation is now 19.1 milliamperes.

With a grid-bias voltage of -550 volts (3 times cut-off), a crest audio-frequency voltage

The grid-bias power supply for the modulated amplifier should have good voltage regulation and the voltage should be readily adjustable, preferably by the use of an auto-transformer such as a General Radio "Variac". A d.c. voltmeter should be provided to indicate grid-bias voltage and a grid-current meter is also essential.

The exciter may be link coupled to the modulated amplifier and should be capable of delivering several times the grid-driving power

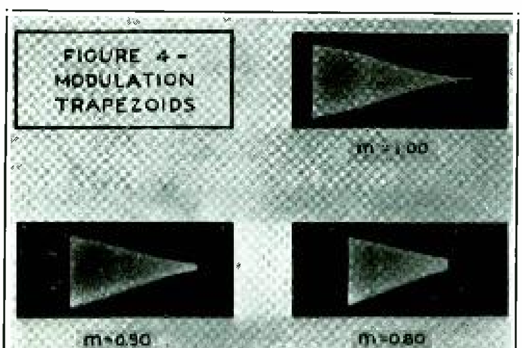


FIGURE 4 - MODULATION TRAPEZOIDS

required for normal c.w. operation. Inspection of figure 3 shows that the maximum grid-driving power for a single 50T is approximately 12.5 watts and the driver stage should be designed accordingly. A bleeder resistance of 10,000 to 20,000 ohms connected across the grid tank circuit of the modulated amplifier will improve the exciting voltage regulation. As previously mentioned, this value of bleeder re-

www.americanradiohistory.com

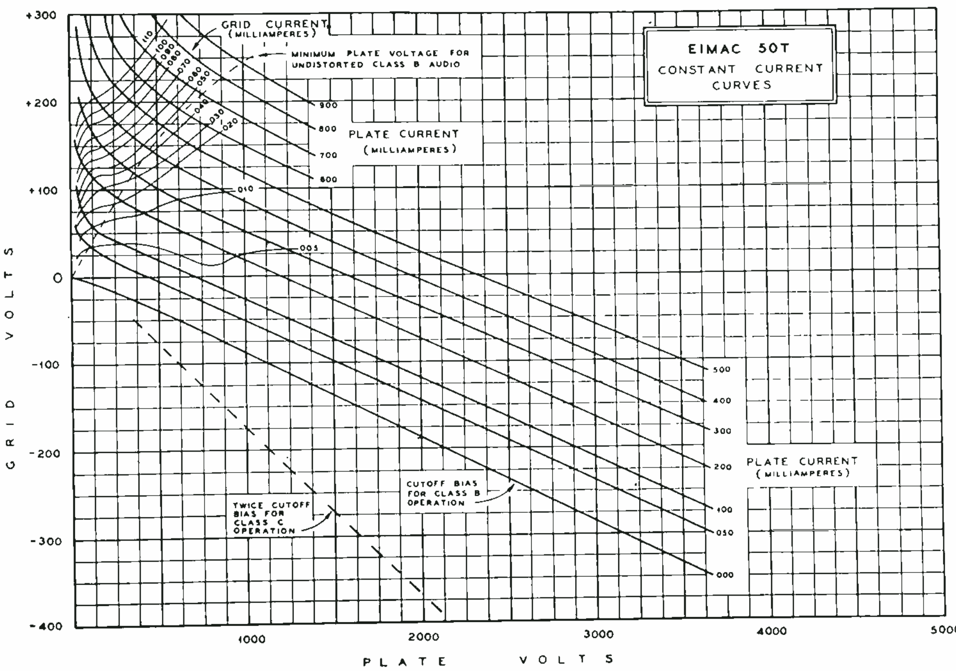


Figure 5. Example of Constant Current Chart

sistance is best determined by trial and error.

To place the modulated amplifier in operation, the first step is to adjust the grid-bias and plate voltages to the desired values. The excitation and load coupling are then adjusted to give the computed grid and plate currents. With this as a starting point, minor adjustments can be made to reduce distortion to a minimum. Figure 4 shows actual modulation trapezoids photographed from a cathode-ray tube and is an example of what may be obtained. With 100 per cent modulation ($m = 1.00$), the measured distortion was 11.2 per cent. With 90 per cent modulation the distortion was 2.07 per cent, and at lower degrees of modulation it is negligible.

To operate c.w., it is only necessary to reduce the grid bias and, if necessary, to increase the excitation. One 50T with 2000 volts on the plate is capable of delivering a grid-modulated carrier of 60 watts or more and, if sufficient excitation is available, the power output on c.w. may be as high as 250 watts.

Driving the grid positive makes it possible to triple the power output from a given tube and at the same time less plate voltage is required. However, the reduction in modulated-amplifier tube and power-supply costs is partially offset by the more severe requirements for the exciter and modulator and, aside from over-modulation, poor voltage regulation of the audio and r.f. drivers is the greatest source of distortion. It is believed, however, that increasing the power output by driving the grid farther positive than customary in the past is not only practical, but good economy.

◆

Glyptal Cement Now Available

Amateurs who have in the past tried without success to obtain Glyptal cement, a derivative of Glyptal alkyd resins that is flexible, transparent, and exceptionally adhesive, will be glad to learn that Glyptal is being placed on the market by the General Electric Company. It will mend or adhere to all common materials except rubber and is both water- and oil-resistant, and has been used commercially for some time.

The new cement is being merchandised through retail household outlets in a handy-sized tube and has dozens of different uses around a "ham" shack.

◆

In 1659 Sweden issued a copper coin, worth about $5.20, which weighed 31 pounds and measured roughly two feet by one foot. What nice shielding they would make!

www.americanradiohistory.com

South of the Sun

By E. H. Conklin, W9FM

R. D. Prescott, HP1A, shown near the Isthmian Airways hangar on the Canal.

Perhaps all of us have thought of visiting the tropics if the opportunity were presented, operating a station with a foreign call, seeing sharks, porpoises, flying fish, alligators and monkeys not in captivity, getting into the jungle, watching the sun stay in the north sky all day. A year ago we would not have thought such a trip possible, but we saw all these things, and more.

The start of it all was a letter from Nelly Corry, G2YL, who took a West Indies cruise last winter. One thing led to another, and finally W9FM and wife, W9SLG, started out from Chicago, late in May. As the south was new country to us, it was decided to drive to New Orleans and sail from there.

On the way, one evening was spent in Birmingham with Julian Dixon, W4AJY, who did so well last year on ten meters. The conversation worked around to magnolia trees and climaxed with us clambering in the dark to find a real magnolia blossom. It couldn't be brought back, but we did get a nice picture of it the next morning.

In New Orleans there was no need to think about radio. The old French buildings in the *Vieux Carré* brought back to mind the history of the city before it became a part of our country. We had dinner in Antoine's—or rather, we tried to have dinner in that famous restaurant under ten dollars each.

We sailed from New Orleans at noon, June 3, aboard the S.S. Contessa, a passenger and freight boat in the banana trade. The trip to Havana was fine, with the gulf behaving like Lake Michigan on a calm day.

On board we met George Innis of YN1BX, who is an operator at YNE, and Salvador Lopez y Espinosa, who operated at YN1 and was going home to Bluefields, Nicaragua, with a load of parts to put a rig on the air.

It was a thrill to get to Havana at sunrise. After an argument with the customs man about bringing ashore a bag full of cameras, we set out to see the narrow one-way streets, wide boulevards, and numerous monuments of the city. The Tropical Beer Garden was a beautiful spot — even if the owner no longer gives away all the beer you can drink. There were many royal poinciana trees, their tops covered with red flowers, and many other flowering

A view of the diamond beams at the Navy radio station (NY1AB) at Balboa, Canal Zone. The short pole in the foreground carries a balanced four wire transmission line which is used with alternate wires connected together. K5AA is located just beyond the buildings, in Fort Amador.

shrubs and trees. We visited a distillery where the crowd made up for the Tropical beer that was not running free. It was a good thing that they didn't have to drive through those narrow streets and blind crossings after that!

With Salvador Lopez as an interpreter, we

www.americanradiohistory.com

tried Havana again in the afternoon. A telephone call to Alfredo Dominguez, CM2AD, was attempted, but the conversation, half in Spanish and the rest in English, gave us the impression that Alfredo wasn't home. We took a taxi to station COCO (6010 kc.) where some dark lads were playing a rumba, and met the operator, Luis Casas, Jr., whose call was CM2LC. From there it was only a few blocks to the office of H. F. McFarland, CO2KC. "Mac" invited us out to his house to see the rig and sign a "CO" call.

The houses that are rented, it seems, are not built for window screens, and everything opens up wide. Mosquito netting is used over beds but no mosquitos were encountered—and few beds—while in Havana.

Frances McFarland demonstrated how to mix a *Cuba Libre*—a jigger of rum and a bottle of Coca-Cola.

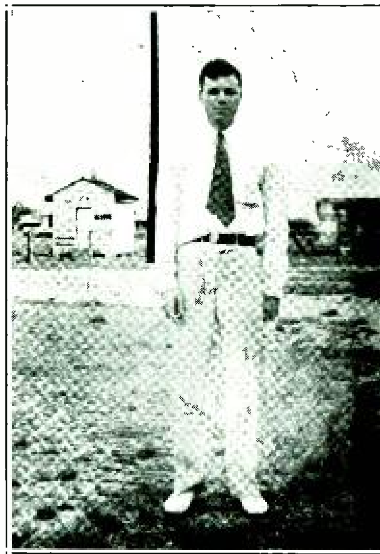
The transmitter used a pair of 211-type tubes working into a 20-meter Johnson Q. It is modulated by a pair of 800's. The receiver was an HRO, with a Peake preselector in front for good measure. With a clear phone channel on 14,140 kc. it was easy to have fine chats with W8LFE and W3CZE. They came in very nicely but only three or four phones would come

Josephine Conklin, W9SLG, in the bow of S. S. Contessa, headed towards Panama. Notice that the sun is well to the north and the shadows fall to the south.

through R9, the rest being down in the QRM. Frances keeps a file card on each station worked so it was possible to start the conversations where they had left off a year before on the previous QSO! Being married does help, you see.

That evening the crowd visited Sloppy Joe's, saw the Jai-Alai games, danced in the open at beautiful Sans Souci and at the noisier Montmartre.

At famous old Morro Castle the next morning it was found that the Cuban army cadets were away on a hike, leaving one man operating a small transmitter using a pair of '45s. The



George Innis of YN1BX, standing in front of the station at Puerto Cabezas, Nicaragua.

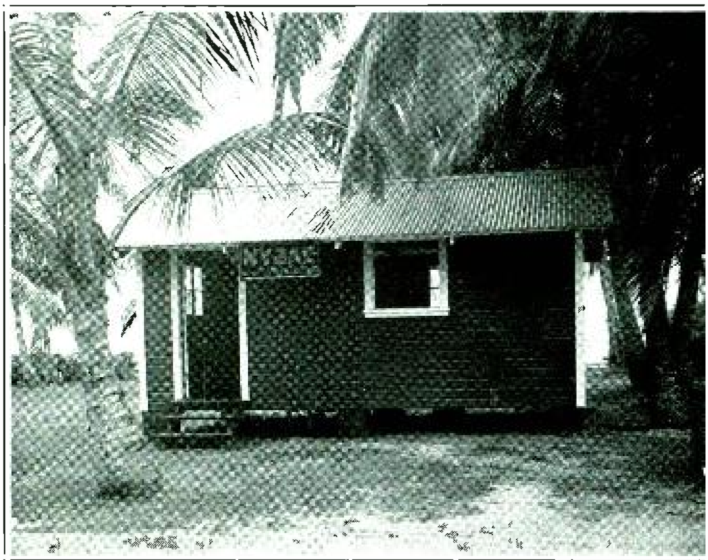
masts were well up in the clear, suitable for a good bit of dx.

Leaving Cuba, we sat on deck in the sunshine and watched the tropical rains pour on the land—but not on us. On the run down to Panama, the course took us by Old Providence Island, part of the Republic of Colombia. It is a fine place for radio, if you bring your own power. Upon arrival at the Canal Zone the ship docked at Cristobal—again at sunrise.

Although the annual rainfall, mainly in May through December, is said to be almost 100 inches at the Atlantic end of the Panama Canal, there was no complaint about the fine weather. Interesting sights included the earliest French canal, jungle, and the three-step lock at Gatun. There are only about ten miles of road on that side of Panama. At France Field there was a K5 station, but everyone was parked horizontally on tables so we didn't disturb their siestas to find out what station it was. At the ship a card from Mary Fritts of NY2AE awaited us with an invitation to see the station that evening.

After an early luncheon we took the Panama

www.americanradiohistory.com



Station NY2AE located at the U. S. Submarine Base, Coco Solo, Canal Zone

Railroad train for Panama City. The road was built by United States interests about 1854 to facilitate transportation from the eastern U.S.A. to California. It is said that each tie represents a life given in its construction through the swamps and jungles, but according to our calculations, if the dead men were all six feet tall and were laid end to end, they would reach only seven miles. However, that only emphasizes the magnitude of the task. Ordinary wooden ties were not satisfactory. The builders used a very hard wood for ties, so as to give the bugs indigestion. The lumber was so hard that holes had to be drilled in it and the rails bolted to the wood. There still is no automobile road across the isthmus.

On the way, we saw a number of thatched huts and small banana groves. At one point there were a half dozen or so of the old towers of the sort that were used years ago on very low frequencies, but to our surprise they were new ones for a Panama-U.S.A. beam.

At Balboa station, Major Prescott, HP1A, met us and arranged a later meeting. We drove to a navy station (also NY1AB) and through Fort Amador, passing K5AA. Then we went out to historic Old Panama, which was established about 1530 and destroyed by the pirate Morgan during his treasure-hunting raid in 1671. The jungle has now been cleared back from the ruins, with the exception of some old ceiba trees growing through walls where they could not be removed.

Major Prescott, who has charge of all communications in the Republic of Panama, was certainly a perfect host.

He told us of an election held five days before. No one knew who had won. All clubs and bars were closed for fear that a drunken argument might start a revolution.

Several days before, a green operator was sent out to an isolated government station. He soon reported that someone was firing on him, so the government sent planes to fly over the station and do a little shooting from the air to scare away the invaders, there being no landing facilities nearby. Instead of being the start of a revolution, however, it was learned that the shooting was not directed at the station, but that the operator was a bit too imaginative.

At home, HP1A turned on two HRO's and one of those large RCA commercial receivers that cost a fortune. No signals came in except thumps from K5AA. It turned out to be one of those 54-day-cycle dead spots mentioned by J. H. Dellinger. The transmitter was a Collins rig with a 203A in the final. Three crystals all fall around 7150, 14,300 and 28,600. The large rig with a pair of 860's in the final was being rebuilt. A separate gasoline generating plant was available for emergency power. Plenty of equipment was on hand, including cathode ray oscilloscopes, a de luxe portable set, and a cabinet full of spare parts. The Major showed us his Contax camera, worth much more than some of those receivers.

The many antennas out back reminded us of home, where by contrast a mast must support wires going in all directions.

We were able to take a plane back from the Pacific to the Atlantic end of the canal, which certainly was a sight to remember a lifetime. So was the surprise when, through a misunderstanding about a Naval Reserve identification card, the pilot turned over the controls for the whole distance—and did we ever make the turn cautiously over Gatun Dam, with only a thousand feet of altitude and no experience in handling a plane! But they say that if you can make some of these "ham" sets work, you can tackle anything.

www.americanradiohistory.com

In Colon, we telephoned "Fritz" of NY2AE who drove in from the submarine base at Coco Solo to get us. Although as tourists we couldn't get into the submarine base, we had no trouble this time! WCTV was at the submarine base also. The station was a single room supported on the ever-present concrete blocks, used to insulate the building from termites. Mary Fritts was keeping the rig going on 14,086 kc. The outfit was mainly home-made, even the audio transformers. The latter were kept in transformer oil because of possible breakdown in air due to the heavy humidity. The final was a pair of 860's with about 500 watts at 2400 volts on either ten or twenty meters, modulated with about 2200 volts on a pair of 211's that were taking plenty of punishment. The 860's in the final were driven by another 860, that by an 802 doubler, and that by a 59 tri-tet from an 80-meter crystal. On 28 mc. the driver is used as a doubler. The antenna is a 75-meter zepp. slanting up to a water tank. This antenna has worked better than a 14 mc. vertical and other ideas tried. A crystal mike is used. The receiver is homemade, using a Tobe tuner. A single knob controls the station ordinarily, making operation simple for everyone who uses the set.

Down in Coco Solo the signals came in just as well as at home. Nothing can be done until after 4 p.m. when the shop machinery is shut down, but after that the noise level is low. Twenty meter phone contacts are made all night long, though at around five or six in the morning the band switches from W6 stations back to the east coast, it seems, with a dead spot traveling across the U.S.A. around sunrise.

W5EUC, W1BR and W5ENL were worked with no trouble at their end in hearing our clear channel. Again it was noticed that the 100 kc. wide phone band was letting through four or five loud stations, not necessarily high-powered outfits. The rest, presumably with poorer antennas or locations, were down in the hash. The edges of the c.w. band were noticeably crowded, but there was no particular trouble in copying any one station unless two of them went exactly into zero beat. If anything, the phone carriers sounded louder than the c.w. signals, which was noticed at home too—or was it imagination?

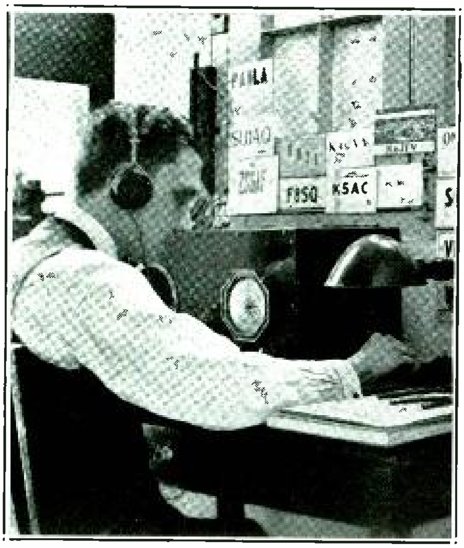
NY2AE has worked all states except Nevada and Utah. "Fritz" is anxious to see all amateurs visiting the Canal Zone, and asks them to telephone F. S. Fritts at Coco Solo, from Colon or Cristobal at the Atlantic end of the canal.

During our stay in Panama in the rainy season, we didn't get wet, although we felt the dampness in our clothes, flew through rain, and missed a downpour by a few hundred feet. The maximum temperature was around 87. It seldom reaches 90. It was quite comfortable in tropical clothes, as long as strenuous exercise was not required.

After leaving Panama we passed Costa Rica and stopped at Puerto Cabezas, Nicaragua, where George Innis of YN1BX and his wife left the boat. His partner, Krug, was operating YNE single-handed so was unable to talk with us. Another HRO was in use and another Collins transmitter. Tall poles held up the 600 meter T-cage, while all the other high frequency antennas went to a shorter pole from either of the tall ones. These antennas were of the delta-match two wire feed type. Eight hours of commercial operating each day left little desire to be on the "ham" bands.

Inside view of NY2AE showing the present transmitter and the receiving position. The audio equipment was behind the camera.

www.americanradiohistory.com



Alfredo Dominguez Jr., CM2AD

In the "Foreigner's Club", George was getting the dope on the revolution from one of the girls who lives in Puerto Cabezas. A few nights before, some of them had driven out to a place where they accidentally walked through bloody sand. The "army" still had its barracks surrounded with a mess of sand bags. So we practically got into the Nicaraguan revolution, too.

The last stop was at La Ceiba, Honduras. Again arriving as it was getting light, we looked out the port hole at a very beautiful sight. The Caribbean was very calm; the ship was docking at a small town at the bottom of a mountain range that rose from sea level to more than 9000 feet. The peak was sticking up through a bank of white clouds. Coconut trees lined the shore. We could hardly wait to finish breakfast and get ashore.

A narrow gauge train took us through the plantations and jungle for about two hours, to the shore of the Salado River where a flat-bottomed boat was ready to carry us up one of the streams. Within a few minutes we saw our first alligator break the surface and dive under. We had fresh coconuts to eat. They were really good compared with the dried ones available at home. On the way back, after hours of looking at jungle and coconut trees, we saw a number of black monkeys sitting or hanging in a tree and watching us. We also saw cranes, a kingfisher, scarlet tanagers, turkey buzzards, red-winged grasshoppers, and everything but a boa constrictor. Near the Carib Indian village where the train awaited us, the gang went swimming in the surf of the Caribbean—close to shore because of sharks. The beach would fit any description of a South Sea island.

Back at La Ceiba we tried to locate Frank Keene of HR1UZ. He had had an orchestra there, but, through short wave broadcasts, had landed a $10,000 job back in the United States. There no longer was a ham rig in town, but while looking for the broadcast outfit, we let ourselves be caught in the nicest tropical downpour that we could imagine. For five or ten minutes the rain came down so hard that houses across the street were invisible. It sprayed us through an umbrella, so we ran for cover. It stopped abruptly and we made our way between deep puddles back to the ship. Aboard, we found our boa constrictor—in a box, though.

Our return to New Orleans was not eventful except for high winds and 50-foot swells due to a minor hurricane that was encountered after passing Yucatan.

Back in the United States we headed for home, stopping one night with Bill Owen, W5WG, who had very kindly asked us to spend a night with him in Ruston, Louisiana. Bill was already preparing to win the Sweepstakes in Louisiana next winter.

Frances and "Mac" McFarland at the operating position of CO2KC in their home in Havana.

We shall be glad to answer any letters about the trip. The accomodations and food were fine all the way. The cost from Chicago, by train or driving, including tips, can be held within $175.00 a person. No new radio equipment for a while at W9FM—but we do have some pleasant memories.

www.americanradiohistory.com

Measuring Grid Drive and Antenna Power

By G. F. Lampkin*

What is your antenna power? The efficiency of class C amplifiers varies between 60 and 90%. If you are using grid modulation it is still harder to hazard a guess as to the output of your transmitter. Or maybe you want to know the power gain of your final stage. You can't figure it unless you know how much grid driving power is being used. This article shows how to approximate these values quite closely by a very simple procedure.

There are two comparatively simple methods of measuring power at radio frequencies which may readily be applied to amateur transmitters. One of the methods has to do with the measurement of driving power into an r.f. amplifier or buffer stage. The other is a system for determining the output power of the final stage. The latter method, of course, may be applied to an intermediate or any other amplifier simply by inserting the measurement circuit after that amplifier.

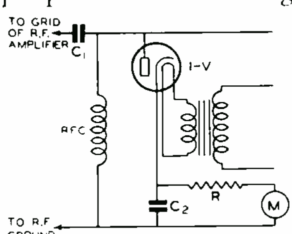


Figure 1

A direct reading peak voltmeter for use at amateur frequencies. Its application for measuring r.f. driving power is discussed in the text. The results will be sufficiently accurate for all ordinary purposes.

When statements are made concerning transmitter performance, they would be much more informative if definite data as to radio-frequency (not input) power could be included. Figures of crystal current, grid current, plate power, etc., are readily obtainable and are often published or given in "rag chews". Figures as to radio-frequency power have as much or more significance than any of the above quantities and they should be included in order to form a sound basis for comparison or judgment. The methods outlined below permit radio-frequency power to be measured almost as easily as plate input power.

The grid driving power into an r.f. amplifier can be determined simply by learning the direct grid current and the r.f. peak voltage applied to the grid. The input power is the product of the two. Put into a formula:

Grid driving power (watts) = Direct grid current (amps.) × r.f. grid volts (peak).

The grid power into a push-pull stage is the product of the total direct grid current and the peak r.f. voltage taken from ground to the grid on one side.

The basis for the method was outlined in a paper published in the *Proceedings of the I.R.E.*[1] It is a "rule of thumb" approximation, but in general, results accurate to better than 10% will be obtained. Why the method happens to give accurate results will not be gone into here.

Provision is made to indicate the direct grid current of a stage in nearly all of the modern transmitter versions. In any case, it is simply a matter of inserting a d.c. milliammeter in series with the bias supply or the grid leak. The peak r.f. voltage most simply can be measured with the setup diagrammed in figure 1. The condenser C_1 is a fixed mica type, from .0005 to .002 µfd., for blocking off from the test circuit any d.c. voltage. The item RFC is a small choke of any type effective on amateur frequencies. It may be a commercial 2.5-millihenry pie-wound unit or a home-made single-layer solenoid. The filter condenser C_2 must be a high-grade mica type with a capacity of .005 µfd. or more. The meter M is a 0-1 d.c. milliammeter, and R is a multiplier resistance of 100,000 ohms or more. The resistance R determines the range of the peak voltmeter. If R is a precision resistor, accurate to within 1%, the range of the peak r.f. voltmeter for all practical purposes will be 0-100 volts. The values can be read directly on the milliammeter scale, taking proper notice of the decimal point. For instance, a scale reading of .83 (ma.) would be equivalent to 83 volts peak alternating input.

When the multiplier is 1,000,000 ohms the range will be 0-1,000 volts, again read directly from the scale by placing the decimal point. Any good grade of wire-wound resistor will do for the multiplier, and for rough work even a metallized resistor will function. An unknown multiplier can best be calibrated by removing C_1 and RFC, and applying various measured values of d.c. voltage to the rectifier input.

Since the voltmeter circuit has an effective

*Lampkin Laboratories, Bradenton, Fla.

[1]H. P. Thomas, *Proc. I.R.E.*, vol. 21, p. 1134; August, (1933).

www.americanradiohistory.com

capacity of some 10 micromicrofarads, its connection across the grid tank will necessitate retuning. Usually the high side of the voltmeter will connect to the grid of the r.f. amplifier, and the low side to the cathode or filament. Any other points of attachment, which carry the respective r.f. potentials, will be satisfactory.

To measure the r.f. power output of a tube or tubes it has been common to utilize a light-bulb resistor for a dummy load. The scheme is complicated by the fact that the resistance of a tungsten lamp changes over a five- or ten-to-one range, from hot to cold. This is illustrated in figure 2, where the resistance of a 60-watt tungsten lamp is plotted as a function of the current. When the lamp is cold, its resistance is some 30 ohms, and when hot about 225 ohms. This fact introduces two major difficulties into r.f. power work. One is the variable load which results at the output of the r.f. tube. If the coupling be adjusted so that optimum load is had, any change in power output will at the same time change the loading on the tube. This interlocking of adjustments is not only annoying, but also conducive to spurious results. The second difficulty is that of knowing the exact value of load resistance, to use in calculating the I^2R output power.

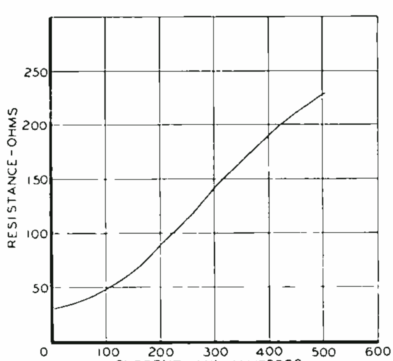


Figure 2
Resistance of a 60 Watt Tungsten Lamp as Influenced by the Current

The characteristic of the tungsten lamp can be compensated by running a carbon lamp in series. The resistance of a carbon lamp decreases with increasing current, and a combination with a tungsten lamp can be found which has practically constant resistance over a wide current range. The curves of three such combinations are given in figure 3. Curve (1) is for a Nalco[2] 2-c.p., 115-volt carbon lamp in

[2]North American Electric Lamp Co., 1120 S. Grand Ave., St. Louis, Mo.

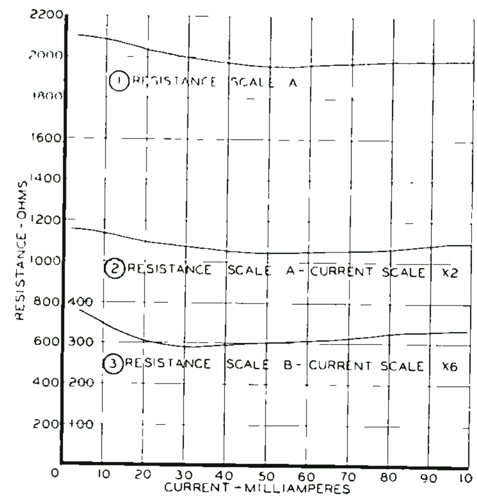


Figure 3
Resistances of Various Series Combinations of Tungsten and Carbon Lamps

series with a G.E. 15-watt, 115-volt tungsten lamp. The total resistance averages 2,000 ohms and is constant to within 5%. The two lamps will absorb up to about 20 watts of power. The resistance of the carbon is higher than that of the tungsten bulb. With 220 volts applied to the two, the former will account for 135 volts while the latter consumes 85 volts, on the average. Thus the carbon lamp is the element which limits the maximum power dissipation.

A combination which will handle up to 40 watts is a 4-c.p., 115-volt Nalco lamp and a G.E. 30-watt, 115-volt item. Their total resistance is around 1,100 ohms and is constant to within 6%. A G.E. 120-volt, 100-watt and a Nalco 16-c.p., 115-volt lamp have, in series, a resistance approximating 300 ohms which is flat at the higher currents and which is capable of consuming up to 110 watts. These combinations are typical of what can be attained in the way of a constant-resistance dummy load for radio frequencies. The individual pairs of lamps could further be combined in series or parallel to build up loads of any required total resistance or power capability.

To measure the power output of a transmitter at a given input, the dummy load is coupled to the output and the current through the lamps is measured with a thermo-couple ammeter, or equivalent. The r.f. power is equal to the amperes squared times the load resistance. In other words:

R.f. power (watts) = R.f. amperes × r.f. amperes × ohms.

[*Continued on Page 74*]

www.americanradiohistory.com

Better Than Breadboard

By Carlos S. Mundt

This last year in amateur radio has seen a growing tendency toward a better and more professional appearance in transmitters. Perhaps this has been largely the result of better looking receivers and a wish to have the transmitting end present a similar appearance. At any rate, the modern John Q. Ham must have a rack and panel or he feels that his equipment is not up to the minute. This is the story of a modest and very inexpensive assembly, easily constructed, and arranged to be placed on top of a table. It is roomy enough for the average medium or small powered transmitter of perhaps three or four stages: oscillator, a buffer or two, and a final amplifier.

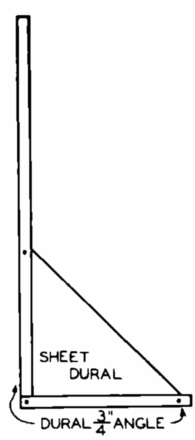


Figure 1

For the rack 3/4 inch duraluminum is used, being light, strong and easy to machine. The thickness depends upon the weight of the various assemblies in the transmitter, such as weight of parts, type of sub-base, etc. For a four section, forty-inch standard rack there will be required two pieces each 40″ long (the verticals) plus two others each 18″ long (the horizontals or table rests) ; besides, two pieces of dural bar are used for crossties, one at the top of the rack and one at the rear of the horizontals, the length being 19″ each. For additional supporting strength use a piece of sheet dural 18″ square and have it cut along a diagonal, thus making two triangular side braces.

The angle dural is first carefully cut to size, making sure that the cutting is at right angles to the length. It is then drilled and tapped for 8:32 assembly machine screws. Each portion with its respective supporting triangle will then resemble figure 1. When completed a tie bar is inserted across at the top and another flat across the rear.

Before assembly the two 40″ verticals are carefully drilled and tapped for machine screws to take standard relay panels. In this case four 8¾″ panels may be accomodated, plus a small top panel carrying the antenna tuning condensers and r.f. ammeter. The writer suggests his own scheme of making up the panels of 3/16″ or ¼″ *tempered* Masonite, which is very inexpensive. Rub in plenty of medium crankcase oil and you will obtain a uniform dark brown color, to which appearance old-style Atwater-Kent dials will add considerably. As previously noted in Radio, the panels may, if preferred, be finished in a black lacquer or even black crackle.

Two schemes are suggested for the general assembly. The first, as used by the writer, utilizes panel 1 (at bottom) for switches, the two power supplies resting on the table immediately in back of the panel. The remaining panels carry the oscillator, buffer, final and antenna tuning. The second scheme is to place the power supplies on a shelf under the table, thus allowing for the use of the entire panel assembly for the transmitter or even two transmitters.

It is wise to make all four panels exactly alike, thus making all units, excepting the antenna one, interchangeable. Each may carry perhaps two variable condensers, two jacks, and one meter. Of course each type of construction may serve an individual need.

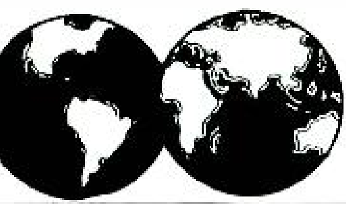
Now for the best news: Total cost of the rack and panel assembly described above will scarcely exceed $2.50. What more do you want for that "professional" touch?

◆

Mickey Mouse, of the cinema shorts, is going more and more ham-minded. There was a grasshopper who pointed his antennae toward another, above his noodle; whereupon, sparks flashed between the knobs thereon, buzzing out a perfect CQ.

www.americanradiohistory.com

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.

From all indications this winter should see no slump in dx worked. Reports come in from all points on the globe to the effect that this season is off to a swell start. The 20 meter band still predominates, but that 10 meter slice of the spectrum right now is again coming into its own, much as it was last spring. Mr. Conklin's (W9FM) account of 28 Mc. activity will give in detail just what is going on down there. Even 5 meters is rising up to heights never heard of before and I wouldn't be a bit surprised that before the winter is over some really good long distance hauls are made on this band.

Now what about the "roaring forty" meter band? Yes, what about it? There seems to be a scarcity of reports regarding this band, and still there is dx coming in there right along. W6GRL has been hearing sigs from South Africa, South America, Asia, and of course from the land down under. Keep an ear on that band, gang, and let's hear what's going on . . . Shoot the info in and we'll pass it on in December RADIO.

W2UK, Tommy Thomas, has had a busy day. His QRA was right on the edge of that hurricane and it raised a little havoc with five of his seven antennas . . . Said the last two were staying up more by will power than anything else. Tommy's shack got in the way of a bunch of lightning, which burned out some tubes and coils in his RME-69, also knocking the pole transformer for a loop, and gumming the telephone company's cables. Some fun, I guess, but not for Tommy.

W2BSR worked VS1AA. W1FH comes to the rescue by saying that 7 Mc. is still good, as on Sept. 19, while listening in for a couple of hours, he copied about fifty Europeans, and worked LY1AF, OE1HP, OK2MF, HAF7N, and F8XE. This was somewhere between 12 and 3 a.m.

Some of the better stuff worked on 14 Mc. by W1FH includes J2LU, J5CC, J2CC, J2JJ, J3FI, K7FCR, KA1US, KA1MD, and UN2A. The dope on UN2A is this: T9, 14,395 kc., and is located in Liberia, the only (?) station in the country. Len Robinson, W6WO, has been doing 14 Mc. lately and has worked a flock of new ZS, ZU, and ZT, together with ZE1JG, ZE1JN, ZE1JS, ZE1JM, CR7AD, CR7ZS, FB8AB. Len says VS1AL, which is a new one, is coming through in the mornings . . . as is his roommate, VS1AJ. U9AL in Siberia wants W6 contacts. MH3X and LDHQ are ships and both are out of the high frequency end of the band. W6WO has worked more South Africans during the past month on 20 than he had during the previous seven years on 40.

W9VW has been putting out a swell sig with never more than 50 watts input . . . However, by the time this is being read, I am told, he will be right up there with the "power trust". Recent QSO's for Hal are J2CC and ZB1J, who was coming in at 0444 G.m.t. and about same frequency as FB8AB. PK1GW is the outstanding PK being heard at W9VW. W2BJ has been breezing around New England during the summer but now has settled down to making some minor changes in his rig. Ray had a visit from a friend of HAF3D, who was in N.Y. for a while.

G5OQ, G2UJ, G5KV, G6OB, and G2YY are really QRP stations; none of them uses more than 10 watts . . . ever. G5OQ has 52 countries to his credit; some of the dx that Baker has worked includes VQ3FAR, FB8AG, VS6BD, U9AL, J2CL, VK4US, VK5KL, PY1AW, ZE1JM, ten different SU's, all U.S.A. districts, and ZB, SV, CT2, and CT3. All of these QRP G stations mentioned above use the "Windom" type antenna. G5OQ says he thinks the W's would work more dx if they all would use QRP. Mebbe so . . . but somehow that just doesn't sound right.

•

Hy Siegel, W3EDP, of Trenton, N.J. has been knocking off some nice dx. Between August 30th and September 2d, Hy worked K6NRF, ZS5U, G5OV, G8BD, D4XPF, G2RC, OE6AX, D4VRR, G5HA, VK6AA, ON4CH, G8AX, G6WO, G2JF, G5AC, OZ7SS, VK6KB, J2KJ, OK3XF, YR5VC, HAF8D, HAF4K, PY1MK, SM5UD, ZS6AJ, ZS6AL, and a flock of VK's. Some other dx that W3EDP has worked during the past three months are: VK6FL, KA1US, J3FI, CN8MU, CN8MB, LY1ZB, YR5VC, PZ1AA, PZ1PA, VK7CJ, ZB1C, ZB1J, YU7VV, YR5IG, VQ3FAR, I1IR, YM4AD, I1ZZ, U9AC, U9MF, U6SE, U2AZ, OH2OV, OH2OB, ES3YY, ES5C, FB8AB, LY1HB, YL2BB, YL2BH, U1AD, SU1CH, CR7GC, YR5RR, SV1KE, VP2DF, YT7KP, U3QT, OH5NR, SP1CS, CP1AA, K7UA, EA6AJ, YR5CP, VU7FY, ZP2AC, LA6F, PY7AB, PY8AG, LX1AO, HAF8I, VE5NO in Zone 2, and EAOAA. . . . By the way, does anyone know anything about the QRA of the EAOAA? Until a couple of months ago, W3EDP was using a pair of '46's in the final with 50 watts into 'em, but now has a 203A with a little more soup. Hy wants to know if all the birds who work those Asiatic stations between 9 and 11 a.m. are night watchmen or just have nothing to do anytime, hi.

I heard through underground channels that a bunch of the boys had quite a time at the Chicago convention over Labor Day. W8CRA, W1KH, W8OSL, W8BSR, W8DWV, W1FH, and W4DHZ were there but from reports CRA and DHZ couldn't stand the pace. W8CRA wore out his thumb trying to get a ride back to "dear ol' Cannonsburg".

W8OSL uses a 200-foot end-fed antenna for both receiving and transmitting and claims it can't be beat . . . that is, excluding fancy beams, of course. His

www.americanradiohistory.com

happens to run North and South. Frank (W8CRA) has been using this type for nearly nine years now. W8OSL has 20 watts on 5 meters and has worked 45 towns in 4 states. Wotta pity.

While W8CRA was sleeping late one morning, W8DFH sneaked a new one on him . . . CR9AB, and Frank is still chasing him. Anyway, when I gave him the razz on that one, he says he *worked* his country Nr. 123 anyway . . . 'twas VR1AK. W6GHU worked FT4AG in Tunis, near 14,400 kc. B. K. Willoughby, W9NTW-W9OHK, has picked up his station and moved the NTW part of it from Decorah to Marshalltown, Iowa. His other station, OHK, has also been moved to Grundy Center, wherever that is, and will operate there week-ends. Willoughby uses a Jones three-band antenna, 136 feet long. He has been mainly on Mc. and has worked some nice dx. The last QSO he had before the moving fever got him was YS1FM. Using a new rig with a T-200 in the final, he will be on 10 and 20 meters a great deal. W9SCW is using a V-beam antenna and gets very good reports on dx . . . 300 watts input. W5CPT, Emmett Simmons, believes in QRP. He has made w.a.c. four times with 8 watts input to his 12-A final, and with one-tenth of a watt he has hooked five continents . . . 45 volts on the plate. Stations worked with .1 watt are OH3NP, PY2DO, W1EZ, ZS4U, K6BNR, needing only Asia for his w.a.c. at this power. Antennas are the V-beam type, and W5CPT really likes 'em. Who wouldn't?

•

G2ZQ, Johnny Hunter, gets his 39th zone and 126th country. U0LC was the guy in that zone, and for new countries Johnny has snagged CR9AB in Macao; HS1PJ, Siam; U8EC, Turkoman and J8CA in Korea . . . Has been chasing VQ2RS with his chirpy d.c. on 14,030 kc., but claims he must not have a receiver, as he never comes back. G2ZQ made a fast w.a.c. . . . almost (except for Europe). Time was 50 minutes or so, but the funny part was *he* worked frantically for a European contact . . . It never dawned upon him to 'phone one of his local pals for that last continent.

If any of you boys happen to work G2PL, might ask him if romance has anything to do with keeping that sig of his off the air. Word gets around here that Pete has taken an 'awful' fall for some y.l. Wonder which one it is . . . Maud or Joan . . . or mebbe it is Ginger . . . Let's find out.

Art Bean, W7AMX, has worked four FB's . . . FB8AD 14,280 chirpy r.a.c., FB8AA 14,350 T9x, FB8AG about same as AA, FB8AB . . . (guess you know that one o.k.). Others by Art are U9AL, 14,340 T8; U9MI, 14,310 T8; VS7RF, 14,345 T9x; VS7RA, 14,080 T9x; VQ8AF, 14,085 T8; VQ8AE, 14,090 and 14,005 T7; HS1PJ, 14,200 T8x; VU2LJ, 14,345 T9; ZB1H 14,375 T9x. Some of the European stations that W7AMX has been working between noon and 3 p.m. p.s.t. include: HAF4K, 14,080 T8x; HAF4H, 14,055; I1KN, 14,145 T9x; I1WW, 14,070 T9x; YT7VN, 14,100 T9x; LA5N, 14,095 T9x; LA6A, 14,095; LA3H; LA4K; SM7YN; OH3NP; OH3OI; OH6NN, 14,340 T9; OH5NF, 14,365 T8; SM5UD, 14,050 T9; ES2D, 14,340 T8; ES5C, 14,310 T9x; FT4AG, 14,145 T7; YM4AF, 14,430; SM7UA, 14,380 T9x; LY1J; LY1HB, 14,150 T9x; LY1ZB, 14,080 T9x; CT1ZZ, 14,075 T9x; U5KH, 14,045 T8. Art does most of his dx in the daytime as his work

"WAZ" HONOR ROLL

G2ZQ	39	W9LBB	33
W3SI	39	W5AFX	33
W6CXW	39	W9ARL	33
W4DHZ	39	W8LEC	33
W8CRA	39	W3EDP	33
W6GRL	39	W5EHM	32
W6ADP	39	W5CUJ	31
W9TJ	38	W9KA	31
G5YH	38	W6GHU	30
G6WY	38	W9IWE	30
W8BKP	37	W6HX	30
W2GWE	37	W6BAM	29
W8OSL	37	W3EVW	29
W6FZY	37	W6HJT	28
W6QD	36	W3EYS	28
W9PTC	36	W6CEM	28
W6GAL	36	W6GNZ	27
G6NJ	35	W6FZL	27
W2BSR	35	W8BOF	27
W9KG	34	W9DEI	26
W8KPB	34	W8IDW	26

If you have worked more than 25 zones and are willing to produce confirmation on demand, send in your score on a postcard.

keeps him up quite late at night, and while I think of it, I remember him telling that without any pre-arranged sked, he has worked our ol' pal, F8EO, 122 times. Nice going, and thanks a million for this info, Art.

W6QL says that VS6AQ had some tough luck in burning up his plate transformer and that it would run about "200 Hongkong berries" to replace it. With it went his best tube. After three years duty in VS, Conway leaves for his home in England this month. W6QL reports that VS5AC in Sarawak is coming through on 7110 kc., also UOLC pokes his sig in about 7100 kc. QL's rig uses a 50-T in the final with 235 watts. W8IGQ, Alan Eurich, is leaving on the first of November with the schooner "Yankee" for a year-and-a-half world cruise. Of course, he will be the op, and the call is WCFT. They will visit many small islands and countries; so you fellows keep your ears open for 'em. The frequencies they can use are 4140, 5520, 6210, 8280, 11,040, 12,420 and 16,560 kc. W9ARL, who is one of the best W9 dxers, has worked over 60 different Africans, and that is something for a W9. W9OCL was doing some nice dx until a bolt of lightning hit his shack and wrecked it, throwing the op out of bed and across the room. W9KG has been having a devil of a time during the summer, being besieged with a bunch of electric QRM from fans, etc. However, at his other station, W9ALV, conditions have been good as he has hooked PK3LC, PK1BX, PK2KO, PK1BO, J8CB, KA1RL, KA1DL, FT4AG, CP1AA, SP1DE, ZS6T, ZS6AL, ZT6Q, ZS5U, ZS5AB, ZS2X, ZT6AY, ZU1T, ZS1T, LU3EV, LU3HK, PY8AG, CX1CX, PY5QD, I1IR, J6DO, VK6SA, CT3AN, EA4BM, OK2AK, SM6UJ. At W9ALV, Keat has worked 46 countries with his p.p. 210's at 95 watts input, and has an R8 from all continents.

Down Arizona way W6DRE says dx not so good,

[*Continued on Page 74*]

A New Type Simplified Coupling

By J. N. A. Hawkins, W6AAR

The introduction of grid neutralization in ham transmitters has allowed many useful antenna matching networks to be used that are not suitable for plate neutralized amplifiers. One of the best of these networks is the one shown in figure 1. It allows a wide and smooth

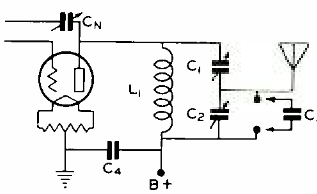


Figure 1
The Coupling System Applied to Antenna Coupling

variation in tube loading to be obtained from practically any type of end-fed or single-wire-fed antenna system. The circuit allows series feed to be used, thus eliminating r.f. chokes, without putting high d.c. voltage across either of the two tuning condensers, C_1 and C_2. It also requires only one blocking condenser and yet no d.c. appears on the antenna or feeder.

C_1 is usually about one quarter the capacity and four times the plate spacing as C_2, for any frequency. Thus 75 μμfd. for C_1 and 300 μμfd. for C_2 will usually be about right for 20, 40 and 80 meter operation. The additional coupling condenser C_3 is required only at very high plate voltages when working into a very low impedance antenna or feeder. C_3 will be a 1250 volt fixed mica condenser of from .0005 to .0025 μfds. It should be arranged with plugs and jacks to allow a variation while tuning.

The circuit is tuned by setting C_2 at half capacity, then tuning C_1 for minimum plate current (resonance). Then if the d.c. plate current (plate loading) is not correct, the load on the tube may be varied by varying C_2 and then restoring resonance with C_1. *Increasing* the capacity of C_2 *decreases* the d.c. plate current and loading at resonance. Likewise, to increase the tube loading, decrease the capacity of C_2 and again restore resonance with C_1.

This same arrangement is very useful as a step down interstage coupler and corresponds to a form of capacitive coupling.

Figure 2 shows the detail of the circuit arranged for interstage coupling.

The driver stage is grid neutralized and the driven stage is arranged for plate neutralization. The adjustment of the interstage network is exactly the same as the antenna coupling network.

Note that the arrangement of figure 2 applies only when a driver tube with high plate impedance drives a driven stage of low grid impedance—in other words, when a step down of voltage and impedance from the driver plate to the driven grid is required.

When a low-impedance driver plate drives a high-impedance driven grid, a voltage and impedance step up may be required between the two stages. In this case the network should be reversed without any changes. The driver plate

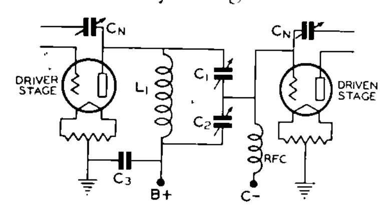


Figure 2
Using the System for Adjustable Interstage Coupling

will then be shunt fed while the driven grid will be series fed. This is desirable as the r.f. choke should always work in the circuit with the lowest r.f. voltage to ground.

◆

C.B.S. AMATEUR RADIO AWARD

On September 6, at the National Amateur Radio Show held in conjunction with the American Radio Relay League's Central Division Convention, announcement was made that William S. Paley, President of the Columbia Broadcasting System, has offered a permanent award to be presented annually to that individual who through amateur radio, in the opinion of an impartial Board of Awards, has contributed most usefully to the American people, either in research, technical development or operating achievement.

Shortly after the flood disasters in the early part of 1936, in which amateur radio operators rendered such useful service to their stricken communities, Mr. Paley felt that some permanent recognition should be made to the amateur

[*Continued on Next Text Page*]

www.americanradiohistory.com

● Mr. C. B. McMurphy in charge of the Radio development work of the Piedmont Police Department, Piedmont, California, who has pioneered and developed one of the finest police two-way communication systems in America today, holding the EIMAC 50T, finally retired after giving such an excellent account of itself.

This **EIMAC** 50T was finally retired after 12,500 hours of grueling 24 hour a day service in a 9 meter police transmitter (W6XBF).

Just another example of the stamina and unusually long life built into each and every **EIMAC** tube.

PLAY SAFE - BUY EIMAC

At Leading Dealers Everywhere

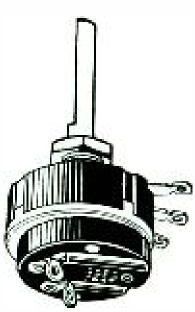
EITEL-McCULLOUGH, INC.

San Bruno, California, U. S. A.

www.americanradiohistory.com

OL' MAN CENTRALAB 'TAKES IT' EITHER WAY

blistering heat, or excessive humidity . . . it's all the same to a CENTRALAB Control . . . Millions of these Controls are "standing up" under unbelievably severe conditions



. . . so the next time a control goes "haywire" change to CENTRALAB . . . and play safe.

Every Radio Service Man should be a member of the Institute of Radio Service Men

Centralab

Milwaukee, Wis.

British Centralab, Ltd.
Canterbury Rd., Kilburn
London N.W.6, England

Centralab
68-70 Rue Amelot
Paris, France

VOLUME CONTROLS

FIXED RESISTORS

[Continued from Last Text Page]

radio enthusiasts of America and Canada, thus limiting the area, for the purposes of making the award, in a field in which no national boundaries are considered, to a practical area from which it is possible to make a thorough and fair survey of accomplishment.

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

Mr. Paley designated the American Radio Relay League, the official organization of the amateur radio operators of the country, whose headquarters are in Hartford, and whose members number nearly 20,000 active operators, as the permanent custodians of the award. Upon it will be engraved each year the name of the winner of the award. A smaller replica will be presented to the individual selected as the winner, by an impartial Board of experienced authorities on amateur radio activities.

Mr. E. K. Cohan, Director of Engineering of the Columbia Broadcasting System, a member of the American Radio Relay League since its earliest days, made the announcement on behalf of Mr. Paley, at the Chicago Convention of the A.R.R.L., before thousands of amateur radio operators assembled from all parts of the United States and Canada. Mr. Cohan has seen the American Radio Relay League grow from a small community club of 50 members to a twenty-year-old organization comprising nearly 20,000 members, and estimates that the licensed radio amateurs of the world now total more than 40,000 operators.

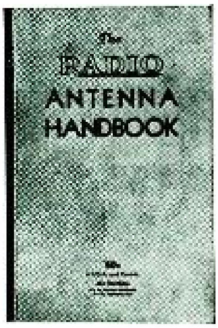
Announcement of the members of the Board of Awards, as well as the selection of the designer, will be made shortly after Mr. Paley's return from Europe. Mr. Paley expressed the hope that in recognizing the work and experimentation done by amateurs, they will not look upon such an award in the light of a contest, but rather as an acknowledgment of meritorious service through amateur radio to the American people and to the advancement of radio communication.

www.americanradiohistory.com

AT LAST . . . a book on

ANTENNAS

. . . and nothing else!



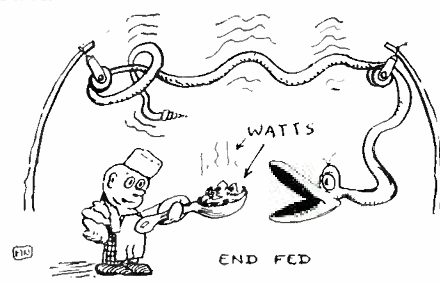
- **Some hams are c.w. men —**
- **Some hams are phone men —**
- **Some hams are dx hounds —**
- **Some hams are traffic hounds —**
- **Some hams are descended from hounds**[1]

[1] According to an annoyed b.c.l. of our acquaintance.

BUT they all have one thing in common:

THEY ALL USE ANTENNAS!

The antenna is the most important part of a station and the most frequently neglected, yet it represents but a small fraction of the total cost. And for only a fraction of the money involved in a good antenna system, you can now get THE book that tells you in simple, easy-to-understand language how to get that last "ounce of performance" from your antenna. A small, inexpensive improvement in an antenna will often effectively double your power.



At all good radio parts dealers or direct from us by mail, postpaid.

DEALERS: Write for trade prices.

The "'Radio' Antenna Handbook"

. . . IS GOING BIG. 80 PAGES, profusely illustrated. Detailed tables make calculations unnecessary. Several practical "all-band" antennas are described. There is nothing like it anywhere and the cost is only **50c in U. S. A. and Canada**

60c ELSEWHERE

RADIO, Ltd.,
7460 Beverly Blvd.,
Los Angeles, Calif.

Please send me .... **copies of the "'RADIO' ANTENNA HANDBOOK".**

Enclosed find $.................... **in full payment.**

[50c in U.S.A. and Canada (Canadian postal notes acceptable); 2/6 in United Kingdom (British postal notes and cheques on London acceptable at par); elsewhere, 60c, U.S.A. funds.]

No stamps, please, unless other means of remittance are not available.

Name ....

Address ....

City and State ....

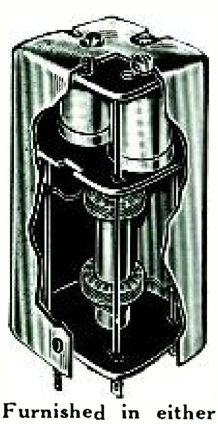
Measuring R.F. Power

[Continued from Page 66]

The coupling to the source must be adjusted so that the lamps present optimum load.

Typical schemes for load coupling and adjustment which might be enumerated are: a separate tank circuit with the lamps either across it or in series with it, coupled either directly or by a link to the transmitter tank; a matching network of the pi-section type or the series-capacity type with the dummy load connected to the output; connection of the load directly on the turns of the transmitter tank coil. The last named is probably the most suitable, but presupposes a coil construction which allows adjustable taps.

The two methods described not only will permit of definite determination of power values, but in most cases their use will point the way toward better overall transmitter performance. Although the peak voltmeter and the lamp-combination resistor have been described with particular reference to radio-frequency power, it will be obvious that they have other applications. The tungsten-carbon combination is useful in many other ways which call for a cheap resistance of high-power rating. The direct-reading peak voltmeter is applicable to measurements in other kinds of a.c. investigations and at frequencies down to 30 cycles, provided the filter capacity C_2 is properly increased.



"Align-Aire" AIR TUNED Transformers

Align-Aire tuning means 3600 degrees of hair line smooth micrometer adjustment; never changing self locking setting eliminating shifting; moisture proof; dust proof; temperature proof. Complete elimination of "drifting." Align-Aire I.F. transformers are double tuned; with top tuning for ease in aligning circuits and uses the new Meissner Perma Strut construction, permanently placing every lead so that they will not "shift."

Furnished in either AIR-CORE or IRON-CORE (Ferrocart) for input, interstage, output, beat frequency oscillator, noise silencer, crystal filter and band expanding I.F. transformers in all frequencies from 175 KC to 3000 KC.

SOLD BY ALL LEADING JOBBERS

MEISSNER MFG. CO.
Mt. Carmel Illinois

28-33 Mc. Mobile Unit

[Continued from Page 35]

writing sufficient tests have not been made to determine the ultimate distance possible as consistent coverage over fairly short distances is all that is desired.

Power for this transmitter was secured from two 300-volt dynamoters in series. Due to the load and insufficient regulation, the voltage dropped considerably (to about 425 volts) but as the operation is intermittent, this overload did no apparent harm.

DX News

[Continued from Page 69]

then rattles off a few new stations he has worked in the last two months . . . YM4AA, PA0LR, SM6WL, G6BS, G5IL, G6WR, G6JZ, G6JF, SM7UC, ZU1C, CN8AH, G5NQ, D4ARR, G6CJ, EI5F, UN2A in Liberia, ZS4J, OE1FH, HB9BD, LY1AG, F8LG. W1EPG has worked PY8AG a couple of times and tries to get his QRA . . . but the guy just doesn't seem to come back . . . Who knows about PY8AG? There are others who would like to get the low-down, too. Has a chirpy note on 13,990 kc. With 45 watts input, W8KPL has worked 20 zones, 38 countries, and is w.a.c. . . . W9PTC of Beloit, Wisconsin, has been on the air for more than 16 years, worked 36 zones, 95 countries, runs 1000 watts to a pair of 150T's, and uses a National HRO receiver . . . and oh yes, is w.a.c. And now I guess that covers that. W3CDG puts me on the carpet for not using some stuff he sent in four months ago. I apologize. Anyway, o.m. Royer has worked himself 54 countries and 24 zones . . . using an 852 with 450 watts. Antenna is a 99-footer and fed at center with EO-1 cable. New ones for CDG are ES2D, ES5C, FB8AB, LY1J, LY1S, HAF8C, OE1ER, OE7EJ, OZ7SS, OZ7ZZ, OZ8J, PY5QG, I1TKM, SU1CH, SP1DC, YL2BB, YM4AA, YR5II, U1AD, U1AP, U1CN, U1CR, U2NE, U9AC, U9MF, U9MI, J2CC, J2LU.

From Havana a phone station pops up with some info. CO2QQ, owned by Eduardo Alvarez, Jr., has a pair of 2A3's in the final and runs about 86 watts input. In the last two months he has had more than 85 contacts outside of Cuba, in about 16 countries (including all districts in U.S.A.). The average report seems to be better than R8. His antenna is a single-wire-fed Hertz, 67 feet long. Frequency 14,103 kc. Good work, Eddie. Now, while I've got phone on my mind, our friend Reg. Tibbetts, W6ITH, of Oakland has really been going to town. Reg. has made his w.a.c. on phone and naturally is very tickled about that, as it isn't a common practice. W6ITH has worked 62 VK phones and has had over

www.americanradiohistory.com

700 QSO's with them. In fact, out of 704 times he has called the VK phone stations, only 7 times did he fail to raise 'em. Brother, that is percentage plus. He says as soon as KA1ME moves he is going to put up a diamond pointed for U.S.A., also that LU5CZ is going in for directional antennas and 800 watts input. Some of the stations worked by Tibbetts lately on phone are ZS2N, 14.260; LU4BH, 14.575 (?); OA4AK, 14.260; OA4AB; CE1BC; CE3AC; ZE1JR and ZS5Z. VP6YB (Barbados) is being heard.

ZL1H, Henry Skinner, arrives in the U.S.A. about the middle of October and expects to travel across the country, stopping at the larger cities: Philadelphia, New York, Chicago, St. Louis, San Francisco, and Los Angeles. If any of you fellows who have worked him would like to see him, you could drop him a line in care of Mr. H. C. Baxter, 915 South 48 street, Philadelphia, Pa. Another dxer from New Zealand, ZL3KM, would like to rustle up a little business on the 80 meter band for this winter. He says there are many W's who get over there between November and March and that there are many other ZL's eager to have 80 meter QSO's. W6HJT, who is a member of the "210 dx Club", has worked 28 zones and 59 countries, but it looks as though his QRP days are numbered, as he has just got a new Eimac 300T and will be on with it any day now. Another of this same club, W6GAL, has just landed his 100th country (YV5AA). George is going to put his lucky 210 in a gilt-edge box or something. His QRP phone rig is also going to town in a very big way. For example, GAL has worked 31 countries in all continents and they were all two-way phone QSO's, and not done by calling on c.w. A few of these phone boys are ZE1JR, 14.260; ZS2N; VS2AK, 14.090; KA1ME, 14.160. His phone w.a.c.

[Continued on Next Page]

NEW BIRNBACH X'mitting sockets AT LOW PRICES

featuring

- SIDE WIPING CONTACTS
- BRASS, NICKEL PLATED SHELL
- HIGHLY VITRIFIED, LOW ABSORPTION BASE
- ALL BRASS HARDWARE • LOW PRICES

50 watts, No. 434. List ea. $1.25 — 10 watts, No. 435. List ea. 90c

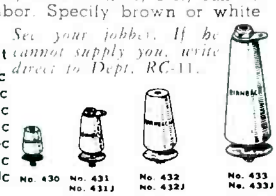
SPECIAL LOW PRICES IN LARGE QUANTITIES

Improved Cone Standoff Insulators

Made of STEATITE, the better ceramic. Complete range of heights. Condenser, coils, tube sockets, etc., can be mounted with minimum labor. Specify brown or white glaze.

See your jobber. If he cannot supply you, write direct to Dept. RC-11.

No.	Heights	List
430	5/8"	10c
431	1"	15c
431J	1"	20c
432	1½"	20c
432J	1½"	25c
433	2¾"	25c
433J	2¾"	50c



BIRNBACH RADIO CO.
145 HUDSON STREET • NEW YORK, N. Y.

AMATEUR RAYTHEON TUBES

New RK-36

A triode designed for high-plate efficiency and power output at all amateur frequencies.

CHARACTERISTICS

Filament Voltage	5 Volts
Filament Current	[illegible] Amperes
Grid Plate Capacitance	[illegible] uuf.
Input Capacitance	[illegible] uuf.
Output Capacitance	[illegible]
Typical Operation	Class [illegible] Amplifier or Oscillator
Plate Voltage	2000 Volts
Plate Current	150 M. A.
D. C. Grid Current	30 M. A.
D. C. Grid Voltage	-360 Volts
Required Driving Power	15 Watts
Power Output	200 Watts
Amateur Net Price	$14.50

Prices Subject to Change Without Notice

New RK-35

A triode designed especially for outstanding performance at ultra-high frequencies.

CHARACTERISTICS

Filament Voltage	7.5 Volts
Filament Current	3.25 Amperes
Grid Plate Capacitance	2.7 uuf.
Input Capacitance	2.5 uuf.
Output Capacitance	.4 uuf.
Typical Operation	Class [illegible] Amplifier or Oscillator
Plate Voltage	1000 Volts
Plate Current	96 M. A.
D. C. Grid Current	15 M. A.
D. C. Grid Voltage	320 Volts
Required Driving Power	6.5 Watts
Power Output	61 Watts
Amateur Net Price	$8.00

RAYTHEON TUBES . . . recognized for years as the finest tubes that money can buy . . . have constantly increased in popularity because of their dependability! Amateurs know that Raytheon Tubes, because they are conservatively rated, will do all that is claimed for them. Buy RAYTHEON Tubes and be sure of results.

THE MOST COMPLETE LINE - ALL TYPES - GLASS, METAL, OCTAL BASE, AND AMATEUR TRANSMITTER TUBES.

RAYTHEON PRODUCTION CORPORATION

420 Lexington Ave., New York, N. Y.; 445 Lake Shore Dr., Chicago, Ill.; 415 Peachtree St., N. E., Atlanta, Ga.; 555 Howard St., San Francisco, Cal.; 55 Chapel Street, Newton, Mass.

www.americanradiohistory.com

[Continued from Preceding Page]

contains R8 reports from all continents but Asia, and an R7 from there. New stations hauled in by George: ZE1JD, 14,405 T9; ZE1JU, 14,400 T9; ZS2N, 14,300 phone; ZE1JG, 14,340 T8; CT1ZZ, 14,050 T9; CR7MB, 14,030 chirpy d.c.; CR9AB, 14,230 T8; FB8AF T7; YV5AA, 14,150 T9; OX7ZL, 14,420 chirpy d.c.; HH2B, 14,120 phone; YL2BB, 14,405 T7x; VP7AA chirpy d.c.; VS7RF, 14,340 T7x.

•

Another W9 has worked some dx . . . Can ya imagine that? W9DEI has recently hooked U3AG, J3FI, FB8AB, ZU1T, U1AP, J2CL, ES2L, U9AZ, and CN8AH. DEI is also on ten quite a bit. W8OQV of Cleveland has a few new ones for his collection: FA3JY, OE1FH, OK1KL, OK2PN, OH3OI, HAF4K, YU7DX, LY1HB, CN8MI, YR5OR, SM5VJ, SM5UU, SM6QN, SM7YA, SM7QC, HB9AO, HB9AW, HB9BD, FT4AG, U1AP, and U5KS. These, my friends, were worked with a couple of '10's . . . 17 zones. W9ZT is worried about a sig on 20 signing XU5UU . . . He wonders if it is the same guy who was prowling around the Pacific a few years ago.

W3EVW of Lester, Pa., uses as low as 15 watts to get his dx, and during the summer he did some nice work . . . HAF4K, VK6AA, I1KN, I1ZZ, I1TKM, I1IT, YU7DX, U1CR, OE6AX, YL2BB, HAF1YL, HAF2L, HAF2D, HAF8I, HAF8D, UE3EL, U2NE, U2AZ, YR5JS, YR5OR, YR5CP, YM4AA, YM4AF, OK3VA, U5KS, SP1DE, OH5NR, SU1TR, FT4AG, HAF2N, FA8SR, and ZB1H . . . 29 zones and 80 countries for Causse, W3EVW. W8BKP has 37 zones now and claims he has cards from 134 countries, which is really piling 'em up. He is one guy that received a card from VU2CQ . . . believe it or not. Geo. is still using an 800 in the final. Roy McCarty, W9KA, has 31 zones and 82 countries . . . Input is usually about 180 watts.

Here's a new country for some of you birds to look out for. A pal of mine who had his station in the same town has been sent to Bahrein Island in the Persian Gulf by a petroleum company. Any time now, I wouldn't be surprised to hear him fire up something. He is Roy Fleming, W6DQD, of El Segundo. Don't know what call he will use, but would appreciate hearing from any of you fellows, should you happen to hook up with him.

•

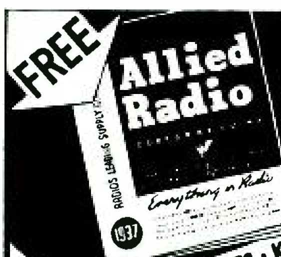
W1APA of Bridgeport, Conn., worked OS1BR who told him to QSL via "Suliman, Suez, Egypt". There seems to be something screwy somewhere because a while back we heard that his QRA was "just outside of Jiddah, Hedjaz, Arabia". In any event, there is a discrepancy and if anyone knows the really correct QSLing address, let's have it so we can relieve the suspense.

Pete Bach, W2GWE, sure did his stuff in the recent German DJDC contest. His total score was 250,000 points. WOW! During the best hours of the contest he was working them at the rate of 16 per hour. Pete had 400 contacts and 250 QTC's, and during his "CQ-DJDC Europe" he was answered by 8 VK's, 1 ZL, K7, SU1CH and a flock of W8's, and W9's . . . So he decided that was a poor practice. In Germany, D4ARR was first and D4XCG second. Other high scores in U.S.A. were W8NUY, 121,968 points; W1RY, W8BFH, W8BTI, W6CUH, W4AUU, W4AJX, W3BES, and others. W2GWE passes along the information that CR9AB's first W QSO was W5EGA . . . that G5GQ is coming to New York for a short visit in October . . . and that D4BIU is supposed to be in U.S.A. now for a year's visit. A short time ago Pete got all hot and bothered when he raised XU8BG . . . only to find that he was operating in London at G5QY. GWE has 37 zones and 123 countries. On September 21st, Pete ran into a good morning, working KA1MD, 14,365 T9x; 3 J's, 4 VK's, and ZL4AO . . . worst report was R8 from the KA. 'Twill never do . . . that R8.

•

All of you "fellers" who have worked 25 or more zones will be included in our list as published in this department. This doesn't mean that these are the only ones from which we want to hear . . . just keep sending in all the dx information you can lay your hands on, and as far as the zones are concerned, when you have snagged 25 or more, your call will be added. Please don't wait until the last minute . . . if you have anything on hand, send it in . . . now, so the column will always be fresh news.

Way out west here where men are hams and the gals say, "So what?" . . . conditions have been pretty good . . . I mean dx, of course. The boys around town have been taking it rather easy, going after the elusive ones mostly . . . and as far as the turmoil in and around my shack is concerned, I'm afraid that it's been mostly around it. However, I can't be given just a goose-egg yet, as my trusty log shows a first-class QSO with W9VW and a few score of his brother W9's. More next month.



RADIO'S GREATEST VALUES!

AMATEUR GEAR · PARTS · KITS · TEST EQUIPMENT · P.A. SYSTEMS · SETS · TOOLS · BOOKS

IN THIS NEW CATALOG

Send for the new 1937 ALLIED Radio Catalog!—Radio's Leading Supply Guide. 152 pages packed with 10,000 selected and approved parts; dozens of Set-Builders' kits; newest Amateur transmitting and receiving gear; complete lines of Public Address equipment; high quality test instruments; latest books, tools, etc. You need this great book! —it contains Everything in Radio at the lowest prices—write for it today! Send coupon now for your FREE copy!

ALLIED RADIO

ALLIED RADIO CORP., Dept. 14-L
833 W. Jackson Blvd., Chicago, Ill.
Send me your FREE 1937 Radio Catalog.

Name ....

Street ....

City .... State ....

28 AND 56 MC. ACTIVITY

By E. H. Conklin, W9FM

At the time this is written, September 22, conditions on ten meters have staged a complete recovery, to the point where all continents have been coming through in the U.S.A. One of our most faithful reporters, J. J. Michaels of W3FAR, mentions that FA8BG and G5FV were heard September 8 for the first European and Northern African of the season. The time was early afternoon until 2:30 p.m. Similar conditions continued up to September 17 when gobs of Europeans were heard and worked. Some of the 28 mc. stations were VP2AT, K5AY, NY2AE, I1TKN, K6MVV, K4DDH, OZ3J, HB9AO, OK1AW and numerous French, German and South American stations.

Frank South, W3AIR, around the first of September heard many VK, HJ, PY, LU, CO, VP6, HH and HI stations. I1KN was the first European, coming through on about 28,300 kc. on the 10th.

VE3DU reported on the 1st before much of the dx was coming through, but remarked about the number of good W6 signals.

W6ITH says that he has listened all summer, hearing locals, K6MVV, and a few weak W4's. The band opened on September 12 for all eastern districts except 1, 2 and 3, but the W2XAM police transmitter on 30.1 came through. Many phone QSO's were made in the following week, on a rig that sounds like a ham's paradise: a pair of 500T's in the final, plate modulated, on 28 mc!

W6QG sends us a very interesting daily log of west coast conditions since mid-July. Central and South Americans, several W4's and a few W2, K6, W7 and W8 were heard up to August 1 when the

[*Continued on Next Page*]

NEW . . . SMALLER . . .

MORE EFFICIENT . . .

PERHAPS we should add "More Value"—but when you think of C-D Transmitting condensers, you take value for granted.

Dykanol "A" makes it possible to get big condenser action from this extremely compact unit. In three years this series has won the approval of thousands of "Hams".

2 mfd. 2000 V. TJ20020 Your cost $4.71
4 mfd. 2000 V. TJ20040 Your cost $6.47

See them at your local C-D distributor, or write direct for Catalog No. 133A giving a complete listing.

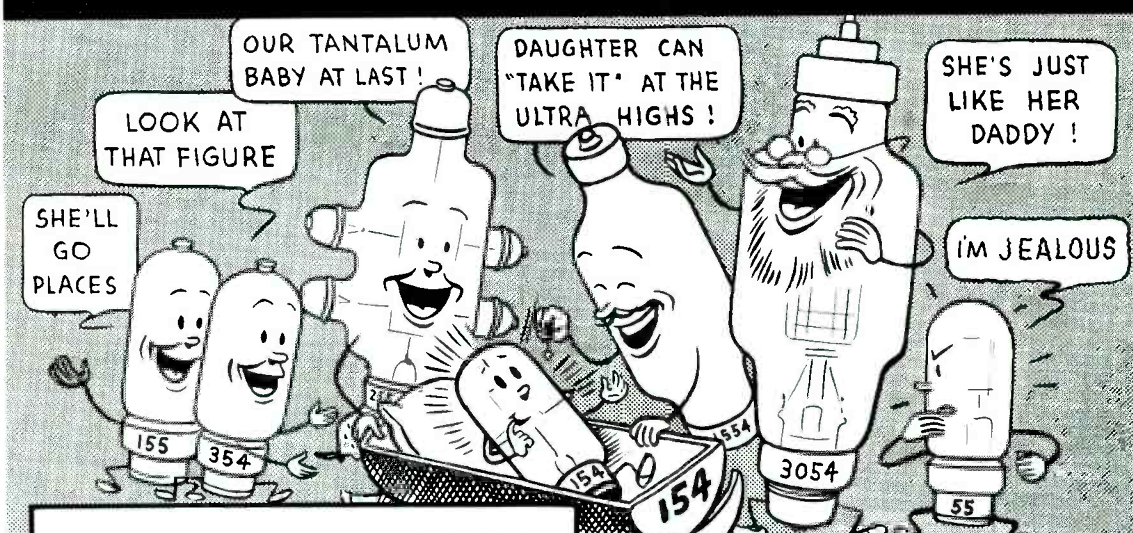
Manufacturers of the world's finest condensers for more than twenty-six years.

MICA • DYKANOL • PAPER
WET & DRY ELECTROLYTIC

CORNELL DUBILIER

1017 HAMILTON BLVD. SOUTH PLAINFIELD, N.J.

A New Arrival **IN THE GAMMATRON FAMILY**



TYPE 154 GAMMATRON
$12.50 AT YOUR DEALER
¼ kilowatt a pair at 1000 VOLTS and 5 meters

HEINTZ AND KAUFMAN LTD
SOUTH SAN FRANCISCO CALIFORNIA U. S. A.

www.americanradiohistory.com

New Schedule of 5-Meter Standard Frequency Transmissions from W1AY

Date—Each Monday evening.
Time—8 P.M. E.s.t.

8:00 P.M.	56.00 Mc.	Voice announcement and tone signal
8:05 P.M.	56.93 Mc.	"
8:10 P.M.	58.00 Mc.	"
8:15 P.M.	59.00 Mc.	"
8:20 P.M.	60.00 Mc.	"

Space-Saver Electrolytics

Typical 3GL 3-in-1 unit above. An 8-8-8 450 v. condenser.

★

Three entirely separate sections. Six leads. Three condensers — but one can.

★

Also new 1" dia. can units. Note GLS unit at left, alongside usual unit of same rating.

★

These new units provide twice the capacity in given bulk; or same capacity in half the bulk.

Both the 3GL (triple-section) and the GLS (1" dia. can) series provide better filtering in less space, for those crowded assemblies you build or revamp.

NEW CATALOG covers the most extensive line of condensers and resistors. Ask your local AEROVOX supplier for your copy. Or write us direct.

AEROVOX CORPORATION
84 WASHINGTON ST. BROOKLYN, N. Y.

[*Continued from Preceding Page*]

first VK came in. HK3JB (former HJ3AJH) then reported poor conditions, having heard the first VK since June. Aussies and eastern stations filled the log in August. VK3BD reported to him that the station would be closed, to be reopened as a VK2. JNJ harmonic came through on 27.9 mc. on September 13. On that day, W4AJY advised of working ZU1SE, G6DH, ZE1PJ, ZE1JU, CN8MQ (using single 800 in final). Aussies, South Americans and strong eastern W stations—calling Europeans—continued up to the 20th, but no Europeans reached W6QG. More J commercial harmonics were heard on the afternoon of the 18th, but J2CE came in on the 19th at 6:35 p.m. Pacific time (first J since April), without any commercial harmonics being audible.

A. W. Alliston, G5LA, gives us the British picture as of the end of August. W4AJY was heard on August 20, W1AVV on the 22d, by G6DH. VK4EI came through on the 19th, VK3JB on the 22d, indicating conditions quite similar to those in the U.S.A. SU1KG, CN8MQ, PY2CJ and I1KN are among calls heard in England. ZS1H was heard on numerous days during August, reporting renewed W contacts, pointing out that VK and South American contacts were a daily occurrence in South Africa.

An odd observation was made September 19 by W3FAR. During the evening the band was full of W6 phones but not a single code station was found!

We notice that the Europeans have been coming through later than last year when they started to come through, peak strength occurring at 1 p.m. or later, Eastern time. This may happen earlier in December and January, but suggests that 28 mc. is not the highest frequency that could have been used to get across the Atlantic. The British continue to listen for U.S.A. signals on straight or modulated c.w. on 56 mc.; so give them a call when conditions to Europe are good on 28 mc.

There have been practically no really dead ten meter days in September. G6DH reported only two dead ones in August. Dust off your coils and come on down!

28 and 56 Mc. Reports

Reports and other material referring to the 28 and 56 mc. bands, should be sent to E. H. Conklin, W9FM, Assistant Editor of RADIO, 512 No. Main St., Wheaton, Illinois, who will correlate and assemble the data for publication. Reports should *reach him* by the 22d of each month.

THE QUESTION BOX

I use primary keying on my final amplifier and the exciter runs all the time. With the key up I can find some r.f. in the plate tank and the final draws about three ma. of plate current. It is not leakage through the keying circuit, as I tried completely disconnecting the primary of the high voltage plate transformer from the a.c. line. Whence comes the plate current?

As long as you have grid excitation, the control grid is exercising a strong accelerating effect on any electrons in the field of the grid. This acceleration is often enough to drive those electrons into the plate without any plate voltage. These electrons then flow around through the power supply bleeder or

www.americanradiohistory.com

rectifier tubes back to filament, causing a small flow of plate current. This is usually a sign of a pretty good transmitting tube, as the more plate current without plate voltage, the more accelerating of electrons the grid is providing, which is highly desirable. This presence of plate current without plate voltage will give a slight back-wave even though the amplifier be perfectly neutralized. The only way to prevent this back-wave is to key at least two stages when using primary keying.

•

I can't hit 40 meters with my final tank. I have tried paring turns, one at a time, from 64 turns down to 6 turns on a 2½ inch diameter form. The tank condenser is a 100 μμfd. single section of good make and the amplifier tube is a 211. I have tried everything I can think of; can you suggest any obscure bug that I might have in the rig? I have built ham rigs for fifteen years but this one has me stopped.

Well, no use outlining the usual procedure of striking resonance; if you have been a ham for fifteen years you know how to do that. Here are two obscure points that crop up once in a while: Check to see that one coil terminal goes to rotor and one to stator of the tuning condenser. Sounds silly but how easy it is to run both coil terminals to same stator! Next look for an internal short in the tank condenser insulation. If neither of those points are it, get the liddiest newcomer in town over to look at it. He will probably see what all the old timers have missed, because he hasn't yet gotten in the habit of taking things for granted.

•

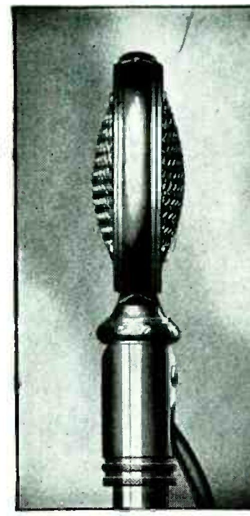
Which is best, a vertical or horizontal half wave antenna for 20 meters?

Neither or both are best, depending on who you

[Continued on Next Page]

ASTATIC

MODEL D-2



ONLY 2½" dia. ½" thick

•

Frequency Response Substantially Flat from 50 to 6000 c.p.s.

•

LIST PRICE

$25

Non-Directional

•

OUTPUT LEVEL —60 DB

•

CHROME FINISH

•

Fully Guaranteed

FEATURING EXCLUSIVE ASTATIC DUAL DIAPHRAGM

Especially recommended for P.A. systems and amateur phone stations where higher fidelity is required. Licensed under Brush Development Company patents—Astatic patents pending.

ASTATIC MICROPHONE LABORATORY, INC.
YOUNGSTOWN, OHIO, U. S. A.

NEW!

SECOND EDITION

★ The new STANCOR book of transmitter circuits and ideas is soon to come off the press. Get your order in early.

★ REMEMBER — STANCOR transformers are designed by Amateurs especially for Amateur use.

★ STANCOR transformers are built and GUARANTEED by one of the oldest and largest transformer manufacturers in the world. Your jobber carries them in stock.

Your Jobber Recommends

STANCOR TRANSFORMERS

MAIL THIS COUPON

STANDARD TRANSFORMER CORP.
850 Blackhawk St., Chicago, Ill.

★ *I am enclosing 25c for Transmitter Manual.*

Name.. *Call*....................

Address..

www.americanradiohistory.com

Announcing the new

INCA Transformer

CATALOG No. L-31

Listing the revised, improved, and amplified INCA Transformer line for 1936-37. Included in the L-31 Bulletin are:

• **Power Transformers** including a new series of units especially designed for hi-power operation. These may be connected in bridge rectifier circuits without fear of failure.

• **Filament Transformers** for all tubes including a bridge filament transformer for 4500 volt circuits.

• **Chokes** for all purposes, including highly insulated units for high voltage circuits.

• **Audio Transformers:** Improvements in the already fine INCA line including universal modulation transformers up to 600 audio watts capacity.

• **Regulating Auto Transformers:** For line regulation and for reducing 220 to 110 volts.

• **Amplifier and Transmitter Kits:** The justly famous INCA "HF" series.

• **INCA Radio Wires**

For the service man Bulletin L-32 listing a complete line of replacement transformers is also ready—Get Bulletins L-31 and L-32 from your jobber or from

The Phelps Dodge Copper Prod. Corp.

INCA MFG. DIVISION

2375 E. 27th St. Los Angeles, Calif.

[*Continued from Preceding Page*]

are working. There is some argument, but my own belief is that the vertical is best for distances up to fifty miles and over about 2500 miles, while the horizontal is best for intermediate distances up to 2500 miles. The vertical radiator gives mostly low-angle radiation, while the horizontal antenna gives the high-angle radiation desirable for short skip distance. The horizontal antenna is usually better for receiving, due to its better discrimination against man-made noise and due to the fact that practically all high frequency received signals arrive with horizontal polarization.

•

Explain what is meant by peak and working d.c. voltage ratings on filter condensers.

A rectified a.c. power supply used as a plate or bias supply delivers some d.c. output voltage on which is superimposed an a.c. voltage which is the ripple voltage. The d.c. voltage is approximately equal to the effective or r.m.s. value of the a.c. supply voltage output of the power transformer. The a.c. ripple voltage has twice the frequency of the supply line (assuming full-wave rectification) and its peak value is something less than about 40% of the d.c. output voltage. Thus the peak voltage on the first filter condenser in a condenser-input filter is equal to the d.c. voltage plus the peak a.c. ripple voltage. This can equal about 1.4 times the d.c. voltage as shown above. Thus if a power supply is to deliver 1000 volts of d.c. output the peak voltage applied to the first filter condenser can be as high as 1400 volts, so that a 1500-volt rating would be necessary to avoid condenser failure. Most condenser ratings are *peak* ratings, so multiply condenser ratings by about .66 to see how much d.c. voltage they should be used with in an r.a.c. filter.

•

Are metal envelope transmitting tubes coming?

I doubt it although they might be used for oxide filament gas-filled rectifiers. All metals now available are far too porous to allow a really high vacuum to be obtained and maintained. A high vacuum is essential to allow the modern thoriated tungsten filament to operate properly, as gas "poisons" the emitting surface.

◆

Determining Antenna Resonance

By E. H. Conklin, W9FM

Most of us have had experience with the apparent broadness of antenna circuits at high frequencies. An antenna ammeter will show but little change in reading with a sizeable change in the antenna driving frequency. Yet there have been but few attempts to find a more accurate way to measure the fundamental of the antenna.

One might ask, "Then why bother to measure it if it is broad anyway?" The objection would be justified except where some form of impedance matching is used—which includes single wire feed and twisted pair feed.

Several years ago we had occasion to adjust the length of a 160 meter half-wave antenna for operation up to its 16th harmonic. Single wire feed had been used to avoid an antenna tuning adjustment. The feeder had to be matched reasonably well on all frequencies in order to take the power directly from the push-

www.americanradiohistory.com

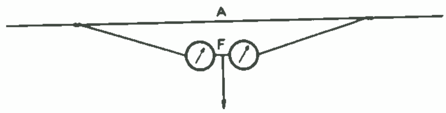


Figure 1
Variation in the "two meter" method of adjusting antenna length. Avoids cutting antenna wire. Tie string from "F" to "A" to keep these points within 3 or 4 inches of each other.

pull amplifier tank without causing appreciable unbalance. The first step was to determine the antenna length accurately, which could conveniently be done by the "two meter method" described on page 32 of the *Antenna Handbook*. One doesn't like to cut a long piece of copper-clad steel wire into short lengths; so an improvement upon the old method of inserting meters was necessary.

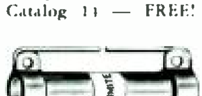
Two 0-1 r.f. ammeters were checked against each other by putting both in a loop of wire and coupling it to the transmitter. They were then placed in series in the middle of a four foot length of wire, and the single wire feeder was attached between them. The wire was jumped across a similar length of the antenna at a point which we guessed would be neither a current loop nor node at the highest frequency. A feeder position 1/8 wavelength from one end is satisfactory for the test on higher harmonics. To support the meters and feeders near the antenna, a string a few inches long was tied around the feeder and antenna. See figure 1.

The feeder was clipped on the final tank and the transmitter frequency was varied until the meters read alike. Because the feeder was near the end on which we intended to trim the antenna, we accidentally shifted the meters past a node by adding wire, and didn't realize the mistake until an extra half wavelength (at 20 meters) of wire was added. Trimming the antenna from the far end would have eliminated this possibility, but being lazy, we went to a lower harmonic and adjusted the length for a full wave on 3600 kc. The method is satisfactory for determining the frequency within 10 or 20 kc. on the 7 mc. band if the meters can be read fairly well.

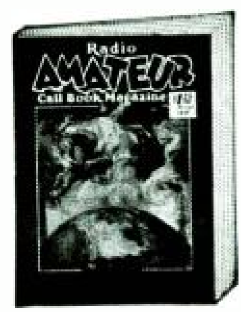
[*Continued on Next Page*]

• Don't risk the loss of valuable operating hours searching for a damaged resistor. "Hot spots" develop and resistor failure results when the winding is uneven and crowded together in places. BROWN DEVILS are *dependable* because the specially developed OHMITE Vitreous Enamel holds each turn of wire firmly in place—during the firing process and in the finished unit. Made in 10 and 20 watt sizes and all practical resistance values. Ask your dealer or write for Catalog 11 — FREE!

OHMITE



MANUFACTURING COMPANY
4837 FLOURNOY ST., CHICAGO, ILL.



The Most Complete Callbook Ever Published

Your QRA is listed in the latest edition

•

The only radio callbook published that lists all radio amateur stations throughout the entire World.

Also a complete list of high frequency commercial stations, International abbreviations and amateur prefixes, "Q, R, & T," systems for reporting signals, new US inspection districts and high frequency time, press and weather schedules.

Each copy contains a double post card addressed to the CALLBOOK for use in reporting your new QRA. We are extremely anxious to publish a callbook that will be 100% correct and want you to help us by checking your QRA at once in the latest edition and advise us of any errors.

PUBLISHED QUARTERLY MARCH, JUNE, SEPTEMBER AND DECEMBER

Single Copies $1.25 Annual Subscription USA, $4.00

Order your copy today from your local radio jobber or direct from:

RADIO AMATEUR CALL BOOK, Inc.

606 South Dearborn Street, Chicago, Illinois

PRACTICAL AMATEUR RADIO TRANSMITTER DESIGNS

By HOWARD S. PYLE
Formerly Asst. U. S. Radio Inspector

A brand new manual devoted entirely to ultra-modern unit style rack and panel transmitter design. Fifteen chapters with photographs, working drawings and circuit diagrams on PROVEN transmitters from 5 to 500 watts. Not a line of theory!

New Introductory Price
50c per copy, postpaid

WESTERN TECHNICAL PRESS
807 FOURTH AVE. SEATTLE, WASH.

www.americanradiohistory.com

Upon returning to the high harmonics, however, we found that on each band the antenna resonated at a slightly *lower* frequency than expected: 3600 on the 2d, 7075 on the 4th, 14000 kc. on the 8th harmonic for a wire 269-2/3 feet long. This was checked for several antenna lengths in the same band but not for antennae in different bands nor for wires at varying heights. The end effect which could shorten only one half wavelength on the wire did not explain the shift as it was in the wrong direction. Another possible explanation was offered —the fact that fundamental ground plane, the effect appearing similar to the radiation resistance curve shown on page 6 of the *Antenna Handbook*.

A formula can easily be written to cover the situation but a similar antenna of different length or height at another location might act differently. We shall await confirming data of other experimenters to avoid making a hasty claim.

Checking a Formula

A little figuring tells us that a half wavelength in space, in feet, is equal to 492,125

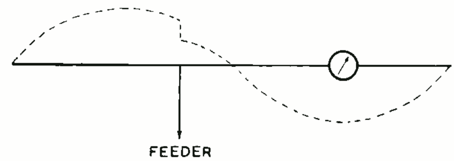


Figure 2
Meter position in harmonic antenna to show current without distortion of sine wave caused by incorrect length.

divided by the frequency in kilocycles. It is often stated that an antenna is about 5% less than a half wavelength in space, which would make the above figure 467,519 or nearly the 468,000 given in handbooks. When we measured a 66 foot horizontal wire 40 feet high, the fundamental was 7165 kc. or 4.1% less than a half wavelength, giving a figure of 472,000 for the formula. A vertical wire with the lower end five feet above the ground was only 3.2% short of a half wavelength and in this case the formula constant was 476,620 (14 mc. antenna). When a reflector was placed ¼ wavelength from the wire, the new length was almost exactly the theoretical 5% less than before, or 8.4% less than a half wavelength.

The object in quoting these figures is, first, to remind the reader that all antennas are not in free space but are affected by their surroundings, making it advisable to measure each one when in place rather than to rely upon a formula, if *correct* length is desired. Secondly, beam elements should be checked carefully because of the interaction between elements.

Feeder Position

The proper point to attach the single wire feeder in order to obtain a correct impedance match varies with the wire size and with the height above the ground plane. A small feeder size—something like no. 22—should be placed farther from the current loop and would be more accurate on the harmonics. The wire size is small and not very practical; so at W9FM we use no. 14 for the feeder even when large antenna wire is necessary for strength. We mention the change in feeder position with height and wire size only to emphasize the danger in using over-simplified formulas. A simple way to determine the position is to put a meter in the antenna at a current loop and slide the feeder along for the best antenna current. For complete elimination of standing waves on the feeder on one band, the adjustment can be checked by placing three meters or neon bulbs along the feeder. See that the current or voltage is constant along the wire.

Occasionally someone mentions that the feeder should be in the proper place for fundamental operation, with perhaps some slight adjust-

I WILL SHOW YOU

that it is to your advantage to buy from me. Your inquiry about any amateur apparatus will prove that to you.

I give you specialized personal service of genuine value that is not available from other jobbers.

I take in trade used apparatus. I sell on time with terms to suit you "with almost" no interest charges. I won't be undersold.

I am jobber for Collins, RCA, RME, Harvey, Marine transmitters and the All Star transmitter in kits or assembled. Trade in your transmitter. Buy on time.

I stock at lowest prices: RCA, Eimac, Taylor, United transmitting tubes. National, Hammarlund, Thordarson, Cardwell, Cornell-Dubilier, Dwyer, Johnson, Astatic, Shure, Ohmite, Trimm, Triplett, Weston, Barr, Peak, Bliley, Mac-Keys other parts. **I ship all receivers on ten day trial. You need send but $5.00 with order.**

TRADE IN YOUR TRANSMITTER OR RECEIVER

The new National NC-100s	**$105.00**
The new NC-100Xs	**127.50**
RME-69s	**118.80**
The new 1937 Breting	**99.00**
Breting 12s prepaid	**87.00**
National HROs	**167.70**
National HRO Jrs.	**99.00**
RCA ACR-175s	**119.50**
Super Pros	**223.44**
The new Sky Buddy	**29.50**
The new Ultra Skyrider	**99.50**
The new 1937 Super Skyrider	**89.50**
The new Sky Chief	**44.50**

IN STOCK—SHIPPED PREPAID

Eimac: 35Ts, **$8.00**, 50Ts, **$13.50**, 150Ts, **$24.50**
Taylor: T55s, **$8.00**, T155s, **$19.50**, 203-As, **$12.50**
Bliley: BC3s, **$3.95**, LD2s, **$4.80**, HF2s, **$7.50**

HENRY RADIO SHOP
211-215 North Main Street Butler, Missouri

www.americanradiohistory.com

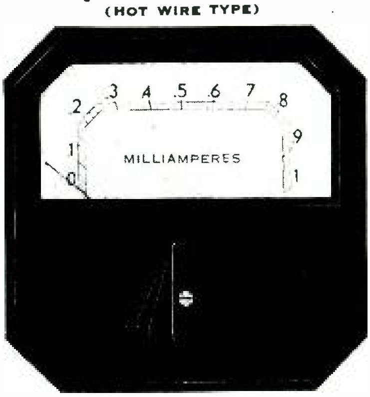
ment for better match on harmonics. However, there are many "proper" positions on a harmonic antenna. At W9FM a 160 meter antenna is fed as a 40 meter antenna with an extra three half wavelengths added on the far end. Bad as this adjustment is on 80 meters, R7 and R8 reports have been received from foreign stations during contests on the 80 meter band.

The Old Way

Ten years ago, single-wire-fed antennas were tuned with a light bulb or meter in the center. The neighbors didn't like the light bulb, but they were not widely removed (the bulbs, not the neighbors) until the *I.R.E. Proceedings* and *QST* articles in October and September, 1929, pointed out the error in tuning for maximum current at the center before correcting the length. The old method still has some value, however. If the frequency and antenna length are unchanged, maximum current in the antenna (and in the feeder, too) means maximum radiation. Another point is that on the harmonics, a meter placed at a current loop in the antenna at a point greater than ¼ wavelength from the feeder will give an accurate indication of antenna power regardless of incorrect antenna length, because the distorted quarter wave is always the one at the feeder connection. See figure 2. In this case, the meter will provide a fair method of determining proper length (broadly) and feeder adjustment if a second meter is not available.

Square R.F. Antenna Meters with Improved Movements

(HOT WIRE TYPE)



These trim new meters with improved movements are rugged and unaffected by frequency changes. They may be used with entire satisfaction in place of a thermocouple meter. The square bakelite meter measures 4¼ inches and is priced to the dealer at $5.00. The round bakelite meter measures 3¼ inches and is priced to the dealer at $3.67. Three ranges are available: 0/1.5; 0/3; and 0/5 amp. If your jobber cannot supply you, use coupon below.

THE BURTON ROGERS CO.,
755 Boylston Street, Boston, Mass.
Sales Division of the Hoyt Electrical Instrument Works

Gentlemen: Find enclosed my remittance for............ of your ☐ Type 577 square R.F. meters. ☐ Type 576 R.F. round meters. ☐ Kindly send information about other Hoyt Meters.

Name...

State.......................City.........................Street.............

AMPERITE presents..

The NEW RBn VELOCITIES

Featuring.. Distinguished in Quality, Design, and Construction

1. Output increased 6 DB.
2. Triple shielded—against all RF or magnetic fields, entirely eliminating hum pickup.
3. Eliminates feedback troubles.
4. Excellent for close talking and distant pick-up.
5. Acoustically designed to eliminate any possibility of cavity resonance.

Models RBHn (High Impedance); RBMn (200 ohms) $42.00 List

NEW! Models RBSn, RSHn —Excellent All-around Microphones for Speech and Music. Slightly lower output and frequency range than above. Appearance same as above. $32.00 List

NOW! A specially designed microphone built to Amperite standards: can be used for both speech and music. No peaks. Flat response. Triple shielded. Shock absorber. Swivel bracket.

Models RAL (200 ohms); RAH (2000 ohms) $22.00 List

FREE! TO DEALERS AND SERVICE MEN: A striking window decal, advertising your SOUND SERVICE, and displaying the new Amperite Velocity. Write for it now!

AMPERITE Co. 561 BROADWAY, N. Y. Cable Address: Alkem, New York

AMPERITE Velocity MICROPHONE

Proof of Quality for TRIMM HEADSETS

is found in the fact that one distributor after another is selling the entire Trimm line. A phone for every need.

Write for descriptive literature Dept. R11

TRIMM RADIO MFG. CO.
1770 W. Berteau Ave., Chicago
Illinois, U.S.A.

www.americanradiohistory.com

HF-100 Exciter Unit

[*Continued from Page 16*]

The 6L6G doubler is connected as a high μ triode by paralleling the control and accelerator grid at the socket. In this way the static plate current is only about 4 ma. with 450 volts on the plate. By the use of a high value of grid leak, 50,000 ohms in this case, the excited plate current is also held down and there is a good dip when the tank is tuned to the second harmonic of the excitation.

Link coupling into the grid of the HF100 is utilized both to obtain a better impedance match from the preceding stage, and to facilitate the switching of the excitation. It is only necessary to put the link over the 42 or 6L6G plate tank to obtain power from either. One of the primary requisites of an efficient doubler is very high bias; consequently in this stage the bias voltage is taken from two sources. First, there is a 10,000 ohm grid leak in the grid return, which with the 20 or so ma. of grid current supplies about 200 volts of bias. Second, there is a 1500 ohm cathode resistor which, with the 150 average ma. of combined plate and grid current flowing through it, produces an additional bias of approximately 225 volts. Thus the combined bias voltage of, say 425 volts, is entirely adequate. Actually, taking the operating plate voltage as 1275, i.e. 1500 less the cathode voltage of 225, and the μ as 23 as given by the manufacturer, the tube is running at 7.8 times cutoff. It is obvious from looking at the high bias that a great deal of excitation voltage will be required. This is obtained by proportioning the grid coil so that it tunes with a minimum amount of capacity. Actually the best operation is obtained when the feedback condenser C_{13} itself tunes the coil almost to resonance, the grid tuning condenser being used more or less as a trimmer. The juggling of these two controls until the point of maximum grid current and greatest dip in plate current at resonance is reached will give the best output. The plate coil should also be quite low "C". The proper design is where half of the coil, that is, the turns between the plate and the center connections, will resonate at just above minimum capacity on the tank condenser. The other half serves as feedback coupling back to the grid circuit. Coupling to the output is obtained by a link around the center of the plate coil, the other end being loosely coupled to the grid tank on the 154.

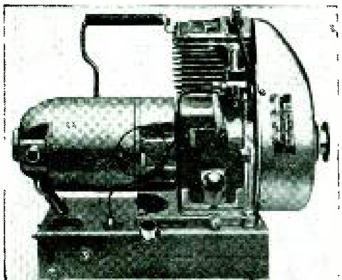
Metering is accomplished in a similar manner to that in the 154 stage. However, a separate 0-250 ma. meter is used in the plate circuit of the HF100, all other circuits being measured by means of a switch and another 0-100 ma. meter. The same method of switching as the 154 final is used; separate 100 ohm ½ watt resistors are permanently connected in series with the plate leads of the 42 and 6L6G and the grid return of the final, the meter being switched across any one of these by a tap switch to show the current flowing in the circuit. Actually the currents to be expected on these tubes, at 450 volts on the oscillator and 6L6G and 1500 volts on the HF100 are as follows: 42 plate current, 40 ma.; 6L6G plate, 30-40 ma.; HF100 grid, 15-25 ma.; and final plate current at 50-60 watts output, 110-125 ma. Under these conditions of operation, everything runs very stably and no color is shown by any of the tubes.

110 VOLTS A. C. ANYWHERE

WITH A KATOLIGHT, JR.

Complete Power Plants $59.95 up.

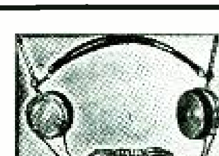
Operate YOUR radio transmitter ANYWHERE, ANY TIME! — with a Katolight, Jr. Compact, fully portable, efficient, economical. Furnishes standard 110-volt, 60-cycle A. C. Generator filtered and engine ignition shielded. Also converters, generators and A. C. and D. C. plants up to 10,000 watts. KATOLIGHT, JUNIOR



6 volt charger, 150 w. $59.95
12 volt charger, 200 w. $59.95
32 v., 300 w., battery ign. $65.00
32 v., 300 w., magneto ign. $72.00
110 v., 300 watt, rope-cranking, A. C. $87.50
110 v., 350 watt, self-cranking, A. C. $98.00

KATO

Engineering Co.
Mankato, Minn.
U. S. A.



DON'T WAKE UP the WHOLE HOUSE

Just because you are INTENT on getting some distant foreign station LATE AT NIGHT . . use

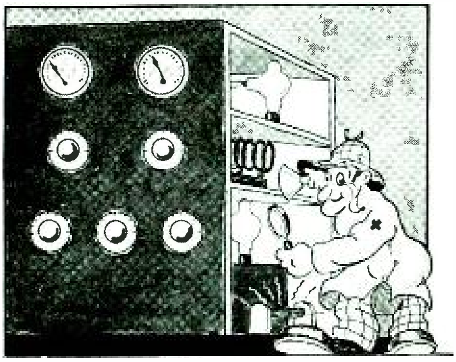
CANNONBALL HEADSETS

and YOU WILL RECEIVE BETTER RESULTS and THE FAMILY WILL NOT BE DISTURBED.
Order from your dealer. If he cannot supply you, we will.

WRITE FOR ILLUSTRATED CIRCULAR L-3

C. F. CANNON COMPANY
SPRINGWATER, N. Y.

www.americanradiohistory.com



Is Your XMTR *Haemophiliac?

Before buying a new plate transformer, why not get the "dope" on our new exclusive triple-winding plate transformer and compare it on merit alone with others? This new exclusive triple-winding plate transformer provides the utmost in flexibility. Over 30 voltages are available ranging from 400 to 1600 volts. Regardless of revolutionary over-night changes in radio, this unit will never become obsolete. *Low in price yet built to stand the gaff.*

** A xmtr utilizing bleeders dissipating wattage in order to obtain correct operating potentials, thereby reducing efficiency and impairing load regulation.*

Kenyon manufactures, in addition, a complete line of quality audio products that defy competition both as to quality and price.

Our new transmitting manual contains complete up-to-date transmitter circuits ranging in size from five watts to one kilowatt. Ten pages are entirely devoted to full page "Ken-O-Grafs" which cover most of the calculations used in radio in a modern and painless method. This book is no subterfuge for a catalog. To receive your copy send 25 cents in coin or stamps.

Have you seen a copy of our monthly live-wire magazine, "The Kenyon Engineering News"? Write for a sample copy today.

CHIEF ENGINEER • AMATEUR DEPT.

KENYON TRANSFORMER CO., Inc.

844 BARRY STREET NEW YORK, N. Y.

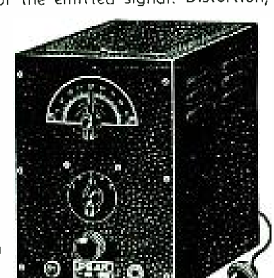
• PEAK • PEAK • PEAK • PEAK • PEAK • PEAK • PEAK • PEAK •

PEAK • PEAK • PEAK • PEAK • PEAK • PEAK •

LINEAR DETECTION

RADIOTELEPHONY MONITOR

This instrument is indispensable to the Amateur who wishes to keep a constant check on his phone transmitter. It provides aural monitoring of the emitted signal. Distortion, audio hum, carrier hum, frequency shift, and break-down or any other irregularity are immediately apparent.



By the addition of a milliammeter, visual check of the carrier is afforded, showing carrier shift, **over modulation**, etc.

RANGE — 5 to 200 meters, continuous.
(Broadcast band coverage available)

Diode detection is used in a **tuned** input circuit — a method especially suitable for aural monitoring as its operating characteristics are essentially linear, making the received signal as free as possible from distortion.

The **PEAK M-2** employs a built-in power supply designed for 24 hour a day operation. It delivers humless power to the resistance coupled audio amplification stage which brings the monitored signal up to headphone volume, even with very little pick-up. Operates on 105 to 125 volts, 50-60 cycle.

PEAK M-2 COMPLETE
Less Tubes
List price, $33.00
Net to Amateurs
$19.80
At all leading Amateur Supply Houses

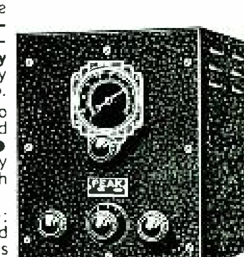
All components are housed in a durable metal cabinet 8½" high, 6" wide, and 10" deep, attractively finished in black crackle. The silver plated contact frequency range switch, the tuning control, phone jack, volume control, AC switch, and pilot jewel are all conveniently located on the front panel. Uses one 84 and one 85 tube. **A Prime Necessity for EVERY Phone Man!**

• WRITE FOR LITERATURE •

PRE-SELECTOR

REGENERATIVE PREAMPLIFIER

The PEAK regenerative High-Gain Pre-selector tremendously increases the sensitivity and selectivity of **any** receiver! Rejects image. Greatly decreases noise to signal ratio.



9 to 200 Meters • Two Tuned Stages • Silver plated contact band change switch • Self contained heater supply • Automatic changeover switch • Smooth control.

The P-11 is so easy to use: a moment and it is connected to any receiver. Every one is sold with an **unqualified guarantee** to markedly improve reception with **any** receiver—far beyond any similar unit sold. It will make a **NEW** receiver out of an **old** set. (Even new receivers with built-in preselection will be improved).

•

PEAK P-11
is highly recommended by Amateurs and Commercials all over the world! Bring your weak, unreadable signals up to R-9. YOU CAN'T WORK 'EM IF YOU DON'T HEAR 'EM!

YOU JUST CAN'T AFFORD TO BE WITHOUT THE PEAK P-11!
PEAK P-11. Complete, less two 58 tubes. List price............$33.00
Amateur net price
$19.80
At all leading Amateur Supply Houses
•
• **WRITE FOR LITERATURE** •

PEAK RADIO PRODUCTS

(Eastern Radio Specialty Company)

227 Greenwich St. • Dept. P-11 • New York City

www.americanradiohistory.com

With the Editors

[Continued from Page 9]

in which to operate, and less expensive for members to visit.

More funds, said the forum, should be available to the directors and their alternates for contacting the members in their divisions, thus impliedly taking issue with the contention of the administration that the Director is not supposed to reflect the wishes of his constituents.

The next resolution suggested that Sumner B. Young, W9HCC "or someone of his calibre" be appointed as a third member of the amateur delegation to Cairo. Mr. Young's comments appear elsewhere in this issue.

Funds were requested to provide for at least one meeting a year between the Director, his alternate, the assistant directors, and the section communications managers in each division.

Civic pride again cropped up in a suggestion that meetings of the Board of Directors be held in Chicago to enable more alternate directors to attend with a minimum of expense. To our minds a more important result of a central location for Board meetings would be the reduction in the time which western directors must take from their businesses in order to attend these meetings. Any changes which would tend toward enabling the Board to meet more often than annually would be highly beneficial. No organization can be adequately directed by its Board in annual meetings, which is perhaps one of the principal reasons why a virtual dictatorship has flourished for so long.

Divorce

To the large number of requests which this publication and *R/9* have received in the last few years that we sponsor a "rival League" or that we at least consent to become the official organ of such an organization, we have always turned a "deaf ear", fearful that an open internecine war might be even more harmful to the cause of amateur radio than weak policies such as have at least up until now prevailed. We have realized, too, that a publication which secures a portion of its revenues from the very interests which seek to retain the frequencies which amateur radio so badly needs may some time be subjected to so high a bias on its grid as to be lukewarm in prosecuting or even to act against the best interests of the organization with which it is more or less loosely affiliated. We think we have seen that very thing happen elsewhere.

An alternate suggestion has lately been received, one on which we make few comments but which we pass on to our readers with a lively curiosity as to their reactions; letters (whether for publication or not) will be welcomed. The suggestion appears to us to be workable, though of course certain objections will occur.

The gist of this suggestion is that the headquarters and operations of *QST* and those of other League affairs should be quite thoroughly divorced; sole connecting links would lie in the fact that all operating officials would report, of course, to the same Board of Directors and that other League departments might command a certain amount of space in *QST* without censorship by *QST* officials. While such a policy might cause a slight additional amount of expense and some inconvenience, it would appear to be one worthy of very careful thought, particularly if it resulted in the appointment of an aggressive defender of amateur rights who "knows his way around Washington" and is far removed from possible influence by advertising and other commercial considerations.

A Truly Representative League

Because it represents the largest single group in amateur radio which has even a semblance of organization, the League has in effect been recognized by the Federal Communications Commission and others as the spokesman of amateur radio. Yet it can never be truly representative of amateur radio while its membership includes but one-third of the amateurs in the country or while non-amateurs can be members.

[Continued on Next Text Page]

Low Wholesale Prices

BIG FREE CATALOG!

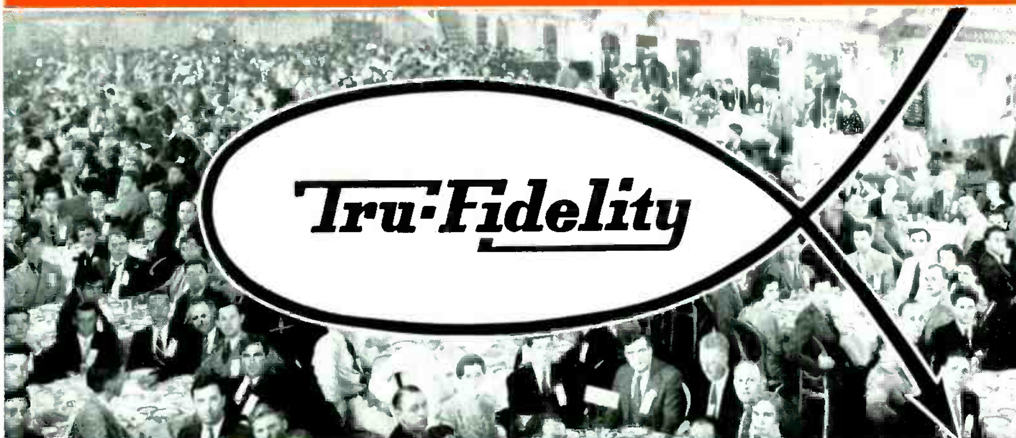
Over 10,000 items in this big catalog including radio receivers, nationally known radio parts and broadcasting equipment at low wholesale prices. A catalog of great value to every dealer and serviceman. Write for your FREE copy of this big catalog today.

Burstein-Applebee Co.
1012-14 McGEE STREET, KANSAS CITY, MO.

www.americanradiohistory.com

ACCLAIMED

THE FINEST AUDIO TRANSFORMER



AT THE RECENT CHICAGO A.R.R.L. CONVENTION

PURE—CLEAR AUDIO POWER

5,000 radio enthusiasts heard Tru-Fidelity live up to every claim we have made for it at the great A.R.R.L. Central District Convention in Chicago. Others tried, THORDARSON has succeeded. Insist on Tru-Fidelity by Thordarson. Enjoy the results gained through the use of transformers built with laboratory perfection in commercial production.

Tru-Fidelity transformers offer every known refinement. High-permeability core; special winding formulae; non-magnetic mounting brackets; perfect symmetry; self-shielding case; sub or above panel leads; single hole reversible rotate mounting.

Send Today for THORDARSON CATALOG 500
Containing curves, diagrams and listings of all Tru-Fidelity transformers. Just out bulletins SD-258 and SD-259 describing Tru-Fidelity uses in power amplifiers. Send for your copies today or see your parts distributor.

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

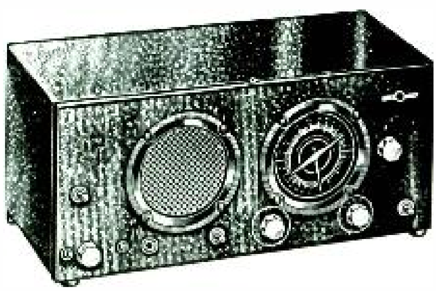
www.americanradiohistory.com

EXCLUSIVE

OUR EXCLUSIVE FEATURE ON "SKY-BUDDY", AT HINDS & EDGARTON, IS THE ADDITION OF A SEND-RECEIVE SWITCH FOR YOUR CONVENIENCE.

SKY-BUDDY

A Superheterodyne Receiver 18 to 555 Meters



At last — a communication superhet with remarkable performance capabilities, excellent bandspread and unusual stability. Iron core I.F. produces high gain and greater selectivity. Just the little "go-getter" you've waited for, OM. Buy your "Sky-Buddy" on Hinds' "Easy Payment" Plan.

- 5 tubes do the work of 8.
- Combined I.F. and beat frequency oscillator.
- Built-in speaker and power supply.
- Single tuning control.
- Iron core I.F. (high gain and select.)
- Accurate logging and direct reading from calibrated dial.
- No backlash—improved tuning control with illuminated dial.
- All controls on front panel.
- Unusual stability. 36 to 1 bandspread.
- Send-receive switch.

MAIL THIS COUPON

HINDS & EDGARTON 19 S. Wells St. Chicago, Ill.
ESTABLISHED 1914

Gentlemen:

Please send me complete details of the new Hallicrafters "Sky-Buddy" receiver and Hind's "Easy Payment" Plan.

Name...Call...............

Address...

City...State...............

OPERATED BY W9APY-W9WR

[Continued from Last Text Page]

The League can never be even approximately a true representative of the radio amateurs of the country until the great majority of the country's amateurs are members. The simplest and most equitable manner in which to accomplish this seems to us to lie in the oft-repeated suggestion that membership be available *without* a subscription to *QST* when the member-prospect so desires; a merely nominal fee might be charged to offset the cost of handling the application, handling mail ballots, and the like. Of course, membership would be included in the *QST* subscription price as heretofore for those licensed amateurs wishing to receive a good magazine every month.

Another important problem in making the League truly representative is the manner in which it seeks to determine the wishes of its membership. We recommend thoughtful study of the use of the referendum, which has proved quite satisfactorily workable in the vastly more complicated affairs of some of our states. An advance listing in *QST* of the questions to be voted upon should be required as a stimulus to adequate discussion and thought before voting. An unbiased or a mixed committee might also choose the best arguments on both sides of the questions for presentation in *QST*.

◆

New 956 "Acorn"

The new acorn 956 is a companion tube to the acorn types 954 and 955. It is very effective in reducing cross-modulation and modulation distortion over the usual range of signal voltages without the use of antenna potentiometers or auxiliary volume-control switches. This super-control characteristic makes the 956 especially adaptable to the r.f. and i.f. stages of receivers employing automatic volume control. Physically the tube looks like the familiar 954.

Experiments with the 956 indicate that it, like the 954, is markedly superior for ultra-high-frequency operation to conventional pentodes. With the 956 operating at minimum bias, it has been found practical to obtain gains of four or more at one meter, a wavelength where conventional pentodes are inoperative.

BE THRIFTY

Take "Radio" for two years and save a dollar!

Learn Code--Develop Speed

You can do it easily by learning with INSTRUCTOGRAPH Code Teacher, the most practical way to learn accurately and improve speed. Practice at your convenience, at any speed desired. Choice of two models. Buy or Rent. Send post-card for complete details now—

INSTRUCTOGRAPH CO. Dept. R-11
912 Lakeside Place, Chicago, Illinois
Representatives for Canada—Radio College of Canada, Ltd., 863 Bay Street, Toronto

www.americanradiohistory.com

NEW BOOKS
AND REVIEWS OF CATALOGS

Short Wave Communication Text

SHORT WAVE WIRELESS COMMUNICATION (Third Edition) by Ladner and Stoner. Published by John Wiley and Sons, New York. $4.50.

The third edition of this useful book contains much new matter as well as considerable revision of the older material. The new material includes data on commercial wireless telephone circuits and covers the terminal, Vodas and privacy equipment used on long distance commercial telephone circuits. There is also some new data on antennas and feed lines. Quartz crystals receive more space than they did in earlier editions, and considerable new material on skip distance and ionosphere matters has been added.

This book cannot be directly compared with anything else available, as it makes no attempt to cover completely the field suggested by the title. However, it does contain much material covered nowhere else and the material on signal sideband and suppressed carrier signalling is particularly interesting. Push-pull is very completely covered as is wave propagation and transmitter modulation.

There is a great deal of practical circuit discussion which should make this book interesting to amateurs generally.

•

R.S.G.B. Radio Handbook

A GUIDE TO AMATEUR RADIO by the Radio Society of Great Britain. 53, Victoria St., London, S.W. Price 6d. plus postage from R.S.G.B.

The 1936, or fourth edition of this useful English radio handbook, has 122 pages, about 25% larger than its predecessor. It is usefully compiled and arranged and is well written. The matter includes theory and design of receivers, transmitter, antenna systems, power supplies, measuring instruments. There is also considerable data on keying systems, modulation and telephony, ultra-high frequency apparatus, and on the adjustment of self-excited oscillators of all types.

This book will find wide use in all English-speaking countries, and although not as complete as the two amateur handbooks published here in the States, the phrasing and point of view is so fresh and different from the more or less standardized ideas common over here that most American amateurs would get new and valuable concepts from the British explanations of radio theory.

Outside of crediting Windom for the Everitt single-wire-fed antenna, there are no other points about the book upon which the W's and the G's might disagree.

Take "Radio" — it's Complete

Jacobs ADJUSTABLE SEPARATOR (Improved)

U. S. Patent 1,950,170—March 6, 1934—others pending

Using this improved glass Separator 2 wire R.F. feedlines of any separation from 1" up to and including 9" (used in conjunction with Hertz Antenna Systems) may be rapidly and efficiently constructed. $1.75 for a set of 6.

Charles F. Jacobs (W2EM) 270 Lafayette St., New York, N.Y.

Conservative Ratings Mean Extra Service . . . Better Results

You get full secondary voltage under load always—with Jefferson Transformers. They have the in-built stamina,—the quality materials,—the conservative ratings to give you far more than you expect under all operating conditions.

Jefferson Filament Transformer No. 464-201—Your Cost only $1.20 Net

A leader in filament transformers—Jefferson quality throughout, at so reasonable a price—2.5 volts CT at 12 amperes 7500 volt insulation test. Suitable for use with '66 tubes . . . Try this model and ask your jobber for catalog, describing the complete Jefferson Line of Filament, Plate Supply, Microphone, Modulation, Power, Output and Input Transformers and Chokes.

Get the best results—good tone quality on phone sets—steady notes on CW,—distance, and real satisfaction by selecting your transformers from the Jefferson Line . . . JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. Canadian Factory: 535 College Street, Toronto, Canada.

JEFFERSON TRANSFORMERS

Jefferson Electric Co.
Bellwood, Ill.

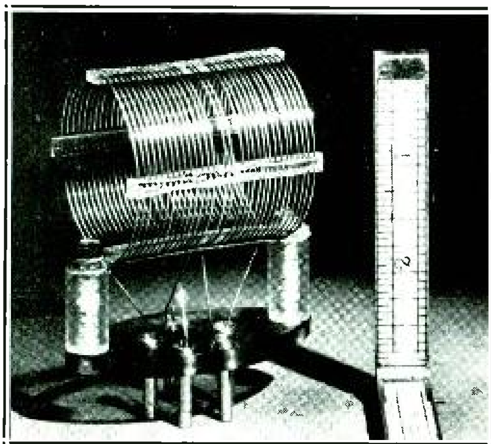
New Amplifier Diagram —Free. 6L6 60-watt Amplifier.

Send amateur Radio Catalog 361R and new 6L6 Amplifier Diagram to

Name ....

Address ....

City and State ....



It's New...

PHOSPHOR BRONZE WIRE... *Plugs into standard five-prong socket.*

10 - 20 - 40 - 80 - 160 meters and all the same size.

• Plain coil;
or center-tapped;
or c.t. with link.

• All priced the same
$1.50 list
(Hams 40% off)

•

If your dealer cannot supply you, order direct from

•

DECKER MFG. CO.
SOUTH PASADENA, CALIFORNIA

Axis Shift Amplifier

[*Continued from Page 15*]

dynamic shift amplification unless bigger tubes are used, and probably 250 to 300 watts of carrier output is the smallest economical size for this system of amplification.

It should also be noted that this rig is nothing for the beginner to attempt to build as its economy of audio power and tube capacity is obtained at the expense of complication. The adjustment is not simple and the fundamentals of linear amplification should be clearly understood before trying to tune this rig up. The transmitter described is merely an experimental model, shown to give the proper tuning procedure and operating conditions. To make the transmitter economically practicable, HF300's, 150-T's, 354's, T-200's or similar tubes should be substituted for the 50T's, and the plate voltage raised to 2500 volts or more.

◆

"HEARD" AND "WORKED"

Many amateurs have wondered why no "stations worked" lists appear in our "Calls Heard" department. Many of the lists of "Calls Heard" sent in are supplemented with long lists of stations worked, and the contributors question why we run the calls heard but not the stations worked.

The calls heard lists are run in order to let amateurs know where their signals are "getting into", and how well. Numerous amateurs, because of either poor receiving locations or limited operating time, rely on calls heard lists to determine how their rigs are "getting out". Then too, some calls heard lists are sent in from countries where amateur operation is prohibited, or from countries where there are but few amateurs but a number of active short wave listeners.

If we should run lists of stations worked, who would benefit thereby? The stations worked already are aware of the fact that you heard them, and how well. What purpose could such lists possibly serve other than to tickle the vanity of the donor? If you have worked a lot of dx and are justly proud, send in your "W.A.Z." score of zones. But please don't send in a list of stations worked to our "Calls Heard" department.

Powerful X cut | O. C. L. Control Crystals | High Output

Unconditionally Guaranteed

7000 KC ± 5 KC $1.85
3500 or 1750 ± 5 KC 1.50

OMAHA CRYSTAL LABORATORIES
544 World Herald Bldg. Omaha, Nebr. — *Jobbers Write* — (Laboratory) North Platte, Nebr.

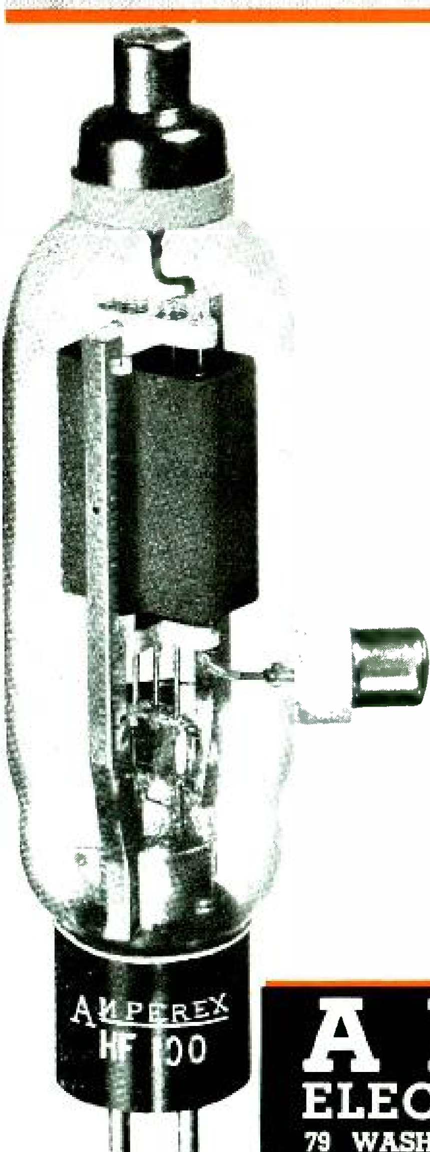
www.americanradiohistory.com

Power...

at Ultra-High and A. F.

300 Watts Class B Audio (Push Pull)
200 Watt Antenna Power at 5 Meters
with the NEW

AMPEREX HF 100



AMPEREX engineers, in designing this HF100, have presented the ham with a remarkable tube that can truly be classed as "all-purpose". For, even though it has produced amazing results in the ultra high frequency field, its range of operation extends into various stages of audio, delivering power outputs which can only be obtained from tubes selling for twice its cost thus making this same tube flexible for similar efficiencies in other circuits.

The HF100 joins the other AMPEREX ultra high frequency tubes (HF200 and HF300) in that it also possesses the highest ratio of transconductance to interelecrode capacities yet attained by any tube manufacturer. It is a REAL experimenter's tube.

$10

CHARACTERISTICS

Filament	Voltage 10 Volts Current 2 Amps.
Amplification Factor	23
Grid to Plate Transconductance @ 100 ma.	4200

Direct Interelectrode Capacitances:

Grid to Plate	4.5 $\mu\mu$f.
Grid to Filament	3.5 $\mu\mu$f.
Plate to Filament	1.4 $\mu\mu$f.

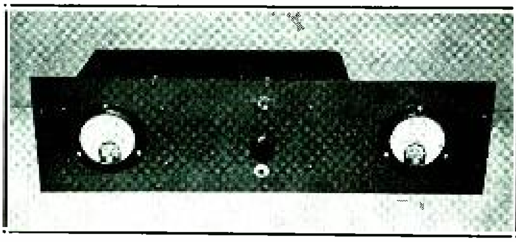
Write to our Engineering Department for Complete Data.

AMPEREX
ELECTRONIC PRODUCTS, Inc.
79 WASHINGTON STREET • BROOKLYN, NEW YORK

www.americanradiohistory.com

An Indicating Modulation Monitor

By Kenneth R. Waltz, W6JIY



Both Aural and Visual Monitoring of Phone Signals Are Made with This Handy Unit

There is nothing new or original in the design of this effective modulation monitor, yet it so combines the virtues of simplicity, economy and utility that it makes an ideal unit for the phone man with little money to spend.

The simple and well known diode rectifier type monitor circuit is provided with means for comparing the a.c. with the d.c. in its output. It may be shown by Fourier analysis that the d.c. output of a linear rectifier used in this manner is independent of the percentage of modulation of the r.f. carrier input—depending only upon the carrier amplitude. The same mathematical solution also shows that no harmonics of the modulation frequency appear in the a.c. output of the rectifier, indicating distortionless monitoring.

The circuit is shown in figure 1. The r.f. choke across the input may be replaced by a coil that will resonate at the transmitter frequency when tuned by C_1. By so doing, the advantages of frequency selectivity and increased sensitivity are gained, but the use of an untuned input as shown obviates the necessity for coil changes when changing bands and makes the unit simpler and more compact. The r.f. voltage impressed across the diode is controlled by C_1, which acts as a variable r.f. shunt across the input. The tube may be any similar type that happens to be handy. Old 27's are usually available in abundance. Incidentally, the calibration of this monitor is not affected by tube changes. Two d.c. milliameters are used, one to indicate relative carrier amplitude and carrier shift and the other to indicate percentage of modulation. A phone jack makes it a simple matter to hear exactly what the modulated carrier sounds like on the air.

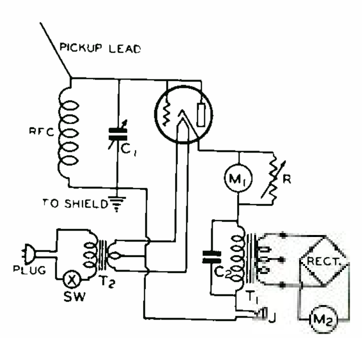
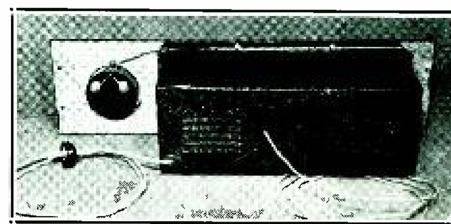


Figure 1

RFC—Receiving type r.f. choke
C_1—100 μμfd. midget
C_2—.00025 μfd.
R—30 ohm rheostat
T_1—Midget class B input transformer
T_2—Filament transformer
Rect.—Instrument rectifier, copper oxide
M_1, M_2—0-1.5 ma. d'Arsonval movement milliammeters
J—Closed circuit jack
SW—S.p.s.t. toggle switch



Back View of the "Triple Duty" Monitor

The meters used in this instrument are both Weston model 301's which happened to be on hand. Their range is 0-1.5 ma. Reconditioned meters of this type are available at moderate cost. Any d'Arsonval type meter should work as well, since calibration accuracy is of no consequence here. The added refinement of the new high-speed meters hardly justifies their cost except for applications where extreme accuracy is necessary. Most standard movements will be fast enough to reach full swing on sounds found in normal speech.

The audio transformer is a small class B input transformer designed to work from a class A-connected 19 to a push-pull class B 19. It so happens that this transformer presents enough impedance to the diode rectifier output so that the rectifier characteristic is essentially linear without the addition of a series resistor which would greatly reduce the sensitivity.

The mechanical design of the monitor is en-

www.americanradiohistory.com

tirely up to the individual builder as the placement of parts is not critical. Let convenience be your guide in this respect. It is important, however, to shield completely the unit to guard against stray r.f. pickup by the wiring. The design illustrated was intended to mount in a standard relay rack, and therefore is mounted on a panel of standard dimensions (5½" x 19"). The panel is made of tempered Masonite, backed by a sheet of galvanized iron. All parts are mounted on the panel which is painted a flat black (Fuller "Velvet Black"). The shield cover shown happened to be one found in the junk pile and was not long enough to include both meters; so the audio meter is left "out in the cold" and a pair of twisted leads are brought out to it. The controls shown at the center of the panel, from top to bottom, are the filament switch, the r.f. input control, and the phone jack. The calibration rheostat shunting the carrier meter, M_1, is mounted so that it may be adjusted by a screw driver through a hole in the shield cover. Once set, it is never touched.

Calibration

To calibrate the monitor so that it will indicate modulation percentage, take it to a station equipped with a cathode ray oscilloscope properly set up to show when the carrier output is being modulated 100% by a sound reaching the microphone. Set up the monitor, turn it on and couple it to the *output* of the transmitter by placing the pickup lead near the antenna feeder or final tank coil. Set the shunt across the carrier meter, M_1, to a low value to protect the meter from overload. Then turn on the transmitter and adjust the r.f. input to the monitor by moving the pickup lead and adjusting C_1 until the audio meter, M_2, will read 1 ma. when the transmitter is modulated just 100% by the sustained vowel sound a as in *tap*. Now adjust the shunt across M_1 until that meter reads 1 ma. (or whatever convenient scale point has been chosen as the calibration point). The monitor is now ready for use and whenever the r.f. input to it is adjusted so that the carrier meter, M_1, reads the calibration value, the audio meter, M_2, will read directly in percentage modulation. The carrier meter will wabble if any carrier shift is occurring. The phones should not be plugged in while calibrating the monitor or using it to check modulation percentage as they present such a high impedance in series with the audio transformer primary that there is little audio voltage left to swing the modulation meter.

The sound a is chosen for calibrating the monitor for modulation measurement for the following reason. The wave forms produced by speech sounds have very high peaks, though the average power in such a wave is very much less than in a sine wave of the same peak amplitude. The reading of a d.c. meter across the output of an oxide rectifier is proportional to the average power of the wave form impressed across the rectifier. Therefore the audio meter in the monitor would give a higher reading for a pure tone of a given peak amplitude than it would for a speech sound of the same peak amplitude. If we calibrated the monitor so that the modulation meter reads 1 ma. with a pure tone modulating the transmitter 100%, a speech sound with its high peaks would modulate the transmitter 100% before the meter reached its reading of 1 ma., and if the meter should swing to 1 ma. on voice the peaks would overmodulate the carrier. So it is important to use a speech sound for calibrating the monitor rather than a pure tone or whistle. The sound a (as in tap) has the highest peak factor of all sustained speech sounds; so it's the one to use for calibration. There is then little chance for overmodulation to occur on speech if the meter is never allowed to swing past the 100% mark.

Note that it is very important in calibrating and using this modulation monitor, as it is with an oscilloscope, that it be coupled only to the *output* of the transmitter being checked. Serious errors in modulation percentage measurements will result if there is coupling to a buffer or other source of unmodified r.f. To make sure that all is well in this respect, after the monitor is set up remove the plate voltage from the output stage of the transmitter. The carrier meter, M_1, should now read the same (nearly zero) whether the remaining r.f. stages of the transmitter are on or off.

MICROMETER FREQUENCY METER

● A quartz crystal is about the ultimate in frequency control . . yet many manufacturers of quartz crystals use the Micrometer Frequency Meter to check their product. They find its precision and stability a distinct asset to their business. Why not try an MFM in *your* station or shop? Write for the story, today!

LAMPKIN LABORATORIES
BRADENTON, FLORIDA

www.americanradiohistory.com

Osockme, Japan.

Radio Magazeen
Dear hon ed. and also Gentlemen:

Last night Scratchi were to a party where the host are expecting guests to amuse selfs playing "knocking knocking whose are there please?". Scratchi get tired of such foolingness and go home early and to bed, where lye awake trying to occupy mind with something worth whiles, like making a million dollars, or maybe one hundred dollars. Colossus idear are come to Scratchi, which are should be big monies making skeem if are promoted by intelligence person like Scratchi. Perhaps, hon. ed., you could interest American advertising agencies which handle radio parts in the Scratchi Super Sales System of Suggestion, which are soon to be patents applied for. Or mayhap you would want to finance Scratchi on new skeem, in which case would starting up the Hashafisti Scratchi Radio Advertising Agency, Ink., with you hon. ed. as President of Vice and owning 51 per scents of stocks, which would have gilt edges trimmed in silver.

Here are the idea for the new *Scratchi System of Suggestion for Radio Advertising*:

In other magazines and elseplace are seeing that to obtaining sucksess of various kind are needing to buy the artikel in question. One advertisement it say, "I did not get anywhere till I start to smoking *Old Silver Cigarettes.*" Another one say, "After he start eating *Baker's Better Bacon,* he were the life of the parties." And nother one say, "She would not marry up with him so he start eating yeast and in two weeks she are flopping in his arms." Nother one say, "Always a bridesmade but never a bride. She start washing her clothes in *Sloppy Suds Sope Slices* and now she have been married five times."

Now Scratchi ads for radio parts would look like followings:

"Even best friends wouldn't tell him. Always turned down when try to marry the boss'es dotter. After installing *Bestyet Feedthru Insulators* in his transmitter he do better yet; he marry the boss'es wife."

Or something like this: "They laughed when I sat down to play, but are having taken *Collins Code Course in Ten Easy Lessons,* and are turn out to be the life of the party."

Or a drawing of fine fizical specimen of gentleman with words coming out of mouth as follows: "I were a nervous rek and lye awake nites till I buying *Gyptron Transmitting Tubes* for my rig. Now I have gain ten pound and have nerves of steal. For digestion's sake, I rekomend Gyptrons."

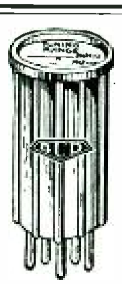
Here are another: "To retire in 40 years on $200 a month, use *Gookem Solder Paste.* It are irradiated with vitamin D and will not giving you pink tooth brush."

So you see, hon. ed., no one could resisk purchasement of such parts as are advertised under Scratchi System. How much monies do you wishing to invest in wonderful enterprise with grate possibilities?

Respectively yours,
HASHAFISTI SCRATCHI.

◆

Is there a theoretical limit to the number of radio receivers which can receive a broadcast from a particular station? By rough calculation, G.E. engineers have estimated that within a 100 mile area of WGY in Schenectady, it would be eight hundred billion. That number of sets all working at once in the area would probably absorb the energy output of the station, but there are approximately only a billion people in the world so there seems no danger of this ever happening.



PLUG-IN COIL FORMS

For every purpose where plug-in inductances are required in S.W. Receivers and Transmitters. Made of Special High Grade Low Loss Bakelite in natural brown color, and in the following three sizes. Ribbed for air space windings.

2½ inch diameter—3½ inch winding space.
No. 734—4 Prong—List .... $.60
No. 735—5 Prong—List .... $.65
No. 736—6 Prong—List .... $.70

1½ inch diameter—2⅝ inch winding space.
No. 125—4 Prong—List .... $.30
No. 126—5 Prong—List .... $.30
No. 310—6 Prong—List .... $.35

1¼ inch diameter—2⅛ inch winding space.
No. 594—4 Prong—List .... $.20
No. 595—5 Prong—List .... $.25
No. 596—6 Prong—List .... $.25

40% Discount to Radio Dealers and Amateurs
New 1937 Catalog Available. Write Today for Same.

BUD RADIO, INC.
1937 E. 55th St. CLEVELAND, OHIO

$40 COMPLETE $40
NEOBEAM OSCILLOSCOPE

• Linear Response • 1 Microvolt Sensitivity • Self-contained power supply and sweep system • Just plug into any input signal and tune in image. Write for free operating notes.
SUNDT ENGINEERING CO., 4236 Lincoln Ave., Chicago, Ill.

NEW THICKER XTALS

7000 KC. Mounted. Low Drift. K-195 .... $3.50
40-80-160. Mounted. Low Drift. K-96 .... 2.75
80-160. Unmounted. Low Drift. K-96 .... 2.00
Low Loss Holders 1.00

ALSO K-288 SUPER THICK FOR POLICE AND COMMERCIAL USE — ATTRACTIVE PRICES

C & S XTALS 836 E. WEBER STOCKTON, CALIF.

NEW CATALOGS

Wholesale Radio Service Co., Inc. has just announced the release of its 1937 catalog. This catalog, like its predecessors, is distributed free of charge to those interested in radio.

The catalog lists a comprehensive collection of radio items, including all-wave and short wave receivers, transmitters and transmitter parts, experimenter parts, service replacement parts, and a complete line of service test equipment. This catalog comprises more than 150 pages, contains over 2,000 illustrations.

Copies may be obtained for the asking at any of the five branches of the Wholesale Radio Service Co., Inc., located at 100 Sixth Ave., New York; 430 West Peachtree St., N.W., Atlanta, Ga.; 901 West Jackson Boulevard, Chicago, Ill.; 219 Central Avenue, Newark, N.J., and 542 East Fordham Road, Bronx, New York.

•

The new 1937 Allied radio catalog has just been published and is now ready for distribution. It contains 152 pages, featuring 10,000 exact duplicate and replacement parts; complete lines of amateur gear, p. a. equipment and service instruments; all-wave kits and sets; books, tools, etc. A free copy may be obtained by writing to Allied Radio Corporation, 833 W. Jackson Blvd., Chicago, Ill.

Another claimant to the "no-antenna honor" comes forth. E. E. Jenkins, W4CQR of Macon, Ga., asserts that VE4DF put an R7 signal into Georgia for a one-hundred per cent QSO, covering a distance of 2400 miles, and the VE had no antenna connected to his transmitter, a single 10 t.n.t. with 550 volts on the plate.

◆

A New England daily paper, in an article reporting amateur 5-meter interference with police radio work, states that the signal *CQ* means "seek you".

◆

If that new 50 watter cost $8.75 it has a *carbon plate*; but if it cost $17.50 it has a *Graphite anode.—W2GVX.*

T. R. McELROY

WORLD'S CHAMPION RADIO TELEGRAPHER

23 Bayside Street, Boston, Mass.

MAC KEY @ **$7.95** a real speed key.
MAC KEY DELUXE @ **$15.00.**
MAC CORD @ **$1.00.** speed key cord.
MAC CASE @ **$3.95.** speed key case.
MAC OSC @ **$3.95** ac/dc oscillator. Tone control.
If u hv Mac Key wri me fo xmy ipt & dsrb ifn.
All my stuff emcy gad best pduts obl. 73 Mac.

HARRISON *has it!* —

No matter what you need—you will find that Harrison is better equipped to serve you—economically and satisfyingly. It is our policy to maintain a most complete stock of the products of all leading manufacturers.
You are cordially invited to make our store your headquarters or to avail yourself of our unusually rapid Mail Order Service.

73, BILL HARRISON, W2AVA

We feature —

Aladdin	Cornell-Dubilier	ICA	National	Signal
Amperite	Coto-Coil	I. R. C.	Ohmite	Sylvania
Amperite Microphones	Eby	Jefferson	Patterson	Thordarson
Amphenol	Esico Irons	Jensen	Peak Products	Trimm Phones
Astatic	Frost	E. F. Johnson Co.	Pioneer Genemoters	Tungsol
Beede Meters	General Electric	Kenco Keys	Radio Receptor	Turner
Birnbach	General Transformer	Leichner	Readrite	Universal
Brush	Gen-Ral	Littelfuse	RME-69	U. T. C.
Bud	Guardian Relays	Lynch	Rola	Ward-Leonard
Cardwell	Hammarlund	Magnavox	Sangamo	Wright DeCoster
Centralab	Hoyt Meters	Mallory	Shure	Yaxley

AT 40% AND 2% DISCOUNT

American Microphone	Clough Brengle	Hickock	Premier Speakers	Rider
Amperex	Communication Products	Janette	Pyrex	Sargent
B & W Inductors	Dunco Relays	Kester	Radio Transceiver Labs.	Triplett
Bliley	Eimac	Krauter Tools	Raytheon RK	Valpey
Breting	Hallicrafters	Mac-Key	RCA—DeForest Tubes	Westinghouse
Burgess	Heintz & Kaufman	Mueller Clips	RCA Transmitters	Weston

AT SPECIAL NET PRICES

Literature will be sent upon request.

HARRISON RADIO CO. *"Short Wave Specialists Since 1925"*

12 WEST BROADWAY — BETWEEN VESEY, BARCLAY AND GREENWICH STREETS — NEW YORK CITY

QUALITY • VALUE • SERVICE

www.americanradiohistory.com

BUYER'S GUIDE

Where to Buy It

CALIFORNIA — Los Angeles

Radio Supply Company
912 So. Broadway

THE AMATEURS' HEADQUARTERS OF THE WEST

All Nationally Advertised Parts for Receiving and Transmitting Carried in Stock at All Times. 9 Licensed Amateurs on Our Staff.

CALIFORNIA — San Jose

COAST RADIO CO.
266 So. First St.

FLORIDA Jacksonville

GLOVER WEISS CO.
2 E. Bay St., Cor. Main

GEORGIA — Atlanta

GARVIN ELECTRIC CO.
75 Forsythe St., N.W.

ILLINOIS — Chicago

CHICAGO RADIO APPARATUS CO., Inc.
Established 1921
415 SOUTH DEARBORN STREET
(Near Van Buren Street)

ALL SUPPLIES FOR THE SHORT WAVE FAN AND RADIO AMATEUR QUOTATIONS FREELY GIVEN ON ANY KIT OR LAYOUT

Short Wave Receivers Taken in Trade
Get our low prices

ILLINOIS — Chicago

WHOLESALE RADIO SERVICE CO.
911 West Jackson Blvd.

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 may usually be substituted without materially affecting the performance of the unit.

●

HK-154 AMPLIFIER UNIT

C_1—Cardwell type MT-50-GS
C_2—Same, type XG-50-KD
CH—U.T.C. type CS-41
T—Inca type C44
RFC—Hammarlund CH-500

DAWLEY AUDIO OSCILLATOR

T_1, T_2—Inca type L-6903
L_1—Same, type L-6904
B_1—Burgess type F2BP
B_2—Same, type Z3OP

ADAMS LOW LEVEL AMPLIFIER

T_1—Jefferson type 467-178
T_2—Same, type 467-427
T_3—Same, type 467-177
T_4—Same, type 463-381
CH_1 to CH_4—Jefferson type 466-280
CH_5—Same, type 466-290
R_1—Electrad type 203
R_9—Same, type 274-W
R_{10}—Same, type 271-W
C_1, C_5—Aerovox type 261
C_2, C_6—Same, type 461
C_3, C_7—Same, type PB-25
C_4, C_8—Same, type 460
C_9—Same, type 284
C_{10}—Same, type 484
C_{13}—Same, type PBS-5
P_1—Amphenol type CP-4
P_2—Same, type PF-4
P_3—Same, type S-5
P_4—Same, type PM-5
Shield Boxes—R. H. Lynch type S
Sockets—Amphenol type S-8
Input-Output Terminals—Two ICA 2417, two ICA 2420
Cable Plugs—Amphenol type MC3-M (two) and PC3-F (two)
Chassis Receptacles—Same, type PC3-F (two)
Dial Plate—Crowe type 261
Pointer Knobs—Same, type 286

PADBERG MOBILE 6L6 UNIT

CH—Thordarson type T-6125
T_1—UTC type UPMG
T_2—UTC type UPM

IOWA — Des Moines

Iowa Radio Corporation
13th and Grand Sts.

MARYLAND—Baltimore

Radio Electric Service Co.
3 North Howard Street
Baltimore, Md.

MISSOURI — Kansas City

BURNSTEIN APPLEBEE CO.
1012-14 McGee St.

NEW YORK — Buffalo

DYMAC RADIO
216 E. Genesee St.

OHIO — Dayton

THE BURNS RADIO CO.
140 East Third St.

PENNSYLVANIA — Philadelphia

Consolidated Radio Corp.
612 Arch St.

TEXAS — Fort Worth

Ft. Worth Radio Supply Co.
104 East 10th St.

WASHINGTON — Spokane

RADIO AND SOUND EQUIPMENT CO.
1026 W. 1st Avenue

www.americanradiohistory.com

The Marketplace

(a) Commercial rate: 10c per word, cash with order; minimum, $1.00. Capitals: 13c per word. For consecutive advertising, 15% discount for 3rd, 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 therefore. Rates and conditions are subject to change without notice.

MODULATOR UNITS as described on page 18 July issue of RADIO, less microphone, $77.50. Dual power supplies on same size chassis, $75.00. Output transformers are our type A-150-M. A real 150 watt universal output transformer, will match most tubes, 7 impedance ratios. Input and output transformers, $16.50 per pair. LANGRICK RADIO ENGINEERING SERVICE, W6PT, 626 Maltman Avenue, Los Angeles, Calif.

FBXA in fine condtion. 20, 40 and 80 coils, tubes, heavy power supply and speaker in matching case. $40.00. W6LVK, 2931 South Catalina, Los Angeles.

BEST cash offer takes complete R.C.A. ACR-175. W6CAW.

SELL half decent bound 1934-1935 RADIO for $7.00. W8APB.

FIRST $40.00 cash takes my Patterson PR-10 with Preselector and adaptor for 10 meters all in excellent shape. W6KSP, Nogales, Ariz.

QSL's. Distinctly different! Samples! "Fritz", 203 Mason Ave., Joliet, Ill.

FABERADIO crystals are the finest. Crystal holders of the new design. Folder sent free. FABERADIO, Sandwich, Ill.

DIATHERMY machine, page 17, October RADIO. Built in our type 14BH steel rack. $6.85. 19 pounds. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

ANNOUNCING a forty-meter oscillator that is fracture-proof and has zero temperature coefficient. Write. CRYSTAL SHOP, Barre, Vt.

QUICK SERVICE on QSL cards. Send for samples. Radio Printers, Lewiston, Minn.

"T9" 40-meter crystals; highly active—ground to resist fracture, only $1.50 postpaid. Fully guaranteed. Attractive 40-meter ceramic plugin holder, $1.10 postpaid. COD orders OK. "Eidson's", Temple, Texas.

---

400 watt phone, complete station all less than three months of use. Rig is "All-Star" on 7 ft. rack. 47, RK25, RK25s pp to 805s pp final; 838s class B mod. xtl mike. Two xtls, coils for all bands, also ant. coupling unit. WAS es many foreign QSL's. The receiver is Breting 12, brand new. Also new Sargent pre-selector. Remote control unit and monitor. All the gear in the shack. Price prepaid to you, $450. Write or QSO W6MGB, Mill Valley, Calif.

STAMP brings you sample Radio Data Digest. Keeps posted. Saves money. Kladag, Kent, Ohio.

QSL, SWL Cards. Neat. Attractive, reasonably priced, samples free. Miller, Printer, Ambler, Pa.

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

VIBROPLEXES, bought, sold, exchanged. Rebuilts, $6. New large base bugs, $9. Lydeard, 28 Circuit, Roxbury, Mass.

RAW QUARTZ—finesr quality, for the manufacture of piezo crystals. Largest, most complete and varied stock in America. Brazilian Importing Co., Inc., 6 Murray St., New York City.

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

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.

CRYSTALS and blanks. X or Y cut; 1750 to 2000; 3500 to 4000; close to your specified frequency $1.35. Blanks, unfinished 60c. Bill Threm, W8FN, 4021 Davis Ave., Cheviot, O.

QSL SWL Cards, neat, attractive, reasonable. Samples free. Miller, Printer, Ambler, Pa.

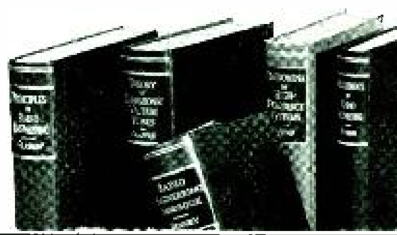
THERMO-COUPLE ammeters repaired, $2.50. W9GIN, 412 Argyle Bldg., Kansas City, Mo.

QUICK SERVICE on QSL cards. Send for samples. Radio Printers, Lewiston, Minn.

BLILEY CRYSTAL bargain. Write W8DED, Holland, Mich.

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

Now – a high-powered –



NEW

The Library now comprises a revised selection of books culled from latest McGraw-Hill publications in the radio field.

Radio Engineering Library

—especially selected by radio specialists of McGraw-Hill publications

—to give most complete, dependable coverage of facts needed by all whose fields are grounded on radio fundamentals

—available at a special price and terms.

These books cover circuit phenomena, tube theory net-works. measurements, and other subjects—give specialized treatments of all fields of practical design and application. They are books of recognized position in the literature—books you will refer to and **be referred to often.** If you are practical designer, researcher or engineer in any field based on radio, you want these books for the help they give in hundreds of problems throughout the whole field of radio engineering.

5 volumes, 3064 pages, 2000 illustrations

1. **Glasgow's RADIO ENGINEERING**
2. **Terman's MEASUREMENTS IN RADIO ENGINEERING**
3. **Chaffee's THEORY OF THERMIONIC VACUUM TUBES**
4. **Hund's PHENOMENA IN HIGH-FREQUENCY SYSTEMS**
5. **Henny's RADIO ENGINEERING HANDBOOK**

10 days' examination. Special price. Monthly payments. $25.00 worth of books cost you only $23.50 under this offer. Add these standard works to your library now; pay small monthly installments, while you use the books.

SEND THIS ON-APPROVAL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N.Y.C.

Send me Radio Engineering Library, 5 vols., for 10 days' examination on approval. In 10 days I will send $2.50, plus few cents postage, and $3.00 monthly till $23.50 is paid, or return books postpaid. (We pay postage on orders accompanied by remittance of first installments.)

Name...

Address...

City and State...

Position...

Company...R. 11-36

(Books sent on approval in U. S. and Canada only.)

www.americanradiohistory.com

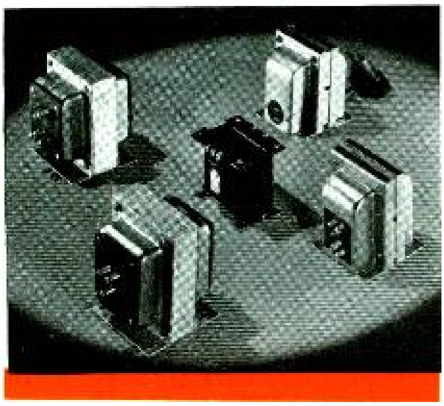
UTC

Most Complete Transformer Line in the World

QUALITY · RELIABILITY

Filament Voltage to Spare . . .

UTC features the largest selection of filament transformers for all the popular transmitting tubes manufactured by Amperex, Eimac, Heintz & Kaufman, Raytheon, RCA, Taylor, etc. . .



SMOOTHING CHOKES

		Net to Hams
CS-301	12 Henry, 200 MA; D.C. resistance 140 ohms. CV mtg.	$ 3.00
CS-302	12 Henry, 300 MA; D.C. resistance 105 ohms. CD mtg.	4.50
CS-303	12 Henry, 500 MA; D.C. resistance 70 ohms. CD mtg.	7.80

INPUT SWINGING CHOKES

CS-304	5/25 Henry, 200 MA; D.C. resistance 140 ohms. CV mtg.	3.00
CS-305	5/25 Henry, 300 MA; D.C. resistance 105 ohms. CD mtg.	4.50
CS-306	5/25 Henry, 500 MA; D.C. resistance 70 ohms. CD mtg.	7.80

FILAMENT TRANSFORMERS

Primary 105-115 Volts A.C. 50/60 Cycles

CS-401	2½ V.C.T. 20 A; 5 V.C.T. 3 A; 7½ V.C.T. 6½ A. 2500 V. insulation	5.10
CS-402	10 V.C.T. 6½ A; 10 V.C.T. 6½ A; 7½ V.C.T. 2½ A; 2½ V.C.T. 5 A; 2500 V. insulation. CD mtg.	6.90
CS-403	11 V.C.T. tapped at 12 and 14 volts at 10 A. 5000 V. insulation. CD mtg.	5.10
CS-404	2½ V.C.T. 12 A; 5000 V. insulation; 10 V.C.T 6½ A. CD mtg.	5.10
CS-405	5 V.C.T. 20 A; 7000 V. insulation. CD mtg.	4.50
CS-406	5 V.C.T. 20 A; 10,000 V. insulation. CD mtg.	6.00
CS-407	2½ V.C.T. 12 A; 7000 V. insulation. CV mtg.	2.70
CS-408	7½ V.C.T. 6½ A; 5000 V. insulation. CV mtg.	2.70
CS-409	10 V.C.T. 6½ A; 5000 V. insulation. CV mtg.	3.00
CS-410	5 V.C.T. 3 A; 5 V.C.T. 3 A; 5 V.C.T. 6 A; 5000 V. insulation. CV mtg.	3.00
CS-411	2½ V.C.T. 6 A; 2½ V.C.T. 6 A; 2½ V.C.T. 12 A; 10,000 V. insulation. CD mtg.	6.00
CS-412	6.3 V.C.T. 5 A; 5 V.C.T. 8A CV mtg.	3.00
CS-413	5 V.C.T 12 Amps. for 3-35 T's, 2-50 T's or 1-150 T. CV mtg.	3.00
CS-414	7½ V.C.T. 20 Amps. for 2-300 T's. CD mtg.	5.10
CS-415	11 V.C.T. tapped at 10 volts at 8 A. 7000 V. insulation. CV mtg.	3.90

★ **Primary 115 Volts. 50/60 Cycles.**

LM-1	2½ V.C.T. 20 A; 2500 V. insulation. OT mtg.	1.80
LM-2	7½ V.C.T. 6.5 A; 2500 V. insulation. OT mtg.	2.10
LM-3	10 V.C.T. 6½ A; 2500 V. insulation. OT mtg.	2.40
LM-4	6.3 V.C.T. 5 A; 5 V.C.T. 6 A; 2500 V. insulation. OT mtg.	2.40
LM-5	2½ V.C.T. 12 A; 5000 V. insulation. OT mtg.	2.10
LM-6	5 V.C.T. 3 A; 5 V.C.T. 3 A; 5 V.C.T. 6 A; 2500 V. insulation. OT mtg.	2.40
LM-7	Three 7½ V.C.T. 2½ Amp. windings; 2500 V. insulation. OT mtg.	2.40
LM-8	2½ V.C.T. 5 A; 2½ V.C.T. 5 A; 5 V.C.T. 3 A; 2500 V. insulation. OT mtg.	2.10
LM-9	2½ V.C.T. 5 A; 5 V.C.T. 3 A; 7½ V.C.T. 3 A; 2500 V. insulation. OT mtg.	2.40
LM-10	2½ V.C.T. 5 A; 7½ V.C.T. 3 A; 7½ V.C.T. 3 A; 2500 V. insulation. OT mtg.	2.40
LM-11	5 V.C.T. 3 A; 7½ V.C.T. 3 A; 7½ V.C.T. 3 A; 2500 V. insulation. OT mtg.	2.40
LM-12	2½ V.C.T. 5 A; 5 V.C.T. 3 A; 6.3 V.C.T. 3 A; 2500 V. insulation. OT mtg.	2.40

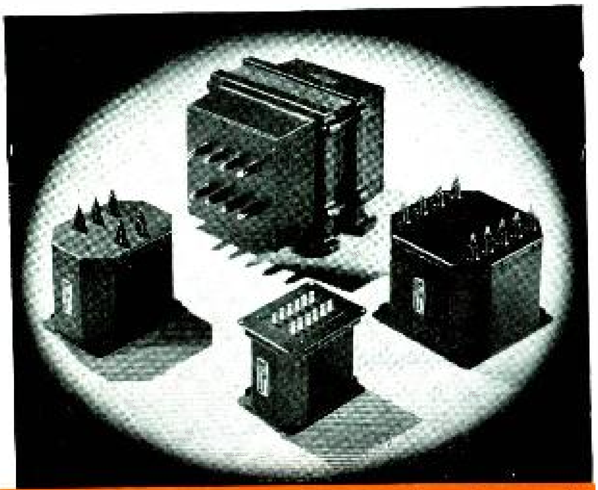
www.americanradiohistory.com

Power to Spare . . .

Built-in integrity that Hamdom associates with every UTC product...at prices that every Ham can afford..

● the *new* UTC PLATE TRANSFORMERS are superior and do not cost any more

ASK YOUR UTC DISTRIBUTOR FOR THESE UNITS



HIGHER VOLTAGES, more current at no increase in cost! Primary 105, 115, 220, 230 volts A.C. 50/60 cycles.

		Net to Hams
PA-110	515 or 625 each side of center at 200 MA 400 VDC or 500 VDC. PA-3	$ 6.00
PA-111	750 or 950 each side of center at 350 MA; DC voltage 600 or 750. PA-4	10.80
PA-112	1250 or 1500 each side of center at 500 MA; DC. voltage 1050 or 1250. PA-6	21.00
PA-113	1750 or 2100 each side of center at 500 MA; DC. voltage 1500 or 1750. PA-6	28.50
PA-114	1750, 2350, 3000 or 3500 each side of center at 500 MA; DC. voltage 1500, 2000, 2500 or 3000, UTS mtg	45.60
PA-154	3500, 4000 each side of center at 500 MA 3050 VDC or 3500 VDC. UTS case	60.00
PA-115	C bias plate transformer for class B 203A's, 830B's, 800's, or 210's using one or two 82 rectifiers. PA-3	6.00
PA-116	1250 or 1500 each side of center at 300 MA; DC. voltage 1050 or 1250. PA-5	15.00
PA-117	3500 or 3000 each side of center at 1 ampere. 2620 VDC or 3050 VDC. UTS case	69.00
PA-118	1750 or 2400 each side of center at 325 MA; DC. voltage 1500 or 2000. PA-6 mtg	23.40
PA-119	1500 or 1750 each side of center at 1 amp. DC. voltage 1250 or 1500. UTS case	45.60

NOTE For reduced power operation, and when required, using these transformers on the 115 volt line, the DC output voltage can be reduced to half of normal value by switching to the 230 volt tap. These transformers will also operate on 25 to 40 cycle current if the 115 volt line is connected to the 230 volt tap.

NOTE CS types are similar in appearance and design to PA types of like voltages and current but differ from PA types in that they are designed ONLY for operation on 115 volt 50/60 cycle current.

		Net to Hams
CS-200	450 each side of center at 150 MA; 5V-3A; 2½ V-10A. CV mtg.	$ 3.90
CS-201	500 each side of center at 200 MA; 2½ V.C.T. 14 A; 5 V.C.T. 3 A; CD mtg	4.80
CS-202	600 each side of center at 200 MA; 2½ V-10A; 7½ V-3A; 5V-3A. CD mtg	6.00
CS-203	800 each side of center at 150 MA; 660 V.P.S. CD mtg.	4.50
CS-204	800 each side of center at 250 MA; 650 V.DC. CD mtg.	6.60
CS-205	750 or 950 each side of center at 350 MA; DC. voltage 600 or 750. PA-4 mtg	10.20
CS-206	1250 or 1500 each side of center at 500 MA; DC. voltage 1050 or 1250. PA-6 mtg.	19.20
CS-207	1750 or 2100 each side of center at 500 MA; DC. voltage 1500 or 1750. PA-6 mtg.	26.10
CS-208	1750, 2350, 3000 or 3500 each side of center at 500 MA; DC. voltage 1500, 2000, 2500 or 3000	39.00
CS-209	1250 or 1500 each side of center at 200 MA; DC. voltage 1050 or 1250. PA-5 mtg.	12.00
CS-210	1750 or 2400 each side of center at 325 MA; DC. voltage 1500 or 2000. PA-6 mtg.	21.00
CS-212	475 each side of center at 500 MA; 5 V.C.T. 6A, for 4-6L6's fixed bias, etc. DC. voltage 400 CD mtg	8.40
CS-213	1250 or 1500 each side of center at 300 MA; DC. voltage 1050 or 1250. PA-5 mtg.	13.80
CS-214	1500 or 1750 each side of center at 1 amp. DC. voltage 1250 or 1500. UTS mtg.	39.00

UNITED TRANSFORMER CORP.

72 SPRING STREET • NEW YORK, N. Y.

EXPORT DIVISION: 100 VARICK STREET NEW YORK, N.Y. CABLES: "ARLAB"

www.americanradiohistory.com

Another RCA "Ultra-Hi" Achievement

The RCA-956 Super-Control R-F Pentode, a new addition to the Acorn Family

The RCA-956 marks another advance in the art of ultra-high frequency communication. The super-control feature (remote cut-off characteristic) provides an easy means for controlling the gain in r-f stages and permits a reduction in cross modulation.

The 956 with its companion tubes, the 954 and 955, provides a complete family of Acorn receiving types for the ultra-high frequencies.

AMATEUR'S NET PRICES

RCA-954 - - -	$5.80
RCA-955 - - -	3.75
RCA-956 - - -	5.80

The RCA-956 is available for immediate delivery. For technical data, see your supplier or write to us.

Listen to "The Magic Key" every Sunday, 2 to 3 p. m., E. S. T., on NBC Blue Network

IMPORTANT NEWS

Prices reduced on three popular RCA rectifier types

TYPE	OLD PRICE	NEW PRICE	
RCA-866	$ 2.25	$ 1.75	RCA 866
RCA-872	16.50	14.00	RCA 872
RCA-872-A	18.50	16.50	RCA 872-A

Increased volume has made possible these substantial reductions. Take advantage of these new low prices on these three famous RCA rectifier types. High-voltage power supply costs are now materially lower. Your supplier can take care of your requirements immediately.

RCA

for Amateur Radio

Address Amateur Radio Section, RCA Manufacturing Co., Inc., Camden, N. J.

A service of the Radio Corporation of America

www.americanradiohistory.com