AUGUST 1929

RADIO BROADCAST

PUBLISHED FOR THE RADIO INDUSTRY



SPECIAL FEATURES IN THIS ISSUE

How to Sell Screen-Grid Receivers

Detailed Summary of the Season's New Sets

What is Happening to Radio Listening Habits?

Other features: All the Facts About Screen-Grid Circuits · The Stromberg-Carlson Receiver · Set Data Sheet That Servicemen Should Know · Analysis of Units Made and Bought in Radio Sets · News of the Industry

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MARIGOLD BALLROOM, MINNEAPOLIS, MINN., PAM EQUIPPED

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Every Service Man and Dealer MUST be equipped with SUPREME DIAGNOMETER Model 400-B if he is to profitably solve every radio service problem.

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☐ Net Cash—$139.50 F.O.B. Greenwood, Miss.

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Signed.....

Firm name .....

Street address .....

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

References:

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

Distributor:

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

The following is a comparison of the Supreme Diagnometer with the three leading set testers, and the most popular test board on the market, which sells for more than double the price of the Supreme Diagnometer.

"x" indicates YES. Blank space indicates NO.

Tests, Functions and Facilities	Set Tester "A"	Set Tester "B"	Supreme Diagnometer	Set Tester "C"	Test Board
D. C. Filament Voltage Reading	x	x	x	x	x
A. C. Filament Voltage Reading	x	x	x	x	x
Plate Voltage Reading	x	x	x	x	x
Plate Current Reading	x	x	x	x	x
Simultaneous Plate Current and Voltage Reading	x		x	x	x
Grid Voltage Reading	x	x	x	x	x
Cathode Bias Reading	x	x	x	x	x
Screen Grid Voltage	x	x	x	x	x
Control Grid Voltage	x	x	x	x	x
Analysis Without Use of Adapter	x	x	x	x	x
Line Voltage Reading	x	x	x		x
Locate Unbalanced Secondaries	x		x		
Reads Both Positive or Negative Cathode Biasing			x		
Oscillation Test of Tubes			x		
A. C. Line Tube Testing			x		
Bias Emission Tube Tester			x		
Tests 15-Volt Filament Tubes Independent of Radio			x		
Tests Screen Grid Tubes Independent of Radio			x		
Tests Overhead Filament Type Tubes Independent of Radio			x		
Tests Both Plates '80 Type Tubes			x		
Rejuvenates Thoriated Filament Tubes Out of Set Without Removing from Set			x		
D. C. Continuity Tester Without Batteries			x		
Furnishes Modulated Signal for Testing			x		
Synchronizing—					
By Thermal-Meter Method			x		
By A. C. Meter Method			x		
By Audible Method			x		
Neutralizing Signals Provided			x		
Thermo-Couple Movement Meter			x		
Tests Gain of Audio Amplifiers			x		
Measures Up To 250 Mils. A. C. Current			x		
External Use of Meters	x	x	x	x	x
Of 750 D. C. Meter	x		x		x
Of 750 A. C. Meter	x		x		x
Of 2.5 Amps. Milliameter			x		
Measures Capacity of Condensers .01 to 9. Mfd.	x		x		x
Tests Charger Output by Meter			x		
Bridges Open Audio Stages for Tests			x		
Positive Milli-Ammeter Protection for Tube Testing			x		
Ammeter Protection			x		
500,000-Ohm Variable Resistor for Testing			x		
30-Ohm Rheostat for Testing			x		
Self Contained Power Plant for All Required Tests			x		
Percentage of EFFICIENCY	38%	26%	100%	25%	36%

SUPREME
Radio Diagnometer

Makes every conceivable test on any Radio Set-

QUALITY **DONGAN** PRODUCTS

Care-Free, Long-Life Reception

—use Dongan Power Parts and get the Best in Radio

EVERY evening the radio is a faithful and hard-working entertainer in millions of homes. No other musical instrument is called upon for such regular and enduring service. Whether we spend the evening quietly reading or entertain at bridge the familiar station announcements keep pace with the family clock.



Anything as much demanded and appreciated, a source of never-ending interest and enjoyment, should not be slighted, should not be the victim of petty economy. Today anyone can own the type of radio receiver that will operate hour after hour without attention. Music and speech are resonant and real.

You can have this kind of radio at a moderate cost. The new UX 245 Tube has made possible an even lower gross cost than was necessary with UX 250 Tube.

It will pay you to find out about this new tube and the accompanying Parts.

No. 994 Power Amplifier Transformer	**$12.00**
either	
No. 2189 Push-Pull Output Transformer	**12.00**
with	
No. 2142 Push-Pull Input Transformer	**4.50**
or	
No. 3107 Straight Output Transformer	**12.00**
with	
No. 2158 Audio Transformer	**4.50**

Two Secondary Windings (for either No. 2189 or No. 3107), one for Magnetic type and the other for Dynamic type Speaker.

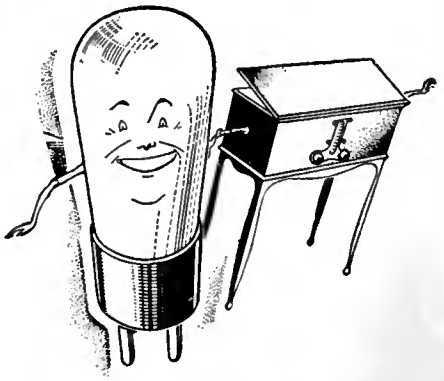
D-946 Standard Condenser Unit	**22.50**

This Condenser Unit is also designed for use with No. 994 Transformer for Power Amplification.

No. 5554 Double Choke, use in Filter Circuit	**11.00**
No. 2124 Transformer	**6.00**

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2991-3001 Franklin Street
Detroit

TRANSFORMERS of MERIT for FIFTEEN YEARS



The child will soon be leading the parent

Here was the split-up of the average radio dollar in 1922:

*10%—$ 6,000,000—spent for tubes
90%— 54,000,000—spent for parts and sets

Between 1922 and 1928 the tube market increased 18-fold—while the market for sets and parts increased only 10-fold—in dollars. Here is the split-up in 1928:

*17%—$110,250,000—spent for tubes
83%—$539,750,000—spent for sets and parts

Your future prosperity depends to a great extent on how well you develop the tube market in your locality.

*Figures courtesy of "Radio Retailing."

The Ce Co Policy

The CeCo Manufacturing Company is embarking on a nation-wide advertising program to help the dealer widen his market for tubes.

The CeCo Couriers broadcast every Monday night at 7:30 Eastern Standard time over the Columbia System.

We have proved the quality of CeCo Tubes by the most severe tests any radio tubes have ever had to stand.

Tests made by independent laboratories have proved that CeCo Tubes have from 30% to 50% longer life than any other tubes tested.

How to increase your tube sales

Send for the dealer book "Tomorrow in the Tube Industry." It contains many helpful suggestions for building up tube sales and shows what progress other dealers are making along this line.



The AC 224 Screen Grid Tube was developed and perfected by CeCo over a year and a half ago.

Licensed under patents and applications of the Radio Corporation of America, the General Electric Company, and the Westinghouse Electric and Manufacturing Company.

Ce Co Manufacturing Company, Inc.
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CeCo Manufacturing Co., Inc., Dept. 108, 1200 Eddy St., Providence, R. I. Send me a copy of the dealer book on the radio tube market.

Name_____
Company_____
Address_____

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Send for it today for complete listings of Radio Convenience Outlets, Connector Plugs, Rheostats, Fixed and Grid Resistances, Jacks, Jack Switches, Phone Plugs, etc.

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Prevents Current-WABBLE

$1.10 with mounting (in U. S. A.) at all dealers.

Install Amperite for every tube and smooth out "A" current wabble that ruins reception. Amperite *adjusts itself* to the exact need of each tube. A type for every tube—A. C. or D. C.

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AMPERITE
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The "SELF-ADJUSTING" *Rheostat*



NO TENDERFEET HERE!

The technique of radio tube production is no schoolboy's exercise, to be learned in a day, a week, or a year. ¶It takes the knowledge so painstakingly learned over a period of years from the incandescent lamp, properly attuned to the newer concepts of physics, chemistry and radio science. ¶To this must be added the most modern equipment, the finest obtainable materials, the organization necessary to combine all smoothly. Satisfy all these requirements and you have the **"SPEED"** Radio Tube. ¶**"SPEED"** dealers have the best proposition in the field. The reason—¶They have implicit confidence in the complete line of **"SPEED"** tubes—tests for volume, clarity, long-life, quicker-heating, bear them out. ¶They have implicit confidence in the **"SPEED"** organization—J. J. Steinharter, J. J. Grossman, Fred Guinther,—all pioneers from lamp days and making radio tubes since 1924. ¶And, when the product is right, the sales and resales are right and the profits take care of themselves. ¶Think it over. Write us—It will pay you.

SPEED
CABLE RADIO TUBE CORPORATION
(formerly Cable Supply Co.)
84-90 North Ninth Street
Brooklyn, N. Y.



224 A. C.
Developed by Cable
in 1928

MAKERS OF RADIO TUBES SINCE 1924

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WITH THE NEWEST!

EVEREADY RAYTHEON

TUBES FOR

TELEVISION

AND TALKING PICTURES



Eveready Raytheon
Kino-Lamp



Eveready Raytheon
Foto-Cell

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THE Eveready Raytheon Kino-Lamp for television reception is the first tube developed commercially which will work with all systems.

With its uniform glow over the entire plate . . . tested performance . . . long life . . . perfect reproductive qualities . . . the Eveready Raytheon Kino-Lamp is a great step forward in television.

The Eveready Raytheon Foto-Cell is a long-life transmitting tube for television. Used also for talking pictures. Made in two sizes, either hard vacuum or extra-sensitive gas-filled.

Correspondence is invited from everyone interested in television. Foto-Cells to special specifications will be made at reasonable prices.

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EVEREADY RAYTHEON

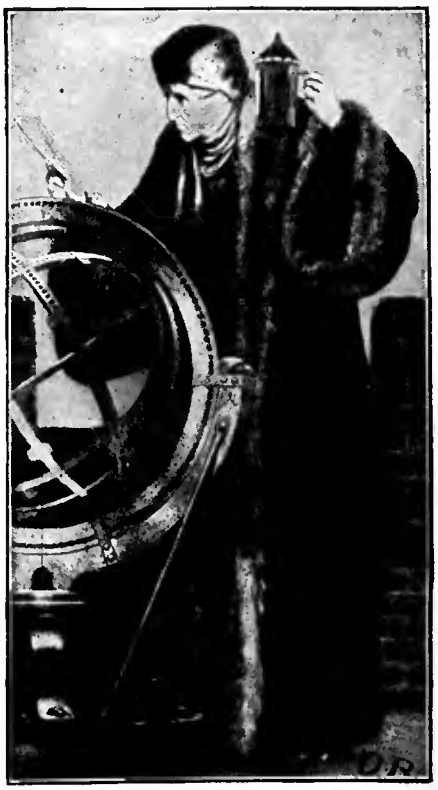
The Spirit of Accuracy

SETTING standards is half the work of science. The standard of length—a platinum-iridium bar; the standard of time—stars passing the hair line on a lens.

And in radio—the standard of reception. This is the ultimate goal of the radio engineer. Progress toward that standard depends upon the uniform excellence of the tubes used for tests.

The Spirit of Accuracy enters into every ARCTURUS Tube and is manifest in each test, check and process of manufacture. Oxides filtered through sieves that hold water... gauges that detect the fraction of a hair's breadth...a vacuum that approaches nothingness—all contribute to the standard the engineer demands.

Radio engineers use ARCTURUS A-C Tubes with the sincere assurance that these tubes are as fine and uniform as it is humanly possible to build them—a new standard in radio tubes.



COPERNICUS
From the Painting by OTTO BRAUSEWETTER

ARCTURUS

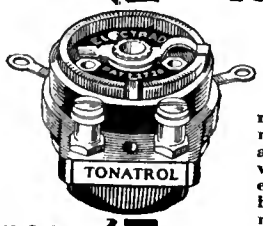
BLUE A-C LONG-LIFE TUBES

ARCTURUS RADIO TUBE COMPANY, NEWARK, N. J.

A Complete Line of Quality Volume Controls

Superior workmanship, smooth operation and long life characterize the

ELECTRAD TONATROL



U. S. Pats. 1593658, 1034103, 1034104.

Made in a variety of values suitable for most circuits. One of the most popular of the many Electrad Voltage Control devices with manufacturers, custom-set builders and experimenters. Supplied with or without filament switch. List, $1.50 to $3.00.

The Super-TONATROL—the remarkable new Electrad Volume Control for use in high-voltage receivers. Entirely different in construction and design. Easily dissipates 5-watts. Resistance element fused to an enameled metal base. Pure silver floating contact gives amazing smoothness. Seven types with uniform or tapered curve. List, $2.40 to $3.50

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Address .....

.....

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Jenkins & Adair

Level Indicator Panel

Type B (Calibrated)



For Broadcasting, Electrical Recording, and Power Speaker Systems

The Type B Level Indicator Panel is designed for direct reading of the voice level on any 500-ohm telephone circuit, the range being from minus 10 TU to plus 20 TU, in steps of 2 TU each. The parts consist of an accurately built input transformer, a specially designed potentiometer, a filter retard and condenser, and direct current galvanometer calibrated for this work.

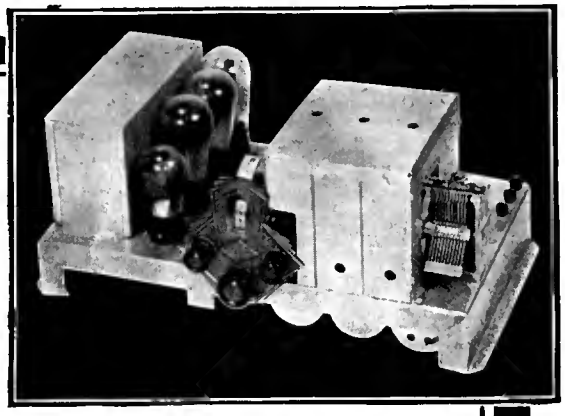
The use of this panel is essential wherever a specific level must be maintained. The calibration is highly accurate, and cannot alter while the tube constants remain normal. The potentiometer is built up of nichrome wire units, held to an accuracy of 1/10 of 1%. The panel is extremely simple in operation, is direct reading in TU's, and minimizes the change of load on the measured circuit when the level settings are changed. This last feature is a great improvement over present types.

The dimensions of this panel are 19 x 7½ in. It is of 5/16 in. black sanded bakelite and weighs, complete, 18 lbs. It operates on 12 volt A battery and 135 volts B battery, and requires a 102E tube (not furnished by us). The parts of this panel are NOT sold separately. Bulletin 8 gives a more complete description and will be mailed on request. The net price in the United States and Canada is $250.00 f. o. b. Chicago.

J. E. JENKINS & S. E. ADAIR
Engineers
1500 N. Dearborn Parkway
Chicago U. S. A.
Manufacturers of Recording Amplifiers

SM

They said— "S-M will do it this year" —and S-M has done it!



BUILDING upon the experience of last year—when the S-M 720 and 710 Screen-Grid receivers set new high marks of accomplishment, both in extreme distance reception (such as Australia to New York on the broadcast band) and in musical excellence—Silver-Marshall announces a development as important to the 1930 builder as was the 1929 S-M supremacy in screen-grid receiver design.

This year there is an entirely new keynote in designs for the setbuilder: CONVENIENCE. Formerly considered as the one feature monopolized by factory-built sets, *perfect convenience in operation* is now brought within the reach of all—and yet with even *better performance* than the *best* "kit sets" of last year—the S-M 720 and 710.

And this, too, at *lower* cost rather than higher—for the great new S-M factory, five times the size of last year's, and one of the largest in America, is bending its mighty power to bring still lower the cost to the setbuilder of those phenomenal results he feels a right to expect from any S-M receiver.

S-M 722
Band-Selector Seven

Far *better* in actual performance than the famous 720 and 720AC Screen-Grid Sixes, as well as more convenient, the 722 Band-Selector Seven is strictly all-electric, and tuned entirely by a single illuminated drum. It embodies a.c. screen-grid amplification in two r.f. stages, band-selector tuning, screen-grid power detection followed by resistance-coupled first r.f. stage, push-pull 245 output tubes, and provision for dynamic speaker. The 722 makes top-notch 1930 quality no more costly than merely mediocre reception.

And If That Sounds Startling — Read This

The Seven-Twelve Tuner
A Refinement of the Sargent-Rayment

For the setbuilder who wants the best regardless of cost, S-M is able to repeat the promise made *and kept* a year ago. The Sargent-Rayment 710 was acknowledged to stand head-and-shoulders above all other receivers offered at any price—and the same laboratory which perfected it now offers a further refinement in the S-M Seven-Twelve Tuner. Though not high-priced, the Seven-Twelve will this year duplicate the achievement of its illustrious predecessor and will *far surpass in performance* anything offered to the setbuilder at *any price whatsoever*. Built to realize every advantage of a precision band selector tuner entirely separate from its audio amplifier, the Seven-Twelve uses 224 a.c. screen-grid tubes in three r.f. stages, band-selector tuning, and power detector. Perfectly adapted to give to the 712 a tone quality in keeping with its own outstanding sensitivity and selectivity is the new 677 two-stage power amplifier (245 push-pull). The 712-677 combination will be the setbuilder's ace for 1930—and at a price that will astonish the most skeptical.

735 Round-the-World Six
All-Electric—Short-Wave and Broadcast-Band

The first completely a.c.-operated short-wave receiver to be offered upon the American market. Built on the same chassis as the 722 illustrated above, the 735 demonstrates in short-wave reception the same mastery of design for the 224 a.c. screen-grid tube which distinguishes the new S-M broadcast receivers. Built into it also is a typical S-M two-stage audio amplifier with push-pull 245 tubes. Plug-in coils give a range of from 17 to 650 meters. Strictly one-dial tuning, full a.c. operation, and provision for dynamic speaker unite to make the 735 a real milestone in short-wave development.

Have you seen the intimate description of these three all-new S-M receivers as first printed in the S-M RADIOBUILDER? If you want to keep up-to-date on the new developments of the S-M laboratories, don't be without the RADIOBUILDER. Use the coupon.

Custom-builders who use S-M parts have profited tremendously throughout the past season through the Authorized S-M Service Station franchise. If you build professionally, let us tell you about it—write now.

Get your order in right away to your S-M parts distributor, for one or more of these 1930 receivers. Net prices will be found in the new S-M fall catalog; see coupon.

SILVER-MARSHALL, Inc.

6403 West 65th St., Chicago, U. S. A.

Silver-Marshall, Inc.
6403 West 65th Street, Chicago, U. S. A.

....Please send me, free, the complete S-M Catalog; also sample copy of The Radiobuilder.

For enclosed.....in stamps, send me the following:

.... 50c Next 12 issues of The Radiobuilder
.... $1.00 Next 25 issues of The Radiobuilder

S-M DATA SHEETS as follows, at 2c each:

....No. 3. 730, 731, 732 Short-Wave Sets
....No. 4. 255, 256, etc., Audio Transformers
....No. 5. 720 Screen Grid Six Receiver
....No. 6. 740 "Coast-to-Coast" Screen Grid Four
....No. 7. 675ABC High-Voltage Power Supply
....No. 8. 710 Sargent-Rayment Seven
....No. 9. 678PD Phonograph-Radio Amplifier
....No. 10. 720AC All-Electric Screen-Grid Six
....No. 12. 669 Power Unit (for 720AC)
....No. 14. 722 Band-Selector Seven
....No. 15. 735 Round-the-World Six
....No. 16. 712 Tuner (Development from the Sargent-Rayment)
....No. 17. 677 Power Amplifier for use with 712

Name .....

Address .....

RADIO BROADCAST

ILLIS KINGSLEY WING . . . . *Editor*
KEITH HENNEY . *Director of the Laboratory*
HOWARD E. RHODES . . *Technical Editor*
EDGAR H. FELIX . . . *Contributing Editor*

VOL. XV. NO. 4

PUBLISHED FOR THE RADIO INDUSTRY

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. . . *among other things*

THERE IS no good in reiterating that broadcasting is the one branch of the radio industry on which every other depends. You can't find a soul to dispute it. But the fact is, that with very very few exceptions, the radio industry has rested secure in the belief that the broadcasters were doing pretty well by themselves, thank you, and have not so much as looked up from the press of their immediate problems. Leaders in the industry paused at the Chicago Trade Show to sound a note of warning about the degree to which direct advertising has come to dominate radio broadcasting. To our mind, an unusually interesting discussion of this question appears on page 244, "Curing the Direct Advertising Cancer." Plain speaking is necessary now, but not dismal pessimism, for we believe that far behind the scenes in the councils that rule broadcasting in various sections of the country, the broadcasters themselves are struggling earnestly, if silently, to decrease the hold that direct advertising has gotten on their programs. It is to be hoped that present conditions are only a temporary phase through which broadcasting seems fated to pass.

THE MACKENZIE RADIO CORPORATION, one of Zenith's New York City distributors, has a most interesting junior salesman plan which M. W. Craddick, vice-president of the organization describes on page 193 of this magazine. Mr. Craddick has found the plan eminently workable for his organization; we should like to hear from heads of other organizations who have found success with a plan in any way similar.

A CAREFUL STUDY of the best retail statistics now shows—as detailed at length in Mr. Phillips' article on page 206—that dealers who sell more than $100,000 worth of merchandise per year are still getting the largest share of the total radio sales. But close examination also shows that the smaller dealer in proportion to his sales volume is getting an increasing share of the business. This is a recent trend. Is it permanent?

THE September RADIO BROADCAST will contain a useful study of trends and facts in radio marketing, a description of an unusually successful house-to-house selling campaign, a practical discussion of the dealer relation to finance companies; the engineering section will present for the first time anywhere a discussion of the Technidyne circuits, an engineering discussion of the new Bosch screen-grid receiver, and many other valuable articles.

—WILLIS KINGSLEY WING.

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COUNTRY LIFE . . WORLD'S WORK . . THE AMERICAN HOME . . RADIO BROADCAST . . SHORT STORIES . . LE PETIT JOURNAL . EL ECO . . WEST

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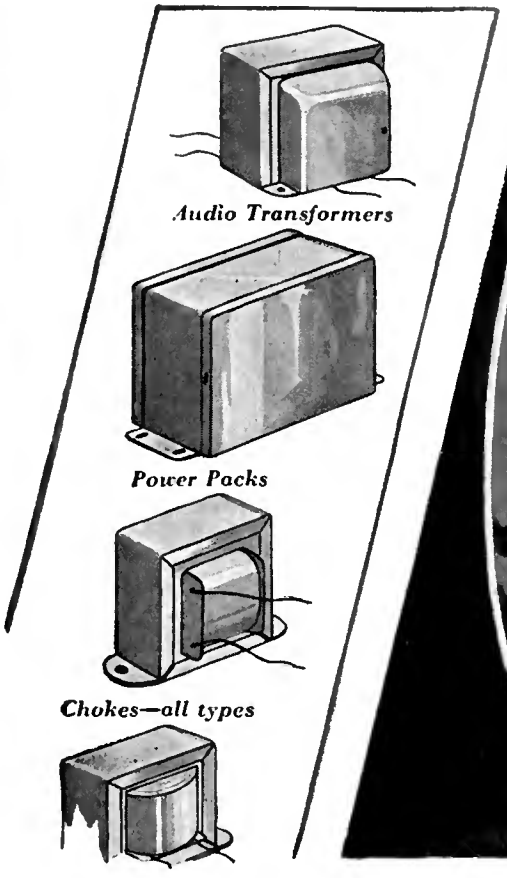
What counts like tone quality ?

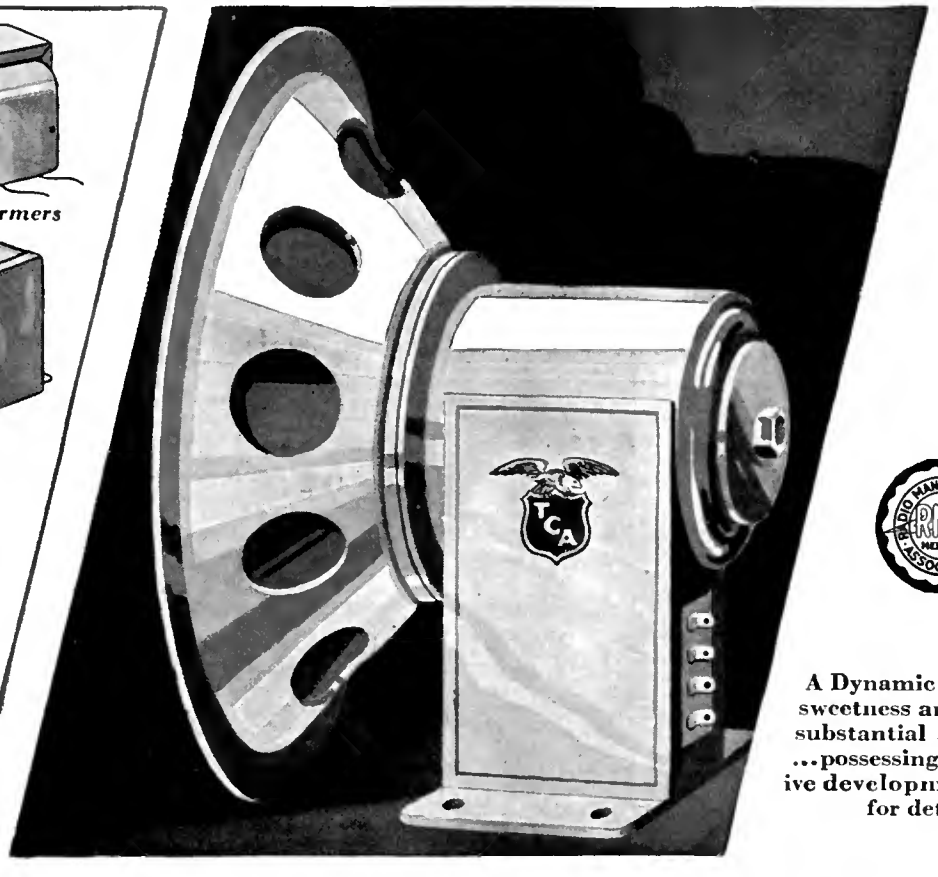
In the last analysis the customer's yardstick is the one by which radio values will be measured. In his judgment tone quality comes first.

The audio end of the set controls the final performance—so transformers and speakers can make or mar a receiver.

T·C·A products meet their responsibility squarely. They deliver the goods. In perfection of design and construction, they fulfill the most exacting demands of your designing department.

Completely manufactured . . . rigidly inspected . . . carefully tested . . . and through controlled volume production, offered at a price no higher than you pay elsewhere.





A Dynamic of exceptional sweetness and volume . . . substantial . . . beautiful . . . possessing many exclusive developments. Write for details.

TRANSFORMER CORP. OF AMERICA, 2301-2319 South Keeler Avenue, CHICAGO

UNIQUE EFFICIENCY

EVEREADY RAYTHEON B-H TUBE



Type B-H—Standard for "B" Power Units. 125 m.a. at 300 volts.

THE ORIGINAL GASEOUS RECTIFYING TUBE FOR "B" ELIMINATOR UNITS

THE Eveready Raytheon B-H Tube uses ionized helium instead of a filament. Not only is it unusually efficient . . . its life is uniformly long and its voltage is sustained.

Unlike a filament, the electron emission of which gradually decreases, ionized helium supplies millions of electrons a second—over and over again.

If you use a "B" eliminator, it was almost certainly designed for the B-H tube. A new tube will probably give you a tremendous increase in power and quality.

If you are experimenting, and require an unfailing source of steady D.C., you can be sure of an efficient heavy-duty rectifying tube in the B-H.

NATIONAL CARBON CO., Inc.
New York, N. Y.
Unit of Union Carbide UCC *and Carbon Corporation*

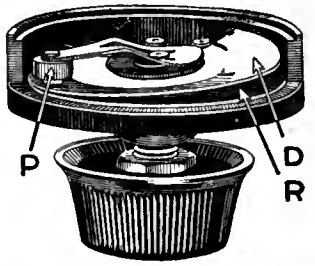
EVEREADY RAYTHEON

FOR WANT OF A NAIL

EVERYBODY remembers the verse about the courier in the battle of Waterloo speeding to get reinforcements for Napoleon. His horse faltered and fell. . . . For want of a nail a shoe was cast . . . and the battle lost.

A radio receiver is very much the same. You may have the "reinforcements" in the form of fine workmanship, good condensers, good transformers and yet there may be a "nail" that causes trouble. Look to the volume control for a great amount of the grief . . . mechanical and electrical noise . . . inadequate and uneven control. Are those the symptoms?

Then turn to Centralab controls whose quality is vouched for by this fact: the great majority of radio manufacturers include them in standard equipment. Be sure the manufacturer of the receiver you sell has done likewise.



This shows the exclusive rocking disc construction of Centralab volume control., "R" is the resistance. Contact disc "D" has only a rocking action on the resistance. Pressure arm "P" together with shaft and bushing is fully insulated.



This is the action of the usual wire wound control after it has been in use for some time . . . like dragging a stick over a cobblestone pavement.



The tailor uses the same principle as Centralab. He does not want to ruin the garment by placing the iron on it so he places a cloth in between. Centralab controls cannot ruin the resistance because the rocking disc is in between the pressure arm and the resistance.

Centralab
CENTRAL RADIO LABORATORIES
20 Keefe Ave. Milwaukee, Wis.

According to Your Specifications



WE ARE prepared to make special models of the Hammarlund Equalizing and Neutralizing Condensers, either single or in gang, to manufacturers' specifications. Superbly designed and constructed—compact, accurate, efficient.

Bakelite base; brass stator plate; mica dielectric; phosphor bronze spring plate; convenient adjusting screw and connecting lugs.

The standard models range in capacity value from 2 mmfds. minimum to 70 mmfds. maximum.

Write Dept. RB8 about your needs

HAMMARLUND MFG. CO.
424-438 W. 33rd St., New York

For Better Radio
Hammarlund
PRECISION
PRODUCTS



Compare Them

The best way to satisfy yourself that Audion 427 is humless is by a direct comparison with the -27 type tubes you now use.

DE FOREST RADIO CO.
JERSEY CITY NEW JERSEY



de Forest
AUDIONS



Screen Grid Tubes and Power Detectors

Get the Thordarson August Bulletin

Input Couplings
Speaker Couplings
Filament Supply
Power Compacts

For the new "245" power tubes—single or push-pull—and the new screen grid power detector.

THORDARSON

Transformer Specialists Since 1895
THORDARSON ELECTRIC MFG. CO.
Huron, Kingsbury and Larrabee Streets
Chicago, Ill.

With an Audio-System really Designed for Short-Wave Work



A special audio system has been built for this Double-Duty National THRILL BOX SW-4. It embodies new improvements on the former NATIONAL Impedaformers, permitting the use of a high-mu audio tube and giving a very high audio-gain. The two audio-units are placed in one case for compactness and to make wiring more simple. And the SW-4 is designed for stable and quiet operation with a 200-A detector—an added and unusual advantage.

Every other detail is just as carefully thought out. The SW-4 is not a copy—it bristles with new and ingenious details for your convenience and pleasure.

Operates from NATIONAL Velvet-B

Write us today for full details

NATIONAL

4 Tube THRILL BOX SW-4

NATIONAL CO. INC., Malden, Mass.

Est. 1914

Potter

True-Tone Electrostatic Reproducer

NEW DESIGN
NEW PERFORMANCE
NEW APPEARANCE

Created
Great Sensation
at
R. M. A. Show

Potter

Type "BE" Electrochemical Condenser

Ideal for Filter Blocks

(Edelman Patents)

The Potter Co.
North Chicago, Illinois

A National Organization at Your Service

THREE OF A KIND



NEW YORK PLANT 829-839 E. 134th St.—where Polymet Condensers and Resistances are made.

COILTON DIVISION Easton, Pa., the home of Poly-Coils.

STRAND & SWEET DIVISION Winsted, Conn.—where Polymet enameled magnet wire is manufactured.

that beat everything!

The Three New Plants of

POLYMET

The seal of good radio set essentials

POLYMET MANUFACTURING CORPORATION
837 East 134th Street New York City

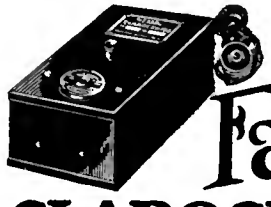
POLYMET PRODUCTS



Improve Selectivity!

PLUG in a Falck Claroceptor between wall socket and radio set and eliminate "static" from motors, street cars, telephones and electrical appliances. This new improvement by a pioneer radio parts manufacturer grounds and thus blocks out line interference noise and radio frequency disturbances. *Also improves selectivity and distance.* Requires no changes in set. Measures just 3½ x 5½ x 2½ inches. Thousands now all over America use the Claroceptor for clearer A. C. reception. Get one right away—at radio parts dealers. Write for descriptive folder.

$7.50 complete with cord and plug



Falck
CLAROCEPTOR

Built by ADVANCE ELECTRIC CO.
1260 W. Second St. Los Angeles, Calif.
JOBBERS and DEALERS, GET OUR PROPOSITION

SPECIAL TEST EQUIPMENT



for use in the service laboratory is soon to be announced. This will include an oscillator for measuring the over-all response characteristics of a receiver for the entire broadcast band. It will be inexpensive, compact, and of General Radio quality.

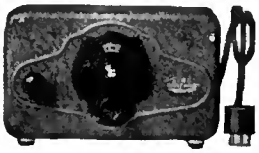
Write for Bulletin G-1

GENERAL RADIO COMPANY

30 State Street
Cambridge, Massachusetts

274 Brannan Street
San Francisco, California

AERO-CALL



Factory-Built, Ready to Plug Into Any Set

Shielded—Filtered No Motorboating

This amazing instrument now makes it possible to reach 'round the world. Geo. Moicroft, of Pa., tuned in England, Australia and Holland on his initial test. Gets stations regular receivers cannot get. No change or wiring required. All complete, ready to operate. Golden brown, compact metal cabinet in crackle finish. Size 9x5½x2¾ in. The only converter we know of that really works on all sets. Twn nindels—A.C. and D.C., at $25.00 each. Write for Catalog and literature and dealers' discounts; also give jobbers' name.

Send for Aero Short Wave Guide

Gives the very latest details on Aero Coils and Kits, Short Wave Radio, newest broadcast radio receivers, short wave converters, telephone transmitters, coil kits, adapters and a host of new wrinkles for 1929. The kits everyone is talking about are fully described. Chronophase, Metropolitan, Trio, International, Standard, Radinphone—in Shield Grid, A.C. and D.C. models—all good summer sellers.

Be sure to send for your copy—worth $25.00 to anyone who wants to keep up with the latest radio wrinkles. Mail coupon for your copy today—**now!**

AERO PRODUCTS INCORPORATED

4611 E. Ravenswood Ave., Dept. 289, Chicago, Ill.

.....MAIL THIS COUPON NOW.....

AERO PRODUCTS Inc.
4611 E. Ravenswood Ave., Dept. 289, Chicago, Ill.

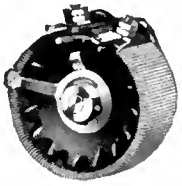
Send me your Short Wave Guide, giving the latest information on what's new in radio, short wave, etc. to help me boost my summer sales.

Name.....

St. & No. .....

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

FROST-RADIO Brass Tack Talks on Rheostats



Your experience with rheostats is likely to have convinced you they are made either to *wear* or to *repair*. Frost Rheostats are made to WEAR. And how they do live up to their reputation! There doesn't seem to be any "wear out" to them. Rheostats we made years ago are still giving the same trouble-free service they rendered the first day they were installed. Windings, contact arms, spring tension, knobs, frames—all are designed primarily for SERVICE.

Having made many millions of rheostats of all sizes and types, we have gained a wide experience that is reflected in today's Frost Rheostats—the finest your money can buy.

It may interest you to know that we could save much by making Frost Rheostats not quite so good—but we don't and we won't. The best of everything, tested countless times during manufacture, is combined with our knowledge of rheostat design and construction to give you as close to absolute perfection in a rheostat as modern science can produce.

For your protection, and to insure the best possible reception for your set, insist that only Frost Rheostats be used. Then you will know that their service will equal that of the set itself.

HERBERT H. FROST, Inc.
Elkhart, Indiana
169 North La Salle Street, Chicago, Ill.
The World's Largest Manufacturers of High Grade Rheostats

ROBERT S. KRUSE

Consultant and Technical Writer

103 Meadowbrook Road, West Hartford, Conn.
Telephone Hartford 45327



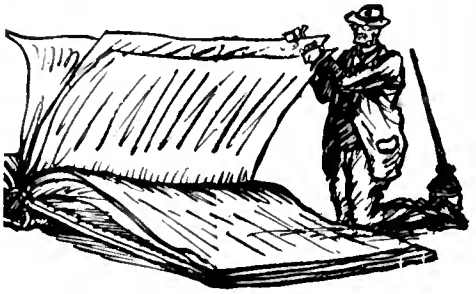
Off the DEEP END

Christopher Morley

. . . "No one doubts the amazing vivacity and facility of Christopher Morley . . . 'Off The Deep End,' like several of its predecessors is a collection of stray pieces, short stories, brief playlets, humorous squibs and Lambsian essays. The reader saunters, so to speak, through Mr. Morley's engaging purlieus admiring the gusts of the greenery, the sparkling quality of the streamlet of wit and the whimsicality of the curious growths"—*New York Times.*

. . . "Whatever he does will be fascinating talk . . . talk which makes his book of essays a pleasant adventure"— *New York Evening Post.*

. . . Other books by Christopher Morley. THE ROMANY STAIN, WHERE THE BLUE BEGINS, THUNDER ON THE LEFT *and* THE HAUNTED BOOKSHOP.



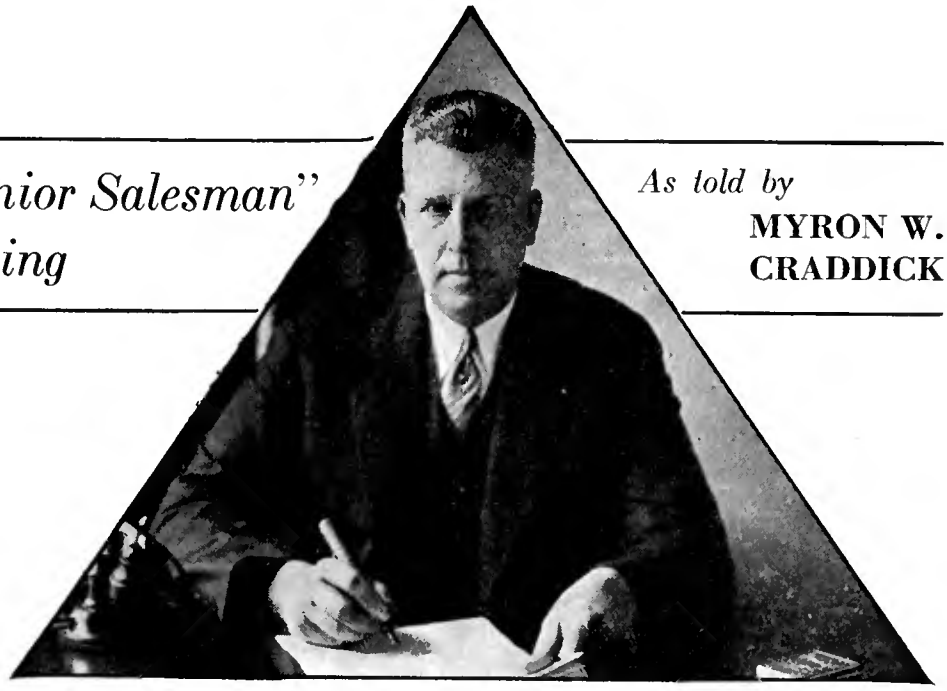
DOUBLEDAY DORAN & COMPANY, INC.

Garden City, New York

$2.50 at all bookshops

Introducing the "Junior Salesman" Plan of Merchandising

As told by
MYRON W. CRADDICK



A JOBBER LOOKS AT HIS DEALERS

THE NEXT few years in radio merchandising will see a rapid development of what can best be described as the "Naborhood Radio Store," a standard-price store carrying recognized lines and giving reliable service to a well-established local clientele, according to Myron W. Craddick, vice-president and general manager of the Mackenzie Radio Corporation.

That prophecy, together with an explanation of his novel "Junior Salesman" system for maintaining close jobber-dealer contact and first-class service for dealer customers, formed the closing part of a recent interview with Mr. Craddick on present merchandising trends and practices. As managing head of the Zenith distributing organizations in Connecticut, southern New York State, northern New Jersey, Westchester, and the Bronx, Mr. Craddick has an intimate knowledge of merchandising methods in the entire gamut of markets: metropolitan, urban, suburban, and rural.

In weighing the worth of present trends in radio merchandising, he balances two sound ones against two unsound ones. The increasing recognition by individual dealers that a small number of lines can mean more business than a large number of lines, and the recent efforts by progressive dealers to build up a permanent clientele, he considers sound. The frenzied price-cutting by some of the chain-stores, and the continued apathy of dealers toward the radio service problem, he terms unhealthy.

The "Junior Salesman" scheme, which will be described in later paragraphs here, was evolved to stimulate dealer-interest in the first two trends, and to offset as much as possible the deleterious effects of the latter two.

A Word of Warning

"BEFORE WE START," Mr. Craddick warned, "remember that while my experience with dealers gives me intimate views of their problems in practically every type of community and market, what I say about one market doesn't necessarily hold true for another. Some of the policies that my dealers in New Jersey towns have found most profitable, for instance, are not acceptable to d alers in the Bronx. And there can be no attempt to impose a majority precept on the minority dealers; each dealer has his own problems for which there can be no text-book solution."

More and more dealers in all types of markets, however, are coming to realize that they can do more business, with greater satisfaction to each customer and a corresponding increase in prospective customers, by handling one or two lines of radio receivers than by handling eight lines, according to Craddick.

"A floor salesman can learn all there is to know about a couple of good makes of sets, where he can't hope to grasp more than a superficial knowledge of each of seven or eight makes. And, of course, a floor salesman who knows his sets inside out can explain and sell any one of them to a customer with conviction and assurance. No customer is easily sold when a salesman talks about a set like an advertising pamphlet, but is unable to answer particular questions about its construction or operation.

"Again, no dealer's serviceman can be expected to become an expert in each of seven or eight different makes. And a dealer's serviceman who makes a service call and can only stall around until he admits that he'll have to get hold of a factory serviceman, has done about all he can do to lose for the dealer the prospects that that customer, if pleased, should normally provide."

Radio Vs. Automobile Trade

THERE IS a close analogy between the radio dealer and the automobile dealer, as Mr. Craddick sees it. The day of the general motor agency, where one dealer handled as many different makes of car as he could contract, has long since passed, even in small communities. Automobile dealers now have one or two different lines, and their salesmen are thoroughly familiar with the product they sell. Furthermore, the man who purchases an automobile to-day has absolute confidence in the dealer's service department, since he knows that the garagemen are experts in that particular make of car. In the early days, the automobile purchaser learned by sad experience that the sales agency's service department was only a tinker-shop, no more wise in the ways of his car than

was the "General Repair" garage down by the freight depot, and was in fact often less capable. That feeling exists now about the average radio dealer's service department, and the sooner it is counteracted by the dealers the better for radio merchandising.

The recent revival of the long-condemned practice of price-cutting has had a serious effect upon the radio retail trade. Whether or not the chain-store system is going to prove economically sound in the radio business, Craddick does not attempt to prophesy; but the cut-price policies of some of the metropolitan stores are, to his mind, short-sighted. The manufacturers who permit their lines to be advertised and sold at cut prices, he points out, may be helping themselves out of a temporary over-produced condition, but they are nipping whatever faint buddings of dealer loyalty and confidence they may have raised.

"No dealer who is attempting to build up a stable business in a community can be expected to utter cheers when he finds that list prices on a certain line are made only for some competitor to undersell," he said. "But the question of price-cutting has been argued ever since radio retailing came out of the novelty trades."

Dealer apathy toward the service problem is decreasing at far too slow a pace, Craddick has found. There are, he adds, one or two reasons why that is so, but they are only superficial reasons.

"Very often the dealer gets a call for service from a customer, and sends the serviceman around only to find that there's nothing wrong with the set. The customer isn't satisfied with that report; he still says the set isn't working properly, and back goes the dealer serviceman for a second time. I've known cases where the dealer serviceman has made four calls, each with the report that the set was operating all right. The customer, still dissatisfied, hounds the dealer until the latter asks the distributor's serviceman, or a factory serviceman, to look the set over. The report is still 'O. K.', but the customer believes the factory man where he didn't believe the dealer's man.

"And the one thing that a dealer's service department should do it doesn't do, in ninety cases out of a hundred. That is, to make an unrequested inspection visit a week or so after a set has been installed in a customer's home. Such a call will often uncover little things that have been bothering the customer; lots of times the customer hasn't learned how to tune the set properly, and doesn't realize that he's not getting the reception he is entitled to have. And, even when that second visit, the 'call-back' trip, as we term it in our organization, doesn't find anything that the serviceman should correct, it makes a splendid impression on the customer and gives him the feeling that the dealer is genuinely interested in having him satisfied.

"Too few dealer servicemen avail themselves of the opportunity of spending two or three days in the factory learning how the sets are made, and why. That's the shortest and surest way for them to become experts in the particular lines that their employer handles, and the distributor and manufacturer are more than willing to give them the free tuition, so to speak, if only they'll signify a desire to receive it."

The "Junior Salesman" plan, which has now had almost six months' trial and has proven itself a thorough success, has incidentally demonstrated the value of the "call-back visit" beyond any doubt.

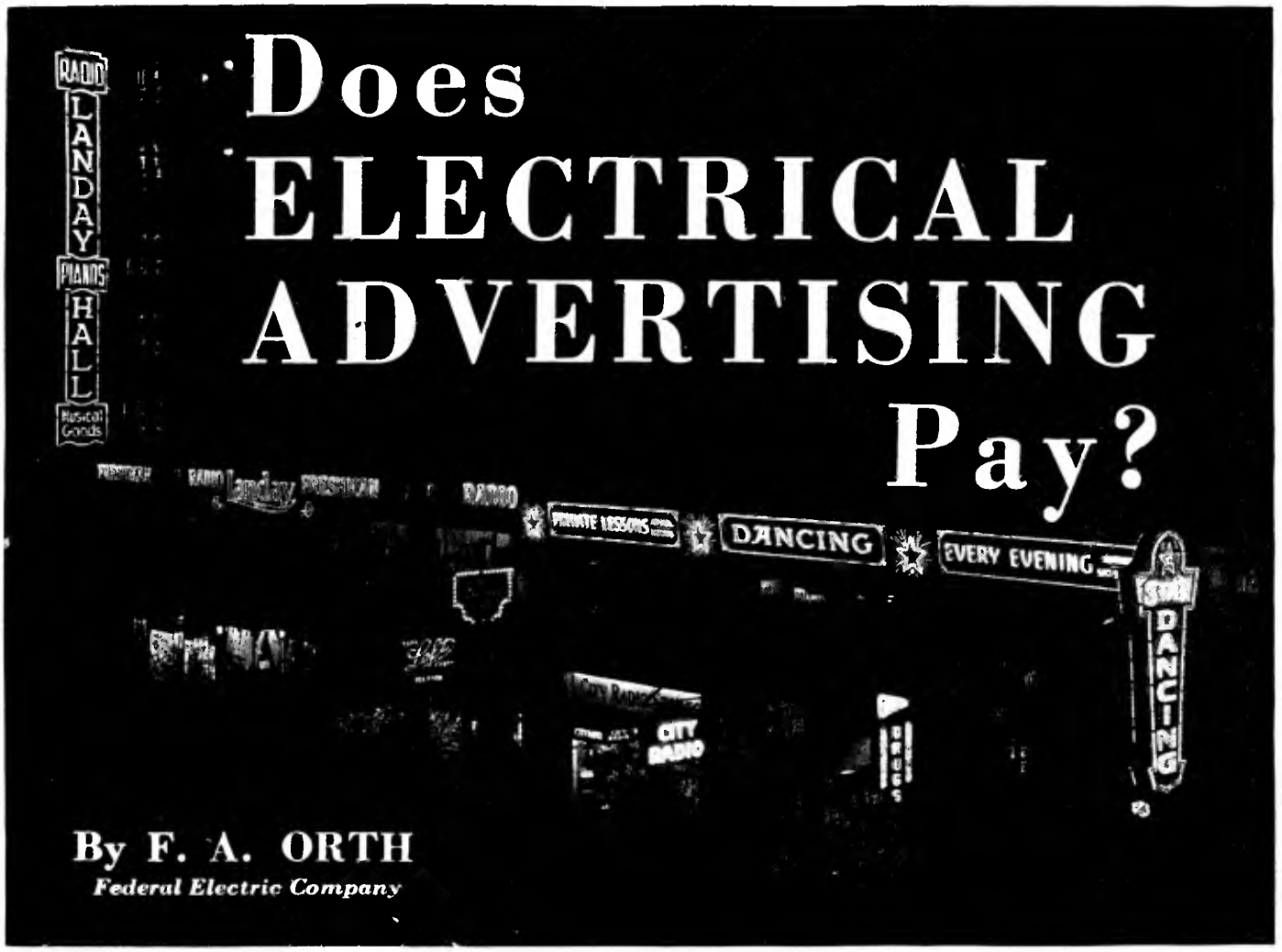
Briefly, the "Junior Salesman" plan is this: the jobber's salesman, who covers a large area and acts as salesman, contact-man, and adviser to

(*Continued on page 242*)



One week after a new set is installed the junior salesman makes an unrequested inspection visit.

Does ELECTRICAL ADVERTISING Pay?



By F. A. ORTH
Federal Electric Company

NEON!

What is it? Is it a man's name? Will a neon sign help my business? Is a neon tube sign to be preferred over a lamp bulb electric sign? Are there wires in neon tubes? What will it cost?

These and many other questions arise in connection with neon tube signs—the most outstanding development in the history of the electric sign industry. Consequently, there will be answered in this article those questions which are asked most frequently, so that the reader may obtain a general understanding of the very real value of this type of advertising.

It was in 1898—thirty-one years ago—that a new gas was discovered by Sir William Ramsay. He gave to this new element the name "Neon," a Greek word meaning "new." Soon afterward, he discovered that when an electric current is passed through this gas sealed in a tube, a beautiful orange red color results. Realizing the possibilities of his discovery from a commercial standpoint, the following year he asked Georges Claude, a Frenchman, to endeavor to develop his discovery so that it might be utilized in this way. Georges Claude accepted Sir William's proposal and together with J. de Beaufort, worked with this new gas in his Paris laboratory, devising methods and devices for its practical use.

As a result, in 1914, the first neon commercial signs made their appearance in France. To-day, many outstanding examples of the advertising value of neon light mark the thoroughfares of Paris and other European cities, as well as those of this country.

What was, perhaps, the first neon sign erected in this country (United States) was the Packard sign manufactured in Paris and brought to San Francisco by Earl C. Anthony. It was placed on the home of Packard Motors in San Francisco in 1922. It read "PACKARD, EARL C. ANTHONY, INC."

The word "PACKARD" predominated in the sign, while "EARL C. ANTHONY, INC." appeared directly beneath the word "PACKARD," and was, apparently, an enlargement of Mr. Anthony's handwritten signature. The sign was forty feet long and twenty feet high. Considerable interest was created along Van Ness Avenue with the appearance of the Packard sign.

Growth of Electrical Advertising

SINCE THEN, successful business men have been quick to realize the commercial value of neon tube signs as a real asset to business. Many who had not previously entertained the idea of electrical advertising, as embodied in the type of sign which derives its lighting effect from electric lamps, immediately grasped the opportunity afforded by neon. Since the appearance of the first neon sign in the United States, the growth of electrical advertising in the neon field has been phenomenal; in the short period of seven years—1922 to 1929—numerous signs and ornamental designs have been erected throughout the country.

Neon signs and ornaments may be used not only where other electrical display signs are adaptable, but in many other places as well. Trade marks and designs may be reproduced accurately inasmuch as the tubes can be bent to any desired shape. They may be erected where the electric lamp sign cannot be utilized.

For example, the tower of the Coliseum in London is outlined with red neon tubes. At night the tower stands out in

beautiful relief against the black background of the sky and has caused unstinted admiration throughout London. This application of neon light to the Coliseum is typical of the various uses of neon. It may be used on buildings of unique architecture to serve as a border for the windows, doorways, or even the entire building. It takes no stretch of the imagination to visualize the beautiful effects which may be created in this way.

Neon tubes do not have in them any wires of any kind. There is merely an electrode extending into the tube from each end for about two inches. The tube is filled with neon gas and when an electric current is passed into the tube, the gas conducts the electricity, giving off a color of a predetermined hue. Different colored lights—yellow, green, blue, tan, and violet—are obtained by the addition of certain gases or the use of glass tubes of special composition.

particular store, and ascertain whether or not an electric sign influenced him in any way.

"By George, you're right," he replied almost before I had finished. "I went out to buy some flowers the other day to send to a friend of mine who is in the hospital. I looked around for a sign, subconsciously. I now realize I saw one erected over a florist's place of business, and went there to buy those flowers."

And so it is. Consciously or subconsciously, in the prospect's mind, an electrical advertising display sign plays an important part in determining for the prospect where he will buy. It reminds him of his needs and wants while he is on the buying path.

During the day, your sign's distinctive lettering, background, and design stand out in sharp contrast to the surroundings, compelling attention and action and bring people

DATA ON A TYPICAL SMALL SIZE DOUBLE-FACED DEALER'S SIGN

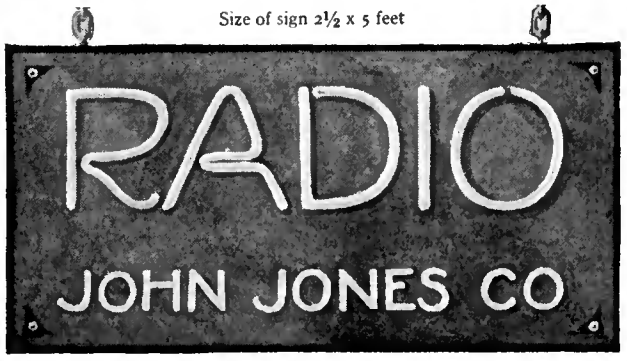
COST OF VARIOUS TYPES

(1) Radio in 12-inch Neon letters and company name in 4-inch Silveray letters. Price: $290.

(2) All reading matter in Silveray letters. Price: $200.

(3) Radio in lamp illuminated letters and company name in Silveray letters. Price: $235.

Size of sign 2½ x 5 feet



OPERATING COSTS

(1) Initial installation all types $18.00

(2) Cost of current.
Sign No. 1 $4.95 per month
Sign No. 2 $9.90 per month
Sign No. 3 $14.88 per month
(See column on left)

(3) Replacement Neon tubes $7.50 per letter. Average life 5000 to 12,000 hours.

Neon signs or ornamental writing are effective twenty-four hours a day. They may be illuminated with almost equal effect both day and night, regardless of climatic conditions. Sunshine has little effect on their brilliancy or legibility.

"But," you ask, "will a neon electrical advertising display sign help my business? Will it pay?" And those are fair questions. In answer, it is interesting to observe that there are over a quarter of a million electric display signs burning every night in this country, and that millions of dollars are spent each year by progressive merchants and manufacturers on electrical advertising display signs. Hard-headed business men who insist that proof of forthcoming results be given with each item calling for an appropriation in the annual budget seem to agree that electrical advertising does pay.

Proof of Sign's Value

AN INTERESTING example of the effectiveness of electrical advertising came to my attention only a few days ago. I was talking to one of my business associates, when he asked me, "How can you prove, without a doubt, that electrical advertising pays? Of course, you can tell me that millions of dollars are invested annually in electrical advertising and that an electric sign guides people into the store over which it is erected, but how can you prove that those people who go into a store having an electric sign would not go into that same store were there no sign erected there?"

In reply, I asked him to see whether or not he could answer that question for himself—to prove from his own experiences, that electrical advertising does pay. To help him along, I asked him to think back over his purchases during the last few days, determine what prompted him to buy in this or that

into your store to buy. At night it blazes your message to passers-by and tells them who you are, where you are, and what you sell. In addition, week after week, month after month, people see your sign and become more and more conscious of your store and what it sells. Then, when they are in need of a radio, your sign's message comes to mind and their wants are satisfied at your place of business.

Tying in on Advertising

A POINT QUITE often overlooked by many radio retailers is that the electric sign enables them to cash in on local or national advertising done by radio manufacturers. It is the connecting link between local or national advertising and the retailer's place of business. Magazine, newspaper, car-card, and billboard advertising create in people the desire to buy, whereas *electrical advertising tells them exactly where to buy the article they want.*

The value of electrical advertising to the retailer under these circumstances becomes at once apparent. Thousands of dollars are spent annually by radio manufacturers to advertise their product—to create in people the desire to buy the particular radio they manufacture. People read these advertisements, decide to purchase the radio advertised, and start out on the buying path. The retailer, having a sign erected over his place of business, indicating that the radio which that person is looking for may be found there, is the one who makes the sale.

Many manufacturers, realizing the value of electrical advertising as a medium which enables them to enjoy greater returns on their national advertising, go to retailers with a proposition like this:

"Mr. Retailer, you agree to handle our radio for a certain number of years and we will pay part of the purchase price of an electric sign to be erected over your place of business. You may suggest the reading matter for the body of the sign. All that we ask is that you include on the sign the trade name of our radio."

Because painted signs peel in hot weather and need repainting at least once every six months to keep them attractive in appearance, users of electrical advertising display signs are turning more and more each day to the vitreous-enameled iron sign. This type of sign needs only an occasional washing with soap and water to keep it always as new in appearance as it is on the day it leaves the factory; it does not fade or peel in hot weather; it is impervious to heat, cold, rain, and snow, and it never requires repainting of its faces. It is manufactured by all reputable sign manufacturers and is invariably recommended by them because of its outstanding advantages over the painted type of sign.

The purchase price of a vitreous-enameled iron sign is slightly greater than that of a painted sign, but, when the cost of repainting a painted sign every six months is added to a painted sign's original cost, the vitreous-enameled iron sign is found to be cheaper in price in the long run. In addition, it is more attractive and, when properly designed and erected, adds considerable attractiveness to the building on which it is erected and to the district in which it appears.

Two Types of Signs

And now for the question, "What should an electric sign say?" The answer is that the sign should say, in effect, either "buy me," "buy here," or both.

A "buy me" sign has on it words such as radio, drugs, or hardware. It tells prospects what they can buy in the store it advertises. It is specific.

A "buy here" sign has on it the name of a company, a trade name, or a trade mark. It, too, tells prospects what they can buy in a store, but does it by carrying a name which, in the prospect's mind, is associated with specific merchandise. It is not specific.

A sign which is specific—which has on it the name of merchandise being sold in a particular store—is usually more effective than a sign that carries only a company name or trade mark.

Of course, if a company name or trade mark is so well known that it is instantly associated in the prospect's mind with a specific product, then it is just as effective as a "buy me" sign.

If the size of the sign permits, it is well to show on it both the type of product which may be bought in the store it advertises and the name of the company. If in doubt as to which type of sign to choose, it is best to purchase a "buy me" sign.

A neon sign costs slightly more than an incandescent lamp sign of the same size, but its current consumption is approximately one third that of the incandescent sign.

Cost of Electric Signs

Information of a definite character regarding the cost of the various types of illuminated signs may be of interest. In this connection a typical double-faced dealer's sign $2\frac{1}{2}$ by 5 feet will be considered as an example.

Assuming that the word "RADIO" is to be in 12" Neon letters and the words JOHN JONES CO. in 4" Silveray (raised white glass) letters, and that the sign is to read the same on both sides, the cost would be $290.00. Should all of the reading matter be in Silveray letters, the cost would be $200.00. Should the word "RADIO" consist of lamps on the outside of the sign and the words JOHN JONES CO. be in 4" Silveray letters, the cost would be $235.00. In each case the installation cost would be approximately $18.00 and the body of the sign would be made of vitreous-enameled iron.

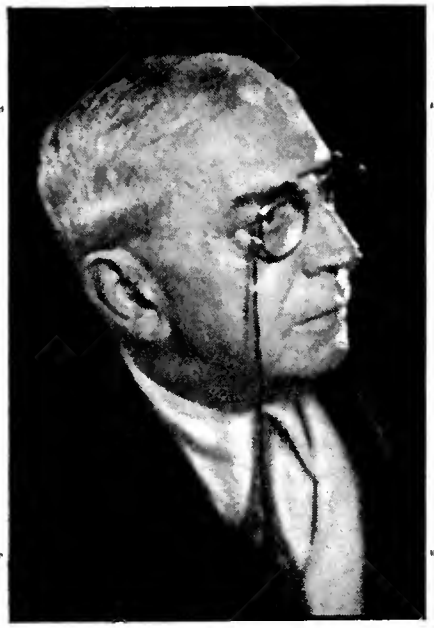
The cost for electricity where the word "RADIO" consists of lamps on the outside of the sign, would be approximately $14.88 per month, while the cost for electricity, should all of the reading matter be in Silveray, would be approximately $9.90 per month. In the case of the word "RADIO" being in Neon and the words JOHN JONES CO. being in Silveray, the cost for electricity would be approximately $4.95 per month. The above estimates are, of course, for average conditions.

It is obvious, therefore, that although a Neon sign costs slightly more than the other types of signs, the difference in cost of current quickly makes up for the difference, at which time the increased value of the Neon sign continues to manifest itself.

The cost of upkeep in the case of Neon means only those costs that are necessary to have the signs washed occasionally with plain soap and water. The tubes burn anywhere from 5000 to 12,000 hours and may be replaced, in this instance, at a cost of about $7.50 per letter. The electric lamps in the sign undergo "casualties" no more than the ordinary lamp in your home.

Vitreous-enameled iron signs never require repainting, therefore the upkeep is confined merely to keeping the sign clean, a cleansing process being necessary not more often than once every three months.





HOWARD W. DICKINSON *says—*

IF I OWNED A RADIO STORE *I'd make it* PAY.

THE ABOVE title comes naturally to one of my breed. Most any advertising man or ex-advertising man is a Mr. Fixit by habit and training.

The idea of my owning a radio shop is not such a far cry, though. I am keen for radio, convinced that it has possibilities much higger than are being realized. I should enjoy retailing. It is the intimate, human side of business contact which interests me. A retailer of experience is apt to be a good judge of human nature. He may or may not be skilled in catering to human beings—but he generally understands them pretty well.

Why I'd Enjoy Radio Retailing

I LIKE MECHANICS and electricity. I am reasonably handy with tools and I like the adventure that lies in the things a radio set can do. Yes, I'd enjoy the retail radio business.

While the above does not prove that I would be a good radio retailer, I hope it indicates that I would be an enthusiastic one. In fact I have enjoyed thinking about it so keenly that I have pipe-dreamed myself into the business already. I am afraid I have even bothered a few dealers by sticking around and asking questions, disguised as a customer. I really am a customer for a new set but I can't afford to buy one from every dealer I've talked to, so I hope the others will forgive me.

In my pipe-dream radio business I am keen to see how my competitors do it. And I am sorry to say I've seen some poor salesmanship in radio shops. I've been rather high-hatted in a great department store's radio department. The "brilliant" young salesman couldn't see why I wanted to look around and ask questions. He couldn't see why I need do any more than follow his advice. He was very courteous about it all, but to me it seemed like the kind of courtesy which comes out of a can rather than from a chummy heart. Evidently he has been instructed on how to work on *averages* of human beings rather than to try to understand individual human beings. In some of the smaller shops I've found proprietors who seemed so keen on repairs and service that they didn't seem to have any keenness left for making a sale. Give them a pair of pliers and a screw driver and they fairly purr. Give them a cash customer for a new set and they don't act naturally, although they really want to make the sale.

That's where I imagine my pipe dream might make me a living. I'd get a tremendous pleasure out of demonstrating and selling. I'd feel that I was selling daily joy, that I was selling high adventure, and I'd try to make my customers see it.

Oh, I wouldn't gush too much about it, particularly with men. "Not half bad," to a man may mean more than "glorious, gorgeous, simply perfect" might mean to a woman. If I were dealing with a woman I'd not try to imitate her adjectives either, as a woman knows how to interpret men, and senses intuitively whether or not they really believe in the stuff they are trying to sell.

Where I have an idea that I might fall down would be on trade-ins. I am afraid I would allow too much on trade-ins and rob myself of profits. On the other hand, I would need every bit of my profits. I know I should need them to support a good service shop and also to put a little money in the bank, and above all things there is another thing I'd try to do. Even if I had a little eight by twelve hole-in-the-wall store, I'd organize it as a business, pay myself a salary as manager, and expect to make a profit as owner in addition to that. I'd have a good bookkeeper, at least part time, and I'd learn how to use a bank for my own profit and advantage.

Many a small dealer falls down by forgetting or by not learning these things. He thinks all the money in the till and in the bank is his, and forgets that all the bills are his too, also that the kind of troubles which may come from sailing too close to the wind will be his, too. He doesn't figure out whether all the money he takes out is salary or profit or what is the proportion of each, and he lacks the check-up necessary to make him increase his working capital up to the point of safety and progress.

Dividing the Surplus

SUPPOSE HE has made a gross profit of $15,000. If he pays himself a $3500 salary—takes a business profit of $2500—he can put $9000 into surplus and working capital, be in position to expand, open another shop, or take a bigger place and equip himself for a bigger business. If that $15,000 means a new high-priced car and a lot of luxuries—look out!

I have seen businesses successful one year, go broke the next year, even when they didn't need to. Usually it is because they used all the profits and put none into sinking fund or usable surplus.

Two valuable things can be had from that $9000 undivided profits—insurance against a temporary slump and more promotion. I've taken the small shop as an example. A $15,000 gross profit is not a big business. The principle is just the same with $50,000 or $150,000 or $6000 gross profits. I consider

a business profit one of the most important things for a beginner in retailing to look out for—and surely the experienced dealer should know all about it.

If I could pay myself a salary as manager of a business and make a profit as *owner*, then my business would be a success and I would only have to hold my extravagant tastes down till the business had grown to such a point that I could afford to gratify some of them.

Another thing I should do is to begin to write off the value of all my equipment, store furniture, and fixings—tools and all. If that equipment cost $5000, I should figure on paying myself for it in five or ten years out of profits. So in my surplus I figure myself as setting aside $1000 cash, or less, for this purpose. Suppose I make it $1000. Then in five years I have made my equipment earn the money to pay for itself. I can add to it or junk it for what it will bring and have the cash to buy more up-to-date fittings. To get in the position where you are five years ahead of your business furnishings in money instead of five years behind them is to be on the road to worth-while success.

Another thing I'd do with a part of my surplus would be to keep my insurance up to the minute.

The Bankers Advice

I SPOKE ABOUT using a bank for my own profit and advantage. I'll tell a simple little true story about that. A grocer in Cambridge, Mass., went to his banker to make a loan. He was a bit crowded on some over-due debts to jobbers. The banker was a good friend of his and a customer of his store. The grocer wanted a $5000 loan. It was refused. Jones, the grocer, said, "Do you know that this refusal of yours may wreck me?" The banker replied, "Sure I do, that's why I must refuse you. I can't see where we'd get our money back. However, Jones, let me ask you some questions. How much do you take out of your till for your own personal use?"

"Oh I guess about $4000 a year, I don't keep track of it."

"Second question, how much do you take home from your grocery stock for your family use?"

"Oh, I don't know, not much. I don't keep track of it."

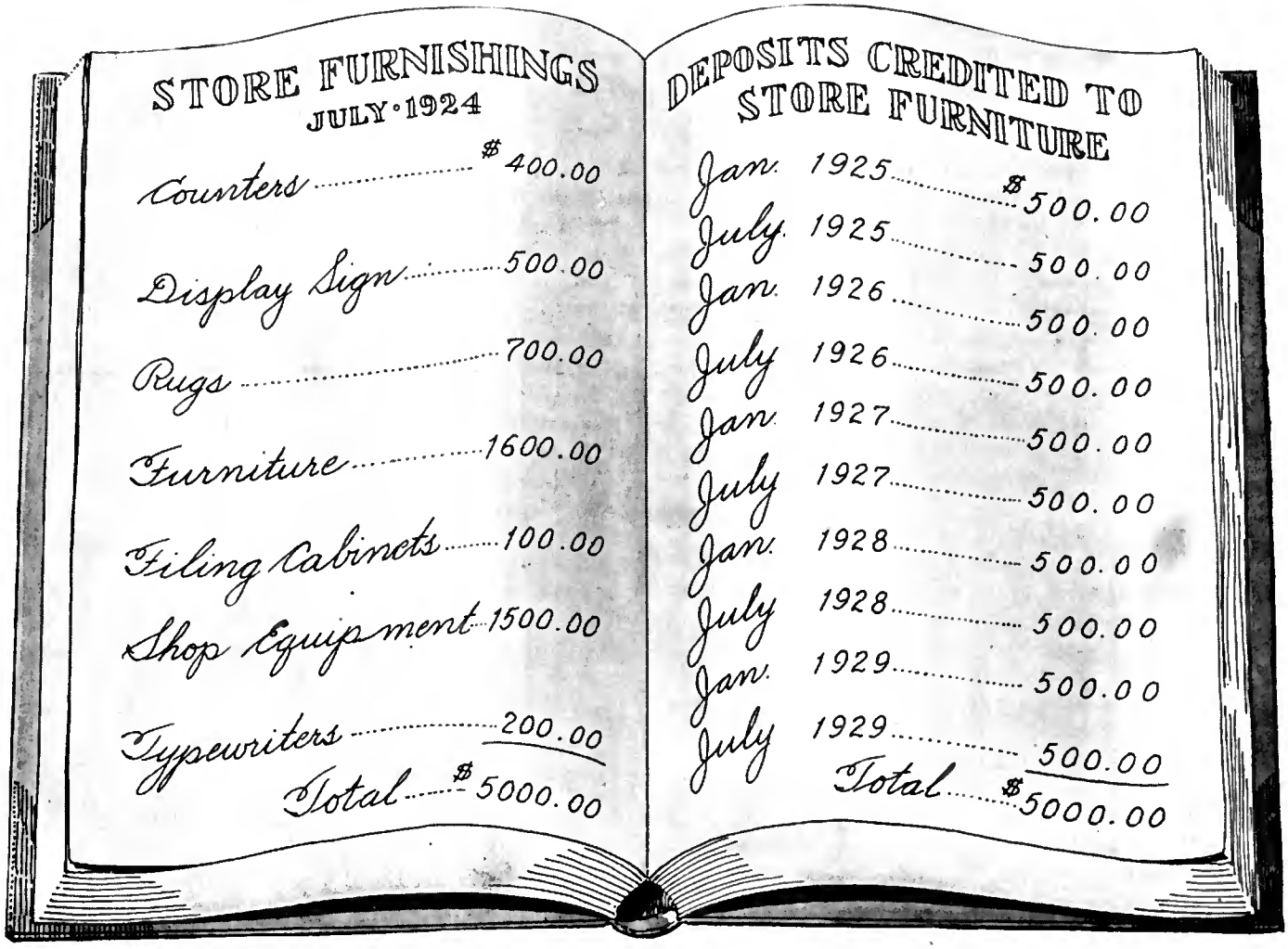
"Jones," said the banker, "if you will do what I tell you to, I'll lend you $10,000 instead of $5000. Here's what I mean. I want your solemn promise to give yourself a salary of $4000 a year, not a cent more. You can pay yourself by the week or by the month as you choose, but never a cent over your salary. Second, you must promise to charge against profits every thing you take home, and keep an exact account of it. At the end of the year you can figure out what profits you have left and they will be yours, but even then you should leave a part of them for extra capital."

Jones agreed. He had to. At the end of a year he had a profit of a little over $5000. He had taken out his salary of $4000 and nothing else, except his own groceries which he charged to himself. He was surprised to see what his own groceries had amounted to, even at wholesale prices. He found that while spending only $4000, his salary, he had to economize and move carefully to get by, but he did it.

Jones admitted to his banker that previously he had probably been spending about three times as much.

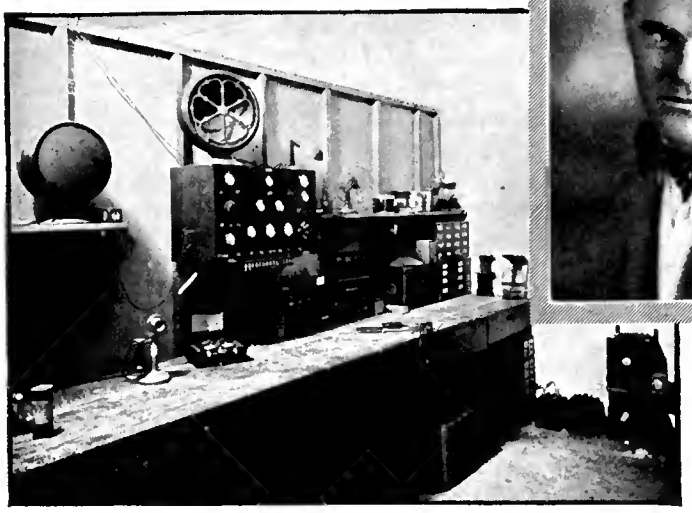
"There you are," said the banker. "Your business makes a

(*Continued on page 229*)

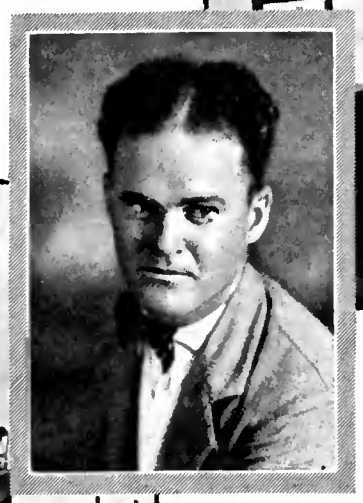


Mr. Dickinson says, "To get in the position where you are five years ahead of your business furnishings in money instead of five years behind them is to be on the road to worth-while success."

A Wide-Awake Dealer Solves Some Problems That Every Radio Merchant Meets



General view of Whitaker's service shop





A corner of the display room

Whitaker, of Bradentown

bases his success on adhering strictly to four business principles:

1. *Prompt and intelligent service.*
2. *Consistent and persistent advertising.*
3. *Outside selling with home demonstrations.*
4. *A simple, complete cost system.*

B. B. Barber *tells—*

WHAT A FLORIDA DEALER DID

OPERATING IN a town of 18,000 where radio reception other than that from local stations is limited to about six months of the year, A. K. Whitaker, of Bradentown, Florida, has done a job of radio merchandising which is outstanding. The factors on which Whitaker has built a monument of success are only four. And these four factors, he feels, will serve to spell success for any dealer anywhere who will apply the principles, adapting them to the more or less local conditions with which he may be surrounded.

Whitaker's Four Principles

AS OUTLINED by Whitaker these principles are:

1. Prompt and intelligent service.
2. Consistent and persistent advertising.
3. Outside selling with home demonstrations.
4. A simple, complete cost system.

After the bottom had fallen out of Florida real estate, Whitaker opened his store, June, 1926, with two lines of radio and an electrical refrigerator account. It is interesting to note that none of the original lines is carried to-day; the electrical refrigeration business passed out of the picture completely, while the two former lines of radio have long since been abandoned in favor of other lines, featuring Atwater Kent. A line of talking machines replaced the refrigerators and to-day the business is exclusively musical, being confined to these two lines and their appurtenances.

In launching his radio business, Whitaker determined at once to secure a line on the radio situation as it existed in the homes of the territory he proposed to serve, to learn what sort of radio equipment had been sold prior to his entering the field, how much of it had been sold, and if possible the condition of that equipment.

As the survey progressed, most of it being done over the telephone on a standardized talk, he realized that he was learning exactly who his prospects were, which families owned sets and which did not, and which owners of old sets were about ready to buy new ones. He wound up with a clean list of interested prospects on which he decided to concentrate his selling efforts.

As his sets began to move into Florida homes Whitaker used his telephone again and again. From his satisfied owners he secured the names of friends who had heard the new instruments and had expressed interest in them. Many of these he converted into customers and then he repeated the process, widening his circle of contacts through sets serviced or sold.

The Service System

BUT GETTING back to Whitaker's four principles for conducting a successful radio business and considering them in their proper order, or at least in the order in which he sets them forth, we find first that he is a stickler for having *all* the facts at hand. This is indicated by the "Service Record Card" which is printed on two colors of stock: pink for those sets which he has sold and white for the sets of other makes sold by others. The "work ticket" numbers of all jobs, whether cash or charge, are kept on the individual card with the amount of the purchase. On these cards, in condensed form, is

a complete record of each customer's business. The details of any particular job or purchase can be found at once from the reference numbers. These are kept in an ordinary box file.

In service work there are three separate problems as Whitaker sees it: first, doing satisfactory work; second, being sure that the customer is pleased with the way in which the work is done; third collecting the money. The whole service procedure is cared for on one card—the "work ticket"—from the time the work is requested for until it is billed. The information is filled in when the customer places the call, whereupon it is passed to the service department. The department record is made upon the reverse side of the card giving complete details as to nature of the trouble, materials used, and time consumed, while a general report goes on the front.

The service department places this card on a clip board. Each day the cards are removed by the bookkeeper, who, whenever possible, checks the operation of the set on the telephone. If the work has not been satisfactory the card goes back to the service department for further attention. If sa isfactory it goes to the administrative offices where the labor is priced and the invoicing okayed.

The numbers of these cards are, of course, transferred to the "Service Record Card" of the individual customer and then filed numerically. These service reports are used for work done in the customer's home. Shop work is cared for by a tag which is attached to each article as it is brought in either by the customer or the service department. Information as to the equipment and trouble is filled in on the front and the record of work done by the service department goes on the back.

Advertising Methods

The advertising budget is set at 5 per cent. of the estimated sales. Originally started with newspapers and direct mail it has been expanded to include billboards. Ordinarily the mat service of manufacturers is used but slight changes have been found advisable from time to time because of local conditions. A daily advertisement is changed monthly.

The direct-mail phases of the company's activities are divided into five general classifications:

1. Manufacturers' campaigns (with space for Whitaker's imprint)
2. Store Introductory Series
3. Demonstration Assistances Series.
4. After Trial Series
5. Monthly Series for Customers.

Each of the above fills its own particular place. The first three are in reality part of the sales campaign.

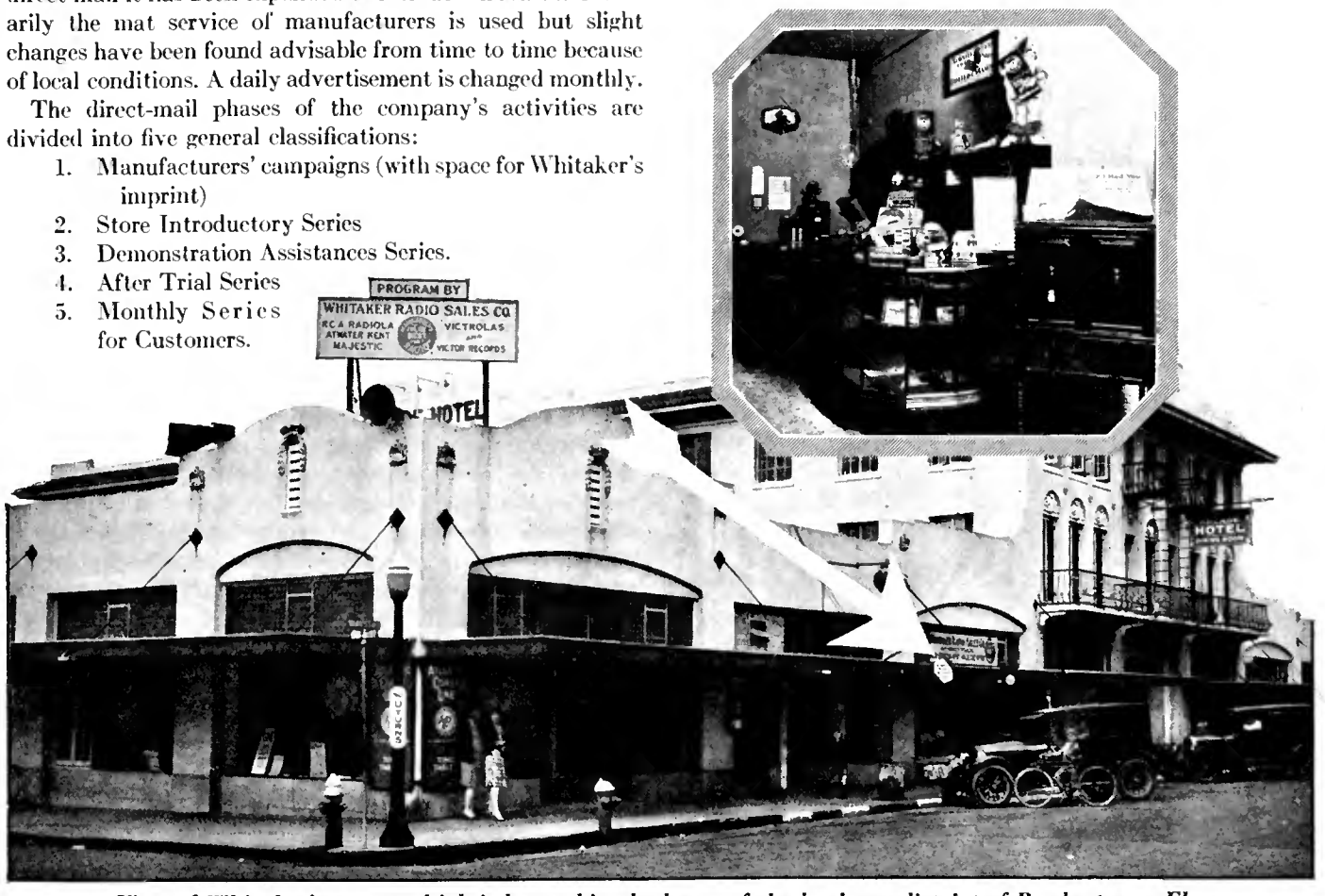
Manufacturer's campaigns are sent to a general list of prospects. These are usually charged with selling copy appropriate for particular seasons such as Easter, Christmas, Inauguration, etc. Whitaker finds them generally effective *if* they are followed up. The store introductory series is sent to active prospects, people whom Whitaker has reason to believe are about ready to buy. There are five letters in this series and they are mailed at three-day intervals. They serve to pave the way for the salesman when he calls.

When a demonstration is secured the Demonstration Assistance Series is brought into play. Again five letters are used, one each day, or until the sale is closed.

When the Sale Is Made

When the sale is finally made the salesman turns in the order, payment-papers, and check for the first payment. The sale is invoiced and confirmation sent to the customer together with the first of the "After Sales Series" of letters. In the case of deferred-payment customers a copy of the contract is attached to a special letter which further impress the necessity of prompt payments.

A week after the set has been installed a letter is sent with a return postal asking for the names of friends who might be interested. Near the end of the sixty-day guarantee period another letter is sent along with two return postals, one for use in case the customer wishes to avail himself of a yearly service contract and the other to permit him to register a complaint in case any trouble has developed with the set. With the advent of the house-current set, which has reduced so greatly the service problem, the yearly service contract is not being stressed as much as it was a year or so ago.



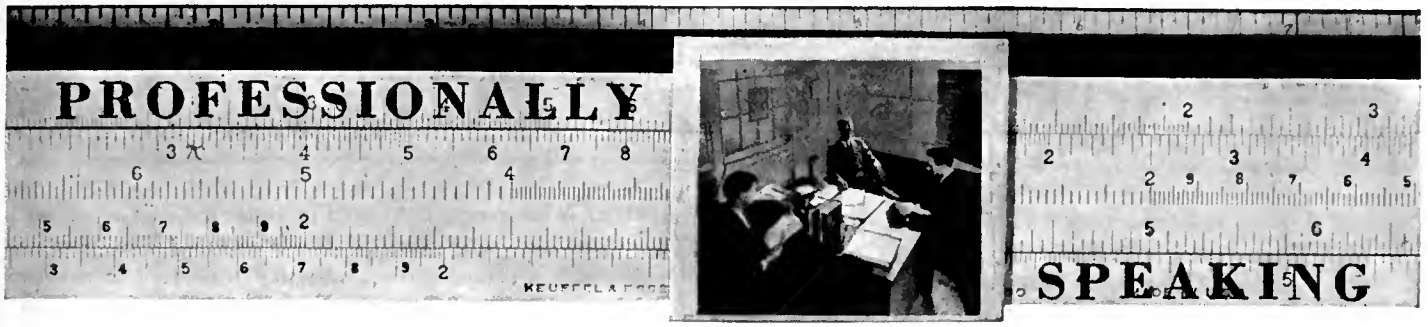
View of Whitaker's store, which is located in the heart of the business district of Bradentown, Fla. Insert shows display counter.

House-to-house sales work is done with the direct-mail assistance described. Sets are demonstrated for two or three nights if conditions are good, or if conditions are unfavorable until a good night or two is secured. Salesmen are paid a straight ten per cent. commission, their money being due and payable when the contracts are accepted and cash payments turned in. Whitaker does not ask, nor does he expect, or desire, his salesmen to work on "cold-turkey" calls. He paves the way for them through his direct-mail campaigns, through telephone calls, and in other ways. He keeps his name before the public in the newspapers, on billboards, and through the mails. But he properly estimates the value of the combined effect of all these forms of advertising, as sales promotion activities and not as actual selling.



Finally we come to the fourth proposition, a simple, complete cost system, and Mr. Whitaker apparently has just that. The forms used by Whitaker Radio Sales show that he breaks down both sales and expenses into various parts from which the monthly operating report is obtained. The cost of goods sold is determined by the average discount method. A complete budget is set up at the beginning of the fiscal year. Sales quotas and expense appropriations are set and divided into months. Estimates and actuals are compared monthly and cumulatively to date for revision. Of course, a finance plan is used. A carrying charge is added to the price for deferred payments. These papers are discounted as needed to meet purchases while collections are made from the store.

The methods and plans outlined above have enabled the Whitaker Radio Sales Company to keep in touch with its market, to work up cold prospects, to introduce its salesmen pleasantly and under favorable conditions, to close sales more easily, to keep its customers happy, and to make some money. And as the company is doing all these things successfully it is not unreasonable to say that it is doing a well-balanced, outstanding merchandising job.



MORE TUBE RESEARCH NEEDED

APPARENTLY THERE must always be some weak link in the broadcast chain. Flushed with pride at what radio engineers had done—as evidenced by the Trade Show—we asked a well-known design engineer what he considered the *protem* major technical problem facing the radio industry. He came back with no hesitation, "Tubes!"

According to this engineer, tubes are lamentably short on life, and long on gas. Tube manufacturers are long on self confidence and short on money for research. A tube manufacturer will willingly pay a super salesman ten per cent. to sell the tubes, but will not pay a research department or consulting engineer five per cent. to make better tubes.

It is true that tubes have changed, but these changes are toward new kinds of tubes, or the same tubes at lower prices. What is desired is a better tube at the same price, or one that costs more but lasts longer.

The Western Electric company has developed tubes that last 20,000 hours. It is true that they cost plenty of good money, and that a set that stays in a consumer's house for 20,000 hours is an exception. But it does seem reasonable that tubes could be made for radio reception that would last longer without going gassy or losing emission.

It is true that few tube manufacturers have installed laboratories or research staff, or have been willing to do anything but copy what someone else has developed. This is a rather serious arraignment against the tube industry, and is probably due to the uncertainty of its patent structure, or to the fact that it was easy to make tubes of a sort, or to the fact that tubes of practically any life and characteristics could be sold.

It seems to us that tube manufacturers will have to do some fundamental research into filaments, metals or elements, the glass wall, methods of exhaust, and bombardment—with the thought in mind that, while the electrical characteristics or present tubes are probably as good as necessary, their life is poor.

It reminds us of the story of an automobile manufacturer who made such a cheap car that it failed prematurely—or whatever it is cars do. Sales began to fall off, public enthusiasm began to wane. The solution was to put the profits from the car back into the car itself—not to decrease the price, but to make the car better. Sales began to climb, public confidence came back, proving again that you cannot sell a poor product, no matter how little it costs.

REGARDING HIGH QUALITY

STATEMENTS OF receiving set manufacturers that 1929 receivers will be more selective than those made a year ago, have already stirred up pleasant dreams in the minds of those who play with frequency assignments. If sets are more selective, why not cut down the frequency band each transmitter can occupy—say to 8000 cycles instead of 10,000 cycles—and, with new selectivity, have the situation that we enjoy (?) now?

Rumor has it that suggestions have already been made to reduce the channel width to 4000 cycles each side of the carrier. Now let us look at this suggestion seriously. This would mean that receiving sets would not deliver to a loud speaker any audio tone above 4000 cycles, just as at present they are not expected to transmit anything above 5000 cycles. The disadvantage would be that the user would get poorer fidelity.

But would they? Is it not a fact that the majority of listeners prefer reception with a minimum of noise, and hiss, and other forms of unwanted racket? Is it not a fact that the general public is not at all critical about fidelity so long as there is plenty of bass? Is it not a fact that the majority of receivers have audio-frequency amplifiers or filters which cut off above about 3500 cycles? Is it not a fact that the efforts of a well-known receiver manufacturer to produce the best fidelity possible a year or so ago failed because of too much high-note reception, and that after many sets of this type came back, a filter was put into the audio system that put its audio amplifier back into the class of those a year before?

We believe all of these things are facts, and we deplore them. We believe that the frequency range of receivers should be broadened, not reduced, that the number of stations should be

(*Continued on page 242*)

clippings

A. ATWATER KENT: "I like a game which puts me on my mettle, which makes me keep my wits about me, which forces me to meet and beat new problems. . . . You can't go stale in radio without going bankrupt, because the other fellow will pass you."

D. H. KELLEY, president, U. S. L. Battery Corporation: "If a concern is making a net profit of 10 per cent. it is better for them to lose ten sales than to be stuck with one finished article on hand. This is a case of simple mathematics, but it is overlooked so frequently."

R. H. WOODFORD, radio sales manager, Stewart-Warner: "Radio sales for 1929 will increase 20 to 25 per cent. Our radio production this year will be quadrupled."

GEORGE M. STUDEBAKER, Colin B. Kennedy: "The point of saturation in the radio field is not in sight, radio, to my mind, being in the same position as the automotive industry was fifteen years ago. . . . Radio reaches the popular fancy to an even greater extent than the automobile."

PRINTERS' INK: "There will be a place for the good specialty jobber for some years to come. He still performs economically a service which the usual manufacturer can't perform for himself except at a high cost."

Showing Extent to Which Leading Producers Assemble Sets

WHAT MANUFACTURERS MAKE AND BUY

RADIO RECEIVER manufacturers will make in their own plants approximately 62 per cent. of the parts they require for use in their 1929–30 receivers. The remainder, or 38 per cent. of the parts, will be purchased from outside companies. All the manufacturers will build their own r. f. tuning coils and practically all of them will build or assemble their own audio and power transformers and filter choke coils. The parts which are generally purchased from outside companies are fixed and variable condensers, fixed and variable resistors, and cabinets.

These are some of the conclusions determined from a survey made recently by RADIO BROADCAST among prominent set manufacturers. Requests for the necessary data were sent to a list of 26 of the largest manufacturers, and, at the time of this writing, replies have been received from 14. The manufacturers who have replied are listed in this article. The list includes many of the largest and probably they will account for the sale of at least 75 per cent. of all the sets to be sold during the coming season.

In gathering the data for this survey it was decided to concentrate on 17 different classifications of parts, it having been found that practically every piece of apparatus that is ordinarily employed in radio receiver construction would fall into one of these groups. The various classifications of parts are given in Table 1. The survey indicated wide variations in the practices of different companies. For example, one manufacturer makes 89 per cent. of all his parts and another prominent company makes only 6 per cent. of the parts, purchasing 94 per cent.

It should be understood that the references in the preceding paragraphs to parts "made by the manufacturer" means simply that the manufacturer does not buy the completed device, although he probably does buy the various components used in the particular part. For example, a manufacturer may not buy a complete audio transformer, but will purchase the coils and laminations and then assemble the transformer, from these parts, in his own plant.

Table 1 gives a complete tabulation of the 14 replies received, indicating by an "x" in each case which parts are purchased and which are manufactured. In some cases it will be noted that an "x" appears under both headings, purchased and manufactured. The parts in which this double classification appears most frequently are fixed resistors and cabinets. This probably means that many companies make the various small fixed resistors required in the set but

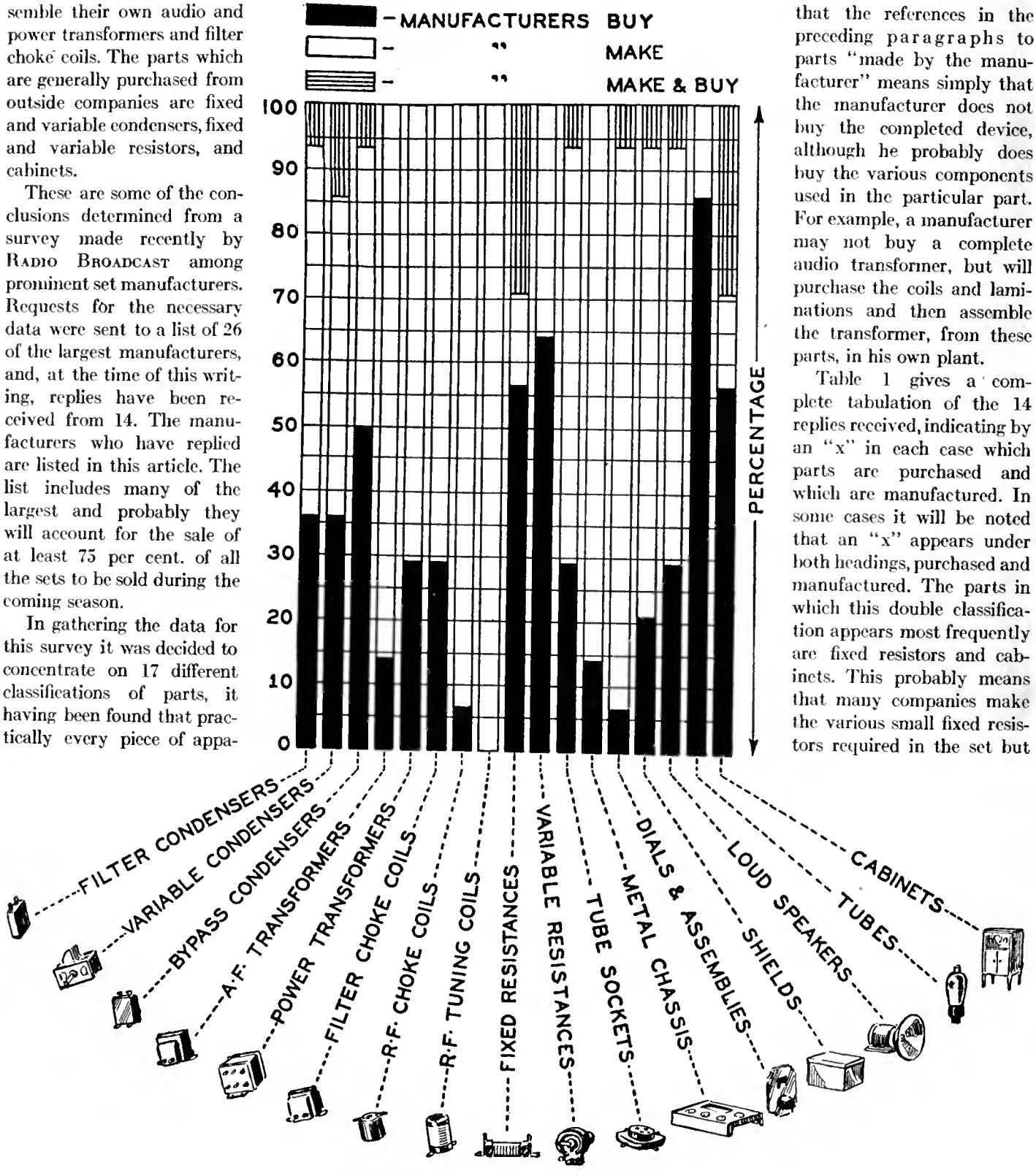


Table I—Tabulation of Parts Made and Purchased by Manufacturers Covered by Survey

Manufacturer →	1		2		3		4		5		6		7		8		9		10		11		12		13		14	
Part ↓	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make	Purchase	Make
Filter Condensers	x		x			x	x	x		x		x		x		x	x			x	x			x		x	x	
Variable Condensers	x	x	x			x		x	x	x	x			x	x		x		x			x		x		x		x
By-pass Condensers	x		x		x			x		x		x		x		x	x		x		x			x	x	x	x	
A. F. Transformers		x	x			x		x		x		x	x			x		x		x		x		x		x		x
Power Transformers		x	x			x	x			x		x	x		x			x		x		x		x		x		x
Filter Choke Coils		x	x			x	x			x		x	x			x		x	x			x		x		x		x
R. F. Choke Coils		x	x			x		x		x		x		x		x		x		x		x		x		x		x
R. F. Tuning Coils		x		x		x		x		x		x		x		x		x		x		x		x		x		x
Fixed Resistances	x		x		x	x	x	x	x	x	x		x	x	x		x		x		x			x	x			x
Variable Resistances	x		x		x		x		x			x	x		x			x	x		x			x		x		x
Tube Sockets	x		x		x			x		x		x		x		x	x			x		x		x	x	x		x
Metal Chassis		x	x			x		x		x		x		x		x		x		x		x		x		x	x	
Dials and Assemblies		x	x			x		x	x	x		x		x		x		x		x		x		x		x		x
Shields		x	x			x		x		x		x	x	x		x		x	x			x		x		x	x	
Loud Speakers		x	x			x	x			x	x	x		x		x	x		x			x		x		x		x
Tubes	x		x			x		x	x		x		x		x		x		x		x		x		x		x	
Cabinets	x		x			x	x		x		x		x	x	x	x	x		x			x	x	x	x		x	x
Total	8	10	16	1	4	14	7	12	6	14	5	13	8	12	6	12	8	9	9	8	5	12	2	16	5	11	6	12

purchase from outside companies the large high-wattage resistors such as the output voltage divider in the plate-supply unit. Many manufacturers evidently make their own metal cabinets but purchase the wooden cabinets.

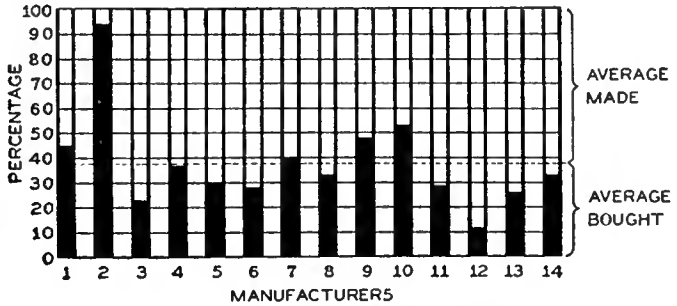
The totals at the bottom of Table I show the number of parts the various companies purchase and make. In Table II these totals have been converted into percentages. Table II, therefore, shows the percentage of parts purchased and the percentage of parts made in the case of each manufacturer. From these figures we arrive at the average percentages given at the bottom of Table II.

Table III gives the percentage of manufacturers who either purchase or buy the various parts, indicating thereby which parts are most generally made and which are generally purchased. For example, filter condensers are purchased by 36 per cent., made by 57 per cent., and partially made and partially purchased by 7 per cent. Dials are made by 86 per cent. of the manufacturers, only 7 per cent. purchased all their requirements of this item from the outside, and 7 per cent. make some dials and purchase the remainder of their requirements. To indicate in numerical order those parts most generally made by manufacturers we

(*Continued on page 238*)

Table II

Manufacturer	Percentage of Parts *Bought*	*Made*
1	45	55
2	94	6
3	22	78
4	37	63
5	30	70
6	28	72
7	40	60
8	33	67
9	47	53
10	53	47
11	29	71
12	11	89
13	26	74
14	33	67
Average	38	62



The data of Table II in graph form. Black bars indicate percentage of parts bought.

Table III

	Percentage of Manufactures who *Purchase the part*	*Make the part*	*Both purchase and make the part*
Filter Condensers	36	57	7
Variable Condensers	36	50	14
By-pass Condensers	50	43	7
A. F. Transformers	14	86	0
Power Transformers	29	71	0
Filter Choke Coils	29	71	0
R. F. Choke Coils	7	93	0
R. F. Tuning Coils	0	100	0
Fixed Resistances	57	14	29
Variable Resistances	64	36	0
Tube Sockets	29	64	7
Metal Chassis	14	86	0
Dials and Assemblies	7	86	7
Shields	21	71	7
Loud Speakers	29	64	7
Tubes	86	14	0
Cabinets	57	14	29

Table IV

Part	*Percentage of Mfrs. who make them*
R. F. Tuning Coils	100
R. F. Choke Coils	93
Metal Chassis	86
Dials and Assemblies	86
A. F. Transformers	86
Power Transformers	71
Filter Chokes	71
Shields	71
Tube Sockets	64
Loud Speakers	64
Filter Condensers	57
Variable Condensers	50
By-pass Condensers	43
Variable Resistors	36
Fixed Resistors	14
Tubes	14
Cabinets	14

ANALYZING THE 1928–29 RADIO SURVEY

By T. A. PHILLIPS

Manager, Research Division, Doubleday, Doran & Co., Inc.



T. A. Phillips

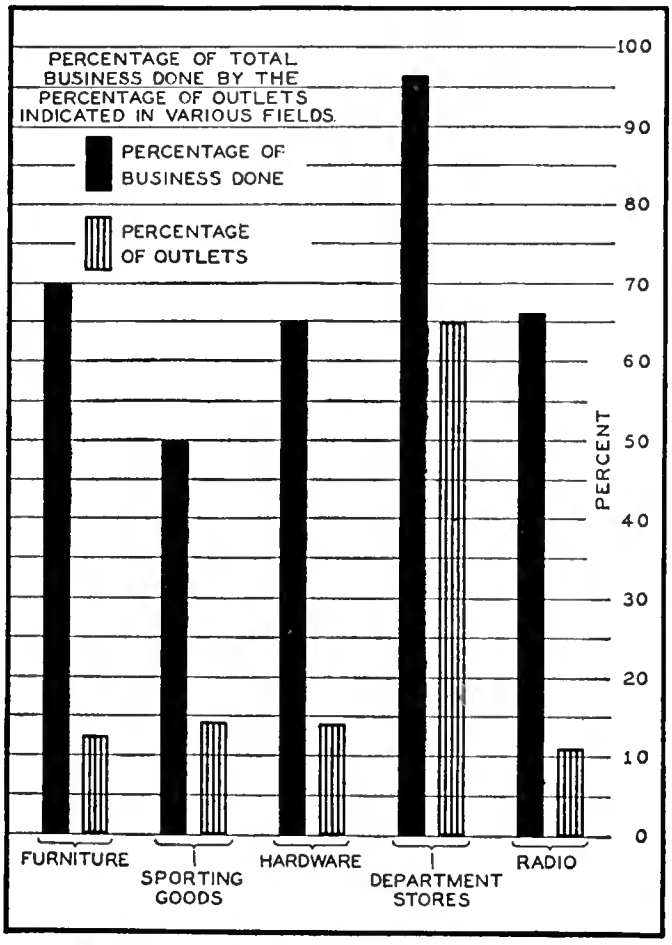
THIS is the second of a series of articles analyzing the quarterly radio surveys made by the Bureau of Foreign and Domestic Commerce with the assistance and coöperation of the National Electrical Manufacturers Association.

It is an old axiom that the rich get richer and the poor get poorer. To the casual observers it has seemed that the large radio dealer with his huge yearly volume is constantly increasing his sales and forcing his smaller competitor to the wall. There is good precedent for this. Twelve per cent. of all furniture dealers do 70 per cent. of the furniture business; 14 per cent of all sporting goods stores do 50 per cent. of the total sporting goods business; 14 per cent. of all hardware stores do 65 per cent. of the hardware business. Department stores having a gross volume in excess of $1,000,000 a year do 95 per cent. of the department store business.

A close study of the distribution of business done by radio dealers, as reported by the Department of Commerce, should gladden the hearts of the average radio retailer whose gross sales do not exceed $20,000 a year. It is very apparent that the narrowing of the margin of differences in merit and prices between the products of various radio manufacturers has made for a much more general distribution of sales among dealers of all sales volume classifications.

The dealers selling more than $100,000 a year are still obtaining the larger share of total sales. However, the number of dealers doing this volume is decreasing. What is more important is the fact that the smaller dealer in proportion to his sales volume is getting a greater share of the business.

To illustrate with a hypothetical case: there are five dealers in a certain community each having a yearly sales volume of $100,000. One of them drops out, leaving $100,000 in sales for someone. If each of the other four dealers absorbed all the business of the dealer who dropped out, they would each increase their sales $25,000. What is actually happening is that the four large volume dealers are getting only part of the surplus business and that the remainder is being distributed among all the dealers down the line who do not do a business of $100,000 a year.



This chart shows how the retail radio business compares with retailing in other industries. In each case it indicates that a few large dealers handle more than fifty per cent. of the retail business. The department stores indicated are those having a gross volume in excess of $1,000,000 a year.

The lesson to be drawn from this condition of affairs is obvious: Mr. X who has decided to buy a radio set is not influenced nearly as greatly by the size of the radio store he will patronize as he is by the merchandising methods used to sell him. *Good merchandising is not the offspring, but the father of the large volume dealer.*

An examination of the Tables I and II shows definitely the trend toward an increasing number of dealers in the smaller sales volume classifications as well as a smaller percentage of total sales done by the large volume dealers. Naturally the number of dealers doing $100,000 a year is greater than the number doing $100,000 for any particular quarter. In order to determine whether or not sales have been distributed equally in proportion to a dealer's sales volume it becomes necessary to reduce the figures to a common base. We do so by determining the amount of business each individual

TABLE I

PERCENT OF TOTAL NUMBER OF DEALERS IN GROUPS ACCORDING TO LIMITS OF BUSINESS DONE

Limits of Business Done	*1928*	*Last Quarter 1928*	*First Quarter 1929*
Under $1,000	20.82%	30.81%	46.31%
1,000 to 4,999	42.05	45.02	38.05
5,000 to 9,999	16.22	12.34	8.89
10,000 to 19,999	9.57	6.77	4.14
20,000 to 49,999	7.70	3.71	2.00
50,000 to 99,999	2.16	.93	.43
100,000 and up	1.48	.42	.18
	100.00%	100.00%	100.00%

TABLE II

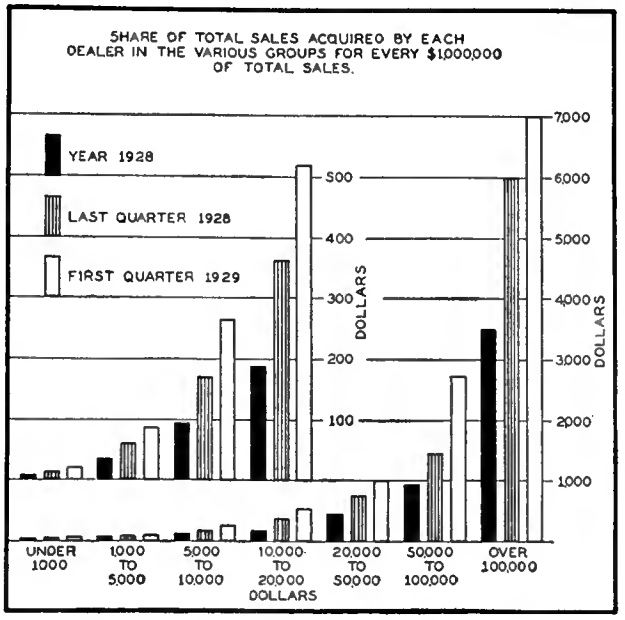
PERCENT OF TOTAL VOLUME DONE BY DEALERS IN EACH GROUP

Limits of Business Done	*1928 per cent.*	*Last quarter 1928*	*First quarter 1929*
Under $1,000	.93%	2.38%	5.61%
1,000 to 4,999	9.90	18.12	24.91
5,000 to 9,999	10.26	14.42	17.90
10,000 to 19,999	11.90	16.06	16,26
20,000 to 49,999	20.95	18.21	16.51
50,000 to 99,999	13.13	11.24	9.01
100,000 and up	32.93	19.57	9.80
	100.00%	100.00%	100.00%

dealer acquired in the various groups, to the total business done. Table III illustrates our point.

TABLE III *reads: 1368 dealers reported a sales volume of $655,308 or an average volume of $479 per dealer. All the dealers reported a total sales volume of $70,877,517.00. Each dealer having a sales volume under $1000 therefore got $6.70 of each million dollars of business reported.*

This analysis shows that the dealers having a volume for the first quarter of 1929 in excess of $100,000 increased their individual proportionate share of business only 98 per cent. over 1928, while the dealers selling from $5000 to $20,000 increased their proportionate share 175 per cent. and 174 per cent., respectively. The slightly above average dealers doing between $50,000 and $100,000 a year show the greatest increase—195 per cent.



The way in which the average dealer of various classifications (grouped according to limits of business done) shares in the total sales of the industry is shown in this chart.

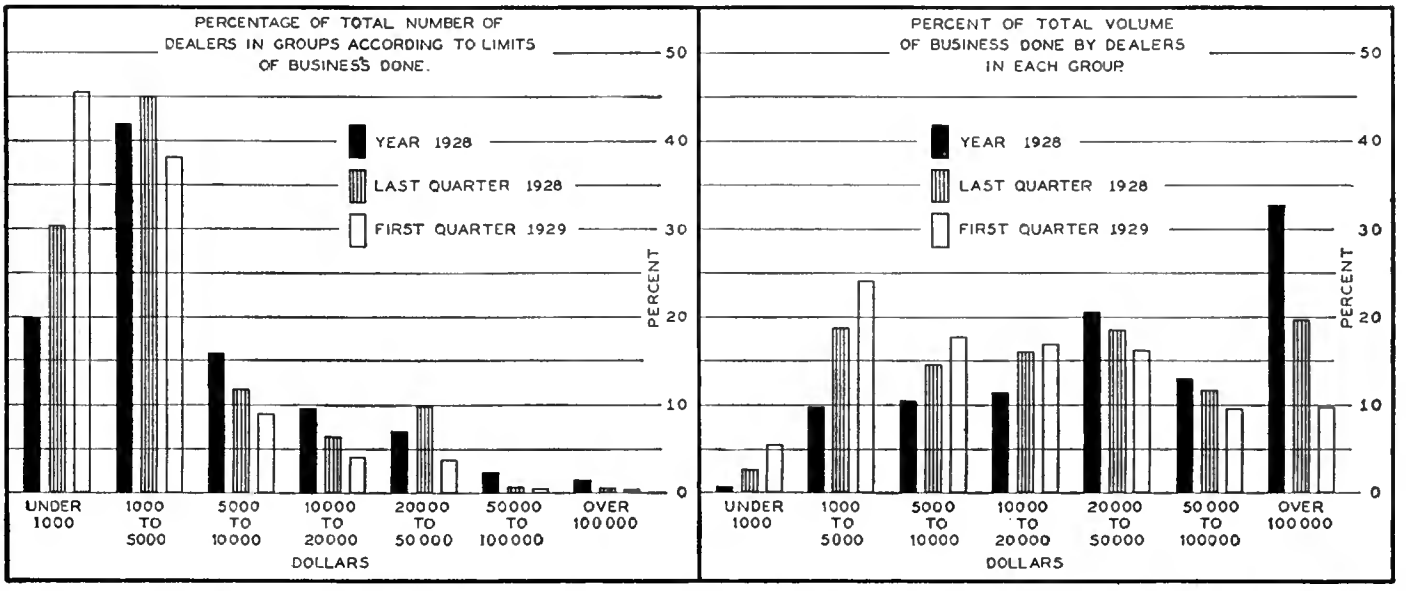
These figures demonstrate, therefore, the soundness of our conclusion at the beginning of this article that the smaller volume dealer is not only increasing in number but is getting a more equitable share of the total business. Sales managers of radio manufacturers should act accordingly.

The smaller radio dealer selling standardized, nationally advertised radio sets is in a position by proper merchandising to compete successfully with his affluent competitor down the street. This survey shows definitely that he is doing just that.

The Bureau of Foreign and Domestic Commerce and National Electrical Manufacturers Association are doing a real service for the radio industry with their quarterly surveys. They deserve the fullest coöperation from every radio retailer receiving a request from them for information. It is well known that government surveys are prepared in such a way that individual firms cannot possibly be identified and radio retailers should not hesitate to coöperate to the fullest extent of their ability.

TABLE III

Limits of Business Done	*No. of Dealers*	*Sales Volume Reported*	*Average Volume per Dealer*	*Each Dealer's share for every $1,000,000 of Sales reported*	*Increase over 1928*
Year 1928					
Under $1,000	1368	$ 655,308	$ 479	$ 6.70	
1,000 to 5,000	2765	7,009,117	2,534	35.70	
5,000 to 10,000	1066	7,273,779	6,823	96.20	
10,000 to 20,000	629	8,440,406	13,418	189.30	
20,000 to 50,000	506	14,844,306	29,336	413.80	
50,000 to 100,000	142	9,307,050	65,542	924.70	
100,000 and over	93	23,347,551	251,048	3,541.90	
TOTAL	6569	$70,877,517	10,800		
Last Quarter, 1928					
Under $1,000	2023	$ 901,143	$ 445	$ 11.70	74%
1,000 to 5,000	2950	6,877,067	2,331	61.38	71
5000 to 10,000	809	5,478,925	6,772	173.80	81
10,000 to 20,000	445	6,095,173	13,697	360.80	90
20,000 to 50,000	244	6,914,072	28,336	746.10	80
50,000 to 100,000	61	3,270,700	53,618	1,411.90	53
100,000 and over	37	8,437,935	228,051	6,005.20	69
TOTAL	6569	$37,975,015	5,780		
First Quarter, 1929					
Under $1,000	3511	$ 1,432,029	$ 407	$ 15.90	137%
1,000 to 5,000	2884	6,352,552	2,202	86.20	141
5,000 to 10,000	674	4,563,041	6,770	265.00	175
10,000 to 20,000	314	4,164,852	13,263	519.30	174
20,000 to 50,000	151	4,215,360	27,916	1,010.90	144
50,000 to 100,000	33	2,304,741	69,840	2,734.50	195
100,000 and over	14	2,506,660	179,047	7,010.50	98
TOTAL	7581	$25,539,660	$13.368		



In these charts all radio dealers are grouped according to limits of business done, i.e., under $1000, $1000 to $5000, etc. The chart on the left shows the percentage of the total number of dealers in each of the seven groups and the chart on the right shows how the total business is divided among the dealer groups.

COMPLETE SUMMARY OF NEW RECEIVING SETS

Company	Model	Price	Table or Console	Screen Grid Tubes	Tubes Used
The A-C Dayton Co.	AC-99	$ 98.00	Chassis only	No	
	AC-98	$ 133.00	Table	No	6-227, 2-245, 1-280; Chassis same in all models
	AC-9960	$ 173.50	Console	No	
	AC-9970	$ 190.00	Console	No	
	AC-9980	$ 210.00	Console	No	
	AC-9990	$ 213.00	Console	No	
	AC-99100	$ 292.00	Phonograph-radio	No	
The Acme Electric & Mfg. Co.	88	$ 139.50	Console	Yes	2-227, 2-245, 1-280, 3-224
	77	$ 99.50	Console	No	5-227, 1-245, 1-280
	79	$ 140.00	Console	Yes	2-224, 2-245, 2-227, 1-280
All-American Mohawk Corp.	93	$ 169.50	Console	No	7-227, 2-245, 1-280
	95	$ 199.50	Console	No	7-227, 2-245, 1-280
	SG-1	$ 184.50	Console	Yes	3-224, 2-227, 2-245, 1-280
American Bosch Magneto Corp.	48	$ 119.50	Table	Yes	3-BY 224; 1-BY 227; 2-BX245; 1-RX280 Same in all models
	48-A	$ 168.50	Console	Yes	
	48-J	$ 240.00	Console	Yes	
	48-17	$ 230.00	Console	Yes	
	48-18	$ 210.00	Console	Yes	
	48-L	$ 230.00	Console	Yes	
	48-R	$ 280.00	Console	Yes	
	48-19	$ 280.00	Console	Yes	
Amrad Corp.	Aria	$ 198.00	Console	Yes	2-227, 3-224, 2-245, 1-280; Same in all models
	Serenata	$ 245.00	Console	Yes	
	Symphony	$ 295.00	Console	Yes	
	Duet	$ 495.00	Phonograph-radio	Yes	
F. A. D. Andrea, Inc.	20	$ 99.50	Table	No	5-227, 2-171A, 1-280
	25	$ 165.00	Console	Yes	4-227, 1-224, 2-245, 1-280
	35	$ 245.00	Console	Yes	2-224, 2-227, 2-245, 1-281
	75	$ 360.00	Console	Yes	3-224, 2-227, 2-210, 1-281
	77	$ 675.00	Phono-radio	Yes	3-224, 2-227, 2-210, 1-281
	18	$ 120.00	Table	No	5-112A, 2-171-A
Associated Radio Mfrs., Inc.	1	$ 165.00	Console	Yes	2-224, 2-227, 2-245, 1-280; Same in all models
	10	$ 149.50	Console	Yes	
	20	$ 137.50	Console	Yes	
	30	$ 126.50	Console	Yes	
	40	$ 99.50	Console	Yes	
Atwater Kent Mfg. Co.	55	$ 88.00	Table	Yes	2-224, 2-227, 2-245, 1-280
	60	$ 100.00	Table	Yes	3-224, 2-227, 2-245, 1-280
	61	$ 88.00	Table	Yes	3-222, 2-112A, 2-271A
	67	$ 77.00	Table	Yes	3-222, 2-112A, 2-271A
Audiola Radio Co.	7330	$ 85.00	Table	Yes	2-224, 2-227, 2-245, 1-280
	8430	$ 95.00	Table	No	5-227, 2-245, 1-280
Balkeit Radio Co.	C	$ 175.00	Console	No	6-227, 2-245, 1-280
Brandes Radio Corp.	B 15	$ 125.50	Console	No	5-227, 2-245, 1-280
	B 16	$ 165.00	Console	No	5-227, 2-245, 1-280
	B 10	$ 85.00	Table	No	5-227, 1-171A, 1-280
Buckingham Radio Corp.	1	$ 119.50	Console	No	5-227; 2-245; 2-280
	2	$ 129.50	Console	No	Same in all models
	3	$ 142.50	Console	No	
	4	$ 69.50	Table	No	
Bush & Lane Piano Co.	30	$ 169.50	Console	Yes	5-227, 2-245, 1-280
	32	$ 179.50	Console	Yes	2-245, 1-280, 1-227, 3-224
	34	$ 187.50	Console	Yes	Either one of above chassis in all models
	40	$ 179.50	Console	Yes	
	50	$ 197.50	Console	Yes	
	60	$ 199.50	Console	Yes	
	70	$ 207.50	Console	Yes	
	90	$ 217.50	Console	Yes	
	21	$ 169.50	Console	Yes	
	12 C	$ 297.50	Phono-radio	Yes	
	20	$ 125.00	Table	Yes	
Colonial Radio Corp.	32 Cavalier	$ 235.00	Console	Yes	4-224, 1-227, 2-245, 1-280; Same for all models
	32 Picadilly	$ 235.00	Console	Yes	
	32 Modern	$ 270.00	Console	Yes	

Company	Model	Price	Table or Console	Screen Grid Tubes	Tubes Used
Columbia Phonograph Co.	C 11	$ 179.50	Console	No	5-227, 2-245, 1-280; Same for all models
	940	$ 297.50	Phono-radio	No	
Continental Radio Corp.	R 20	$ 435.00	Console	No	7-227, 2-250, 2-281; Same for all models
	R 25	$ 475.00	Console	No	
	R 30	$ 525.00	Console	No	
	RP-40	$ 725.00	Phono-radio	No	
	R 105	$1600.00	Console	No	
	RP 115	$1800.00	Phono-radio	No	
Crosley Radio Corp.	21	$ 49.00	Table	Yes	3-222; 2-201A; 1-171A
	22	$ 88.50	Console	Yes	3-222; 2-201A; 1-171A
	31	$ 55.00	Table	No	4-226; 1-227; 1-171A; 1-280
	32	$ 99.50	Console	No	4-226; 1-227; 1-171A; 1-280
	41	$ 70.00	Console	No	4-226; 1-227; 2-171A; 1-280
	41 A	$ 70.00	Table	No	4-226; 1-227; 1-171A; 1-280
	42	$ 125.00	Console	No	4-226; 1-227; 2-171A; 1-280
	40 S	$ 80.00	Console	Yes	3-224; 2-227; 2-245; 1-280
	41 S	$ 85.00	Table	Yes	3-224; 2-227; 2-245; 1-280
	42 S	$ 140.00	Console	Yes	3-224; 2-227; 2-245; 1-280
	82 S	$ 160.00	Coosole	Yes	3-224; 2-227; 2-245; 1-280
	82 II	$ 150.00	Console	Yes	3-224; 2-227; 2-245; 1-280
	61	$ 85.00	Table	No	5-201A; 3-171A
	62	$ 135.00	Console	No	5-201A; 3-171A
	83	$ 155.00	Console	No	5-201A; 3-171A
Day-Fan Electric Co.	66	$ 115.00	Table	No	5-226, 2-245, 1-280, 1-227
	68	$ 169.50	Coosole	No	5-226, 2-245, 1-280, 1-227
	72	$ 175.00	Console	No	5-226, 2-245, 1-280, 1-227
	69	$ 225.00	Console	No	5-226, 2-245, 1-280, 1-227
	73	$ 65.00	Table	No	6-201A, 1-112A
	74	$ 119.50	Console	No	6-201A, 1-112A
Thomas A. Edison Inc.	R 2	$ 225.00	Console	No	1-227, 4-226, 1-250, 1-281
	R 1	$ 260.00	Console	No	1-227, 4-226, 1-250, 1-281
	C 2	$ 395.00	Phono-radio	No	1-227, 4-226, 1-25), 1-281
	C 1	$1100.00	Phono-radio	No	1-227, 4-226, 2-250, 2-281
	R 5	$ 167.50	Console	No	5-227, 2-245, 1-280
	R 4	$ 197.50	Console	No	5-227, 2-245, 1-280
	C 4	$ 295.00	Phono-radio	No	5-227, 2-245, 1-280
Electrical Research Lab.	C 5 F	$ 119.50	Console	No	4-226, 1-227, 2-171, 1-280
	C 4 F	$ 189.50	Phono-radio	No	4-226, 1-227, 2-171, 1-280
	30	$ 165.00	Console	Yes	3-224, 2-227, 2-245, 1-280
	31	$ 147.00	Console	Yes	3-224, 2-227, 2-245, 1-280
	32	$ 165.00	Console	Yes	3-224, 2-227, 2-245, 1-280
	33		Phono-radio	Yes	3-224, 2-227, 2-245, 1-280
Federal Radio Corp.	M 41	$ 295.00	Console	No	5-227, 2-245, 1-280
	M 46	$ 295.00	Console	No	5-227, 2-245, 1-280
	M 10	$ 175.00	Table	No	5-227, 2-245, 1-280
	E 10	$ 95.00	Table	No	4-201A, 1-112A, 171A, Raytheon BA
	M 36	$ 245.00	Console	No	5-227, 2-245, 1-280
	L 36	$ 149.50	Console	Yes	3-224, 2-227, 2-245, 1-280
	L 46	$ 179.50	Console	Yes	3-224, 2-227, 2-245, 1-280
Freed-Eisemann Radio Corp.	55	$ 99.50	Console	No	2-227, 3-226, 2-171A, 1-280
	78	$ 145.00	Console	No	5-227, 2-245, 1-280
	79	$ 172.50	Console	No	5-227, 2-245, 1-280
	95	$ 225.00	Console	No	6-227, 2-245, 1-280
	56	$ 75.00	Table	No	2-227, 3-226, 2-171A, 1-280
	53	$ 55.00	Table	No	5-201A, 2-171A

EXHIBITED AT THE CHICAGO RADIO TRADE SHOW

Company	Model	Price	Table or Console	Screen Grid Tubes	Tubes Used
C. A. Earl Radio a division of Chas. Freshman Co., Inc.	21	$ 92.75	Table	No	2–227, 3–226, 2–271, 1–180
	22	$ 117.25	Console	No	2–227, 3–226, 2–271, 1–180
	31	$ 161.50	Console	No	5–227, 2–245, 1–180
	32	$ 191.50	Console	No	5–227, 2–245, 1–180
	41	$ 250.00	Console	No	6–227, 2–245, 1–180
A. H. Grebe & Co., Inc.	285 A & B	$ 285.00	Console	Yes	3–224, 1–227, 2–245, 1–280;
	270 A, B & C	$ 270.00	Console	Yes	
	219.50 A	$ 219.50	Console	Yes	Same for all models
	450 A	$ 450.00	Phono-radio	Yes	
Grigsby-Grunow Co.	91	$ 137.50	Console	No	5–G 27; 2–G 45; 1–G 80
	92	$ 167.50	Console	No	5–G 27; 2–G 45; 1–G 80
	181	$ 265.00	Phono-radio	No	5–G 27; 2–250; 2–281
Gulbransen Co.	291	$ 139.50	Console	Yes	5–226, 1–224, 2–245, 1–280;
	292	$ 149.50	Console	Yes	
	295	$ 159.50	Console	Yes	Same for all models
Howard Radio Co.	Consolette	$ 175.00	Console	No	5–226, 2–245, 1–227, 1–280; Same for all models
	Highboy	$ 199.50	Console	No	
	Sheraton	$ 235.00	Console	No	
	Hepplewhite	$ 235.00	Console	No	
	Louis XVI	$ 255.00	Console	No	
	Florentine	$ 275.00	Console	No	
	Gothic	$ 275.00	Console	No	
Kellogg Switchboard & Supply Co.	523	$ 250.00	Console	Yes	3–224, 3–227, 2–245, 1–280
	524	$ 295.00	Console	Yes	3–224, 3–227, 2–250, 2–281
	525	$ 395.00	Phono-radio	Yes	3–224, 3–227, 2–250, 2–281
Colin B. Kennedy Corp.	210	$ 159.00	Console	No	5–227, 2–245, 1–280
	310	$ 197.00	Console	No	5–227, 2–245, 1–280
	220	$ 159.00	Console	Yes	3–224, 2–227, 1–245, 1–280
	320	$ 197.00	Console	Yes	3–224, 2–227, 1–245, 1–280
King Mfg. Corp.	Imperial	$ 169.50	Console	No	6–227, 2–245, 1–280
	Royal	$ 149.50	Console	No	3–226, 2–227, 2–171, 1–280
Kolster Radio Corp.	K 43	$ 235.00	Console	Yes	3–224, 2–227, 1–280
	K 44	$ 325.00	Console	Yes	2–224, 2–227, 2–281, 2–245
	K 45	$ 500.00	Console	Yes	3–224, 4–227, 2–281, 2–250
	6 D	$ 89.50	Table	No	5–201A, 1–112A
McMillan Radio Corp.	959	$ 159.50	Console	No	5–226, 2–245, 1–227, 1–280; Same in all models
	965	$ 165.00	Either	No	
	975	$ 175.00	Console	No	
	999	$ 199.50	Console	No	
	925	$ 225.00	Console	No	
	935	$ 235.00	Console	No	
	937	$ 237.50	Console	No	
Minerva Radio Co.	1	$ 125.00	Console	No	5–227, 2–245, 1–280; Same in all models
	2	$ 175.00	Console	No	
	3	$ 250.00	Console	No	
	4	$ 350.00	Console	No	
National Carbon Co., Inc.	31	$ 115.00	Table	No	5–227, 2–171, 1–280
	32	$ 175.00	Console	No	5–227, 2–171, 1–280
	33	$ 210.00	Console	No	5–227, 2–171, 1–280
	34	$ 225.00	Console	No	5–227, 2–171, 1–280
	42	$ 180.00	Console	No	5–227, 2–245, 1–280
	43	$ 215.00	Console	No	5–227, 2–245, 1–280
	44	$ 230.00	Console	No	5–227, 2–245, 1–280
	52	$ 185.00	Console	Yes	3–224, 2–227, 1–280
	53	$ 220.00	Console	Yes	3–224, 2–227, 1–280
	54	$ 235.00	Console	Yes	3–224, 2–227, 1–280
Philadelphia Storage Battery Co.	65	$ 67.00	Table	Yes	2–224, 2–245, 1–227, 1–280
	65 Lowboy	$ 119.50	Console	Yes	2–224, 2–245, 1–227, 1–280
	65 Highboy	$ 139.50	Console	Yes	2–224, 2–245, 1–227, 1–280
Philadelphia Storage Battery Co.	65 Highboy DeLuxe	$ 195.00	Console	Yes	2–224, 2–245, 1–227, 1–280
	87 Lowboy	$ 129.50	Console	No	1–227, 1–280, 2–245, 4–226
	87 Highboy	$ 149.50	Console	No	1–227, 1–280, 2–245, 4–226
	87 Highboy DeLuxe	$ 205.00	Console	No	1–227, 1–280, 2–245, 4–226
The Pierson Co.	740	$ 250.00	Console	Yes	3–224, 2–245, 4–227; Same in all models
	750	$ 300.00	Phono-radio	Yes	
	780	$ 600.00	Console	Yes	
Pioneer Radio Corp.	66	$ 99.50	Console	Yes	1–224, 2–245, 1–227, 3–226, 1–280; Same in all models
	68	$ 125.00	Console	Yes	
	70	$ 135.00	Console	Yes	
	72	$ 150.00	Console	Yes	
	62	$ 77.50	Table	Yes	
Radio-Victor Corp. of America	33	$ 69.50	Table	No	4–226, 1–227, 1–171A, 1–280
	33	$ 77.50	Console	No	4–226, 1–227, 1–171A, 1–280
	18	$ 95.00	Table	No	4–226, 1–227, 1–171A, 1–280
	44	$ 110.00	Table	Yes	3–224, 1–245, 1–280
	60	$ 147.00	Table	No	7–227, 1–171A, 1–280
	46	$ 179.00	Console	Yes	3–224, 1–245, 1–280
	62	$ 350.00	Console	No	7–227, 1–171A, 1–280
	64	$ 550.00	Console	No	8–227, 1–250, 2–281
Shamrock Mfg. Co.	Console	$ 139.50	Console	Yes	
Silver-Marshall, Inc.	Highboy	$ 195.00	Console	Yes	4–224, 1–227, 2–215 1–280
	Lowboy	$ 160.00	Console	Yes	4–224, 1–227, 2–245 1–280
Sparks-Withington Co.	930	$ 189.50	Console	No	6–484, 2–182, 1–280
	931	$ 179.50	Console	No	6–484, 2–182B, 1–280
	89 A	$ 375.00	Console	No	6–484, 1–250, 2–281
	109	$ 495.00	Console	No	6–484, 2–250, 2–281
	110	$ 395.00	Console	No	6–484, 2–250, 2–226, 2–281
	301	$ 274.50	Console	No	6–484, 2–250, 2–281
	99	$ 875.00	Phono-radio	No	6–484, 2–250, 2–281, 1–226
	101	$ 795.00	Phono-radio	No	6–484, 2–226, 2–250, 2–281
	49	$ 76.00	Table	No	6–686, 2–301B, 1–182
Steinite Radio Co.	40	$ 135.00	Console	No	5–227, 2–245, 1–280
	45	$ 165.00	Console	No	5–227, 2–245, 1–280
	50	$ 185.00	Console	No	5–227, 2–250, 2–281
	60	$ 169.50	Console	No	5–227, 2–245, 1–280
	102	$ 250.00	Phono-radio	No	5–227, 2–245, 1–280
	80	$ 179.50	Console	Yes	3–224, 1–227, 2–245, 1–280
Sterling Mfg. Co.	A-2-60	$ 129.50	Console	Yes	1–224, 4–227, 2–245, 1–280
	B-1-60	$ 187.50	Console	Yes	3–224, 2–227, 2–245, 1–280
Stewart Warner Corp.	901	$ 89.75	Table	No	5–227, 2–245, 1–280
	911	$ 95.25	Table	No	5–227, 2–245, 1–280
	921	$ 97.25	Table	No	5–112, 2–171
	931	$ 72.50	Table	No	5–201, 2–112
	951		Table	Yes	3–224, 2–227, 2–245, 1–280
Story & Clark Piano Co.	1	$ 199.50	Console	Yes	2–245, 2–227, 3–224, 1–280; Same for all models
	2	$ 249.50	Console	Yes	
	3	$ 299.50	Console	Yes	
Stromberg-Carlson Telephone Mfg. Co.	641	$ 155.00	Table	Yes	3–224, 1–227, 1–245, 1–280
	642	$ 247.50	Console	Yes	3–224, 1–227, 1–245, 1–280
	846	$ 347.50	Console	Yes	3–224, 3–227, 2–245, 2–280
Temple Corp.	860	$ 149.00	Console	No	6–227, 2–245, 1–280; Same for all models
	880	$ 189.00	Console	No	
	890	$ 289.00	Phono-radio	No	

(*Continued on page 242*)

MERCHANDISING SCREEN-GRID RECEIVERS

AMERICAN BOSCH MAGNETO CORP.



F. Goodman

FRANK W. GOODMAN, General Sales Manager, Radio Division: The merchandising of screen-grid radio receivers will largely take care of itself. Like any other major improvement in any commodity, the public becomes conscious of it almost as quickly as the trade. The introduction of screen-grid sets may be compared readily to the introduction of balloon tires on automobiles. It took no particular effort on the part of the automobile dealer to merchandise balloon-tired cars; the public was eager for them and recognized the advantages almost instantly. In the same manner, the public will recognize the advantages of screen-grid radio receivers, and will buy more readily because a lower investment is necessary.

The most important factor in merchandising screen-grid radio receivers is, from the viewpoint of the dealer, "which screen-grid set shall I sell"—and from the customer's viewpoint, "which screen-grid receiver is best for me to buy."

There will be a large number of screen-grid receivers available this year. However, any well-versed radio engineer will explain without hesitancy that the screen-grid tube is ticklish until properly mastered. The introduction of one or two screen-grid tubes in a radio set is not the answer to this year's problem. A radio receiver must be engineered carefully from the ground up in order to obtain all the advantages of the screen-grid tube and at the same time avoid the pitfalls.



F. A. D. Andrea

To turn again to the automobile industry, in the first season of balloon tires, many manufacturers placed these tires on cars then in production in order to meet quickly the public's demand. As a result many disadvantages were evident because proper clearances were not available in existing models, turning radii were too great, etc. On the other hand, those manufacturers who properly designed their models to secure the full advantage of balloon tires were successful, their dealers made money, and the public was satisfied. Those manufacturers who have carefully engineered their screen-grid receivers this year will also be successful, their dealers will have a profitable business, and the customers will be well pleased. The public will quickly seek out the well-designed receivers and will obtain performance such as they have never had before.

F. A. D. ANDREA, INC. (FADA)

FRANK A. D. ANDREA, President: Radio receivers using screen-grid tubes really speak for themselves. Therefore, merchandising is best linked up with actual demonstrations. No dealer can fail to become personally enthusiastic over the performance of the best new receivers, and he should pass that enthusiasm along. It is more of a paramount factor in sales success than ever before—in overcoming competitive pleas and promises.

Dealers should precede the demonstration of a receiver with an analysis of the advantages accruing from the use of these tubes. To do that the dealer must study the information concerning the 224-type tubes which is readily available to him from the manufacturers of sets and tubes. He should absorb this information so that he is able to translate it into simple terms for the benefit of customers who know little about radio receivers other than that they bring in the desired programs. Not all dealers are technical experts, but there are a few who do not have a basic conception of a set and its operation and who do not have a trained serviceman at their beck and call. Such dealers should make an effort to improve their knowledge if they wish to compete in the 1929 market.

At the present time the conception of the screen-grid receivers by those who have not seen them (meaning the majority of our population) is that they are better—"in some way." Telling what that "some way" is forms the first job of the radio dealer. And he must not neglect to emphasize that with the screen-grid tube it is necessary to use specially designed circuits, differing considerably from those employed in previous years and which used lower "mu" tubes like the 227's.

The dealer should make it clear that the screen-grid tube receiver is not an experiment—that it need not be regarded with suspicion, but that it represents long-term development in the radio art. Only after months of intensive laboratory experimenting have the a. c. screen-grid tubes been released.

In addition to technical facts the dealer should know that the screen-grid tube is not new, although it was not used generally in broadcast receivers until this year. The great possibilities of this tube were disclosed by engineers of the General Electric Company in 1919 when laboratory models were perfected and used in a four-stage r.f. amplifier which gave an unusual amount of amplification without any tendency toward oscillation.

It has required most of the interval of ten years that has elapsed between the time the first laboratory models were made and the present date to perfect the tube for general use.

FEDERAL RADIO CORPORATION

EDWARD C. HILL, Sales Promotion Manager: There is always an important factor in the merchandising of any product, and that is knowing that product. This is especially true in selling screen-grid radio receivers.

The all-electric set of last season using a.c. 227-type heater tubes, push-pull amplification, and a dynamic loud speaker left little to improve, but, although there were signs of stability in the radio industry, every manufacturer has been striving to produce better apparatus at lower cost. This has been accomplished this year in the better makes of screen-grid sets.

In the mind of the radio retailer there is no question that performance is the outstanding feature in selling radio apparatus; tone quality, selectivity, distance, and reliability are still considered the chief selling points of a radio set. With the advent of the new screen-grid tube, which has created such wide-spread interest through the publicity given to it by trade journals and newspapers throughout the country, the dealer and the public look to this development to give them the utmost in



E. C. Hill

radio performance. We believe that the dealer should know the fundamental features of this tube as an amplifier in a radio receiver with a properly designed circuit. With this information the dealer can build up a splendid sales talk that will be of great interest to his customer.

Aside from technical advantages, which are many, the greatest consideration from both the manufacturers' and dealers' point of view is that the screen-grid tube marks the advent of quality receiving apparatus at a price that will enlarge the replacement market and attract the new set buyer who has remained out of the market because the price of real performance was not obtainable for the amount he was able and willing to invest. In other words, the screen-grid tube by permitting simplification of circuit design makes it possible to offer outstanding performance at a relatively low price. A properly designed screen-grid receiver represents not only an initial saving but also a substantial saving in the matter of tube replacements, etc., when compared on a basis of performance with sets employing the older types of tubes in the radio-frequency stages. Hence, Federal's message to dealers will be: wider markets to tap, increased stock turn over, and decreased service expense.



H. C. Bodman

SILVER-MARSHALL, INC.

HAROLD C. BODMAN, Sales Manager: We are on the threshold of a new era in radio receivers and with a greatly improved product—the screen-grid set—we are destined to see greatly improved methods of merchandising. Just as the a.c. receiver, two years ago, opened up a vastly broader market for radio receivers by rendering them more convenient to install and to operate in the home—so the screen-grid tube opens up new markets for screen-grid radio receivers, and new methods of merchandising them.

A well-designed screen-grid receiver allows certain feats to be accomplished that were never before practical or possible. For instance, the sensitivity is so high that all local stations and many distant ones may be received with a finger touching the antenna post serving as the only antenna. Then also, it possesses selectivity such as is found in none of the previously known receivers without sacrifice of tone quality. These two advantages alone offer the radio dealer such tremendous opportunities for effective home demonstrations that it would be almost a miracle if screen-grid receivers did not revolutionize radio merchandising in 1929.

Radio "retailing" is fast changing to radio "merchandising." The dealer who waits for customers to come to his store to buy is fast being supplanted by the "merchandiser" who extends the four walls of his store to embrace his entire trading area. And no development that engineering genius has provided since light-socket operation has been so vitally important to the dealer as to-day's well-designed screen-grid set.

In selling screen-grid receivers, a dealer can arrange three or four demonstrations in a single evening due to the fact that such sets may be installed as quickly as a floor lamp. And, when he can use a lead pencil a pen knife, or even an ice pick as an antenna, and bring in stations that are inaudible on previously known types of sets, is it conceivable that he would not take fullest advantage of the home-demonstration method of selling? This year it is expected that at least 70 per cent. of all radio sets sold will be sold in the homes of the prospects, and not on the floor!

From the dealer's viewpoint, the particular screen-grid receiver which he plans to merchandise makes all the difference in the world. Screen-grid tubes don't make a screen-grid receiver any more than "clothes make the man." The most important thing for the dealer to consider is: "What make of screen-grid receiver best lends itself to the home-demonstration method of selling. When a screen-grid receiver has been selected which has a reputation back of it, which performs as a real screen-grid receiver should perform, and which is confidently and aggressively pushed by the manufacturer, half the battle is won.

The other half of the battle is to train salesmen, establish a trade-in policy, follow a safe financing plan, advertise effectively, and watch administrative expenses.

In connection with the actual selling of these receivers it should be pointed out that the most successful and most profitable method of making home demonstrations is not by "cold-turkey canvassing" but by being *invited* by the prospect to demonstrate. Door-to-door canvassing does not build prestige for the store nor customer good will. On the other hand, the most advisable method of securing customers is to reach out for prospects by means of well-aimed letters to the householders of your community, asking for an opportunity to demonstrate your screen-grid radio receiver. Your telephone, too, provides an effective means of introducing yourself and your product to picked prospects. Advertising in your local paper will also cultivate the families of your community and establish your identity, bringing inquiries and prospects and making your selling job easier and quicker.

These are days of great opportunity and strenuous competition for the customer's dollar. While the old time retailer is "watching and waiting" for customers, the "merchandiser" of 1929 is going out after them, building a reputation for being alive and building up his bank account as well.



G. A. Scoville

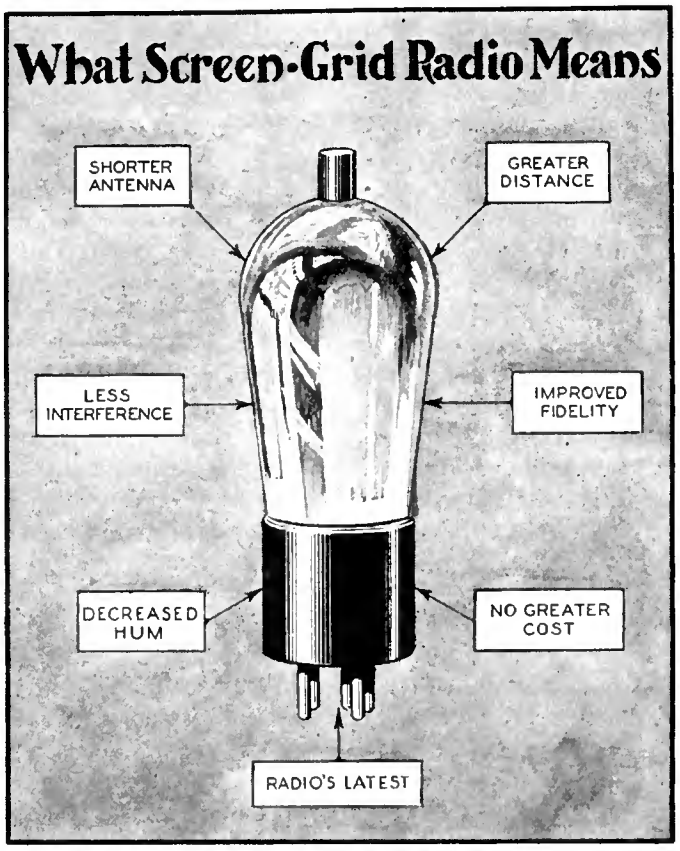
STROMBERG-CARLSON TEL. MFG. CO.

GEORGE A. SCOVILLE, Vice-President and Sales Manager: Merchandising of the new screen-grid receivers on the part of the dealer need differ in no way from merchandising any new and better product. It is true that screen-grid receivers represent a very important step forward in radio; it is unquestionably the most noteworthy advance since "total shielding" of receivers and the introduction of house-current operation. Screen-grid receivers, which are *really* screen-grid receivers—not simply a screen-grid tube or two stuck into an ordinary circuit—offer to the customer something better in radio than anything that has been on the market heretofore, and it naturally presents something of a problem to dealers in connection with present stocks.

Yet, the problem will right itself quickly if the dealers, and manufacturers as well, will use discretion. The foregoing statement is made with facts behind it, for, when a.c. tubes were introduced, which was a more abrupt change than the screen-grid tube presents, our company produced nothing but receivers with direct-current tubes for a full year afterwards. We were probably affected by the advent of a.c. tubes, yet our sales actually did increase during that period.

Automobile dealers have been confronted with the same situation which screen-grid tubes have created in radio to-day, and a good many times in the history of their industry, and so have the typewriter people, and many others. Advancement in product, the bringing out of goods radically better than anything before, is what gives zest to an industry. It stimulates sales. It is the life of trade.

WHAT THE SCREEN-GRID SET DOES



MANY ARGUMENTS pro and con on screen-grid receivers are taking place behind and in front of counters where sets are sold, and it is no secret that such arguments have occurred in the offices of large set manufacturers, or that these manufacturers are divided into two general groups, those who do and those who don't believe that screen-grid radio is 1929's panacea.

What are the facts about screen-grid radios? In the following paragraphs some of the advances that are possible in receiver design because of the advent of this new tube are pointed out. It must not be assumed merely because such advances are possible, that they already exist. Nor must it be assumed that the screen-grid radio will displace other types of sets. In the words of several large set engineers, the screen-grid tube is another tool; a useful one, but one which must not be taken as the cure-all for every radio ill.

Some of 1929's receivers using screen-grid tubes will be superior to sets made a year ago without the advantage of the new tube; it is equally true that a general advancement has taken place in the year and that sets using three-element tubes throughout have progressed toward the goal of better selectivity, better sensitivity, and improved fidelity.

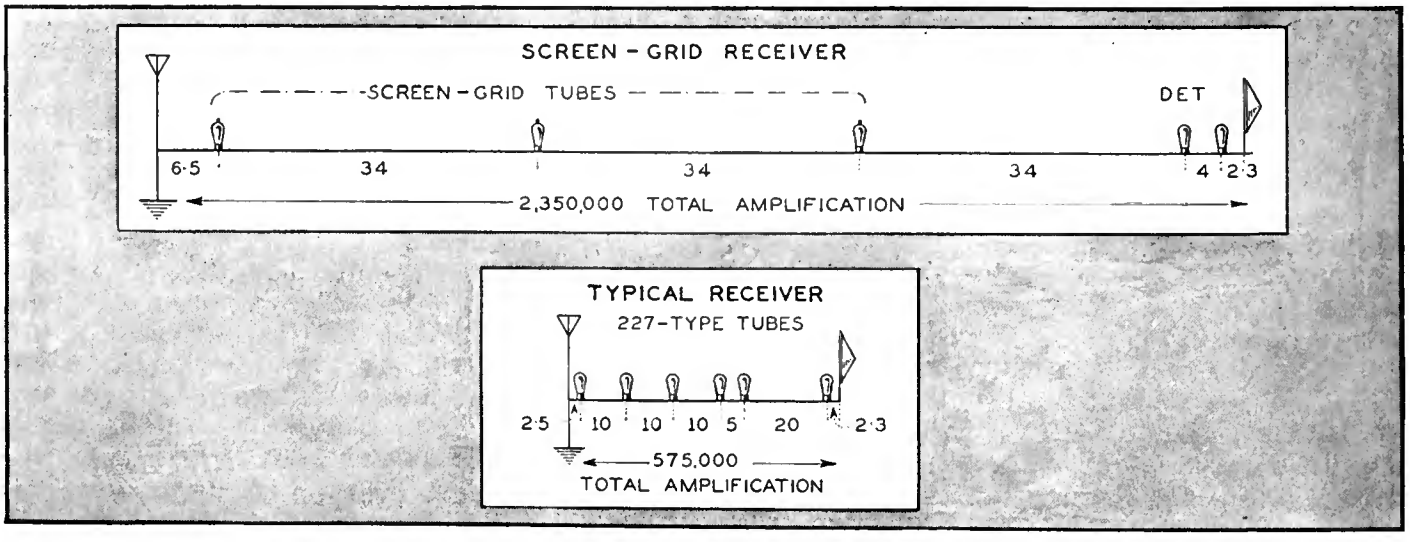
Screen-grid tubes make possible a more sensitive, and more selective receiver than was possible a year ago, and one in which the fidelity of reproduction may be improved over that obtainable in 1928.

Let us look at the sensitivity angle. Last year (1928) receivers were about ten times as sensitive as those of a year or two previous. And many sets of 1929 are ten times as sensitive as those of 1928!

What does this mean? It means that one can receive more distant stations, or a given station louder, or a given station from a greater distance, or lower-powered transmitters, or he can attain all of last year's results on a smaller antenna.

On page 213 will be found a drawing showing the effect of increasing the sensitivity of a receiver by ten times. If an antenna 12 feet high was required in 1928 to deliver a given loud speaker signal from a given station, an antenna only 1.2 feet high will be necessary in 1929. Well-designed screen-grid receivers can get along with only a very small wire or a metal screen as an antenna. For apartment dwellers, this means the complete elimination of the unsightly and dangerous antenna erected on the roof far from the receiver.

In another illustration an attempt s made to show how the receiving range of a receiver may be increased by the use of screen-grid tubes. If the sensitivity of a receiver is increased ten times, the receiver can be placed ten times the distance from a given station and still deliver the same loud speaker



A screen-grid receiver using five tubes compared in overall amplification with a six-tube receiver using three-element tubes

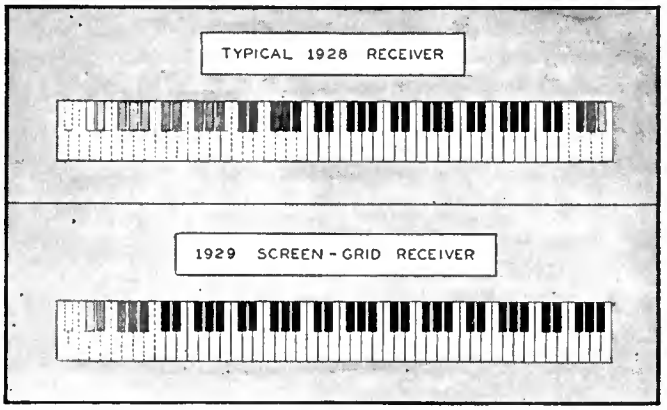
signal. This implies that the set is located in a quiet place which is free from local noise.

So much for the sensitivity of the 1929 screen-grid sets.

In proper designs, the new tube makes possible a more selective receiver. The difference between the selectivity of receivers built in 1928 and those of 1929 may be somewhat difficult to determine because some of the sets of a year ago were so selective, due to regeneration, that high audio notes were badly chopped off. Because of reasons inherent in the screen-grid tube itself, somewhat greater selectivity is possible.

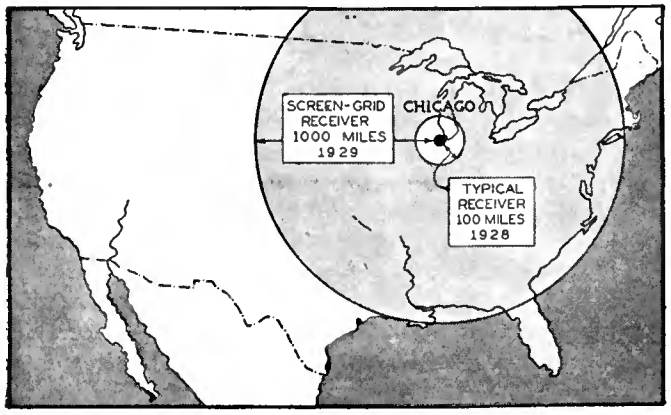
Previous to the present season, receivers had to depend upon a sensitive detector of the grid leak and condenser type for a considerable part of their sensitivity. This kind of detector is a notorious offender when considered from the viewpoint of fidelity. In some receivers using this type of detector, the distortion occurring in the detector circuit alone amounts to 25 per cent. of the desired signal. This much distortion is audible to the most hardened listener. At the same time high audio tones have been reduced by the old-type detectors. With high gain r.f. amplifiers C-bias detection can be used and this type of detector does not discriminate against the high audio frequencies.

The picture diagram accompanying this article shows how the amplification available from new sets compares with those of 1928. A considerable part of the amplification that existed after the detector, in 1928, now comes before the detector. This means that the detector input signal has been increased over that of last year. And so, the "power" detector comes into the radio picture. It is a detector that will handle large input signals without overloading. Also the detector circuit can be designed to have a linear characteristic so that it will put out large signals without the 25 per cent. addition of distorting harmonics. At the same time it need not discriminate against high audio tones as does the older type of detector.



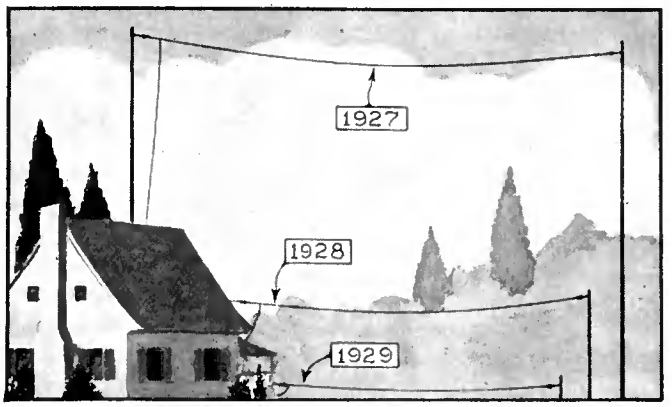
This drawing indicates how the fidelity of response may be improved at both ends of the musical scale with screen-grid tubes.

In well-designed circuits the tube not only increases the musical range over which a receiver may respond, but at the same time permits a clearer reception of this range. In the picture of the piano keyboard, the hazy keys indicate the frequencies which are not clearly received by the average set.



A receiver in a quiet locality has its range increased materially by the use of screen-grid tubes.

At the same time the major qualities of a radio receiver have been improved, certain other electrical and mechanical improvements and simplicities may be effected by the use of the screen-grid tube.



1928 results may be obtained with a 1929 screen-grid receiver with a smaller antenna.

The high gain in the r.f. amplifier makes it possible to eliminate one stage of audio-frequency amplification so that the power tube follows directly after the detector. With one stage of audio there will be less hum and less tube noise and sets will be less microphonic. The elimination of one stage may reduce the manufacturing cost so that the purchaser gets equivalent or better performance for the same money.

Because the screen-grid tube makes possible such a sensitive receiver, it must be engineered more carefully than a set of less amplification. This means that a purchaser in 1929 should get a set engineered and equipped with more care than a similar set of two years ago. The mere matter of having each tuned stage lined up properly assumes much greater proportions in a screen-grid set. The problem of shielding is one which must be looked at more carefully in 1929 than in 1928.

All in all, a well-designed 1929 screen-grid set should give a customer a better radio than he could buy in 1928, at a price no greater than he would have to pay for a receiver a year ago. It is a set that will get more stations, stations farther away, and stations that now seem a bit too close to others in frequency for happy results. Signals ought to sound better. And all of these results may be obtained with a smaller antenna!

NEW MARINE REGULATIONS

THE CONFERENCE on Safety of Life at Sea, which met in London during April and May, adopted regulations respecting radio telegraphy aboard vessels, requiring transmitting and receiving equipment on all passenger ships and all cargo vessels over 1600 tons. This agreement, if adopted by our Government, will require many new radio installations, since our radio law now prescribes only that all steam vessels carrying 50 or more persons shall have radio equipment, thereby exempting small cargo steamers, motor ships, and sailing vessels.

The MARCH

The R. M. A. Elects New Officers
Improvement In Radio Programs Needed

Curing the Direct Advertising Cancer

WHILE GRATIFYING progress has been made in the technical improvement of broadcast transmission and reception, the fundamental concern of the radio industry—the broadcast program reproduced in the listener's home—is suffering dangerously from an insiduous "cancer." Little by little, the incubus of commercialism, at first welcomed because it brought economic independence to broadcast station operation, is now threatening radio broadcasting with paralysis. The commercial announcement has evolved from a courteous and restrained good-will appeal to a



knockout dose of advertising, so potent that one can no longer enjoy a radio program without a feeling of apprehension.

For several years, while it was owned and operated by the American Telephone and Telegraph Company, WEAF set unimpeachable standards for commercial broadcasting. The organization which evolved the economic foundation for broadcasting, launched radio advertising upon an indisputably high plane. Its clients fought for concessions, but nothing more than the firm name and slogan at the beginning and end of each program were allowed to get out over the air. Fulsome descriptions of products, testimonials strangely reminiscent of quack medicine advertising and smart-aleck announcement characteristic of to-day's offerings, were simply prohibited. After two or three years of activity, the company withdrew from broadcasting station operation and sold WEAF to the Radio Corporation of America, which, together with Westinghouse and General Electric, formed the National Broadcasting Company.

Three years of operation under these auspices has resulted in an enormous extension of radio advertising and chain broadcasting. Powerful salesmanship was exerted upon the advertisers, with the result that appropriations for radio programs increased enormously. The professional standing of artists appearing before the microphone has been lifted to the highest standards. But broadcasting has receded from its position as a prime interest of the American public. The good-will program has evolved from a courtesy to an annoyance, in spite of its improved artistic standing. The habitual listener is now as grateful for the commercial program as he is for the billboards which grace the principal highways.

To be satisfied with their investment in broadcasting, announcers are compelled by sponsors to launch into detailed descriptions of their products; they must attempt to intrigue their audiences with countless slogans, discuss financial arrangements, detail payment plans, quote prices, enrapture supposedly gullible listeners with high-priced testimonials, and proclaim real or imaginary points of superiority with which the spon-



sors consider their products to be endowed. How far from the standards originally charted for commercial broadcasting has the art wandered!

In fairness to broadcast managements, it must be said that most of them have attempted to resist misguided attempts to make radio a direct-advertising medium. Many programs are still models of good taste. Having brought prosperity to commercial broadcasting, however, the demands of many affluent advertisers for stronger and stronger doses of advertising are not easily curbed. On the printed page, advertisers may say what they please; why not over the air? They certainly pay enough for the privilege.

No one objects to superlative statements on the printed page because the reader can, by a turn of the page, dismiss the advertisement instantly, without sacrificing the entertainment or educational value for which he purchased the publication. The radio listener, on the other hand, must dismiss not only advertising but entertainment as well. Unless he seats himself at the controls of the receiver, within a few inches of the reproducer, dismissing unwelcome advertising is a considerable inconvenience.

Many in the broadcasting profession accept the advertising announcement as a necessary evil which must be tolerated. But they are traitors to the ideals which ought to animate the broadcasting industry. By their attitude, they acknowledge

The New R.M.A. Leaders

GREAT WISDOM *was shown by the membership of the Radio Manufacturers' Association in choosing the officers who are to guide the destinies of that body for the coming year. H. B. Richmond, the new president, is acclaimed on every side as an able and popular leader. As chairman of the Engineering Committee of R. M. A. for a number of years, Mr. Richmond has demonstrated a wide knowledge of industry problems, a remarkable ability to "get things done," and a diplomacy and kindly suavity that promises much to the radio industry with leadership of this calibre, One of the outstanding elements in the make-up of the new R. M. A. president is a broadness of vision which will keep association activities on the highest of planes, free from petty politics and pointless bickerings.*

Aiding Mr. Richmond is an unusually able and representative group of officers and directors. They are: T. K. Webster, Jr., treasurer; Morris Metcalf (American Bosch), vice-president; Henry C. Forster (Utah Products), vice-president; William Sparks (Sparks-Withington), vice-president. The new directors, elected for three years, are: H. C. Cox (Columbia Phonograph), Henry C. Forster, George C. Furness (National Carbon), B. J. Grigsby (Grigsby-Grunow), Ralph H. Langley (Crosley), A. G. Mesick (U. S. Radio), R. T. Pierson (Bremer-Tully), and H. B. Richmond (General Radio).



H. B. Richmond

—W. K. W.

OF RADIO

Regarding Screen-Grid Receivers
The Listener's Attitude Should be Studied

their failure to make advertisers appreciate the attitude of the listener who finds, at least a dozen times in an evening, that he has invested a hundred dollars or more in a means of inviting poorly disguised canvassers into his home. These apologists for radio advertising have failed to devise a method of capitalizing good will gained through a high-grade program by means of an effective but inoffensive tie-in because their ingenuity is incapable of originating a practical method of enticing audience response. There is no logical user of broadcasting for whom a tie-in cannot be originated, appealing directly to his prospects.



The task of assuring the intelligent and effective utilization of commercial broadcasting would be much easier if accurate investigations of listener attitude were made. The "statistics" distributed by most broadcasting stations as to coverage are of little value. The population and wealth within an arbitrary distance of a broadcasting station gives no indication of a particular station's real audience and almost invariably embraces areas not served by the station involved. Popularity contests mean still less because unrepresentative groups respond to them and questionnaires are subject to the same failing.

The great public utilities have learned accurate methods of measuring public attitude, employing investigations of a comprehensive character and involving highly specialized techniques. No organization in the radio field has gone further than to estimate the total potential audience for all stations in an arbitrary radius. It is entirely within the capabilities of scientific investigation of public attitude to determine the habitual audience of a given station at all hours of the day in its true service area, as indicated by field-strength surveys; to evaluate the good will loss or gain for specific types of announcements and the relation of the good will won through broadcasting upon the effectiveness of printed advertising and upon sales resistance.

Once modern methods, which have been successfully applied in other fields, are used by the broadcasting fraternity, the advertiser will readily appreciate that radio as a good-will medium has tremendous potentialities, fully justifying huge appropriations, and that, employed as an *advertising* medium, it creates more ill will than good will. In the meanwhile, the average listener, because of the increasingly offensive and effusive character of the announcements, becomes less and less responsive to the good-will influence of broadcasting.

Screen-Grid Receivers, Good and Bad

As THE forward looking element of the radio industry has anticipated for two years, the appearance of the a. c. screen-grid tube resulted in its instant adoption by practically every manufacturer in the industry. The tube manufacturers had only to produce an alternating current screen-grid tube and its superior amplification possibilities assured its immediate utilization. Here and there, however, we hear rumors that there is to be grief in connection with the screen-grid tube, and that there is still a great deal to be learned before service difficulties are overcome.



Similar rumors floated about when the alternating current tube first appeared and, prior to that, when the a. c. power-supply unit replaced the battery. Grief did accompany these innovations, which was quickly dispelled by engineering and manufacturing experience. But there is no question about the future of the screen-grid tube. If there is to be criticism, the failure will not lie with the tube but with faulty engineering of the receiver to which it is applied unsuccessfully. There are many examples of marvelous engineering design and successful application of the screen-grid tube which will prove to the rest of the industry that competent and forward looking engineering pays. These receivers are the product of months of experimental work with the battery-type screen-grid tube which has long been available to the laboratory.

This is the season when slap-stick designing and engineering by imitation will expose itself. We have tried some screen-grid sets which must have been hurriedly put together in May in order that the manufacturer might be at the trade show in June with a screen-grid receiver. Some of these are merely inefficient so that little of the benefits of screen-grid amplification are obtained; some are regenerative with disastrous results in audio quality, culminating in obvious loss of the higher frequencies so essential to clear articulation of speech and brilliance in music; one or two which we tried actually oscillated at one or two sections of the dial so that we were reminded again of the regenerative receiver days. But the screen-grid tube technique will yield to good engineering and, presumably before large-scale production begins, these deficiencies will be remedied.

To the radio dealer, who must judge numerous offerings made to him, we recommend exhaustive tests and discriminating selection. This is a screen-grid year and the dealer must be ready to meet the demand. It will pay him to use caution and to determine by actual comparison whether he is considering a product of hasty engineering or whether there is a year or two of experimental experience with screen-grid tubes back of the line which he selects.

The Men Who Write Our Radio Laws

THE PROGRESS of radio seems to be made and unmade by the legislation adopted respecting it. No body is more important in determining the course of that legislation than the Senate Interstate Commerce Committee. For some time, this august body has been taking testimony from hither and yon in order to clarify its views with respect to the Couzens Bill, providing for a combined radio, telephone, and telegraph commission. Apparently the Federal Radio Commission has either discharged its duties to the satisfaction of the Senate or it is considered not to have enough to do. Senator Pittman of Nevada distinguished himself during these sessions by

(*Continued on page 256*)



The TUBE Business







IN JUNE, without doubt, there was a serious shortage of good screen-grid tubes. At that time an estimate was made that the total production of all prominent tube manufacturers was only 15,000 screen-grid tubes a day, although the demand was for about 75,000.

Everyone believed that the problem of making a good screen-grid tube at the price announced by the Radio Corporation was a major problem indeed, and one which was not at all certain of solution. Several tube manufacturers coincided with the belief that such tubes would cost in the neighborhood of $2.00 to build, and that plant production would be reduced by from 40 to 60 per cent. by their construction. There is no certainty yet that the tubes will stay good in service after they are made.

It is a fact that the more complicated a tube becomes, the shorter its life. The fact that the 226-type tube is going out of the radio picture strikes out one of the easiest tubes to make. The screen-grid tube with its additional material becomes very difficult to make and to keep free from gas.

It is our belief, and one which seems to be shared by some tube manufacturers at least, that more coöperation between tube and set designers would be welcome. If, say a year before any new idea is to be exploited, the tube and set people were to get together and discuss the problems of each, is it not possible that a better set could be engineered, with the certainty that the tubes would last longer? Or is it a fact, as many have darkly hinted, that the tube people do not want tubes to last very long? We cannot believe that a reputable tube manufacturer who refrains from selling seconds and thirds and who is not here to be gone tomorrow, would hesitate to increase the life of his tubes.

There is a race among tube manufacturers to determine who can make the most tests and checks on the tubes before releasing them to the trade. The greatest number we have seen is 137 and, according to the engineer who made the statement, it is only by such an array of tests that it is possible to deliver uniform tubes. It seems to us that this is an admission that modern methods of making tubes are somewhat faulty. If any tube manufacturer has more tests than 137, we'd like to hear about it.

EARNINGS OF TUBE COMPANIES

ACCORDING TO NEWSPAPERS, DeForest earned 22 cents a share on its outstanding stock during the first three months of 1929. Cable, it is reported,will institute a dividend of 50 cents a share.

SCREEN-GRID VS. SERVICE

SPECULATION AS to whether the screen-grid tube will increase the service problem of radio set manufacturers seems to disturb many in the industry. It will not according to Paul Ware (now making the Ware Radio), who states that set people who have really engineered a receiver will experience none of the troubles from oscillation, suppression of higher audio tones, and other griefs in which the manufacturer who has merely thrown together a screen-grid set will find himself.

1929 RADIO TUBE SALES

EDWARD T. MAHARIN, vice-president in charge of sales, CeCo, believes the radio industry will absorb seventy-five million tubes in 1929. He thinks at least six million new sets will be sold. Since sixty-one million tubes were sold in 1928, Mr. Maharin's estimate seems somewhat conservative. Others have guessed as high as 130 million tubes. The best guess seems to be in the neighborhood of 100 million for new sets and old.

ZETKA CHANGES NAME

ZETKA LABORATORIES, INC., for several years manufacturers of special-purpose tubes and a series of long-life tubes for one of the large communication companies, has become the Radio Utilities Corporation. Its entire effort will be concentrated on the production of power and rectifier tubes.

PERRYMAN'S PRODUCTION

PERRYMAN ANNOUNCED in June that daily production in three plants was 10,000 and that by the end of this summer the production would be increased to 24,000. According to Benjamin S. Katz, president, the company had unfilled orders for 2,000,000 tubes including 600,000 sold at the Chicago show.

CABLE'S UNFILLED ORDERS

THE CABLE RADIO TUBE CORPORATION had unfilled orders of $2,000,000 in June; the daily production of 8000 was soon to be raised to 10,000 and to reach 25,000 by September 1.

CECO RECEIVES LARGE ORDER

A SINGLE ORDER for tubes to the extent of $550,000 was secured by CeCo—the tubes to be furnished to Sears Roebuck. May sales were 217 per cent. ahead of May, 1928.

ARCTURUS TUBE PRODUCTION

AT THE BEGINNING of 1929, Arcturus made 14,000 tubes a day. In June the production had been speeded up to the tune of 23,000 a day.

REGARDING SLOGANS

DEFOREST produces an interesting booklet entitled *Dealer Manual for 1929*. It describes window posters, etc., all of which emphasize the DeForest slogan, "The Father of Radio." This reminds us that few of the tube manufacturers have created slogans, names, or cartons that can be remembered by the layman. Many of them claim to make "high-vacuum" tubes, but this means little to the man who buys the tube. He must have a catch phrase, something that will stick in his mind.

A NEW RECTIFIER TUBE

WITH dynamic loud speakers and push-pull 245's, the 280-type rectifier tube is being called upon to deliver so near its maximum current and voltage that some tube people are working on a new tube which can stand up under this load. Such a new rectifier tube will probably have a heavier filament and a larger plate.

In the meantime it is understood that some set manufacturers place 400 volts per anode on the 280-type tube and that everything works out properly provided the total current taken from the tube does not exceed 110 milliamperes.

A $200,000 ORDER

A SINGLE ORDER for over $200,000 worth of tubes was secured by E. A. Tracey, vice-president of the Northern Manufacturing Company (Marathon), at the Trade Show.

TUNE IN ON TRIADORS

Triad joins the ranks of tube manufacturers who take time on the air. WJZ and associated stations broadcast the Triadors on Friday evenings from 8 to 8.30.

BATTERY MAKERS ENTER TUBE BUSINESS

THE ADVENT OF BATTERY manufacturers into the tube industry is a new and interesting phase of the radio business. The Eveready-Raytheon combination has already been noted. Tubes are also sold under the names of Ray-O-Vac, Bond, and Diamond. Burgess, we understand, has also made some overtures in this direction.

THE TRIAD GUARANTEE

WITH EVERY TRIAD tube is packed an insurance certificate which guarantees the efficient life of the tube for at least six months. Any tube found faulty within that time and returned to the dealer with the certificate will be replaced.

WHY TUBES ARE RETURNED

FOR THE FIRST six months of operation, the return of tubes to DeForest were less than 1 per cent. This percentage would be reduced, according to A. H. Fajen, engineer in charge of inspection, if the public would be sure to put each tube in the proper socket of the set, and would not remove or replace a tube without turning off the power. Frequently, a tube will be damaged by putting it in a socket with the power on so that the filament and plate terminals make contact before the grid does, with the result that a high plate current flows—corresponding to zero grid bias. Premature failure of power tubes may be traced frequently to such mishandling.

Sixty-five per cent. of all tube burn outs may be traced to placing tubes in the wrong sockets, says Mr. Fajen.

IN THE RADIO MARKETPLACE

News, Useful Data, and Information on the Offerings of the Manufacturer

CONDENSED FACTS REGARDING NEW RECEIVERS

BREMER-TULLY: Three stages of r.f. amplification, a detector, and two stages of audio are used in the new sets of the Bremer-Tully Manufacturing Company. The output tubes are 245's in push pull. The cabinet models use a 10-inch dynamic loud speaker.

ZENITH: Automatic tuning continues to be a feature of the radio receivers manufactured by this company. Model 39A uses ten tubes including rectifier and is designed for operation on a loop antenna. A phonograph pick-up jack permits the set to be used for the playing of phonograph records. Screen-grid tubes are used.

FREED-EISEMANN: The new receivers announced by this company use a neutrodyne circuit in conjunction with an inductor dynamic loud speaker. Two chassis, one eight tube and one nine tube, are being used in these sets.

ATWATER KENT: The new A. K. screen-grid radio receivers use the a.c. screen-grid tube in the r.f. amplifying circuit with two 245-type tubes in push pull in the output circuit.

DAY-FAN: Type 245 tubes in push pull, improved dynamic loud speaker, phonograph pick-up jack, and a shielded detector circuit are among the features of the Day-Fan Electric Company's new sets. The chassis employs nine tubes including five 226's, one 227, two 245's, and one 280.

KOLSTER: Remote control and automatic tuning with screen-grid tubes in the r.f. stages are the features of the new Kolster receivers. Two 250-type tubes are used in the output of the Model K-45. The Models K-43 and 44 use 245-type tubes.

BOSCH: All the new receivers of this company will use screen-grid tubes in the r.f. amplifier circuit. All models are designed for dynamic loud speaker operation, the consoles being supplied with the new Bosch dynamic loud speaker. Bosch tubes will be marketed this year with Bosch sets.

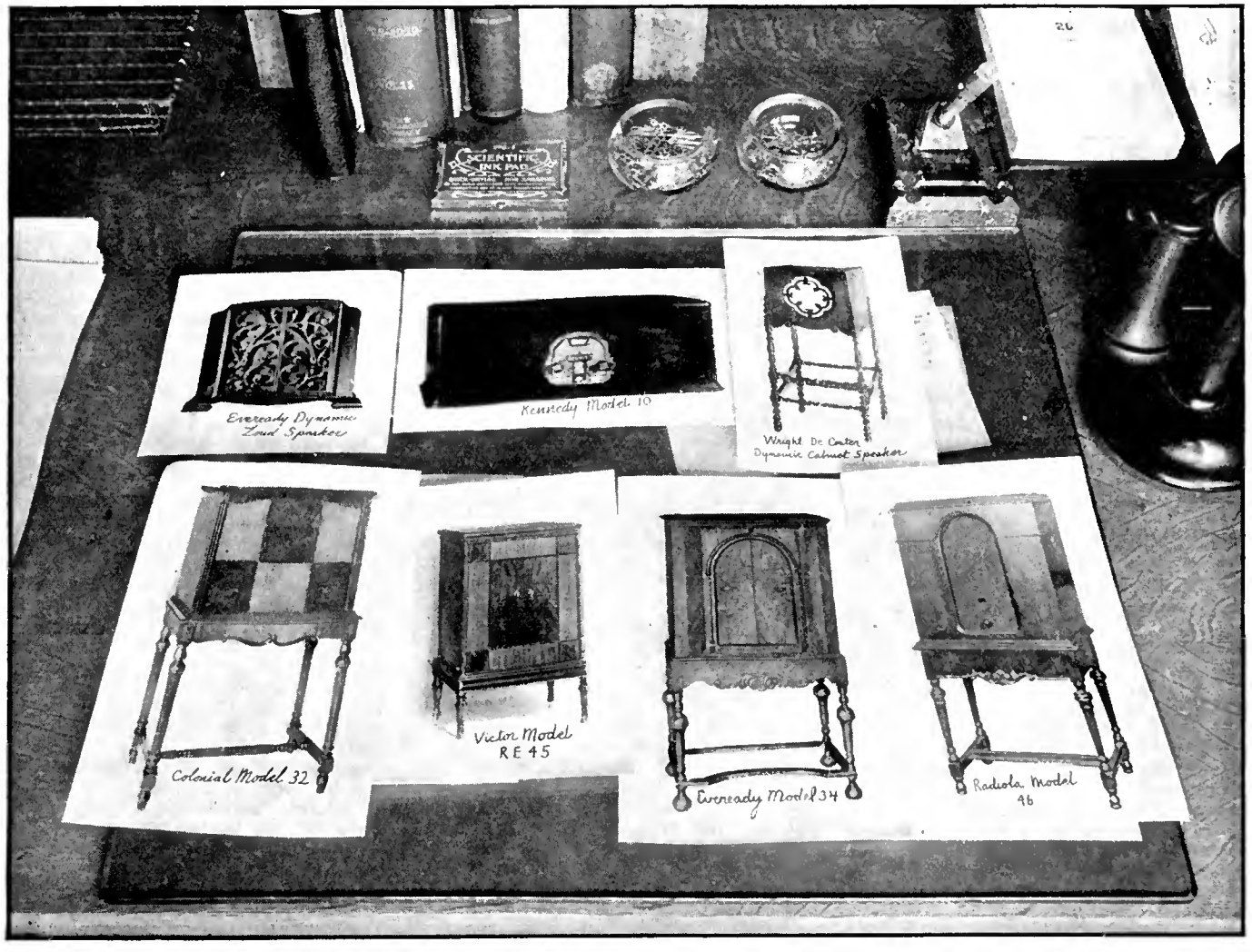
BRANDES: A "selector tuner" is used on the new Brandes receivers. With this tuner there is always in full view on the dial the eight favorite stations of the user.

GREBE: Three screen-grid tubes, band-pass filtering in the r.f. stages, power detection, push-pull amplification, automatic line voltage control, and a dynamic loud speaker are features of the new receivers made by A. H. Grebe and Company.

VICTOR: A "Harmonic Modulator" is used in the new radio receivers manufactured by the Victor Division of the Radio-Victor Corporation of America. The chassis utilizes six 226's, one 227, two 245's, and one 280 tube. Tuning is accomplished by a single leader control which operates over a full-vision scale calibrated in kilocycles with space at the top for marking the names of favorite stations.

KENNEDY: Two new receivers, the Royal Model 310 and Royal Model 210, are being manufactured by the Colin B. Kennedy Corporation.

CONTINENTAL: This corporation manufacture a number of "Star-Raider" receivers. The Technidyne circuit is used. The console models are equipped with phonograph pick-up jacks and the Model RP-40 is a combination radio and phonograph. The dynamic loud speaker used in the console model has a 14-inch cone.



A few of the season's new models viewed from the Editor's desk.

SPARKS-WITHINGTON: The new Sparton receivers continue to use the Equasonne circuit with its automatic-tuned amplifier and band-pass filter which has proven so popular in previous receivers made by this company.

SILVER-MARSHALL: The new Silver radio receivers use screen-grid tubes in the detector circuit and in the r.f. amplifier. The output circuit uses two 245-type tubes in push pull. An automatic line-voltage regulator maintains the voltage supply for the tubes constant even though the supply varies from 90 to 130 volts.

FRESHMAN: The Earl radio receivers of the Charles Freshman Company, Inc. use an eight-tube circuit with 227-type tubes and 245's in push pull in the output. The circuit is of the neutrodyne type.

GRIGSBY GRUNOW: New Majestic receivers incorporate several new features, one of the most interesting of which is an automatic sensitivity control consisting of a device connected to the gang condenser assembly which automatically varies the bias of the r.f. tubes to maintain the sensitivity more nearly constant.

STERLING: This company is building two radio receivers, the Oxford and the Stuart. The former set is a cabinet model using a tuned radio-frequency circuit of three stages and two stages of a.f. with 245-type tubes in the output. The loud speaker is of the dynamic type with a 10-inch cone, the field circuit being supplied with current from the B-power unit. A phonograph pick-up jack is included in the circuit. The Stuart uses three stages of screen-grid r.f. amplification followed by a detector and audio amplifier similar to that used in the Oxford.

COLONIAL: The new Model 32, a receiver using four screen-grid tubes, three of them in the r.f. amplifier and one as a detector, has been announced by the Colonial Radio Corporation. Uniform sensitivity is obtained. The sensitivity as measured on a General Radio signal generator is 5 microvolts per meter. The circuit includes a filter network to prevent the possibility of cross-talk on strong local stations. The detector feeds into two 245's in push pull which, in turn, supply power to a Cutting dynamic loud speaker.

RADIO-VICTOR: Two new receivers, the Radiolas 44 and 46, have been announced by the Radio-Victor Corporation of America. The Radiola 44, a table model, uses three screen-grid tubes, two of them as r.f. amplifiers and one has a detector. The detector is followed by a single stage of audio using one 245-type tube. A rather unusual dial is used on the 44. When the set is in operation the scale markings are projected upon a screen in the center of the escutcheon plate. The set has a local distance switch. The Radiola 46 uses the same circuit as the 44 but is a console model including a dynamic loud speaker of the model 106 type.



F. H. Schnell

KING: The new Royal model, a product of the King Manufacturing Corporation, uses an eight-tube neutrodyne circuit in conjunction with a dynamic loud speaker. The set is contained in a console.

A-C DAYTON: The "Navigator" receivers employ the Technidyne circuit in which all tuning is accomplished before the signal is amplified. Nine tubes are used with 245's in push pull in the output. The set is available in both console and table models.

BUSH AND LANE: A number of receivers are manufactured by the Bush and Lane Piano Company. The company is licensed under RCA and Hazeltine patents. All the receivers use the same chassis with screen-grid tubes in the r.f. amplifier. The console models use dynamic loud speakers.

NATIONAL CARBON: The new series 30 Eveready receivers incorporate several features among which are sturdy mechanical design of the chassis foundation, a variometer tuning of the antenna circuit, and dual loud speaker provision so that either dynamic or magnetic loud speakers may be used. The new sets are very sensitive and the National Carbon Company, manufacturers of these receivers, recommend their use with an indoor antenna or an outdoor antenna of not more than 20 feet. The receivers incorporate three stages of r.f. amplification with 227 tubes, a detector, and two stages of audio with 171A-type tubes in push pull in the output.

KELLOGG: Features of the new receivers of this company are automatic volume control, screen-grid tubes, 250-type tubes in push pull in the output, power detection, and a rugged dynamic loud speaker capable of handling tremendous volume.

EDISON: "Light-O-Matic Tuning" is a feature of the new Edison radio receivers. With this tuning device a red light indicates whenever the user is tuned to one of his favorite stations. The circuit utilizes five 227-type tubes and two 245's in push pull, in some models, and in other models the 245's are replaced by 250's.

FADA: The new receivers of this company use screen-grid tubes, a band-pass filter, power detection, and push-pull amplification. All models can operate on a light-socket antenna thereby requiring no loop, antenna or ground.

RECENT OFFERINGS BY LOUD SPEAKER MANUFACTURERS

AT THE RECENT Chicago Trade Show many of the loud speaker manufacturers showed new models. In the following paragraphs some data is given on some of the more important new improvements.

Jensen Radio Manufacturing Company's newest loud speaker is the "Concert dynamic" loud speaker which uses a ten-inch cone. The other two models in the Jensen line are the "Standard" with an eight-inch cone and the "Auditorium" with a twelve-inch cone. According to Peter L. Jensen, president of the company, the new "Concert" dynamic is unique in that it uses an especially prepared and treated material for the cone and heavy aluminum wire for the moving coil. Both of these factors increase the rigidity and strength of the loud speaker, at the same time increasing the lightness and freedom of motion of the cone so that it gives a better response. Loud speakers are available in various cabinets in both a.c. and d.c. types.



W. Bouck

The *Transformer Corporation of America* has developed a loud speaker incorporating several modifications among which are the use of an unusually large diaphragm made of one piece and the complete elimination of the suspension spider at the apex so that perfect centering of the voice coil is easily obtained. All the connections are grouped at the back on convenient lugs mounted on a bakelite panel. These loud speakers are available with or without rectifiers and transformers.

The *Rola Company* offers both magnetic and dynamic loud speakers in about twelve different models for either a.c. or d.c. operation and either in cabinets or just chassis. Prices vary from about $15 for the magnetic chassis to $60 for a dynamic mounted in a cabinet and completely equipped for light-socket operation.

Four dynamic chassis are being made by the *O'Neil Manufacturing Company*. Two models are for d.c. operation and two models are for a.c. operation. These loud speakers are provided with an adjustment for the moving coil which makes it possible for the most inexperienced person to realign the coil by simply loosening two screws, adjusting the coil, and then tightening the screws. These cones are made with either nine-inch or twelve-and-one-half-inch diaphragms.

The *United Reproducers Corporation* offer a number of Peerless reproducers in three types; magnetic, dynamic, or condenser. The condenser loud speaker known as the "Kylectron" is available in several cabinet models listing at prices up to $600. The magnetic loud speakers in cabinets list at about $25, the chassis being about $14. The dynamic loud speakers in cabinets list at about $50. The dynamic loud speakers use a voice coil consisting of but a single turn of copper wire of sturdy construction so that it is impossible for the coil to get out of alignment.

The *Wright-DeCoster Company* offer new dynamic loud speakers in distinctive cabinets and also a combination phonograph and power radio speaker. This latter unit consists of a phonograph turntable with pick-up unit in conjunction with a Samson amplifier and a dynamic loud speaker. It is priced at $425 less tubes. This company also offer baffles and horns designed for use with their loud speakers in theater installations.

Inductor dynamic, electrodynamic, and magnetic loud speakers are being made by the *Farrand Manufacturing Company*. Prices vary from $12 for the magnetic chassis, $18–$20 for the inductor chassis, $26–$30 for the dynamic chassis, and up to $60 for the dynamic chassis in a cabinet.

A variety of horns designed especially for use in theaters and auditoriums are manufactured by the *Kersten Radio Equipment Company*. For driving the horns this company also make two electrodynamic units priced at from $40 to $75.

The *Utah Radio Products Company* offer a number of dynamic lond speakers in various types of cabinets priced at from $35 to $55. They also have two magnetic loud speakers, one priced at $15 and the other at $19.50.

The *Best Manufacturing Company* offer a new dynamic loud speaker using an unusually large pot magnet, which, according to the manufacturers, gives a flux density of 114,000 lines, much greater than that found in other dynamic loud speakers. The diaphragm has a diameter of approximately 13½ inches. The chassis lists at $95 less tubes.

PERSONAL NOTES OF THE RADIO INDUSTRY

APPOINTED SALES MANAGERS

PAUL HITTINGER has been appointed sales promotion manager of Freed-Eisemann. His task is to sell radio sets to those who have never before owned one. "When we create a new radio fan," he says, "we are enriching the industry far more than when we sell replacement sets."

WILLIAM B. NEVIN has been appointed sales manager of Colin B. Kennedy. He returns to this company after an absence of seven years, having been sales and advertising manager in 1921–22. Kennedy plans to make 150,000 receivers this year and they will be merchandised exclusively through distributors.

RICHARD GRAVER, who answers to the cheerful hail of "Dick" all over this country, has been appointed to the general sales managership of the CeCo Manufacturing Company. His headquarters will be at the home-office in Providence, but like all the rest of the CeCo sales officials he will be a hardy traveler.

WILLIAM C. HEATON has been appointed sales-promotion manager of Fada. He has been with the Welte-Mignon Corporation, manufacturer of reproducing pianos. Frank C. Kenyon, Jr., formerly with Batten, Barton, Durstine & Osborn, Inc., an advertising agency, has been appointed assistant general sales manager. Eric Palmer, widely known radio and publicity man, has resigned from the Allied Broadcasting Companies and will have charge of the new department in the Fada organization designed to coördinate the work of the sales, advertising, and public relations departments.

JULIAN A. GREEN resigned as district manager for Atwater Kent Manufacturing Company on April 15 to accept the position of general sales manager of the Supreme Instruments Corporation, of Greenwood, Miss. Mr. Green is now planning an aggressive merchandising campaign through distributor channels.

NEW DIVISION MANAGERS

AFTER FIVE YEARS with Crosley, R. P. Crawley has rejoined the Kennedy organization. He is in charge, as division manager, of the Kansas City district.

ED LEVY, formerly with Sonatron, is now district manager for Triad in charge of their New York office. Six salesmen will operate under him at 34 West 33rd street, New York.

WITH HIS resignation as sales manager of the Sunset Electric Company, of Seattle, Washington, W. E. Kennard left to enter the services of the Colin B. Kennedy Corporation, of South Bend, Indiana, in the capacity of Pacific Coast division manager.

NEW OFFICIALS ELECTED

LOUIS SISSKIND, until recently president of the Central States Electric Supply Company, has joined the Harrison Wholesale Company, Chicago, as vice-president. Harrison Wholesale handles the Earl line as well as electrical supplies, lighting fixtures, automotive equipment, and sporting goods.

THREE IMPORTANT officials of the CeCo Manufacturing Company, makers of CeCo tubes, have been made vice-presidents of the company. They are N. O. Williams, chief engineer; John E. Ferguson, plant engineer, and Edward T. Maharin, sales director.

WORCESTER BOUCK has resigned from The Equitable Trust Company, of New York, where he served as an official for many years, to become a vice-president, treasurer, and a director of the Arcturus Radio Tube Co., of Newark. Mr. Bouck, who resides at Montclair, N. J., will make his headquarters in the general offices of the Arcturus company at Newark and will have supervision over the company's financial affairs.

OTTO N. FRANKFORT, vice-president in charge of sales of the All-American Mohawk Corporation, of Chicago, manufacturers of Lyric radios, and De Witt L. King, treasurer and factory manager, have been elected to the board of directors of the corporation. Mr. Frankfort and Mr. King replace E. N. Rauland and G. Frankel, who recently left the board.



P. Hittinger

Messrs. Frankfort and King have both been with the All-American Mohawk Corporation since its inception. Mr. King recently completed a reorganization of manufacturing facilities.

HAVE NEW POSITION

ROBERT V. DACOSTA, who for the last twelve years has been in charge of the manufacture of coils and condensers at the Atwater Kent plant, is now the production manager of Atwater Kent's neighbor, in Philadelphia, the H. H. Eby Manufacturing Company, Inc., makers of binding posts, sockets, and tip jacks. Before going to Atwater Kent, he had headed the enamelled wire and winding department of John A. Roebling Sons for seven years, and had been a member of the firm of the Doyle and DaCosta Manufacturing Co., of Easton, Pa., for two years.

LT. COMMANDER F. H. SCHNELL, U. S. Naval Reserves, for six years traffic manager of the American Radio Relay League, and more recently with the Engineering and Research Laboratory of the Burgess Battery Co., has become chief radio engineer of Aero Products, Inc., of Chicago, specialists and manufacturers of short-wave radio equipment.

R. R. KARCH, who has been associated with THOMAS A. EDISON, Inc. for the past eleven years, was recently appointed assistant to A. L. Walsh, vice-president of Thomas A. Edison, Inc. In his new position, Mr. Karch's major duties will be to correlate the Edison jobbers' activities with those of the Edison factory and wholesale distributors of Edison radios, phonographs and records.

Practically all of the fourteen branches of the Edison Distributing Corporation were established personally by Mr. Karch.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, of Chicago, has recently appointed Edward J. O'Neil assistant to C. W. Hunter, Kellogg sales representative in the Pacific Coast territory. Mr. O'Neil has been associated with L. G. Reno Company, Oakland, California, distributor, whom he represented until recently.

A. P. SIROIS is now advertising manager of Colin B. Kennedy, South Bend, Ind. Several notable national advertising campaigns are to his credit, among them being those for: Benjamin Electric Company, makers of Crysteel electric ranges and electric refrigerator cabinets, Cle-Ra-Tone radio sockets, industrial illumination; Yaxley Manufacturing Company, radio appliances; Trimm Radio Company, loud speakers and head sets.

SALES REPRESENTATIVES

THE HANDEL-DAVIES COMPANY, 202 Chester-Twelfth Bldg., Cleveland, Ohio, has been appointed district sales representatives for De Forest. Their territory is Ohio and Kentucky.

J. J. BACKER COMPANY, 2607 Second Avenue, Seattle, Wash., has been chosen district sales representatives for De Forest covering the states of Oregon, Washington, and Montana. This organization also maintains branch offices at Spokane and Portland. The Backer Company at one time handled Raytheon. Now, in addition to De Forest, they handle Audak and Wright-De Coster.

NEWS OF TRADE ASSOCIATIONS

GEORGE H. CURTISS, secretary of the Pacific Radio Trades Association, reports that an East Bay Retailer's Association has been organized and meetings are held regularly from 8 to 9 A. M. once a month at the Leamington Hotel, Oakland, California. An active program of work is in progress, notably with reference to cooperative advertising and radio interference elimination.

HERBERT J. FREEMAN, of the Freeman Radio Shop, Allentown, Pa., was chosen president of the Lehigh Valley Radio Trade Association. Other officers are: Harold Lucky (Lucky Radio Co.) vice-president; Earl Arnold, secretary-treasurer. Retiring officers are Francis J. Hardner, president and Michael McGee, vice-president. The association has been discussing elimination of the "home free trial" of sets without a deposit.

FRIENDS OF J. W. A. Henderson, manager of the Edison Distributing Corporation, Minneapolis Branch, are congratulating him upon his recent election to the Board of Directors of the Northwest Radio Trade Association.

PAUL B. KLUGH, vice-president and general manager of the Zenith Radio Corporation, announces the resignation of Thomas H. Endicott as general sales manager, announcing at the same time, the appointment of Mr. Endicott as Zenith distributor for the entire state of Connecticut.



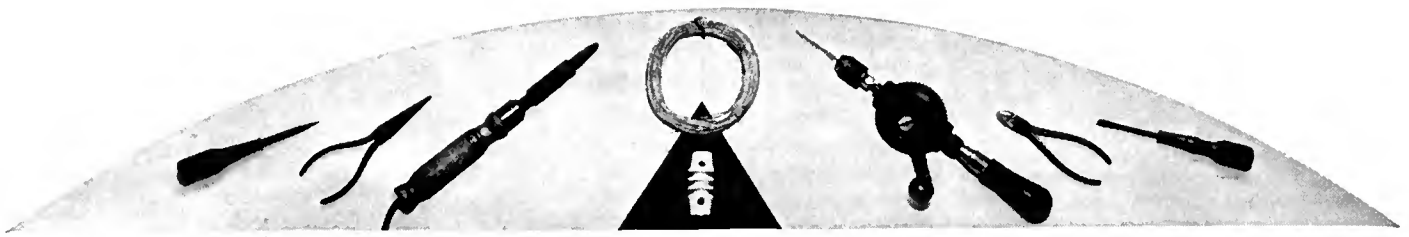
A. P.Sirois

Mr. Endicott will head a distributing corporation which he is forming. Headquarters will be established in Hartford.

NEW LYRIC DISTRIBUTORS

TEN NEW Lyric distributors in various parts of the country are announced by the All-American Mohawk Corporation, of Chicago, manufacturers of Lyric radios. They are: The Bloomberg-Michael Furniture Co., of Richmond, Va., H. G. Bork & Son, of Watertown, S. D., The Electric

(Continued on page 241)



THE SERVICEMAN'S CORNER

More Information on Hum

HUM, ACCOADING to many servicemen, is still a major consideration in apparatus operated from the house power lines. We shall continue to publish data on its reduction as it comes into "The Corner." Here is a new and logical slant on the subject from BORIS S. NAIMARK, with the Riverside Auto Supply and Radio Company, of 4746 Broadway, New York City, general service and dealers in Colonial and Steinite:

"In my experience as a serviceman I have learned that some of the finest B power packs produce a hum which is quite pronounced during the silent periods of a radio broadcast. If a thorough examination of the operating conditions discloses that such a trouble is caused neither by the electromagnetic coupling between the power unit transformer and the receiver proper nor by an improperly biased last audio stage, the remedy described below will be found effective in reducing the hum.

"It is a well-known fact of electrical engineering that the inductance of a choke (audio) increases with any decrease of direct current flowing through it. Thus, if we could only keep out of the chokes used in the power pack the direct current ordinarily drawn by the power tube in our last audio socket, the filtering action of the remainder of the current supplied by the power pack would be increased.

"A study of the diagrams below will illustrate just how this can be accomplished by taking the high-voltage tap off between the chokes, as shown, instead of from the output side of the second choke. Such an arrangement will reduce the filtering of the current supplied to the power tube, but will improve the filtering of the B current supplied to those portions of the set's circuit that are most susceptible to a.c. hum, i.e., detector and first a.f. tubes."

Center-tapped resistors: FRANK FOLSOM, of the Flint Broadcasting Company, operating station WFDF in Flint, Michigan, and specialist in Radiola service, finds resistor troubles at the bottom of many hum complaints:

"I want to take this opportunity to pass on a few wrinkles that I used recently. One example is the case of an a.c. receiver taken out of a table model cabinet and installed in a console cabinet with dynamic loud speaker. The set was installed in a home but the customer complained of a hum which was very disagreeable. One of the troubles was that the center-tapped resistor across the 1.5-volt line was open. This, of course, was replaced and the set was returned to the home. Still a very bad hum was present. The trouble was located finally in the dynamic loud speaker which was located too close to the detector tube. It was impossible to move either set or loud speaker enough to help, so by shielding the dynamic loud speaker and grounding it all objectionable hum was eliminated. As a safety measure a 1-mfd. condenser in series with the ground lead was used.

In these days of good and inexpensive all-electric radio equipment, it may seem illogical that many receivers, originally designed as battery sets, are in everyday service in thousands of homes throughout the country. The serviceman runs into many of these, and invariably encounters the problem of modernizing this equipment, in reference to the audio channel, and in rearranging it for operation from the house current. How do YOU handle this job? Exactly what equipment do you use, what do you pay for it, and how do you figure your profit? How long does it take you to do the job? We are making an effort to collect information on this subject.
—THE EDITOR.

"I have found that by inserting a 1000-ohm variable resistor from the center-tapped resistor on the 226-type tubes to the negative B wire the hum can be reduced; then by measuring the amount of resistance in the circuit with a bridge the desired value can be obtained by substituting a fixed resistor. This also helps in suppressing oscillation and improves the tone.

"Sometimes you can minimize a persistent hum by shielding the 227-type detector tube and grounding it.

"In my experience as serviceman the customer usually doesn't understand very much about taking care of his set and if you take a little time to explain as fully and as simply as possible what he should do and also what he should not do to his set you will be rewarded with his business again. Try to impress upon him that you want to help him get more service for his money and not that he is not supposed to know anything about such complicated things as a radio.

"Many descriptions of servicemen's kits have been printed. I carry everything I need in a cornet case which has clips to hold screwdrivers, pliers, etc. so they will not juggle around and break my meters. By having a place for everything and keeping everything in its place in your kit you are not so apt to lose or misplace your tools."

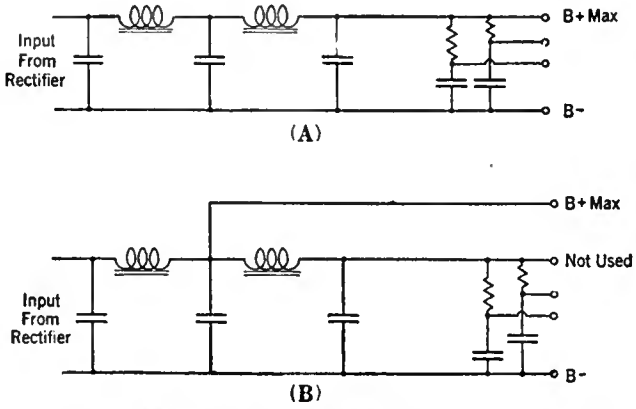


Fig. 1—Mr. Naimark's suggestion (B) for the reduction of hum by eliminating the current to the power tubes through half the chokes; (A) shows the usual circuit arrangement.

Some Cases of Noise

ON A RECENT tour of western New York state, the editor of "The Serviceman's Corner" had the opportunity of talking over service problems with a dozen or so active experts who are servicing in urban and rural districts. It was a general concensus that while noisy reception was directly responsible for only ten per cent. of all service calls, unnecessary noise was present in no less than sixty per cent. of all service cases. Set owners, it appears, often take noise as a necessary concomitant of radio reception, and hesitate to call in a serviceman for this trouble alone. However, clearing up noise, in the course of other service work always results in greater satisfaction to the client. The following contributions on this subject will be of value to all servicemen:

The noisy volume control: "I read the tip regarding noisy volume controls in *Fada Sales*. When it becomes noisy it is all right to shut off the set and turn the knob back and forth a few times, but this will do only temporarily, because it will come in a few days or hours. Here's my idea of cleaning the volume control. Take out the volume control, and with your pen knife scrape off the oxidation. Do this to the arm and element, making a clean line. When the arm is unremovable, as it is in some sets, be careful not to bend the arm too much or it will not run tightly and the trouble will appear again. I don't like to use emery cloth or sand paper because the sand grains will give trouble in a short time. If after many knife scrapings the volume control continues to cause noise then it is best to put in a new control."

WALTER OSTROWSKI, JR., Radio Station W9CMX, Chicago, Illinois.

Queerly enough, some servicemen recommend a touch of grease between the contact arm and the element in a noisy volume control. C. F. REXER, of Grinnell Brothers, Pontiac, Michigan, is among the fraternity in favor of a little judicious oiling.

The lightning arrester: "As I am engaged in the reduction of interference for my company I run into some strange things that may be of help to some of the

others who are employed in the same game. Here's one:

"This trouble was experienced on a Bosch all-electric set and manifest itself as a loud buzz at one spot on the dial. The noise would would rise and fall in volume and would cover the whole dial at times.

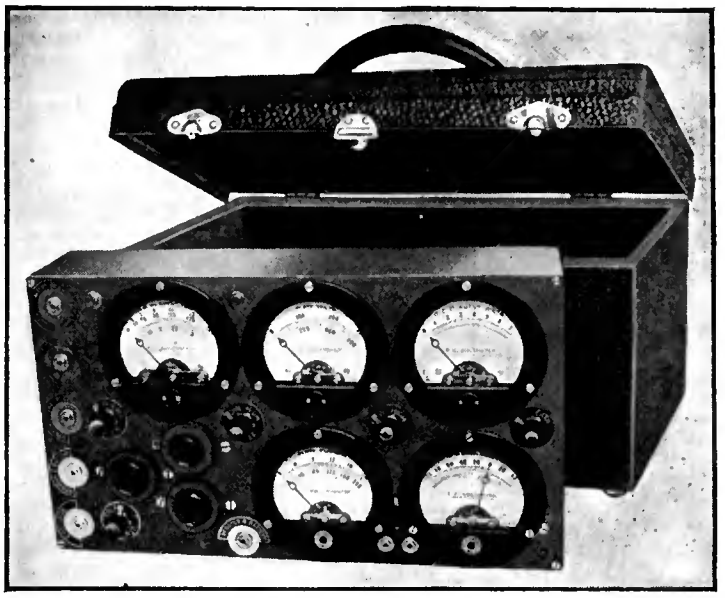
"It could not be heard outside of the house with a portable superheterodyne and disconnecting the antenna and ground stopped the noise. The wiring in the house was inspected but nothing was found. After much scratching of heads we decided to disconnect the lightning arrester. This stopped the noise.

"The arrester was taken into our shop and tested for short circuit, and, with a high-resistance voltmeter and a 110-volt battery, it would show a very irregular swing of from 50 to 100 volts.

"On breaking open the arrester it was found that the brass points were set in the porcelain with melted sulphur which had corroded until it would pass current between the gap.

"It may have been due to moisture as the arrester was mounted in such a way as to let water run down into it if there were a small crack in the sulphur filling."

J. E. Deiners, W9CV, Kansas Power Light Co., Topeka, Kansas.



The Hickok No. 4600 a.c. test set listing at $135.00. This test set contains the necessary shunts and resistors for practically every type and continuity encountered in servicing work.

More trouble with arrestors: J. P. Howard, of the Fayette Tire and Battery Service of Fayette, Mo., dealer in Crosley, Bosch, and Majestic, comes to a similar conclusion.

"As a serviceman I have found a defective lightning arrester causing trouble in several cases. The symptoms in each case were weak distorted signals or none at all.

"The trouble was located by disconnecting the antenna or ground from the arrester while the set was in operation and noting the change in reception.

"In one case the terminals were found to be directly shorted. In several cheaply constructed arresters, moisture was found across the insulation due to defective sealing."

Pilol lamps and noise: "a call for aid in eliminating a noise of this nature, tick, tick, tick, for all the world like an arc light doing its bit, was received recently. The rub was that it was daytime with no lights burning. Investigation failed to located the offending tick and the set was about to be sent back to the shop when it was noticed that the dial light was flickering; and when replaced by another the trouble ended."

Raymond Wafner, Erie, Pa.

Archie Klingbeil, of the thriving metropolis of Ashtabula, Ohio, veteran contributor to "The Corner," ran into pretty much the same thing:

"A source of varied and intermittent crackling noises in an a.c. receiver was accidentally discovered to bave been caused through the vibration of the receiver from loud speaker volume on certain tone frequencies, which in turn vibrated the small dial light bulb, making and breaking the bulb circuit rapidly at intervals and causing a short series of occasional crackling. This bulb was only slightly loose, and the vibration was so rapid and intermittent that it was noted merely as a variation of light intensity through the figure scale when we chanced to be looking at the scale. When the bulb was at rest it was not loose enough to become extinguished."

Noisy Transformers: "Transformers in the audio systems of modern radio sets often become 'noisy,' that is, cause a scratching noise in the output of the set. A good remedy for this, while not always successful in curing a transformer which has become noisy, is to short the highest B-power unit (or battery) voltage across the offending winding. Very often a transformer that has been shorted in this manner will operate satisfactorily for a long period of time."

W. Gordon Genner, Jr., Great Neck, N. Y.

Another case of "static": We have published before something along the complaint recorded by B. F. Steiger (an electrical engineer with a large radio manufacturing company) but as this condition is apparently somewhat prevalent, we feel justified in the repetition.

"A peculiar case of radio interference was encountered recently in connection with a sensitive a.c. receiver. The latter, located in the dining room of a residence, emitted the most ungodly static when anyone walked up or down the cellar stairs. As the receiver was grounded to the steam radiator system, it was at first thought that a loose joint in the steam pipes caused the noise, when vibrated by the passage of a person on the stairs. Rather than attempt to locate the supposed loose joint, the receiver was grounded to the plate of a baseboard a.c. outlet. (Baseboard outlet plates are grounded in many house wiring systems, forming a very convenient ground for a radio set.) However on negotiating the cellar stairs again, the static persisted undiminished. After carefully examining the steam and water pipes under the stairs a place was discovered where the BX conduit of the house wiring, rubbed lightly on a steam pipe. Upon separating the conduit from the pipe, the trouble was cleared up. Since the radiator system and the BX conduit were both grounded, it is not clear why rubbing the two together should cause a noise in the receiver. Possibly, paralleling the two ground systems changed in the ground-antenna constants of the receiver sufficiently to produce the disturbance."

B. F. Steiger, Newark, N. J.

Noisy detector tubes: Mr. Steiger has also run into noisy a.c. detector tubes:

"With the advent of power-operated radio receivers, the question of 'noise' interference has increased in importance. Much of this interference cannot be corrected, but some, however, is curable.

"One cause of curable noise, which is frequently overlooked, is the cathode detector tube of the 227 type. Numerous cases have been encountered, in service work, where disturbances, having all the ear-marks of line noises, have been traced to this tube. For example, there is the 'snoring' detector, a common trouble maker. This disturbance manifests itself, in the loud speaker as a noise repeating itself at more or less regular intervals and sounding exactly like a person snoring. With some tubes, the snore is loud and annoying, with others, weak, and noticeable only at low volume. Sometimes the snore may vary with a code-like disturbance, or even a scratchy static sound. The noise may start as soon as the tubes are warmed up, or an hour may elapse before it appears.

"The deceiving thing about the 'snorer' is that most 227-type tubes do it to a greater or less degree. Thus changing the detector tube may not locate the trouble unless the replacement tube is free from the disturbance. Tubes which are bad offenders usually show a pronounced flicker in the heater filament.

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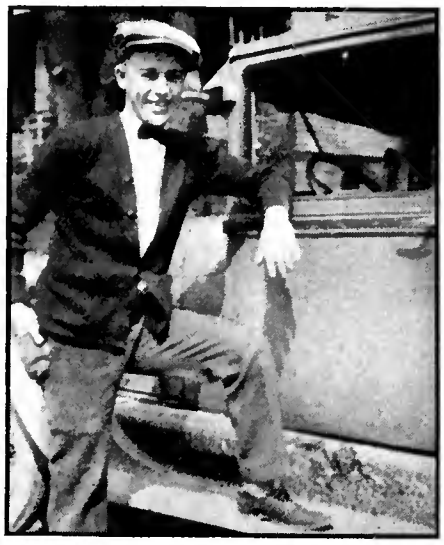
"In addition to the above mentioned disturbances, several rarer cases have been encountered, among which two of special interest will be mentioned. In the first case, reception rose to normal volume and then died out, repeating the performance in a regular cycle. In the second case, a slight whistle interfering with reception built up and died down periodically. Both of these troubles were caused by defective heaters which open circuited when the cathode warmed up and closed again when the cathode had cooled off.

"Recently, some experiments were made with the Arcturus 127 tubes. While the few tubes tried were found to be absolutely free from the above-mentioned disturbances, the tests were not exhaustive enough to prove anything conclusive."

A Book for Servicemen

RADIO TROUBLE SHOOTING, by Enno R.Haan, E. E.:

This is a book by an associate editor of *Popular Mechanics Magazine*, and is published by the Goo dheart Willcox Company. It is written as an elementary practical manual for the average serviceman, and as such it fills the bills effectively. While I should hesitate to say that no serviceman should be without it, certainly most servicemen, and par ticularly the beginner, will benefit greatly by reading it and then keeping it handy. There are excellent chapters on tools, equipment, service procedure, installati on, and specific and general trouble sh ooting. The book, today, is thoroughly up to date, and should be valuable as a ref erence work for several years to come.



Frank Folsom of WFDF who services Radiolas on the side and gives serious thought to the problems of hum reduction.

Items of Interest

¶WE HAVE commented before on the difficulty experienced by independent servicemen in securing reliable data on different receivers directly from the manufacturers. As a large percentage of all service work must inevitably be carried on by the independent serviceman, and the ultimate reputation of any set manufacturer rests upon the service obtained by the owner, it is obvious that the manufacturer is doing a four-fold injustice to himself, his dealer, the serviceman, and the set-owner in withholding this information from any reliable serviceman regardless of whether or not he retails that particular receiver.

¶MELVIN L. SHOOK, of Shook and Jones, radio maintainance and service, of Akron, Ohio, writes:

"Here is something that may interest you. Needless to say, as soon as I receive the latest edition of RADIO BROADCAST the first articles I read are those on *Service*. Well, a couple of months ago, I happened to read John Dunham's article which said that the wide-awake radio manufacturer would be glad to send service data to service concerns, if said service concern wrote on their business letterhead. I immediately wrote to 28 of the possibly 35 known radio manufacturers. Twenty one sent us their manuals, two others charged fifty cents and one dollar, respectively (We don't mind paying for a manual if it is any good), one never answered, and four refused.

"While we have only 14 makes of the various 28 sent for, represented on our customer file, the manuals have facilitated things considerably, and we have the data for the sets of future customers.

"We find it helpful to examine the circuit diagram of the set to be serviced before starting to service the set, no matter how many times we have serviced that same model before.

"The four manufacturers that refused were: R.C.A., Temple, Bosch, and Stromberg-Carlson. The latter two referred me to local dealers—a futile source of information for independent servicemen."

¶*The I. R. E. 1929 Year Book:* A publication of considerable interest and value to the serious serviceman—the expert verging on the engineering side of his art—is the *1929 Year Book of the Institute of Radio Engineers*. This publication is available to non-members from the Institute at 33 West 39th Street, New York City, for $1.00. Over one hundred pages of the Report of The Committee on Standardization make up a volume of authentic and useful radio information from the definition of radio terms to the description of standard tests on radio receivers. Some of this latter material will be of use to the general serviceman.

Letters from Servicemen

A FEW NOTES on the economics of servicing: "Dear Ed.: Here's my idea of how much a serviceman should charge. This is when service calls are made in the city. I don't know how much to charge the out-of-town service calls because I never had one.

"When I come in a house to service a radio set, the customer does not pay me for the work I do but for how much I know. Here's an example. I walk into the parlor and turn-on the switch for the set. If I find that the set is giving insufficient volume and a tube is the cause of it, I replace the defective tube. My charge is two dollars for the call plus the retail price of the tube. I never give or service a set on trust. This is bad business.

"If I find from routine tests that there is a broken connection or something is burned out then I will most likely take the set to the repair shop. However, if I can fix the set right then and there, I will, so as not to keep the customer waiting and putting a burden on my shoulders. If a transformer or fixed condenser is blown, right to the shop it will go, where I have no interference. This is how I charge on sets brought in. The service call is a standard two dollars. If anything is blown or burned out I charge the retail price for replacement. I also charge two dollars per hour on repairing. Even if I work only a half or three quarters of an hour, I charge two dollars. In this way of charging I am not the loser and no other good radio serviceman should be. When a customer calls on you he expects you to fix up his set properly and he also expects a bill. Some servicemen find that customers will not pay. With my system, if I have the set in my hands, I do not take it back until the bill is paid. If I put the set in the console and make it work and they refuse to pay the full amount, then, after several unsuccessful attempts of collecting, I put his name on my black list which means that no service until the bill is paid."

WALTER OSTROWSKI, Jr., Radio Station W9CMX, Chicago, Illinois.

A new phase of real service: "I am in the service business as far as the locating and cure of radio interference is concerned. But after all that is one of the most important branches. This work is not limited to our sets but to everyone that complains of interference to the power company.

"We have a truck equipped for this work—a standard half-ton panel body—and in it there are three sets, a Radiola 26 super, a four-tube radio-frequency set and a three-tube set on loop. All sets are portable. These sets are mounted on spring supports to take the shocks away from the tubes.

"We also carry all kinds of filters, choke coils, and condensers so that most any kind of a cure can be recommended.

"In my work I have found most everything in the catalog that interferes and some that are not in it. Some of these things would no doubt be of interest to others that are in the same game and a help to those that are trying to clear up their town to increase sales."

J. E. DEINES, W9CV, Kansas Power Light Co., Topeka, Kansas.

Telephone Directory Advertising: "Unintentionally we have become specialists in servicing one make of set. In running an advertisement in the classified section of the telephone book, we used a small Fada cut mainly to make the copy more prominent and compelling to one glancing through that section. This has brought in quite some Fada service, and is, in fact, the only advertising that seems to pay for itself. Outside of that we have been taking care of everything that has come along. I think I have run into almost every breed of receiver at one time or another, old ones, new ones, and plenty of trick ones."

E. D. MORELL, Service Radio Laboratory, East Orange, N. J.



Boris S. Naimark who describes himself as a "temperamental debutante."

Messrs. Doubleday, Doran & Co.

announce the selection of Mr. Russell Doubleday *as Editor of* World's Work. *From the conception of the idea of this magazine and from the publication of its first issue,* Mr. Doubleday *has been closely associated with it. His work with this house, including his connection with the management of its periodicals, his authorship of several books and, in recent years, his services as editorial head of its book publishing department, has given him a sympathetic understanding of the aims and purposes of* World's Work; *and so, our loyal friends and readers can confidently be offered the assurance that the highest ideals of the founders and former editors will be upheld.*

On the following page is reproduced a memorandum from the Editor to the Circulation Manager. It is printed here because of its interest to the thousands of men and women who have followed this magazine for nearly thirty years.

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May 29th, 1929

Dear Mr. Eaton:

Now that the WORLD'S WORK is about to enter its thirtieth year it seems fitting that its ideals and convictions should be restated and some suggestions made of its history and background. I was fortunate in being present at the modest birthday party of the WORLD'S WORK and took part in many of the discussions in early 1900 when the plan and scope of the magazine were fixed.

Walter Page, in the opening editorial of the first number, forecast the position this country was to occupy in world affairs and with amazing prescience and clearness set forth our national responsibility and our opportunities for usefulness, and the part the magazine hoped to play in these foreseen great events. He ended with this paragraph:

> *It is with the activities of the newly organized world, its problems and even its romance, that this magazine will earnestly concern itself, trying to convey the cheerful spirit of men who do things.*

The founders of the magazine believed very definitely in certain principles. This being a forward-looking country just emerging from its pioneer days the WORLD'S WORK should express that spirit. It was believed that the wrongs, the mistakes, and injustices should not be ignored but the remedies should also be set forth. Great progress in industry, in government, in science, in art, come through the power and genius of man, so, much of the magazine was to be devoted to fact stories of men and women who do things. It was believed that beauty and interest should go hand in hand and that good writing is not incompatible with sound information. I have heard Page say a thousand times: "But the man can't write!" and out would go the article. It was planned to illustrate the magazine with photographs or reproductions of great paintings because it was believed that good photographs carried conviction and could still be beautiful.

The WORLD'S WORK has for more than a quarter of a century been built month by month on these solid foundations and some notable achievements in periodical journalism have been given to the loyal supporters of the magazine during those momentous years.

It is with a mixed feeling of humility and confidence that I take up the work of editing the WORLD'S WORK: humility because I realize the greatness and capacity of Walter Page and his successors and because I

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quite understand that comparisons will be made with their work and mine. But I have some confidence also, because I have lived with the magazine since its birth. I have worked for it, had to do with its management, written for it—at times suffered when it did not come up to its best standards, and was cheered when it did its job well, as often happened. If this varied experience is helpful in editing the WORLD'S WORK, I am fortunate. I believe it will be useful in my new job.

Certain of the characteristics (I will not call them features) of the WORLD'S WORK which have been rather lost sight of recently, we shall restore. The March of Events, that summary of important doings here and abroad, will be put back in the front of the magazine. We hope to make it vigorous, interesting, and progressive. The financial articles will resume their rightful place. Authoritative information was never so much needed as today. The flood of new books makes a general survey impossible, but we hope to show their tremendous importance in our daily lives through an account of various human experiences. But of that more later.

All this is general. To be specific: We shall have the biographies of two of our important diplomats:

Myron T. Herrick, so many years ambassador to France, and Henry Morgenthau, who recently accomplished that enormous job of repatriating the Greeks. I wish I had space to tell you how he made the Bank of England turn over to him $50,000,000.

The disregard for law is one of our national sins. A series of articles by various authorities will be published on this subject. And an attempt will be made to lay the situation bare and then remedies will be suggested. An exposure of a sore is useless unless a remedy is suggested.

Much can be done to change and I hope improve the magazine in two or three months but you realize, I am sure, that it will take some time to get articles written and prepared for press.

The WORLD'S WORK has a big job to do and I hope that I may count on you and all the able men and women in our business to help me do it.

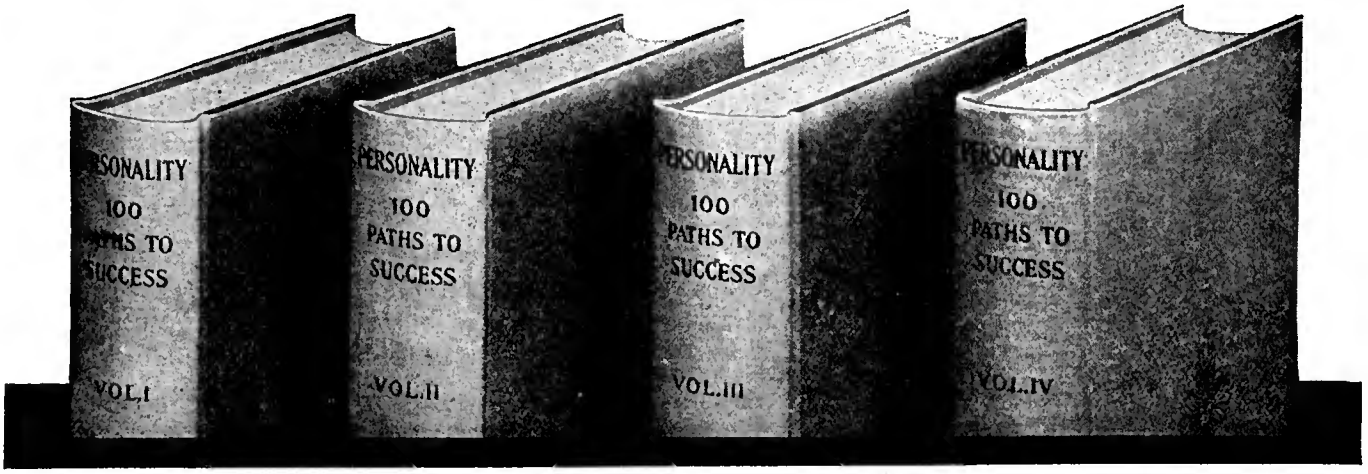
Let us work together "to convey the cheerful spirit of men who do things."

Heartily yours,

Russell Doubleday

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FREE—*with the compliments of* WORLD'S WORK



Thrills, secrets, emotions—passions, ambitions, successes . . . 100 of the world's most powerful biographical stories in this complete four-volume set—"PERSONALITY—100 PATHS TO SUCCESS"—are yours ABSOLUTELY WITHOUT COST with an 18 months' new, or renewal, or gift subscription to WORLD'S WORK.



A SULTRY NIGHT. Boston's waterfront showed but a dim silhouette of steeples, warehouses, and the feathery lacework of spars and rigging. A red-headed immigrant boy, starved and penniless, furtively crept from the steerage hold to the deck and dropped into the murky waters of Boston Harbor.

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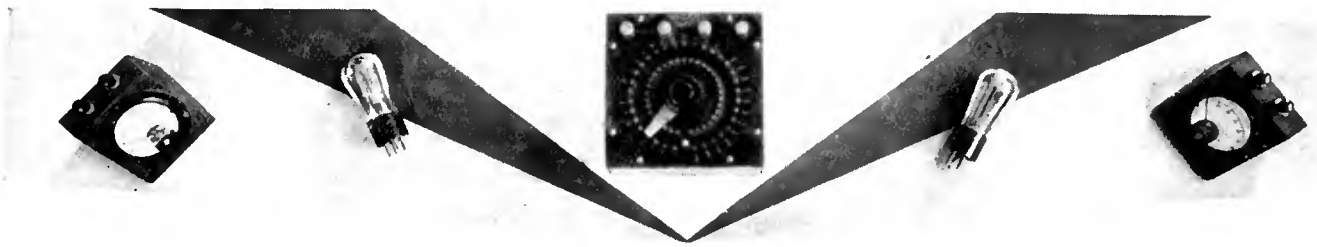
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STRAYS *from* THE LABORATORY

Free Detector Voltage

A SCHEME FOR using the C bias of a power tube as the plate voltage for a detector is shown in Fig. 1. In this circuit the upper part of the C-bias resistor, which is in the center tap of the filament winding of the power tube, is more positive than the lower part by the voltage drop along the resistor. For example, this resistance is of the order of 2000 ohms with most power tubes and the voltage along it varies from 40 volts for the 171 tube to 80 for the 250 when worked at its maximum voltage. These voltages are of the same order that are required for detector plates. It is only necessary to connect the heater of the detector tube to the point of lowest potential on the C-bias resistor and the plate circuit as shown to apply this voltage to the tube in question.

The only advantage we can see is the decreased cost due to the elimination of one resistance, that used to lower the conventional 90 volts for amplifier tubes down to 45 volts. The disadvantage is that common coupling between two tubes is provided. If the condenser across the resistor is large, so that its reactance at low frequencies is small compared to the resistance of the unit, little a.c. voltage will be developed along the resistor and very little coupling between tubes should occur.

Radio and the Stock Market

THE FOLLOWING story may be interesting to those who either do or do not believe that the Federal Reserve Board should have anything to do with stock market speculation.

The wife of an economics professor in a southern university bought a little battery-operated Radiola—long ago. She was so interested and pleased with the set that she thought thousands of other people would be in the same frame of mind, and had a "hunch." If so many people were liking radio so much, stock of the Radio Corporation ought to be valuable. She learned from her husband exactly what to do and bought some Radio at about $80. After a little her stock went to $140 and taking her husband's advice sold out. Subsequently Radio went sky high as everyone knows.

In the same university a professor of English bought a Victrola and enjoyed it so that he too had a "hunch." He bought all the Victor stock he could on margin, breaking all the rules for conservatism and mortgaging everything he owned. When the Orthophonic came along his stock went up and up and after a little he sold out clearing something like $100,000. This is another one of those stories to which the reader must connect his own moral.

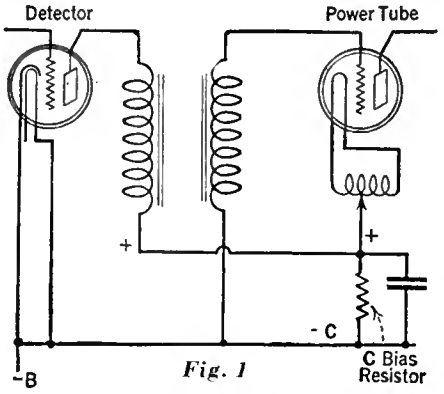


Fig. 1

Graf Zeppelin Transmissions

THOSE WHO listen on frequencies other than broadcast may want to keep an ear open for communications from and to the Graf Zeppelin when—and, if—she turns her nose toward the United States again. Her call letters are "DENNE" and instead of making "V's" she will send "ANNA" as test letters. Her high frequencies are 5677, 8470, 11,990, and 18,170 kc. She calls and answers on 143 kc. and listens on 600 kc. She will have schedules, probably, with Washington who will work on 8030, 12,045, or 16,060 kc.

Output of Rectifiers

IN AN article by R. J. Kryter, Prest-O-lite Storage Battery Company, on a method of using copper-disc rectifiers in connection with milliammeters as a.c. voltmeters, which is now in the editorial office and waiting its turn for publication, we find this interesting statement.

"The d.c. output into a resistance load of a perfect rectifier operating with a pure sine wave on its input is 0.901 times the effective a.c. input. Thus, the output current as read by a d.c. meter would be 90 per cent. of the true a.c. input current to the rectifier."

Measuring Resistance

AN INTERESTING and useful method of measuring resistors follows. It was taken from the service manual of Radiola 44. For resistors of 5000 ohms or less, use a low-resistance voltmeter. For example, the Weston Model 301 and 280 meters have sensitivities of 62 ohms per volt which means that a meter reading 100-volt full scale would have a resistance of 6200 ohms.

Read the voltage of the battery and then put the meter in series with the unknown resistance and put this combination across the battery. Then the resistance desired may be calculated from

$$R=\left(\frac{E}{E'}-1\right)R_M$$

Where E=battery voltage
E'=voltage across battery and resistor
R_M=Meter resistance

For example, a 100-volt Model 301 Weston meter when placed across a battery reads 100 volts and when in series with a resistor indicates 55.25 volts. What is the unknown resistance?

$$R=\left(\frac{100}{55.25}-1\right)6200=(1.81-1)$$
$$6200=0.81\times 6200=5000 \text{ ohms}$$

Intelligent Servicemen

THE SERVICE DEPARTMENT of this magazine received a request for information on how to neutralize receivers. This came from a serviceman. He was told to saw off the filament prongs of a tube which he was to place in the r.f. socket of the particular stage he was to neutralize. Then he wrote back wanting to know if he should saw off the prongs of the power tube too. What's wrong with this story?

Eliminating Interference

THE BUREAU OF STANDARDS has issued a circular letter on "Elimination of Interference to Radio Reception." Such subjects as power noises made by electrical devices (X-ray machines, battery chargers, telephone ringers) power-line induction, electrical smoke precipitators, etc. are discussed. The paper is Circular Letter No. 182.

Short-Wave Schedule

Courtesy W. H. Merriman, *Wireless World*, London

Call Letters	Location	Wavelength & Frequency	Power	Transmissions
AFK	Doberitz, Germany	67.65 meters 4434 kc.	5 kw.	Mon. Wed. Fri. 6:00 A. M. to 7 A. M. 2:00—3:00 A. M.
AFL	Bergedorf, Germany	52 meters 5775 kc.	3 kw.	
EATH	Vienna, Austria	37 meters 8108 kc.		Mon. Thurs. 5:30—7:00 P. M.
FL	Eiffel Tower, Paris	32.5 meters 9231 kc.	20 kw.	Time signals daily 2:56 A. M. and 2:56 P. M.
5SW	Chelmsford, England	25.53 meters 11751 kc.	15 kw.	Daily except Sat. and Sun. 7:30 to 8:30 A. M. 2 P. M. to 7 P. M.
HB 9Oc	Berne, Switzerland	32.0 meters 9375 kc.		Mon. Tues. Sat. 3:00—4 P. M.
YN	Lyons, France	40.2 meters 7463 kc.		Daily except Sun. 11:30 A. M. —12:30 P. M.
RFN	Moscow, Russia	50 meters 6000 kc.		Tues. Thurs. Sat. 8:00 A. M. to 9:00 A. M.
PCJ	Hilversum, Holland	31.88 meters 9590 kc.	25 kw.	Thurs. 2—4 P. M. 7—8 P. M. Fri. 8 A. M.—11 A. M. 2—4 P. M. Sat. 8 P. M.—2 A. M.
PCL	Kootwijk, Holland	18.4 meters 16300 kc.	25 kw.	6 A. M.—10 A. M.
		38. 8 meters 7895 kc.		10 A. M.—8 P. M.
PHOHI	Huizen, Holland	16.88 meters 17779 kc.	40 kw.	10 A. M.—noon
7LO	Nairobi, Kenya Colony	31 meters 9677 kc.		11 A. M.—2 P. M. 2—3 P. M.
JB	Johannesburg, South Africa	32 meters 9375 kc.	1 kw.	Daily 2—6:45 P. M

WHAT SERVICEMEN SHOULD KNOW

By JOHN S. DUNHAM

QRV Radio Service Inc.



John S. Dunham

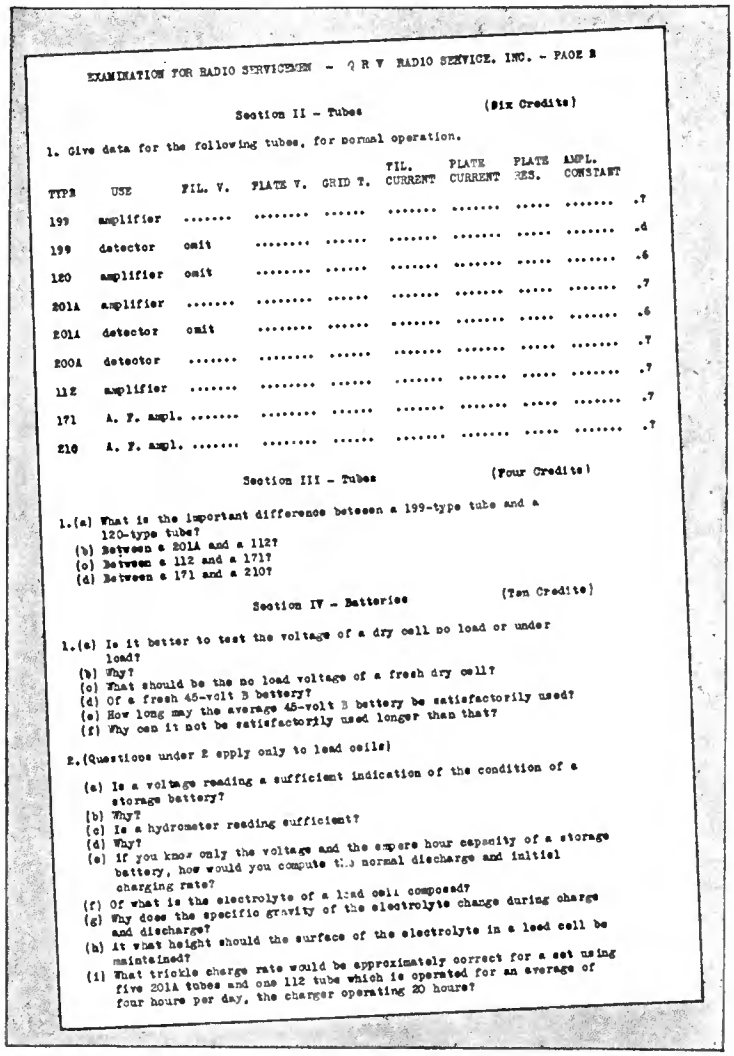
WHAT INFORMATION must a serviceman have about tubes and batteries in order to service properly radio receivers? Of what practical value is a knowledge of the plate, filament, and grid voltages, filament current, plate current, plate resistance, and amplification constant of all the standard tubes in use? When can a serviceman find definite use for information on the life of B batteries under various current drains? Here are certain definite questions—and our answer to them is that such information is almost essential if a man is to service all types of receivers quickly and satisfactorily. That the writer is of the opinion that servicemen must have such knowledge is indicated by the examination (see page 405, August, 1929, RADIO BROADCAST) which is given to all newcomers in his organization. In this organization a serviceman without this knowledge would be

An idle member and good for nothing

—Russus Ephesius.

If there is one characteristic peculiar to the radio industry it is the number and variety of designs which it produces annually. These tricks and changes in circuit arrangements will put any serviceman on his mettle and they will put the serviceman with practical experience only at a distinct disadvantage in comparison with the man who has added to his practical experience the knowledge we have found so essential.

We realize quite fully, however, that many servicemen feel that they can get along satisfactorily without this knowledge—they damn it with the triumphant question, "Of what use is it?" Therefore, we will discuss the subject for the double purpose of showing employers the knowledge which their servicemen should have in order to build up customer satisfaction and of showing servicemen how they may increase their ability.



EXAMINATION FOR RADIO SERVICEMEN - Q R V RADIO SERVICE, INC. - PAGE 2

Section II - Tubes (Six Credits)

1. Give data for the following tubes, for normal operation.

TYPE	USE	FIL. V.	PLATE V.	GRID V.	FIL. CURRENT	PLATE CURRENT	PLATE RES.	AMPL. CONSTANT	
199	amplifier	.....	.....	.....	.....	.....	.....	.....	.7
199	detector	omit	.....	.....	.....	.....	.....	.....	.6
120	amplifier	omit	.....	.....	.....	.....	.....	.....	.7
201A	amplifier	.....	.....	.....	.....	.....	.....	.....	.6
201A	detector	omit	.....	.....	.....	.....	.....	.....	.7
200A	detector	.....	.....	.....	.....	.....	.....	.....	.7
112	amplifier	.....	.....	.....	.....	.....	.....	.....	.7
171	A. F. ampl.	.....	.....	.....	.....	.....	.....	.....	.7
210	A. F. ampl.	.....	.....	.....	.....	.....	.....	.....	.7

Section III - Tubes (Four Credits)

1.(a) What is the important difference between a 199-type tube and a 120-type tube?
(b) Between a 201A and a 112?
(c) Between a 112 and a 171?
(d) Between a 171 and a 210?

Section IV - Batteries (Ten Credits)

1.(a) Is it better to test the voltage of a dry cell no load or under load?
(b) Why?
(c) What should be the no load voltage of a fresh dry cell?
(d) What should be the no load voltage of a fresh 45-volt B battery?
(e) How long may the average 45-volt B battery be satisfactorily used?
(f) Why can it not be satisfactorily used longer than that?

2.(Questions under 2 apply only to lead cells)
(a) Is a voltage reading a sufficient indication of the condition of a storage battery?
(b) Why?
(c) Is a hydrometer reading sufficient?
(d) Why?
(e) If you know only the voltage and the ampere hour capacity of a storage battery, how would you compute the normal discharge and initial charging rate?
(f) Of what is the electrolyte of a lead cell composed?
(g) Why does the specific gravity of the electrolyte change during charge and discharge?
(h) At what height should the surface of the electrolyte in a lead cell be maintained?
(i) What trickle charge rate would be approximately correct for a set using five 201A tubes and one 112 tube which is operated for an average of four hours per day, the charger operating 20 hours?

This page of the QRV examination for servicemen contains the questions considered in this article.

Value of Tube Knowledge

FIRST LET us talk about tubes and see if we can't give some sound examples to indicate the value of a knowledge of tube characteristics. Probably the most familiar data on tubes is the filament voltage, E_f, required by the various types, but a knowledge of the filament current, I_f, requirements is perhaps not so common—and there are cases where knowing the filament current is essential. Take, for example, the case of a battery-operated radio receiver (there are still many in use) supplied with filament current from a storage battery. The job is to connect a trickle charger to the storage battery and adjust it so that it will keep the battery charged. Unless one is familiar with tube data and can determine the total filament current drain of the tubes in a set, there would be no simple way with the usual field service equipment, which does not contain an ammeter of sufficiently high rating of determining how much current the trickle charger would have to supply to keep the battery charged. On the other hand, if the serviceman has a knowledge of tube data he can calculate that the total current drain of a five-tube set, for example, is 1.25 amperes, since each tube requires $\frac{1}{4}$ amp. Multiplying by the number of hours the set is used per day, for example five, we get the number of ampere hours which in this case is 6.25. Because the battery is only 75 per cent. efficient somewhat more than 6.25 ampere hours must be supplied to keep it fully charged. Therefore, let us say that in the 19 hours (24—5) the trickle charger must supply 7.75 ampere hours. Dividing 7.75 by 19 gives 0.41 ampere as the current required from the trickle charger.

It is equally, if not more important, for the practising serviceman to know the plate voltage, E_p, and the plate current, I_p, requirements of standard tubes. In battery-operated sets, one must know the E_p requirements to determine how many B batteries are required and the I_p requirements to determine whether light- or heavy-duty batteries are necessary. In choosing a B-power unit to be used with a particular set, one must be able to determine whether the current and voltage the unit can supply is sufficient for the receiver. Suppose a particular radio receiver uses a single 171A tube supplied with 180 volts on the plate from a B-power unit and that the owner of the set wants it changed over to 171A's in push pull because the single tube overloads too readily. Will the B-power unit be able to supply sufficient voltage with the additional 171A in use? A knowledge of the plate current requirements of all the tubes in the set to which must be added the additional plate current drain due to the extra 171A tube would enable one to know definitely whether the total plate current consumption would be greater than that which could be supplied by the B-power unit.

Problems in A.C. Sets

THE ABOVE examples have referred particularly to battery sets but the increasing use of a.c. receivers should make it obvious that a knowledge of the E_p and I_p requirements of a.c. tubes is also essential. Sometimes when servicing an a.c. set the serviceman may have on hand the charts supplied by the manufacturer indicating the plate currents and plate voltages, but frequently such information is not available. If the average operating characteristics of the tubes are known, however, the serviceman will be able to know approximately, in most cases, the voltage values he should find applied to the various tubes. Similarly he will be able to judge whether or not the grid voltages are approximately correct. Without this information he can only guess—and guessing is a pretty certain indication of inefficiency.

A knowledge of the plate resistance and

amplification constants of various tubes is not as essential as is a knowledge of the plate, filament, and grid voltages and plate and filament currents, but, nevertheless, it is highly desirable. If one type of tube is to be substituted for another type it is generally advisable that they have about the same plate impedance. If a low-impedance tube is used in an r.f. amplifier in place of a high-impedance tube it is likely that the amplifier will oscillate. If one substitutes a power tube with an amplification constant of about 3, the 171A, for a power tube with an amplification constant of 8, the 112A, he would find that somewhat greater signal voltage would be required on the grid of the 171A tube to deliver the same output as was obtained from a 112A. These voltages might be high enough to overload the preceding audio amplifier tube. Therefore, when using a low-mu power tube in place of a power tube of a higher-mu, it is always advisable for the serviceman to consider the possibility that the preceding audio amplifier stage may be overloaded with a new tube in use.

Such information as this is not only valuable in this very practical manner, but is also useful as stock information to enable the serviceman to answer intelligently the questions of his customers when they ask why a 171A tube should be used in their set in place of a 112A or why the B-power unit they have will not be satisfactory with a new type of tube.

A knowledge of batteries seems perhaps to be a prosaic sort of information and perhaps, in the years to come when all sets are a.c. operated and batteries are simply a curiosity, servicemen will be able to get along without knowing very much about them. Nevertheless, we venture to prophesy that such information will prove of daily value for the next ten years.

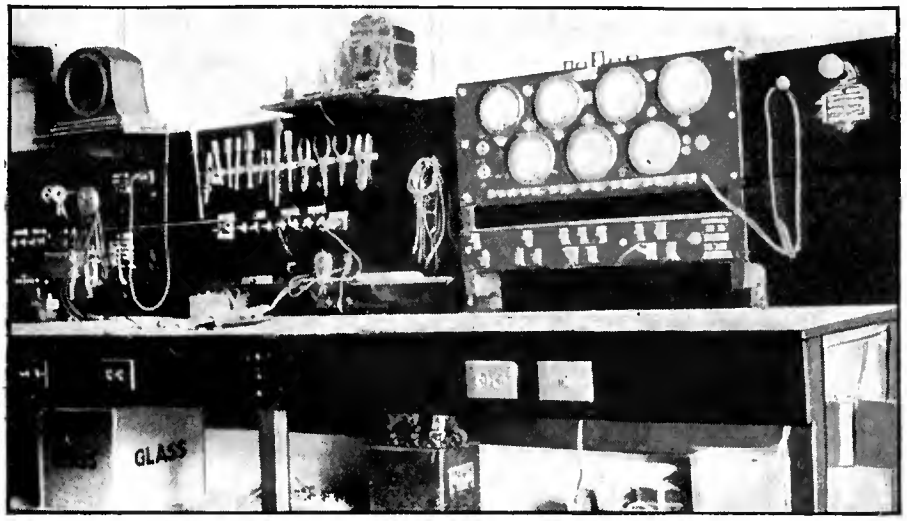
Some servicemen feel that the right way to test dry batteries is simply by connecting a high-resistance voltmeter across them. It is not so, however. When batteries that have been in use for some months are to be tested, the set should first be turned on and be permitted to run for several minutes before measuring the voltage of the batteries. Dry-cell batteries recuperate considerably when not in use, and, if their voltage were measured without first turning the set on, it would show up much higher than would be the case with the batteries in service.

Testing Batteries

After much practical experience in measuring batteries we have found that good new dry cells which will have a long life show an initial no-load voltage between 1.55 and 1.6 and that B batteries show between 46 and 48 volts. Supposedly new dry cells or B batteries which show lower voltages under the same conditions are either not fresh or are of inferior construction. This is information which we have obtained after numerous tests and it is well worth while to keep these voltages in mind when installing new batteries. B batteries should be discarded when their terminal voltage under load is less than 37 volts.

In our examination we also test the applicant's knowledge on the care and operation of storage batteries. In this connection it should be pointed out that the method of testing batteries is not always fully understood. A voltage reading, for example, to determine the condition of a storage battery is of very little value and serves only to indicate whether the voltages of the three cells are approximately equal. The state of charge of an ordinary lead-cell storage battery can be determined most accurately by means of a hydrometer. When fully charged the hydrometer will read about 1250 and a battery should never be permitted to discharge below the point where the specific gravity, as indicated by the hydrometer, is less than 1100.

The height at which the electrolyte should be maintained is very important, especially when a rather high trickle charger rate is used. With such an installation there is liable to be considerable gassing and if the electrolyte is too high in the jars some of the acid spray will escape through the vent holes and cause corrosion of the terminals. If the electrolyte does not cover the plates, the uncovered portions will heat excessively and the wooden separators will be damaged. A knowledge of such things is obviously of daily usefulness in insuring the greatest life of the battery.



A view of the test bench installed in the Newark office of the QRV Radio Service, Inc.

Conclusions

We hope we have succeeded to some extent in our endeavor to indicate why we know information of this sort on tubes and batteries is so essential. We don't for a moment believe that the serviceman should be academic—he must be practical. But, figuratively speaking, we don't want to argue whether the horse or the cow is most useful. Both are essential just as practical and theoretical knowledge are essential to good service work.

The road to knowledge—any knowledge—is a difficult one. We can't personally conduct one along the way but have only tried to indicate the path. In a sense, when one takes the path he is a searcher into the unknown, but facts of importance may be in the path of any digger—though he digs only for potatoes.

The prime requisite in increasing one's knowledge is that the added information should be usable. We remember reading a sportsman's recipe for cooking porcupine which included long stewing with many changes of water. The recipe concluded with the advice to throw it all away without serving. Excellent advice under the circumstances, perhaps, but the writer can assure the reader that if he goes to the trouble of getting sound radio knowledge he won't have to throw it away without using.

IF I OWNED A RADIO STORE I'D MAKE IT PAY

(*Continued from page 199*)

profit of between $9000 and $10,000. You are spending $12,000 and going into the hole. Your business was making more than double the profit you thought it was, and you were spending over three times as much as you thought you were. This year you've paid your loan, on the dot, made another and paid that on the dot. You've done other things too. You've looked out for your collections, got your money in; your store looks better and more attractive; you buy your stock less wastefully. Now what are you going to do with your profits?"

"I need $1500 of them. The rest I'm going to keep in the business."

The banker who told me this story also told of doing the same sort of thing for an Italian fruit dealer and several others.

We make a great mistake if we think that the whole function of a bank is just to say, "Yes, you can have this loan," or, "No, you can't have this loan." Bankers themselves recognize their obligations to give advice and the profit there is to them in establishing confidential and advisory relations with their customers. While a banker may not always be able to give important advice on business promotion, he is always able to give the best practical ideas on the financial layout of a business.

Really there isn't an awful lot to learn in order to establish a business on a basis to take care of costs, profits, overhead, promotion, and expansion, but there are altogether too many who neglect these things and who fail where they might succeed if they knew just where they stood financially.

If I could put into my pipe-dream radio business the simple financial organization which I have been talking about and add to my equipment the belief I have in the immediate *possible* development of radio sales which a merchant can stimulate with good promotion material, I have a hunch that I might make a little money.

Personal good-will building, working capital increase, salesmanship, advertising, service—you or I may be better naturally at some of these things than at others, but we've got to have them all well covered to succeed and grow.

A MODERN DESIGN OF RADIO RECEIVER

VIRGIL M. GRAHAM

Radio Engineer, Stromberg-Carlson Telephone Manufacturing Company



Virgil M. Graham

It is with considerable pleasure that we present this article by Mr. Graham, of the Stromberg-Carlson Telephone Manufacturing Company, for few organizations are as generally held in high esteem as the engineering department of this company. This article on the design of the new Stromberg-Carlson screen-grid receiver, models 641 and 642, will, we are sure, prove especially interesting and helpful to our readers.

—THE EDITOR

IN DESIGNING modern radio receivers one of the principal problems confronting engineers is that of selecting the vacuum tubes to be used. This selection must not be made haphazardly as a well-engineered job must have a sound reason for everything.

The latest addition to the list of tubes which may be considered by engineers for use in the r.f. stages of broadcast receivers is the 224-type a.c. screen-grid tube. If the receiver designer contemplates using this tube in his radio amplifier stages he must satisfy himself that there are very definite reasons for employing it, other, of course, than the fact that it is new.

The designers of the receiver described in this article—The Stromberg Carlson Receiver, Models 641 and 642—studied the problem carefully and found very good reasons for adopting the a.c. screen-grid tube for radio amplifiers. The first consideration was, of course, the effect on fidelity of reproduction. Investigations showed that a material gain in this characteristic could be obtained when three radio amplifier stages with 224-type tubes were used as this made possible two improvements in the detector-audio system. One of these is the use of the "linear" power detector, which reduces to a negligible value the harmonic distortion common to the ordinary square-law detector; the other, dependent on the first, is the use of a single audio tube, the power output stage being fed from the detector. These advancements are made possible by the greatly increased radio-frequency voltage which can be supplied to the detector by a radio amplifier using 224-type tubes. Both the above mentioned improvements depend on this increased radio-frequency voltage. (See "Detection at High Signal Voltages, Part I" by Stuart Ballantine, delivered at U. R. S. I.—I. R. E. Meeting, Washington, May 15, 1929.) A detector having linear characteristics—that is, characteristics which avoid distortion of the audio frequencies in the output when the signal has high modulation—is essentially a device which works on comparatively high voltages. A detector which supplies enough audio voltage in its plate circuit to enable the single stage of audio amplification also requires the high radio voltages whether it be of the "linear" type or not.

Let us now consider the second problem, namely, selectivity. The examination in this case showed that with properly designed radio-frequency transformers the 224-type tubes would enable the selectivity of the receiver to be improved appreciably. The very high plate resistance of this tube working into the proper transformer does not reflect as much loss into the tuning secondary as does the much lower plate resistance of an ordinary three-electrode tube of the 227 type.

The third and last of the main considerations with regard to using the a.c. screen-grid tube was that of sensitivity. Experiments quickly showed that increased sensitivity could be obtained without sacrificing any desirable characteristics of the receiver.

From the above brief analysis it is evident that the three major characteristics of any receiving set, namely the selectivity, sensitivity, and fidelity, may be improved through the use of screen-grid tubes in the r.f. amplifier. Having reached this decision, the next problem was to design circuits for the screen-grid tube. In solving this problem there were many questions for which we had to find the correct answers. Some of the most important problems were, of course, associated with the design of the radio-frequency transformer to be used between the screen-grid stages. Gain and selectivity curves were made on a number of different types, but in this article we will present only the data on the final model.

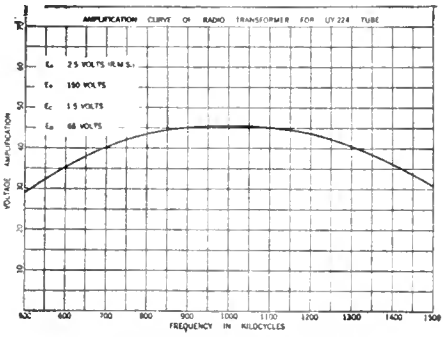


Fig. 1—Amplification curve of a radio transformer used with the 224-type tube.

Description of Curves

FIG. 1 shows the voltage amplification curve of the radio transformer mentioned above, taken with voltage as applied to the 224-type tube that correspond to those used in the receiver.

Fig. 2 shows what is known as the "analysis" of the radio amplifier; that is, a series of curves taken to show the overall sensitivity and the relative amplification of each r.f. stage and the detector. The overall sensitivity is taken with the signal fed to the antenna and ground posts

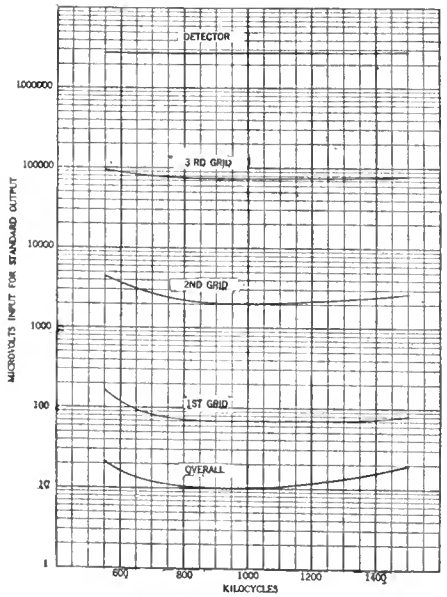


Fig. 2—An "analysis" of the screen-grid r.f. amplifier described by the writer.

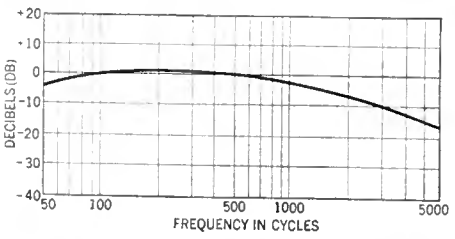


Fig. 3—Fidelity curve of the screen-grid receiver designed by Stromberg-Carlson engineers

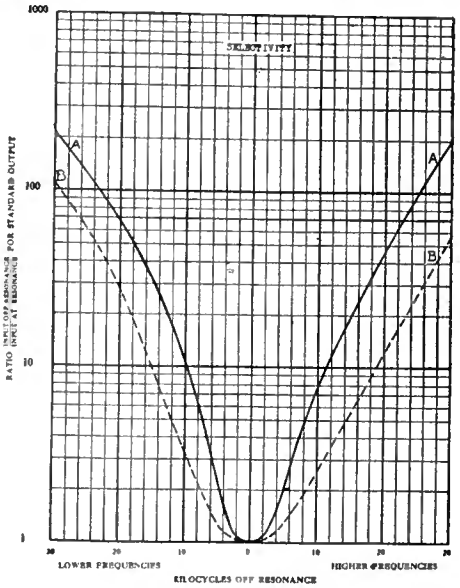


Fig. 4—(A) Selectivity curve of a screen-grid receiver; (B) curve of a standard good receiver.

of the receiver through the standard I. R. E. dummy antenna. The ordinates are plotted in microvolts for convenience and not in "microvolts per meter." The former unit may be converted to the latter by dividing by four (the standard antenna assumes a height of four meters). The curves showing the microvolts necessary at the various control grids to produce a standard output were taken with the signal fed to the control grid through a one-half microfarad capacitor and with the tuning system of that stage realigned to compensate any capacity from the lead wires to ground. Examination of these curves will show that the voltage gain in the antenna transformer is quite appreciable and that the distances between the curves for the successive grids are substantially uniform, allowing, of course, for the usual variation in tube characteristics. It will also be noted that the value of the voltage amplification agrees very well with that shown in Fig. 1, being slightly lower on account of the various leads which are present in the receiver but which are not used in the "ideal" set-up for measuring transformer characteristics only.

Fig. 4 shows the selectivity of the receiver taken at 1000 kc. The dotted line shows the selectivity of a good receiver employing 227-type tubes in the same number of radio amplifying stages. In taking these selectivity curves the interference output is not used, but they are plotted as the "Ratio of Input Voltage off Resonance to Input Voltage at Resonance for Standard Output."

Fig. 3 shows the fidelity curve of this screen-grid tube receiver. The ordinates are in decibels (DB) and show response throughout the range with respect to the standard signal obtained at 400 cycles as "zero level" or reference point.

Complete Shielding Needed

IN DESIGNING a receiver employing a. c. screen-grid tubes for radio amplifiers, as described above, where the radio voltage applied to the detector runs from three to ten volts, great precautions are necessary to insure proper shielding, adequate bypassing, and correct location of wiring. In this receiver the radio transformers are enclosed in seamless copper shields which have tight-fitting overlapping covers. These copper shields are $2\frac{1}{2}$ inches inside diameter and $2\frac{1}{16}$ inches inside length. The transformers are wound on $1\frac{1}{4}$ inch outside diameter formica tubing. The secondary of an interstage transformer is wound with 96 turns of No. 30 B & S enameled wire and the primary is wound over one end of the secondary "turn for turn." The primary consists of 53 turns of No. 39 triple-silk-covered resistance wire, the total resistance of the winding being about 380 ohms.

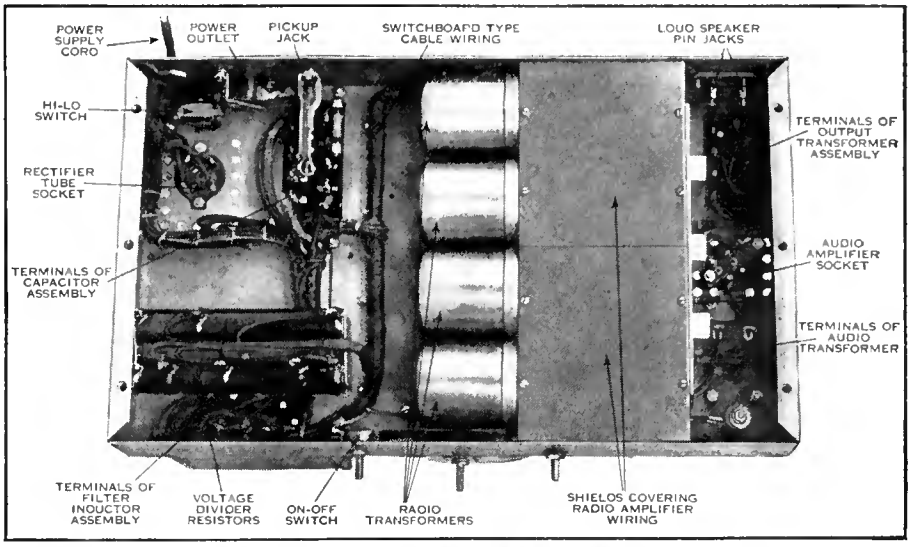


Fig. 5—Bottom view of the screen-grid chassis with all shields in place.

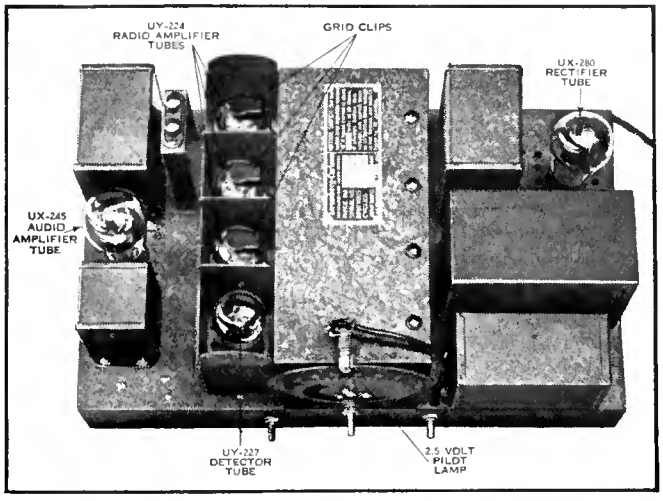


Fig. 6—Top view of the screen-grid chassis with covers over the r.f. and detector tubes removed.

Each unit of the variable gang capacitor is enclosed completely in a metal compartment and special short contact springs are provided to ground the rotors to the partitions between the units. Such short springs are necessary to prevent undesirable effects due to the inductance of longer springs. Fig. 9 shows the construction of the gang capacitor. The radio amplifier and detector tubes are each enclosed in a metal compartment adjacent to the corresponding units of the gang capacitor.

The by-pass capacitors are specially made, low-resistance units and have their lowest impedance at the frequency where maximum gain is obtained in the receiver. A radio-frequency filter in the detector output circuit, located close to the plate terminal, is employed to prevent radio frequency from getting into the audio system. This filter consists of a ten-millihenry choke and two 0.0005-mfd. capacitors in the usual pi arrangement. Fig. 6 shows the top view of the chassis with the tube cover removed and all tubes in place. Fig. 5 shows the bottom view of the chassis with the shields in place and Fig. 7 shows the receiver with the flat shields and the transformer shields removed. It will be noted that the arrangement of apparatus is such as to secure all shielding possible; for instance, the bypass capacitors serve as shields between the radio amplifier tube sockets.

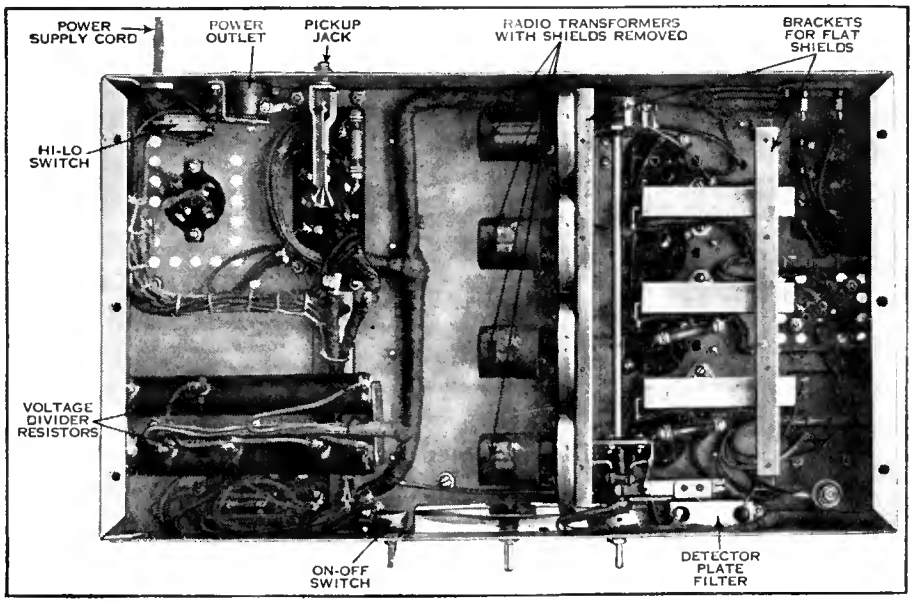


Fig. 7—Bottom view of the screen-grid chassis with all shields removed.

Schematic Diagram

Fig. 8 is the complete schematic circuit of the chassis. The secondary of the output transformer is designed to work into the moving coil of the built-in dynamic loud speaker and the current to energize the field of the loud speaker is obtained from the power outlet shown connected across the output of the rectifier tube.

The 227-type tube is used as a linear detector with automatic bias, the grid bias being adjusted automatically to the proper value for the strength of signal received. This type of detector does not overload

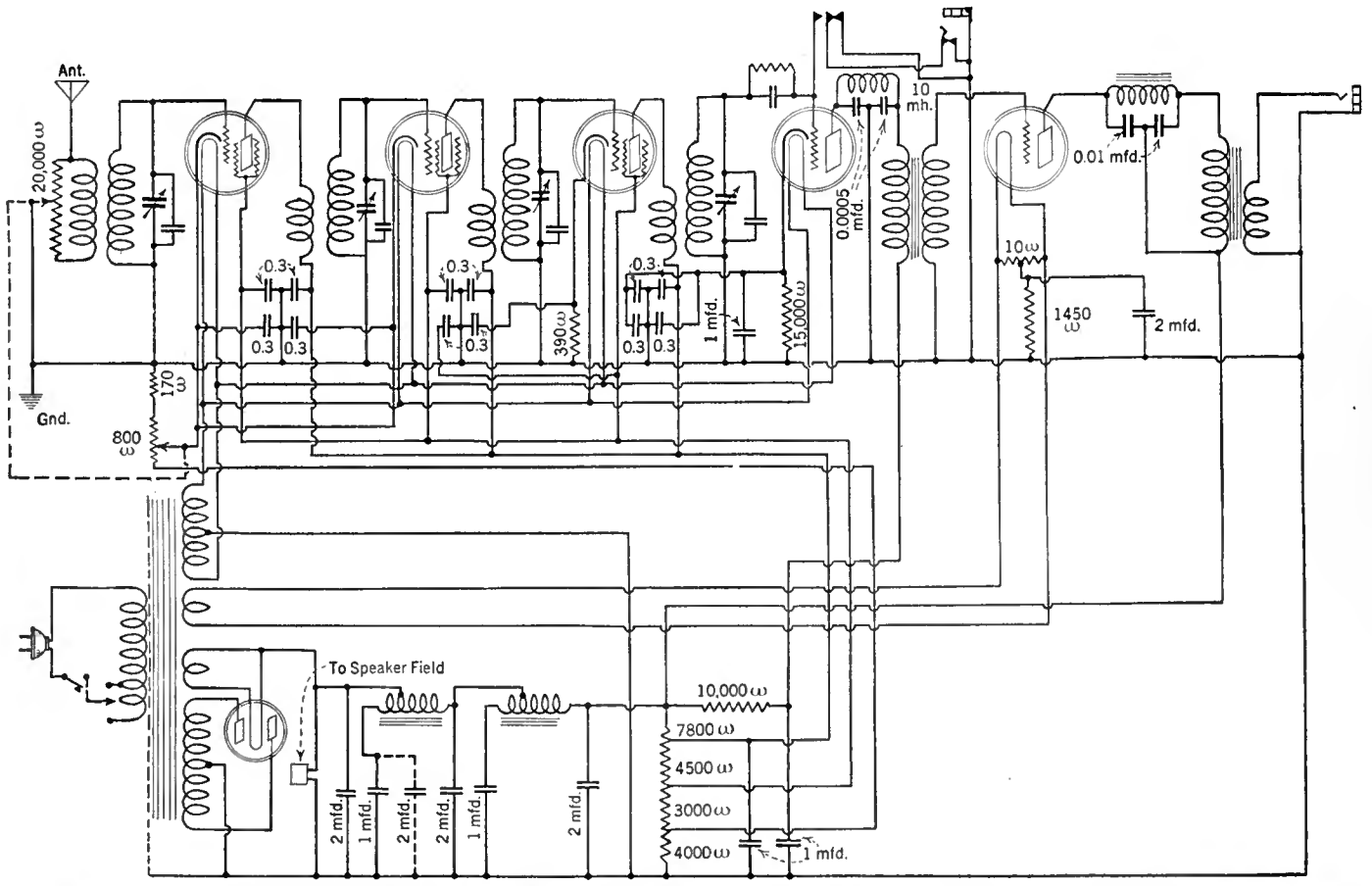


Fig. 8—Complete schematic diagram of the Stromberg-Carlson screen-grid chassis. This receiver is designed to operate in connection with a special built-in dynamic loud speaker.

readily and the output of this set is automatically prevented from passing the level of serious overload and "blasting" in the power-output stage.

The circuit diagram also shows the double-acting volume control, functioning to reduce both the voltage supplied from the antenna and the gain of the amplifier, It is arranged, however, so that the biases on the grids of the first two radio amplifiers are not changed until the signal is reduced greatly by the antenna input control, preventing distortion due to overload of the first radio amplifier tube. Such an arrangement is accomplished by operating two potentiometers by a single knob. The first is connected across the antenna primary ("high-impedance" type) with the antenna attached at one junction of coil and resistor unit and the lever or movable contact connected to ground. Thus, as the knob is rotated, varying amounts of signal are admitted to the radio amplifier. The second potentiometer is connected so that the biases of the control grids of the first two radio tubes are increased as the signal into the radio amplifier is reduced by the first potentiometer. To prevent the overloading effect mentioned above, this second potentiometer is constructed so that the bias voltages are not changed until the movable contact has traveled about one quarter of a revolution. This insures that the signal applied to the first radio tube is of small enough value to avoid distortion.

It will be noted that while the detector is of the plate-rectification type, there is a grid leak and capacitor shown in the circuit. These have nothing to do with the detector action, but allow the magnetic pick-up unit for phonograph operation to be connected directly between the detector grid and ground without short circuiting it through the radio transformer secondary, thus greatly simplifying the switching arrangement necessary. The 0.00025-mfd grid capacitor also serves as a scratch filter for the magnetic pick-up unit which is designed to operate with these receivers. The pick-up unit is connected for operation by turning the volume-control knob counter-clockwise.

The audio filter between the power tube and the output transformer is designed to secure the proper cut-off above the useful range of audio frequencies.

The B-Supply Circuit

THE B SUPPLY employs two stages of specially designed filter to secure the extreme filtering action that is necessary. The tapped inductors in the arrangement shown allow much greater filtering action

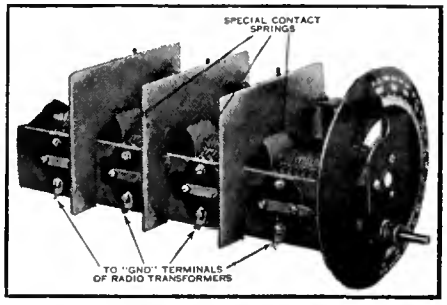


Fig 9—View of the gang tuning condenser unit showing special short contact springs to the rotors.

to be obtained per stage with the same amount of material than is possible otherwise. This additional filtering is accomplished by a "bucking" action between the fields set up by the current in the two portions of the inductor, one in the main circuit and the other in the branch circuit in series with the capacitor.

There is little else unusual about the B supply. It should be noted that the speaker field circuit is connected directly across the output of the rectifier tube as indicated in Fig. 8. Although not so indicated the power transformer is arranged with four taps on the high-voltage secondary. The inside taps are used in the model 641 set which is designed for use with a magnetic loud speaker. Because of the extra load imposed on the filter system by the dynamic loud speaker used in the model 642, somewhat greater voltage must be applied to the rectifier tube and the outer taps are therefore used.

FRESHMAN ORGANIZES CANADIAN COMPANY

CHAS. FRESHMAN CO., INC. in conjunction with Canadian interests has organized the Freshman-Freed Eisemann Radio Ltd. with headquarters located at 20 Trinity Street, Toronto, Canada.

This recently formed Canadian radio corporation has issued $400,000 preferred stock and 1000 shares of common stock, all of which has been absorbed by private subscription. C. A. Earl president of the Chas. Freshman Co., Inc., heads the new corporation and George H. Gooderhan, of Toronto, is vice-president. The Board of Directors includes C. A. Earl, Joseph D. R. Freed, and Warren J. Keyes, representing the Freshman interests and George H. Gooderhan, H. S. Gooderhan, W. S. Turnley, and K. S. MacLacklan, representing the Canadian interests.

Over half a million dollars worth of business has already been booked by the Canadian Corporation and the new distributors and dealer outlets for both the new Earl and Freed Radio Receivers are being contracted for every day. The sets will be assembled in Canada under special Canadian licenses which have been granted by the Neutrodyne and other patent owners.

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THE FEDERAL MODEL "L" RECEIVER

THE MODEL L receiver is not the first Federal set to utilize the new a.c. screen-grid tubes but this new set does constitute a distinct step forward in the design of screen-grid receivers. Because of the use of these particularly effective tubes and the new 245-type power tube, outstanding performance is obtained.

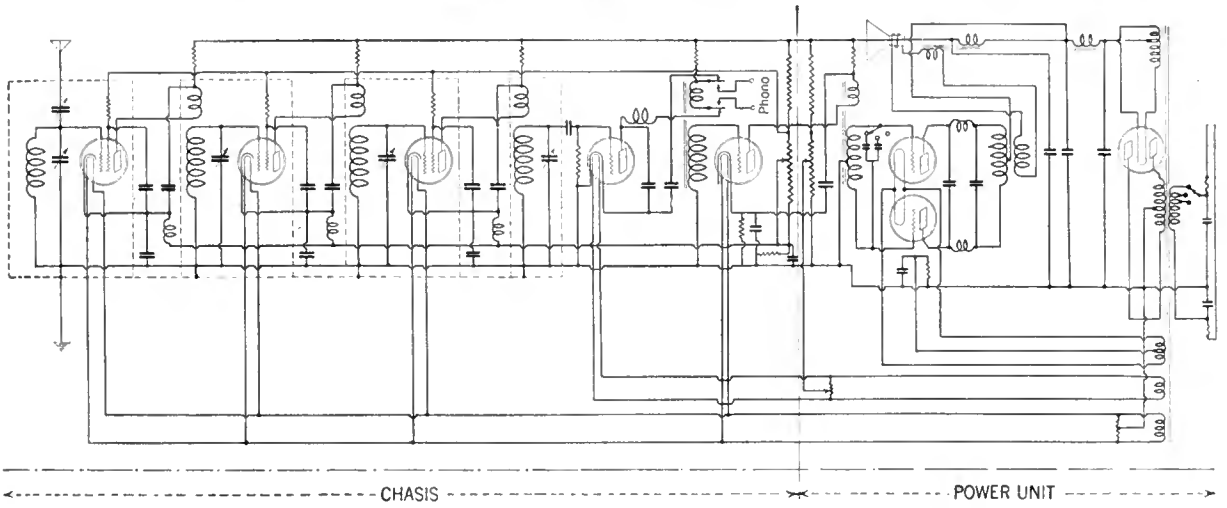
The receivers are housed in conveniently arranged cabinets. In the upper compartment of the cabinet is the radio set proper consisting of three stages of radio-frequency amplification, a detector, and the first audio-frequency stage. In the lower compartment is located a ten-inch dynamic cone, the second-stage audio-frequency amplifier, and the power apparatus. The radio receiver is mounted on a sliding shelf which may be withdrawn completely from the back of the cabinet, the shelf still acting, however, as an extensible support which holds the receiver while tests are being made or the tubes are being replaced.

If the radio receiver housed in the upper compartment were examined carefully it would be found to contain three stages of r.f. amplification with a tuned-coupling transformer between the antenna circuit and the first r.f. amplifier tube, a detector using special circuit arrangements, and the first stage of audio-frequency amplification. The elements of each radio-frequency amplifying stage, namely the tuning condenser, transformer, and a screen-grid tube, are completely shielded. In addition there is a second shield around each of the r.f. transformers and around each tube. All of the power leads to each r.f. stage are filtered thoroughly. This extreme care is used in the design of the set so that maximum gain will be obtained from the screen-grid tubes and so that the complete amplifier will be perfectly stable and free from distortion.

In the design of this receiver the vital dependence of the hum output on the design and circuit arrangement of the detector stage was realized and a dual type of hum eliminator was installed in order to keep the detector hum completely under control. The power amplifier circuit is composed of two high-quality push-pull transformers, a cut-off filter, a timber control, and, of course, the two 245 tubes. The cut-off filter eliminates the very high audio frequencies.

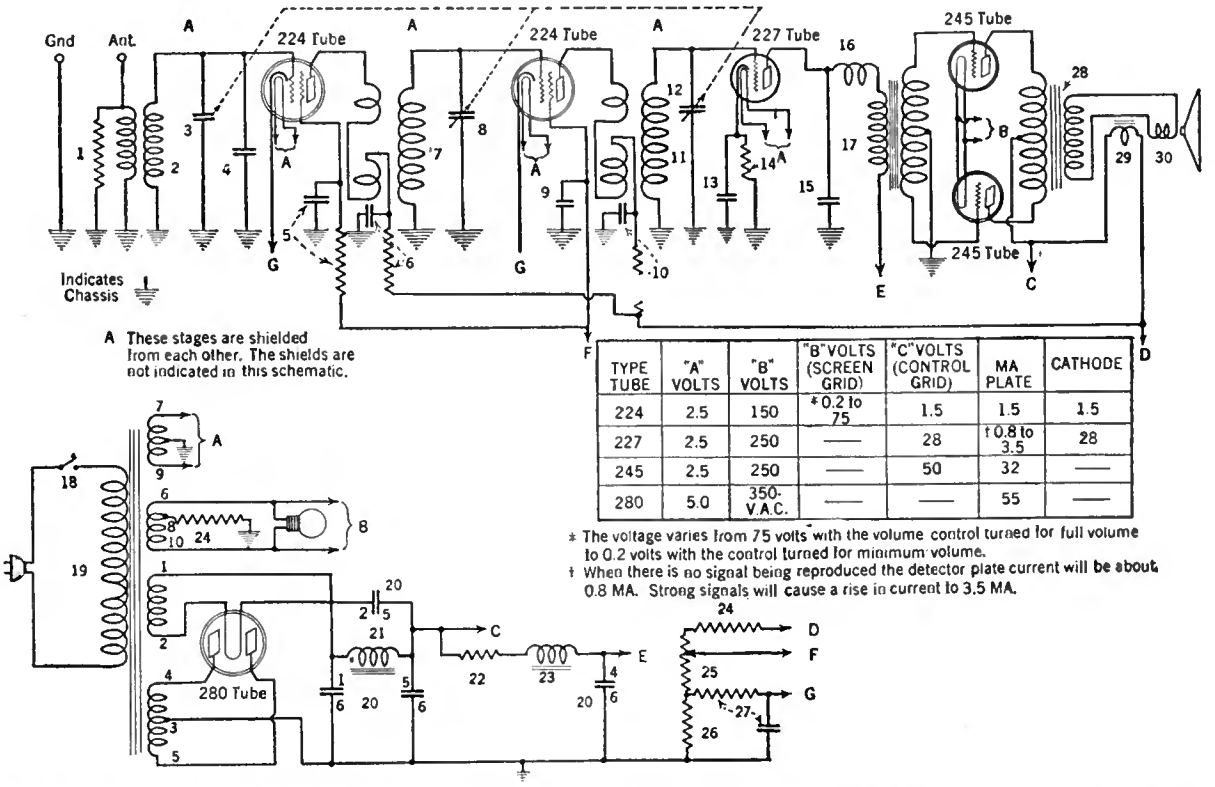
The timber control is an essential part of the receiver. It contains three positions, each having been given a name to indicate the type of reproduction it provides. These three names are utilized in connection with organs to indicate which stop is being used. The first position on the timber control is known as the "Clarion" stop which, as its name implies, gives very brilliant reproduction. It is especially useful in rooms that are acoustically rather "dead." If the set is to be used in more normal surroundings, the "Mezzo" stop should be employed. With this stop some brilliancy is sacrificed to secure somewhat better balance. This is the most useful of the tops and Model L receivers when shipped have the control set on the Mezzo stop. The third position is known as the "Bourdon" stop. With this stop considerable emphasis is given to the extremely low tones.

[Note: We are advised that changes in this circuit are being considered. If necessary, a revised circuit will be published—*Editor.*]



THE PHILCO MODEL 65 RECEIVER

Since the issuance of the circuit below on the Model 65 by the Philadelphia Storage Battery Company, one change has been made in the antenna circuit. The antenna coil shunted by a resistance has been replaced by a tapped coil, the taps making connection to a "local-distance" switch on the panel. Note the use of double primaries on the r.f. transformer to give more uniform gain throughout the band.



TYPE TUBE	"A" VOLTS	"B" VOLTS	"B" VOLTS (SCREEN GRID)	"C" VOLTS (CONTROL GRID)	MA PLATE	CATHODE
224	2.5	150	*0.2 to 75	1.5	1.5	1.5
227	2.5	250	——	28	†0.8 to 3.5	28
245	2.5	250	——	50	32	——
280	5.0	350-V.A.C.	——	——	55	——

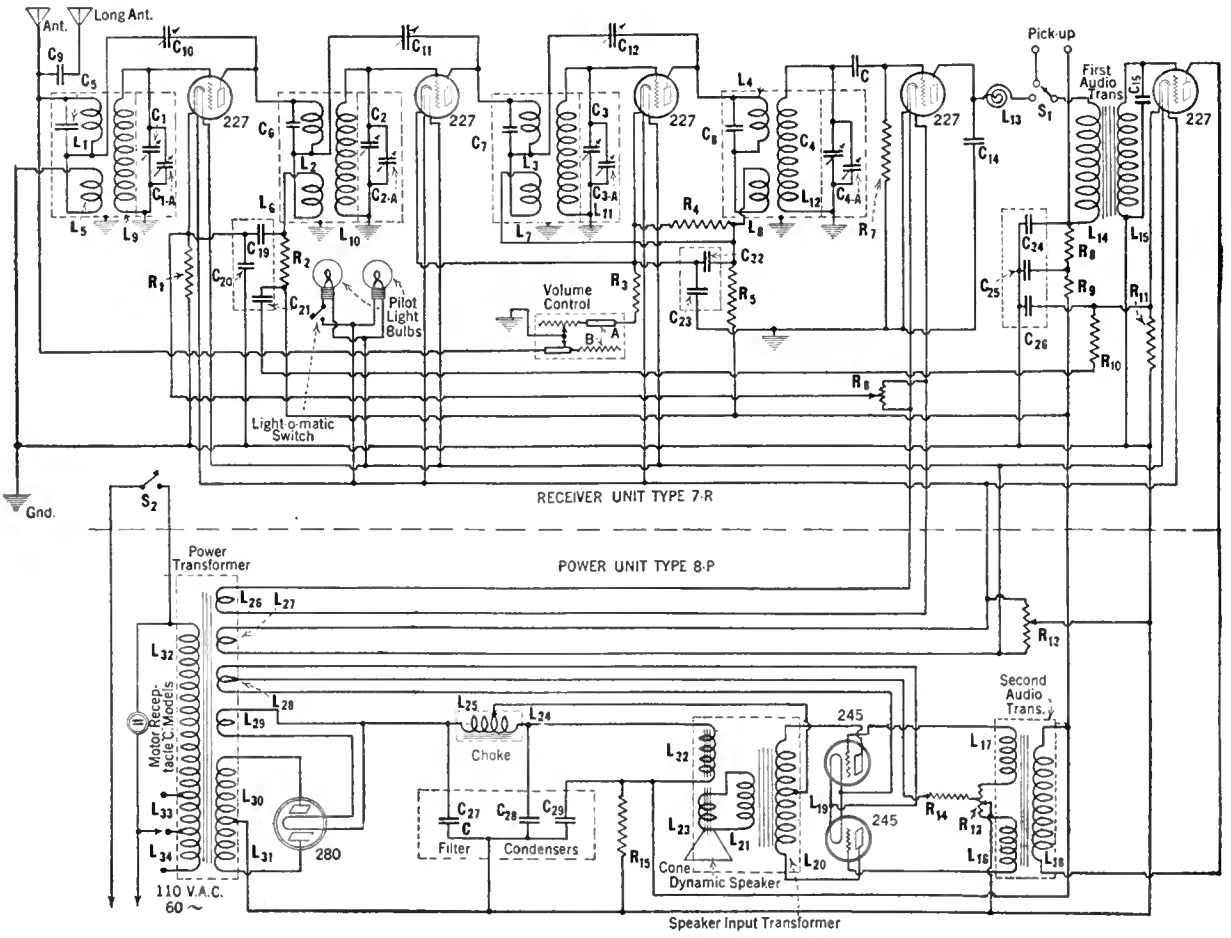
* The voltage varies from 75 volts with the volume control turned for full volume to 0.2 volts with the control turned for minimum volume.

† When there is no signal being reproduced the detector plate current will be about 0.8 MA. Strong signals will cause a rise in current to 3.5 MA.

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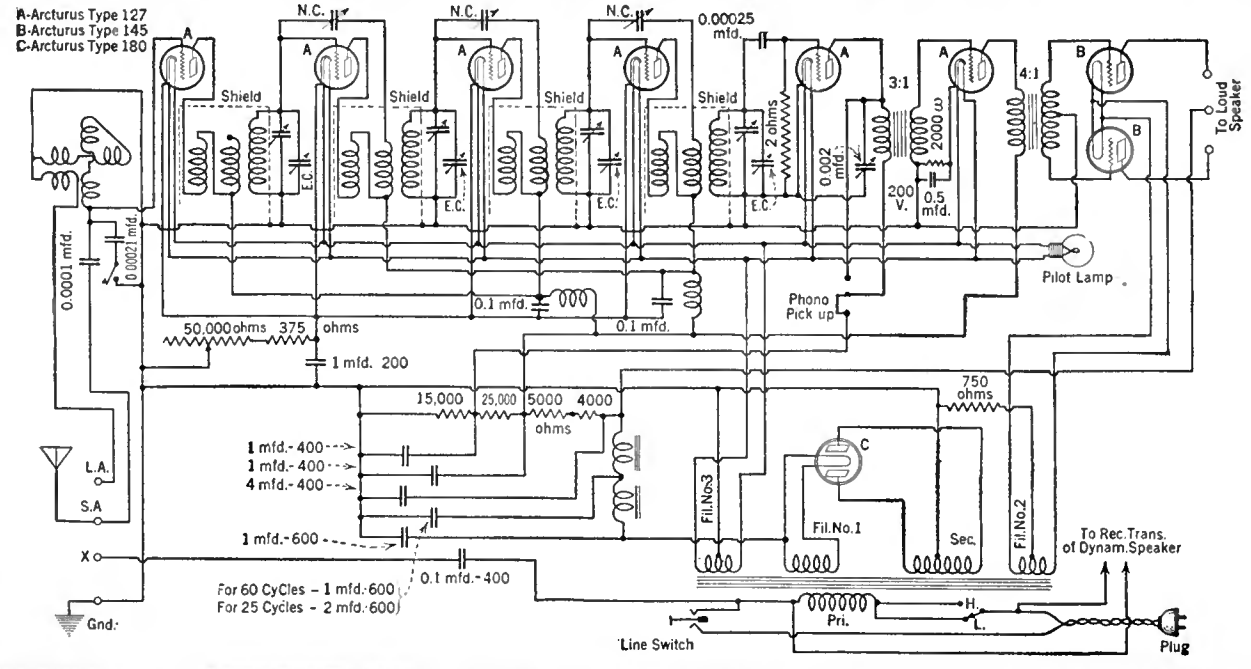
THE EDISON MODELS R-4, R-5 AND C-4 RECEIVER

These receivers incorporate several unusual features among which are an interesting hum adjustor (R-13) connected to the mid point of the push-pull transformer feeding the two power tubes, the double primary windings on each of the r.f. transformers, and the "light-o-matic" switch which automatically indicates when the set is tuned to a favorite station. Type 227 tubes are used throughout except in the output circuit where there are two 245's. The volume control functions to reduce the input from the antenna and also to increase the r.f. bias.



THE FREED-EISEMANN NR-95 A.C. RECEIVER

Four stages of r.f. amplification, a detector and two stages of audio-frequency amplification are used in this receiver. The antenna circuit is tuned by means of a variometer. Each r.f. amplifier stage is neutralized by means of double-wound primaries on the r.f. transformers. In all the stages except the last heater-type tubes are used. The use of heater tubes conforms with a general tendency among set manufacturers to utilize this type of tube rather than the 226 type. A light-socket antenna is provided in this receiver.



A SYSTEM FOR UNIFORM AMPLIFICATION

By W. A. MacDONALD

Chief Engineer, Hazeltine Service Corp. Laboratories

ONE OF THE faults with a radio receiver of the tuned radio-frequency type is that it is not possible to attain uniform amplification over the broadcast band unless certain definite measures are taken. A receiver without these definite measures will have considerable amplification at high frequencies and much less at lower frequencies where the selectivity is somewhat greater. The effect upon the user is a receiver that seems very selective at low frequencies, and rather broad at the high frequencies; or from the standpoint of amplification, the receiver is comparatively insensitive at the longer waves and very sensitive at short waves. This is a disadvantage.

This article is the result of work by engineers of the Hazeltine Service Corp. Laboratories. It describes an antenna coupling system which makes possible an almost uniform voltage step-up over the operating broadcast range or, by slight modification, a greater voltage step-up at the low-frequency (long-wavelength) end of the range than that obtained at the high-frequency or short-wavelength end of the range. In any case, the voltage step-up obtained at low frequencies is a substantial improvement for a given number of tubes, over methods now in use.

Two Systems Now in Use

BEFORE GOING into a detailed description of the arrangement, a better understanding of it may be had by a brief discussion of the two forms of antenna coupling arrangements now commonly used. Fig. 1 consists essentially of coupling the antenna structure to the input of the radio receiver by means of a comparatively small number of primary turns rather closely coupled to the secondary or input tuning of the receiver. Where a separate tuning adjustment is provided for in the input stage, the mutual inductance between

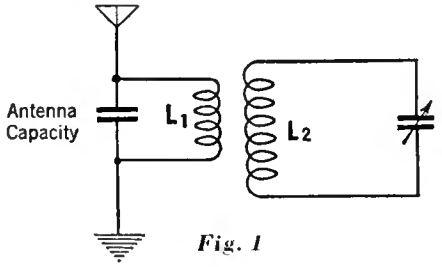


Fig. 1

the primary and secondary of the input transformer may be fairly large. That is, the primary or antenna winding, L_1, may consist of a coil of 15 or 20 turns of wire supported on a 2″ form, having an inductance of possibly 25 microhenries, which is very closely coupled to the secondary winding, consisting of, say, 70 turns of wire, supported on a 2″ form having an inductance of 200 microhenries. When an input transformer of this character is connected to an antenna structure, a certain amount of the antenna capacity will be reflected into the secondary circuit; hence the minimum capacity of the circuit is increased, which in turn requires an increase in the maximum value of the input tuning condenser of approximately nine times the value of the effective minimum increase. With a circuit of this type operating with an average antenna having a capacity of 200 mmfd., the voltage step-up, as measured across the secondary circuit, is approximately 35 or 40 at 1500

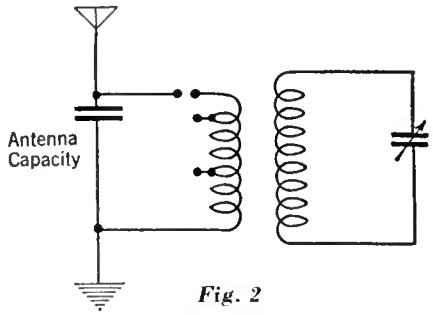


Fig. 2

kc. and 7 or 8 at 550 kc. The amount of detuning of the first circuit as compared with the following circuits is then a function of the size and character of the antenna employed, the detuning being small for a small antenna and increasing as the antenna capacity is increased.

Where a circuit of this nature is employed with a uni-control receiver, it has been found necessary to decrease materially the effect of the antenna upon the secondary circuit of the transformer. A convenient way of accomplishing this is by providing two or three taps on the primary or antenna coil, as in Fig. 2, so that when the receiver is used with a small antenna about 15 or 20 microhenries may be employed in the antenna coil and, as the antenna capacity is increased, a smaller and smaller inductance value may be employed. With such an arrangement it has been found necessary to provide an additional capacity for the remaining stages of the amplifier so that they will "track" properly with the input stage. The value of the capacity is usually in the neighborhood of from 7 to 10 mmfd., which means that the effect of the antenna upon the input circuit may be in the neighborhood of from 7 to 10 mmfd. In this way the various stages of the amplifier are made to track, but at a considerable expense: first, in the form of voltage step-up as determined by the input stage, and second, by increased cost in the tuning condensers, for, as the minimum capacity of all tuning condensers is increased by at least 7 mmfd., it will be necessary to increase the maximum capacity by approximately 60 mmfd. The voltage step-up in a transformer which produces, with an average antenna, an increase in the grid-filament capacity of the first stage of from 7 to 10 mmfd. is approximately 20 at 1500 kc. and 2 at 550 kc.

A Coupling Tube Circuit

CIRCUIT NO. 3 employs an antenna-coupling tube or a substantially aperiodic input circuit which links the antenna to the input of the radio receiver. A convenient way of accomplishing this is by employing either a high resistance or high inductance connected between antenna and ground and utilizing the voltage drop to supply signal voltage to the input of the coupling tube. The output of this tube may be coupled to the receiver by one of the conventional coupling transformers. With such an arrangement the antenna constants have little or no effect upon the tuning of the following circuit.

In some cases, it has been possible to secure a small voltage step-up in the coupling tube. This may be obtained most conveniently by utilizing a choke coil connected between antenna and ground which, in conjunction with an average antenna, tunes to approximately 500 or 550 kc., provides a voltage step-up in the neighborhood of 4 at resonance and diminishing to 1 for remote frequencies. It has not been found practicable to employ a greater voltage step-up than this in the coupling stage because of the effect of powerful local stations, which produce an effect termed "cross-talk" in the receiver. That is, even though the radio receiver may be tuned to one station, the large voltage developed in the input coil, as a result of the proximity of another station, tends to modulate the input tube, thereby allowing both signals to be heard.

A New Circuit

THE ARRANGEMENT discussed in the following paragraphs eliminates certain objectionable features of both of the previous arrangements. It consists fundamentally of a rather large inductance which may be coupled to the tuned secondary. The value of the primary or input inductance may be selected to come either just within or somewhat outside of the lowest frequency in the broadcast range when employed with an average size antenna.

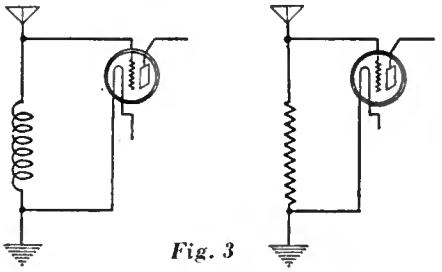


Fig. 3

Assume that a 200-mmfd. antenna is to be employed, then the magnitude of the primary inductance will probably be in the neighborhood of 400 to 600 microhenries. This would produce a circuit resonant to about 560 to 460 kc. which would pass the least current at 1500 kc. and the greatest at resonance. The voltage induced in the secondary circuit by a given primary current, however, is the highest at 1500 kc. and the lowest at 550 kc. The resulting effect of these two conditions produces a substantially uniform voltage step-up over the operating range, with a somewhat higher value at low frequencies. Where antenna capacities in excess of the

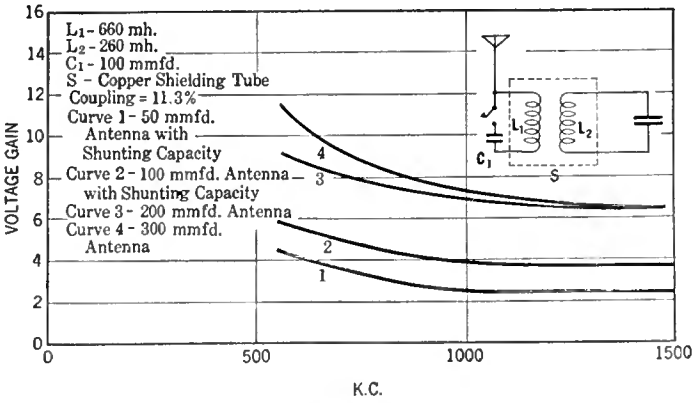


Fig. 4

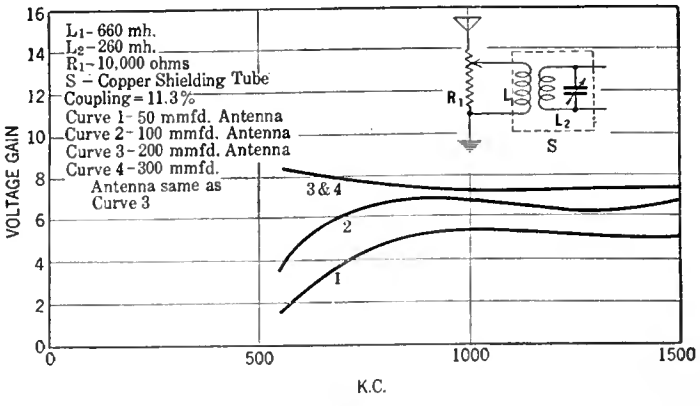


Fig. 5

value mentioned are employed, the effect is to reduce slightly the amplification obtained at the low-frequency end of the range. This is because the resonance of the primary circuit is farther removed with the result that there is less current flowing in that circuit and less voltage developed in the secondary circuit. Where antenna values less than 200 mmfd. are employed, the voltage step-up will increase until the resonant peak of the primary is reached at 550 kc. Where still smaller values of antenna are employed, so that the resonant point of the input circuit comes well within the operating range of the receiver, the effect, as a whole, is rather detrimental but can be minimized by observing special precautions, as explained later.

With the fundamental arrangement as described, the effect of the antenna circuit upon the secondary circuit of the receiver, is exactly the reverse of the arrangement described in paragraph one. Its effect is to decrease the effective inductance of the tuned input circuit. This effect is not very serious and may be compensated by a few added turns on the secondary coil, an increase in inductance of between 1 and 2 per cent. being adequate.

There is some difference in the character of the voltage step-up curve, depending upon whether the capacity coupling between the primary and secondary coils is aiding or opposing the magnetic coupling. If it is aiding, the voltage step-up at 1500 kc. will be considerably higher and the final response curve over the frequency range will be almost a straight line. If the capacity coupling is opposing the magnetic coupling, there will be a decrease in the amplification at 1500 kc. with a gradual rise to maximum at 550 kc.

When the antenna circuit is allowed to become resonant to some frequency within the broadcast range the detuning effect upon the secondary becomes objectionable on the inductive side of resonance unless the input is properly loaded. One method of obviating this condition is in providing a small shunting capacity across the primary (See Fig. 4) for use when an especially small antenna is employed so that the resonant point of the input system will always be outside of the lowest frequency in the broadcast range.

A preferred arrangement would be to combine the loading means and volume control. This arrangement is obtained by employing a fixed value of resistance permanently connected between antenna and ground with an adjustable arm connecting to the primary coil. (See Fig. 5) When coupling this arrangement it is unnecessary to provide several switch arrangements to accommodate antennas of various sizes, the one connection being sufficient.

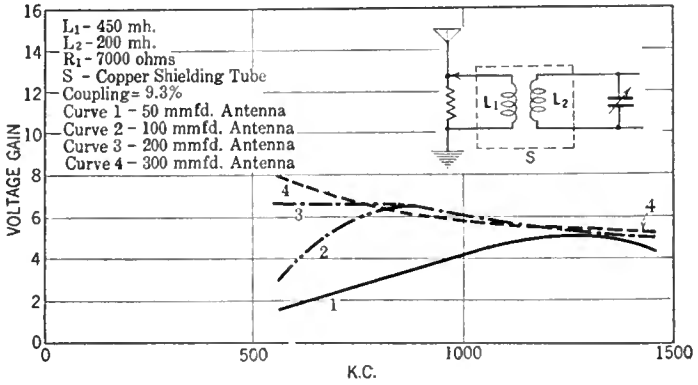


Fig. 6

A typical series of values that might be employed in designing a circuit of this type, are:

TRANSFORMER NO. 1.
LPri = 650 to 700 microhenries
LSec = 260 "
Coupling = 12 per cent.
Shunted capacity for very small antenna—100 mmfd.
Voltage step-up 1400 kc. = 7
600 kc. = 11

TRANSFORMER NO. 2.
LPri = 650 to 700 microhenries
LSec = 260 microhenries
Coupling = 10 per cent.
Shunted resistance across primary = 10,000 ohms
Voltage step-up about as No. 1

TRANSFORMER NO. 3.
LPri = 400 microhenries
LSec = 200 "
Coupling = 10 per cent.
Shunted resistance across primary = 5000 ohms
Amplification values—1400 kc. =6
600 kc. =8 to 9

In certain of the experiments the primary coil consisted of a small flat bobbin having a $\frac{1}{2}$" diameter core and a $\frac{3}{16}$" slot wound with approximately 200 turns of No. 36 d.s.c. wire. The secondary consisted of a $1\frac{1}{4}$" supporting form, wound with 100 turns of No. 28 enameled wire. The primary was located at the low-potential end of the secondary and in the same plane as the secondary winding. The entire transformer was enclosed within an open-ended copper can $2\frac{3}{4}$" long and $2\frac{1}{4}$" in diameter.

The accompanying curves (Fig. 6) give a series of absolute values of amplification obtained under various conditions and are complete in themselves.

THE MARCH OF RADIO

(Continued from page 215)

remarking, while the testimony of Louis G. Caldwell was being taken, "I think advertising is a fast disappearing part of the radio service." Maybe he was talking about television.

The testimony which attracted the greatest attention was that of Col. J. I. McMullen, of the Office of the Judge Advocate General of the Army, who stated that, in his opinion, the Schloemilch and Von Bronck patents anticipate Alexanderson and that the two Federal District Court opinions, favorable to Alexanderson, were based on evidence which did not adequately set forth the Schloemilch and Von Bronck claims. These cases, he said, were "a rather put-up job by the General Electric Company to have the Alexanderson patents validated over the Von Bronck." Lt. Com. Harold Dodd stated that the Navy paid the Alien Property Custodian about $1690 for the Schloemilch and Von Bronck patents. In Canada, these patents constituted a successful defense against Alexanderson by Fada Radio, Ltd., when it was sued by the Canadian General Electric Company there. The Canadian patent law makes all research work done in Europe relevant in fixing dates; in the United States, however, only foreign *publication* is of weight; hence it does not follow that American and Canadian judges differed on these cases—they each passed judgment on a different case. Col. Manton Davis, with his usual crystal logic and courtesy, called the attention of the Senate Committee by letter to the decisions of Judges Bodine and Thatcher in the Splitdorf and Atwater Kent cases. It must be said that these decisions are only indirect refutation of Col. McMullen's statements because, if what he says is true, the German patents were not adequately presented before the Judges who rendered these decisions.

After all, the argument is quite academic because all the principal radio manufacturers have long ago admitted the validity of the Alexanderson patent and agreed not to contest or to aid anyone in contesting it.

Just what the Senate has to do with this matter, which has been and could again be brought to the courts, is not clear. Delving into such matters is, of course, very interesting, but we suspect some of those who have taken frequent opportunities to address the press through the medium of Senate hearings to be mere busybodies. If the charges they make are true, they should hasten to the courts rather than the Senate and the press.

—E. H. F.

Interesting Data on Their Design and Use

CHARACTERISTICS OF R. F. CHOKE COILS

By ROBERT S. KRUSE
Consulting Engineer



R. S. Kruse

In a recent article in Radio Broadcast, the author made the general statement that it is sometimes quite troublesome to have an r.f. choke present a capacity reactance instead of the inductive reactance that one usually attributes to it. A request has been received for a more specific statement on this point.

Unfortunately it is difficult to make any statement that is both specific and general. More or less qualification is necessary and the reader is asked to keep in mind the necessity of some analysis of his particular circuit before deciding if the remarks apply there.

Rather obviously the choke will act as an inductance at low frequencies, since its distributed capacity is of no importance then. As the frequency is raised one eventually arrives at the point where the choke is in resonance; that is, the inductance and the self-capacity of the choke tune it to the frequency being fed to it. The result is that the choke presents a high impedance to the r.f. (which is desirable), but at the same time tends to develop a large "circulating current" inside the choke itself. This circulating current can be thought of as going in one direction through the inductance of the choke and returning through its self-capacity. Since these constants are distributed it follows that the circuit is not a simple one but instead is capable of showing multiple resonances. On one side of each of these resonances the choke presents (to the external circuit) an inductive reactance; on the other side it presents a capacitive reactance—both being high in normal designs of chokes.

Further general statements become impossible; we must consider the various types.

An Incorrect Assumption

From what has been said one may assume that it is necessary always to operate in the inductive-reactance regions, avoiding the resonant points and those of capacitive reactance. This assumption is not correct. In many cases it is of little consequence whether the reactance is positive or negative, as long as it is high enough—and for some applications it does not even need to be high! Furthermore, the resonance points need not be avoided in the more common cases for reasons that are given in the following paragraphs.

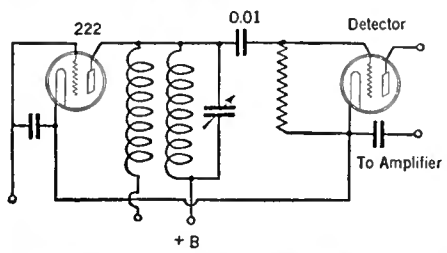


Fig. 2—In this circuit the r.f. tube was fed through the tuned circuit of the following tube. Somewhat higher output was obtained because of the relatively higher load impedance.

Let us first take the case of the simple cylindrical choke, having one layer of wire, the length of the coil being perhaps 4 times the diameter, and the wire size small. Measured alone, this coil will show prominent resonance at a frequency such that a half wave is standing on it (voltage at both ends and none at the center), likewise at 3 times and 5 times this frequency, above which the resonances become less distinct. It will be noted also that the alleged third harmonic is not exactly at 3 times the lowest resonance frequency, likewise the fifth is not at exactly 5 times the fundamental. This is the usual action of a resonant circuit with distributed constants;

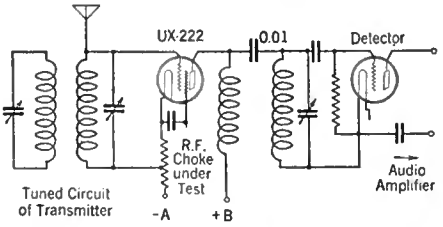


Fig. 1—The effectiveness of the choke between the detector and amplifier was noted by the signal obtained from the two-stage amplifier following the detector.

antennas act similarly. The reason is that at each system of resonance we have a different current distribution which is equivalent to rearranging the current carried by each of the various small portions of the coil's self-capacity. The effect of these self-capacities accordingly varies from that at the fundamental.

So far we have dealt with laboratory conditions—a coil hung out in space and measured by a weak field cautiously coupled into it. This is not the way the equipment will be used. Instead we will connect apparatus to the two ends of the coil and feed r.f. to the coil through this apparatus. This is quite different from the process of magnetically manufacturing the voltage in the coil itself, and again we find the elusive self-capacities shifting about so as to alter the seeming resonance points. It follows that the goodness or badness of a choke depends not only on the choke but also on the suitability of the job for the candidate. This leaves us badly at sea. We have not determined anything and have discovered several new variables. Until one has learned something by trial and error it is usually impossible to generate useful theory. Let us see, therefore, what practice teaches us, then perhaps we can apply the theoretical speculation to step on toward a better type—to be given practical test. Let us leave the single-layer coil for a moment.

We find that where the r.f. voltage across a coil is high, or where a very high impedence is necessary, it is essential that the coil have physical length. If we do not have length—distance between the two terminals—we obviously will have fairly strong electric fields directly between the ends of the coil without much regard to the manner in which the wire wanders about. If the frequency is high there will be entirely too much bypassing due to this end-to-end capacity of the coil, entirely without any reference to the turn-to-turn capacity or the layer-to-layer capacity. Very well—when is this serious and what's to do about it?

The reply to this is that it is serious only for receiving equipment working with shunt-fed screen-grid tubes, short-wave sets working below 50 meters, and for transmitting sets using shunt feed of plate supply or grid bias. The cure depends on which of the cases we consider.

Screen-Grid Circuits

Shunt feeding screen-grid tubes is fairly common practice, frequently with small regard for the effect on the gain of the stage. Unless one knows what the load of the tube looks like it is hard to say if the feed-choke should have a capacity or inductive reactance. One knows with certainty, however, that it should have a very high reactance. Even at broadcast frequencies this means that the inductance must run to many millihenries and the distributed capacity to a very few "micromikes." The average receiving r.f. choke entirely fails to supply such a combination, since it consists of a mere "scramble winding" divided into sections. This sort of choke works well enough when it is required only to keep r.f. out of an audio-transformer primary or to perform some other chore in connection with a 201A or a 227 tube. Inspection of the tube constants suggests that equally good work at the same wavelengths with a 222 or 224 tube will require $\frac{1}{10}$ the self-capacity and 10 times the inductance—or something of that general sort. Such an improvement is hardly to be hoped for, hence we must either put up with the nuisance of feeding through a tuned (tunable) circuit or else do the best we can. The obvious way to improve the choke seems to be that of lengthening it and making it slimmer so as to reduce self-capacity. Unfortunately, one is limited as to space and this process does not help much before the inductance

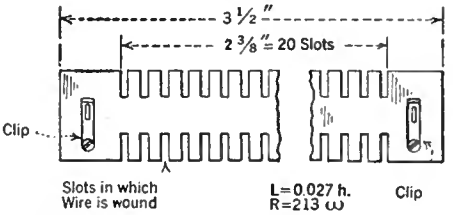


Fig. 3—A common type of multi-section choke. The slots were wound full of No. 38 wire, and when placed near a heterodyne wave meter, resonances were found at or near the following frequencies: 982, 1022, 1620, 1930 kc. Other small resonance peaks were also found.

begins to fall off badly. The next obvious weak spot is the "scramble" winding of the usual choke, since this permits choke-coil turns to slip down inside the winding and come near other turns that should be removed from them. A systematic winding would seem to be of advantage but trial shows that plain layer winding produces so much inter-layer capacity as to ruin the choke rather completely. This leaves the expedient of a winding with narrow layers of the "universal" or "honeycomb" type, or else a winding with layers but one wire wide! This last sounds foolish but is actually done in the Samson choke which consists, in effect, of spirals (one wire wide) laid side to side. Lest this seem to run to hair-splitting let us show a few concrete figures. To secure these a tuned 222 stage was fed from a 1-meter antenna, the driver being a sinusoidally modulated 50-watt transmitter some distance away. The r.f. output of the 222 stage was fed to a detector and two-stage audio amplifier, the a.c. output being measured with an a.c. meter suited to the modulation frequency of 120 cycles. Various chokes were used to shunt-feed the 222 tube whose plate load was the detector-input tuned circuit.

Choke used	Meter Readings (Scale 0–200) 15 meters	80 meters	360 meters
A	1	8	80
B	0	10	50
Samson	5	25	100
C	3	18	90
D	4	6	35
E	6	28	110

The chokes used were as follows:
A Commercial tube using a wooden form with three unequal grooves wound full of No. 38 enamel.
B Same as A except as to proportions. Wire size about 34.
C Three small "Universal" coils 2¾" diameter by 1⅜" wide, wound with No. 38 single silk.
D One Universal coil 16 1/16" wide and with outside diameter of 2".
E Feed through tuned circuit

It will be seen that even the best of the chokes drops off in impedance with wavelength. This is *not* altogether the fault of the choke, since the tube falls off also. For comparison there is provided the set of figures obtained with the same tube fed through the tuned circuit, as in Fig. 2. It is only fair to say that the chokes used were considerably better than the average. Some of those sold gave no reading at all at 80 meters and values as low as 10 at 360 meters.

The circuit used here would work well as long as the choke reactance was high *regardless of its sign:* that is, whether it was capacitive, inductive, or resonant. Fortunately, also the lumped types of chokes have so many resonance points that they overlap into a sort of mountain range, giving a fairly uniform high impedance over a wide range and then sinking imperceptibly into the normal X_C and X_L curves. One accordingly has a wide useful range. Though the peaks are not as high as in a simple solenoid, which is very much better *over a small range*, the voltages involved are low and the circulating currents due to resonance are accordingly low also.



Dr. E. F. W. Alexanderson (right), consulting engineer of the General Electric Company, examining the memory meter which he developed for depth sounding from airplanes. The memory meter intercepts the radio echo and records the altitude for the observation of the pilot. With Dr. Alexanderson in the picture is his assistant, S. P. Nixdorff.

The case for the transmitter is different. Here the voltages are materially higher and serious currents will flow through the choke unless its impedence is very high indeed. If we attempt to run the impedence up to the requisite value by using a "tuned trap" (coil shunted by a variable condenser) we will have large circulating currents and large losses in this trap. Fortunately, the transmitter, unlike the receiver, is not required to work at *all* wavelengths and we are enabled to do away with tunable circuits, using instead a coil having small C, large L and ample length so as to cut down the field intensity. In general, this becomes a slim solenoid or else a series of small honeycomb coils strung on a rod with their fields additive. In the latter case the sections may be equal or unequal without marked change in performance. The wire size must be as small as possible—frequently a small wire will heat less than a large one. However, the smaller wire must retain the same thickness of covering to secure this result. The effect is even more noticeable if the spacing in turns per inch is kept constant as the wire size is reduced. This is often difficult without the introduction of grooved forms, whose value is dubious indeed in this work.

It has frequently been denied that working a choke at resonance is a practical operating condition but the writer can find no case where resonant operation is not satisfactory, given a suitable choke design. This statement has not been checked above 3000 volts and the experimenter may get into difficulties higher up on the scale. A distinct exception must be made in the case of regenerative operation—which is to say either in transmission or in receiving with a regenerative stage or one imperfectly neutralized. Here a resonance peak on a choke is a nuisance since a change of tuning may throw the choke reactance positive or negative with an unpleasantly strong effect on the degree of regeneration. In the case of the receiver this may be dodged by using the types of chokes which have multiple resonances in sufficient number to cause the peaks to tie together throughout working range. Abrupt changes of voltage distribution in the choke may be found but these are harmless.

At ultra-high frequencies, corresponding to wavelengths below 20 meters, it is best to arrange circuits so as to minimize the need of r.f. chokes, since it is almost impossible to combine satisfactory choke performance and good mechanical arrangement. Where chokes must be used a special effort must be made to decrease the inter-turn and the end-to-end capacity. Very small "basket weave" or Lorenz coils are fairly satisfactory if the wire is not over number 34 and the leads are continued for several inches with the same wire before reaching larger wire or metal parts. A diameter of ⅜" works out well and may be made on a form consisting of five slim wire nails driven into a board and beheaded.

WHAT MANUFACTURERS MAKE AND BUY

(Continued from page 205)

have rearranged these data in Table IV.

In the preceding paragraphs we have pointed out some of the salient facts obtained from the survey. It is hoped the executives of the various set manufacturing companies will be able to obtain some useful information from the various tables. It should be helpful to compare the practices of the various companies who coöperated in this survey with the practices in one's own plant. Whether or not one makes a particular part will depend on the manufacturing facilities available, keeping in mind always that outside manufacturers who make a specialty of a particular item might, in many cases, be able to build it more economically than could an individual set manufacturer. Particularly in the case of the small set manufacturer, the more parts he purchases on the outside, the more space and time can he devote to the making of complete sets. However, among large set companies with adequate manufacturing facilities available, the tendency, as indicated by our survey, is build as many parts as possible in the plant.

The companies from whom data were obtained for the figures in this article are:

All-American Mohawk Corporation
American Bosch Magneto Corporation
Atwater-Kent Mfg. Company
Crosley Mfg. Company
Day-Fan Electric Company
Federal Radio Corporation
Chas. H. Freshman Company
Grigsby-Grunow Company
Kellogg Switchboard & Supply Company
National Carbon Company
Philadelphia Storage Battery Company
Sterling Mfg. Company
Stromberg-Carlson Telephone Mfg. Company
Temple Corporation

MAJESTIC SERVICE FOR DEALERS

GRIGSBY-GRUNOW is now publishing, for dealer distribution, an illustrated rotogravure paper called "The Voice of the Air." It is supplied fortnightly. In addition to many news pictures of general interest, the new publication includes a complete timetable of network programs, pictures of radio stars, and a radio log of all leading stations, divided into four geographical areas. The first issue, it was announced, had an edition of 1,170,000 copies.

CALCULATING DETECTOR OUTPUT

By J. M. STINCHFIELD

Engineering Dept., E. T. Cunningham Inc.

WHEN REDUCED to its simplest form the detector action of a vacuum tube should be as readily understood as the generally accepted relations for the amplifying properties of a tube. When considering amplification, the tube may be replaced by a generator whose voltage is μe_g, whose internal resistance is r_p, and whose external load impedance is Z_p. The useful part of this voltage, that impressed across the load, is the voltage μe_g multiplied by the ratio between the load impedance to the total impedance in the plate circuit.

In an amplifier tube, plate and grid voltages are chosen which will insure operation over a nearly straight portion of the characteristic. For detection voltages are chosen which place operation on a curved portion of the characteristic. For example, if the bias on an amplifying tube is increased until operation takes place about a point near plate current cut-off, then, in addition to the voltage μe_g appearing in the plate circuit, there will be a rectified voltage, E, due to the curved characteristic. This voltage, E, may be expressed as,

$$E = \left(\tfrac{1}{4}\frac{r_p'}{r_p}\right)\left(\mu E_o\right)^2 \text{ volts D. C.} \qquad (1)$$

Where, E_o (peak) is applied to the grid, for instance a carrier wave, and r_p' is the derivative of r_p with respect to E_p.

Taking small intervals along the characteristic E_p — I_p curve and dividing the E_p intervals by the I_p intervals, we obtain r_p. Plotting r_p against E_p and taking intervals of r_p and E_p, the quotient is r_p'.

Knowing these characteristics of the tube, the rectified voltage is readily calculated. The voltage E is the total internally generated, rectified voltage and is analogous to the voltage μe_g in an amplifier. The portion of this voltage appearing across the load Z_p is,

$$e_{pd} = E\left(\frac{Z_p}{r_p + Z_p}\right) = \left(\tfrac{1}{4}\frac{r_p'}{r_p}\right)\mu^2 E_o^2 \left(\frac{Z_p}{r_p + Z_p}\right) \qquad (2)$$

This is the d.c. voltage appearing across Z_p (where Z_p is the impedance to d.c., i.e., resistance) when a carrier wave of E_o peak volts is applied to the grid. If the carrier

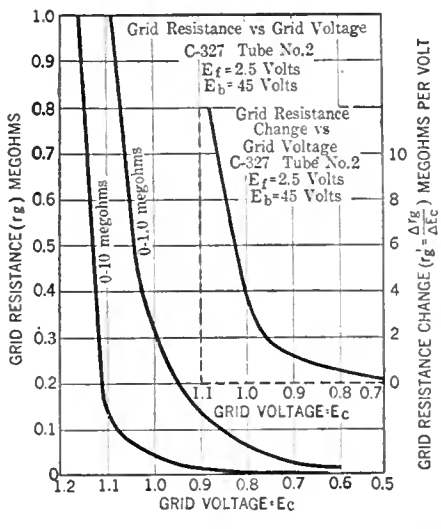


Fig. 2

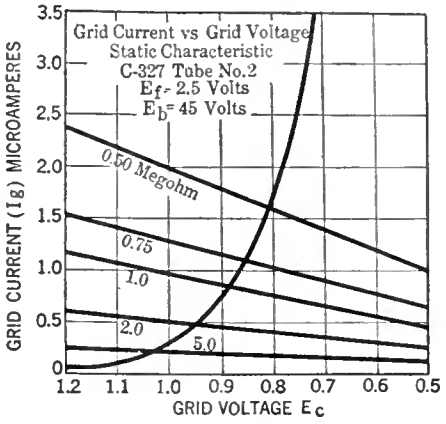


Fig. 1

wave is then modulated M × 100 per cent., the d.c. voltage will be increased by the factor $\left(1 + \frac{M^2}{2}\right)$. A voltage of modulation frequency resulting from the variation in amplitude of the rectified voltage will also appear. Its amplitude will be 2M times the internally generated voltage of rectification due to the carrier alone. See equation (1). The internally generated audio voltage analogous to μe_g is then:

$$\left[\left(\tfrac{1}{4}\frac{r_p'}{r_p}\right)\mu^2\, E_o^2\, 2\, M\right] \qquad (3)$$

The useful audio output voltage depends upon the impedance of the load Z_p to audio frequencies. The basic relation for plate current detection, when it is entirely due to the curvature of the characteristic and the amplitude of the signal is small, is:

$$e_d = \left[\left(\tfrac{1}{4}\frac{r_p'}{r_p}\right)\mu^2 \left(\frac{Z_p}{r_p + Z_p}\right) 2\, ME_o^2\right] \text{ peak volts} \qquad (4)$$

A brief explanation of the expression for the internally generated voltage, should clear away any vagueness of the physical interpretation.

The term $\left(\tfrac{1}{4}\frac{r_p'}{r_p}\right)$ E^2 is the typical expression for the internally generated voltage of rectification due to the curvature of an E-I static characteristic. The same expression is valid whether it is for a plate current-voltage characteristic, or for the grid current-voltage characteristic, or for the current-voltage characteristic of say a crystal when a small voltage, E sin ωt, is applied to its terminals. The r is the slope of the E-I characteristic. The r′ is the slope of the E-r characteristic.

The term μE_o represents the amplitude of the carrier in the plate circuit. If a radio-frequency by-pass condenser is connected between the plate-filament terminals the entire amplitude, μE_o, will be effective on the internal resistance of the tube. The factor 2M is equal to the ratio of the amplitudes of the audio or modulation frequency to the rectified d.c. of the unmodulated carrier.

In many tubes a considerable decrease in mu occurs as the plate current approaches cut-off. With plate current rectification, the point of operation is usually in this region. The mu variation increases the rectified output. Adding a term $\left(\tfrac{1}{2}\frac{\mu'}{\mu}\right)$ to the term $\left(\tfrac{1}{4}\frac{r_p'}{r_p}\right)$ will rather closely account for the detection resulting from the variation of mu. Here μ' is the slope of the μ-E_p curve at the point of operation.

The basic principles of grid-leak detection are similar to those outlined above. The grid is connected through a high-resistance grid leak to some point having a small positive voltage with respect to the negative filament terminal. The small positive voltage brings the grid circuit to a point of operation on the lower bend of the grid current curve. If a small sine wave of radio-frequency voltage is applied through a grid condenser to the grid-filament terminals, a rectified voltage due to the curvature of the Eg-Ig curve will appear in the grid circuit. The portion amplified by the tube appears as:

$$\left[\mu\left(\tfrac{1}{4}\frac{r_g'}{r_g}\right) E_o^2 \left(\frac{Rg}{Rg + r_g}\right)\right] \text{ volts d.c. in the plate circuit} \qquad (5)$$

When the radio-frequency carrier is modulated M × 100 per cent., the amplitude of the internally generated audio voltage is 2M times the internally generated d.c. voltage. The portion developed across the plate load, Z_p, depends upon the ratio between Z_p and $Z_p + r_p$. The detected audio voltage across the load, Z_p, due to the curvature of the grid-current characteristic is

$$e_d = \left[\left(\tfrac{1}{4}\frac{r_g'}{r_g}\right)\mu\left(\frac{Rg}{r_g + Rg}\right)\left(\frac{Z_p}{r_p + Z_p}\right) 2\, ME_o^2\right] \text{ peak volts} \qquad (6)$$

TABLE I

A. F. Modulation (M) = 0.20 at 60 cycles
Z_p = 50,000-ohm power factor unity
E_c = —4.5 volts
E_p = 45 volts

Carrier Volts r.m.s.	*A.F. Volts r.m.s.* $(ed \div \sqrt{2})$	*D.C. Plate Current Change* $\triangle I_p$ *Microamp.*	*Measured* $\triangle I_p$ *Microamp.*	*Equivalent a.f. from Meas.* $\triangle I_p$
0.100	0.0027	0.8		
0.200	0.0107	3.3	3.3	0.0107
0.354	0.034	10.4	10.5	0.034
0.707	0.134	41.7	42.00	0.136
1.000	0.269	83.4		
1.500	0.605	187.		

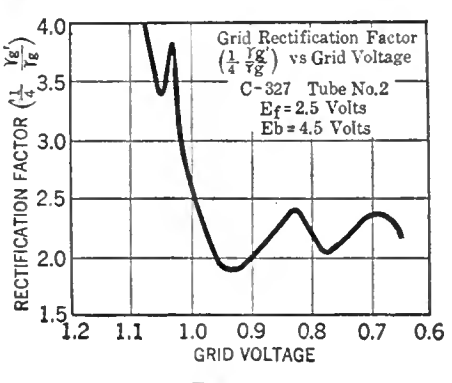


Fig. 3

To illustrate the use of these relations the detector characteristics of a Cunningham type c-327 tube will be calculated. A grid current-grid voltage curve of a typical c-327 tube is shown in Fig. 1. Reading the grid current at intervals of 0.025 volt along this curve, and dividing the current change into the voltage change per interval gives a good approximation to the value of the grid resistance (r_g) at the mid-point of the interval. This data is plotted in Fig. 2. Two scales from zero to one and from zero to ten megohms have been used to extend the accurately readable range. A similar procedure is applied to the r_g curve. Increments of grid resistance are divided by increments of grid voltage and these data are plotted as the r_g' curve shown in the insert graph of Fig. 2. At any given operating point the factor for the internally generated $\left(\frac{1}{4}\frac{r_g'}{r_g}\right)$ voltage of rectification can be evaluated readily from these curves. For convenience this factor is plotted against grid-bias voltage in Fig. 3.

The operating point can be determined by drawing a line with slope equal to the grid-leak resistance and interseeting the

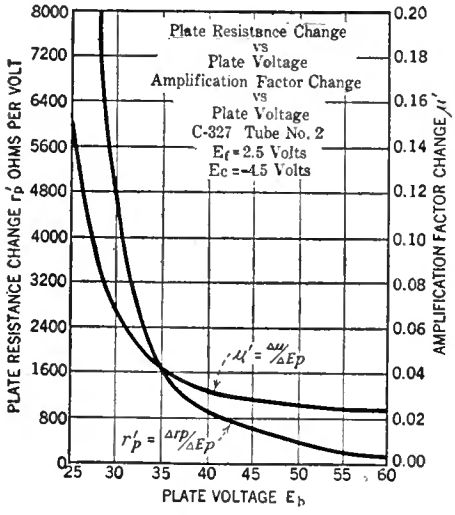


Fig. 5

E_c axis at a voltage equal to the biasing potential. On filament-type tubes the positive filament or A terminal gives a bias of plus 5 or 6 volts. The internal contact potential of the c-327-type tube causes sufficient grid current flow with the connection returned to the cathode. The intersection of the grid-leak line and the grid current curve determines the operating point. In Fig. 1 these points have been located for grid leaks from 0.5 to 5.0 megohms. Referring to the corresponding points in Fig. 2 the grid resistance is found to range from 67,000 to 450,000 ohms. This accounts for the broad tuning in the stage feeding a grid-leak detector. In a later section, it will be shown that the smaller size grid leak is advantageous in reducing the loss of the high audio frequencies in the grid condenser and in maintaining good detection with large signals.

Assuming a grid-leak of one megohm, a load resistance of 50,000 ohms, and 20 per cent. modulation, the detected audio voltage can be calculated from equation (6). The results are shown below.

The last column shows data obtained by actual measurement with a 675-kc. carrier modulated 20 per cent. with 60 cycles. The measured data is about 15 per cent. low due to a loss of radio-frequency voltage in the leads from the signal generator and in the grid condenser. Usually the measured and the calculated data are in close

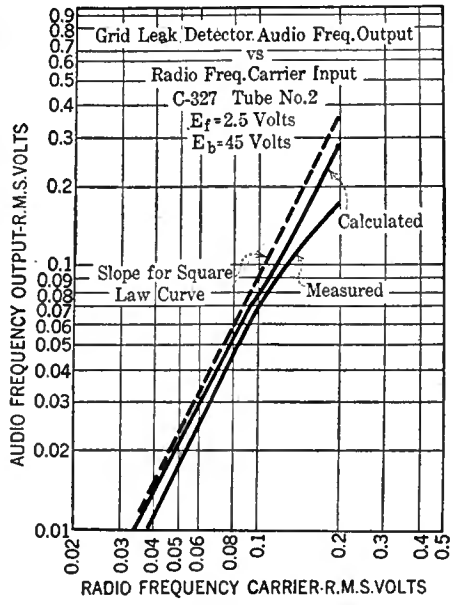


Fig. 4

agreement for small signal voltages. An increasing error is evident with larger signals.

A.F. Modulation = 0.20 at 60 cycles
R_g = 1.0-megohm grid leak
R_p = 50,000-ohm plate load
E_p = + 45 volts

Carrier Volts r.m.s.	*E_c Volts d.c.*	*r_g Ohms r.m.s.*	*A.F. Volts r.m.s. (ed÷√2)*	*Measured a.f. Volts r.m.s.*
0.020	—0.88	127000	0.0034	—
0.040	—0.88	127000	0.0134	0.0115
0.060	—0.89	138000	0.0290	0.0255
0.080	—0.89	138000	0.0516	0.0445
0.100	—0.90	150000	0.077	0.067
0.140	—0.93	188000	0.138	0.113
0.170	—0.94	202000	0.202	0.150
0.200	—0.95	218000	0.285	0.175

The data above is plotted on logarithmic coördinate paper in Fig. 4. The dotted line has a slope of 2, representing a true square-law detector. The measured data follows the square law until an amplitude of nearly 0.100 volt is reached when the measured output increases at a lower rate than the square law.

Since equation (6) is the first term of an infinite series resulting from an expansion of a function in the region of a point by Taylor's Theorem, it is only a first order approximation and accurate only for amplitudes over which the slope-derivatives remain constant. If the current characteristic is parabolic over the range of operation the second derivative is a constant and rectification would be proportional to

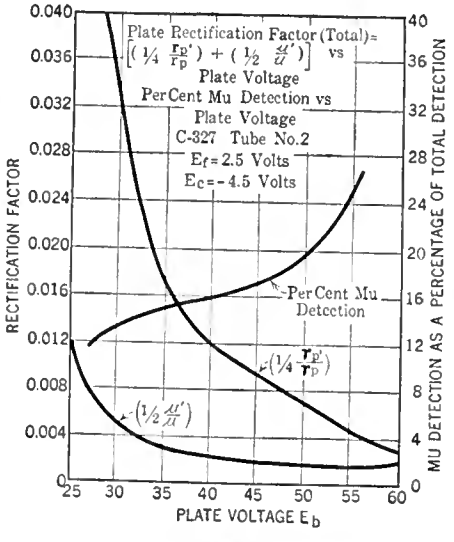


Fig. 7

the square of the signal voltage. In addition to the amplitude limitation on the characteristic of Fig. 3 the d.c. component of the rectification causes an increase in the bias voltage developed across the grid leak. Also a small decrease in mu and increase in plate resistance occur. The plate detection which is approximately in phase opposition to the grid detection may become large enough to cause a small reduction of the detected voltage. All of these factors contribute to the reduction of the detected audio output voltage when the signal is large.

Plate Circuit Detection

Inserting a bias of —4.5 volts between grid leak and cathode would bring the grid circuit to a point of operation well beyond grid current cut-off. Signal amplitudes having a modulated peak from 3.0 to 3.5 volts could be applied without causing any flow of grid current. Assuming 45 volts of plate potential, the plate circuit operating point will be well down on the curved part of the characteristic. Taking increments of current and voltage the plate resistance (r_p) curve

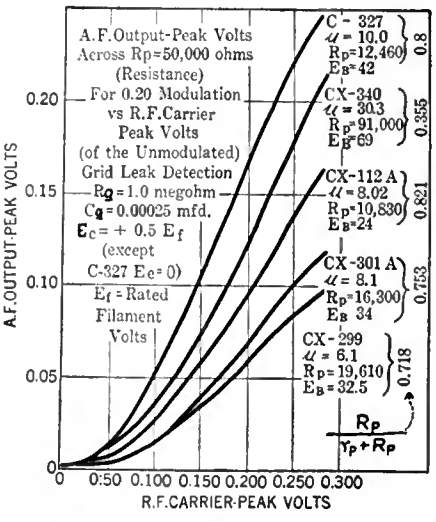


Fig. 6

may be obtained. The mu curve may be read on a Miller bridge. This curve can be obtained very accurately by taking the slopes of plate voltage-grid voltage curves plotted for constant plate current as the parameter. In the usual range of operation these curves are straight lines for many tube types. When this relation holds the mu is a function of plate current only. This relation does not hold with the type c-327 tube though the method is useful for indicating the mu variations.

The curves of Fig. 5 for r_p and μ were obtained by taking increments on the curves. The factors for the plate circuit rectification due to the plate resistance variation and to the mu variation are plotted in Fig. 5.

Assuming a load resistance of 50,000 ohms, an effective plate voltage of 45 volts, —1.5 volts grid bias, and 20 per cent. modulation, the detected audio voltage is calculated from equation (4). The results for several signal amplitudes are shown in Table I. The term $\left(\frac{1}{2}\frac{\mu'}{\mu}\right)$ is added to the term $\left(\frac{1}{4}\frac{r_p'}{r_p}\right)$ of equation (4). The contribution due to mu variation is about 16.7 per cent. of the total detection. The detector output for a signal of 0.2 volts r.m.s. is only 6.1 per cent. the output at this voltage when grid detection

(*Continued on page 242*)

IN THE RADIO MARKETPLACE

(*Continued from page 219*)

Specialty Co., of Dallas, Texas, C. E. Hamlin Sales Co., of Jackson, Mich., National Auto Supply Company, of Independence, Iowa, Michigan Automotive Supply Co., of Detroit, Mich., Radio Supply Co., of Tulsa, Oklahoma, The Royal Furniture Co., of Baltimore, Md., Southern Ohio Radio Corp., of Cincinnati, Ohio, and the Union Tire & Supply Co., of Burlington, Iowa.

It is also announced that the distributorship for Rhode Island has been given to the Plymouth Electric Company, New Haven, Conn., of which R. J. Mailhouse is the head. The company will open offices in Providence.

CAMPBELL & PENFIELD have completed arrangements with the Federal Radio Corporation of Buffalo, whereby they have become distributors in the Detroit area for Federal Orthosonic receiving sets. Showrooms and warehouse have been opened in Convention Hall at 3181 Woodward Ave. where the new Federal "M" and "L" models are now on display.

THE STATE RADIO DISTRIBUTING COMPANY, with headquarters in Newark, N. J., will act as wholesaler for Federal Orthosonic radio in the northern New Jersey territory, operating as far south as Trenton, N. J.

THE FEDERAL RADIO CORPORATION'S distributor for the New York area is the Superior Cabinet Corporation, 206 Broadway, New York City. B. J. Greenbaum is general manager.

A. D. STRATHY, sales manager of Cable Supply, announces the appointment of the following distributors for Speed tubes: The Gardner Radio and Electric Corporation, 2728 Locust Street, St. Louis, Mo., is handling southern Illinois and the state of Missouri exclusive of Kansas City; F. C. Somers, 115 E. 66th Street, Kansas City, Mo., is handling Oklahoma, Kansas, Iowa, and Nebraska; C. M. McIntosh Company, McClintock Building, Denver, Colorado, is handling Colorado, New Mexico, Wyoming, Utah, and Eastern Montana; H. V. Scott & Company 506 S. Canal Street, Chicago, Ill., is handling northern Illinois including the Chicago territory and Wisconsin; J. E. Date, 818 Nicollet Avenue, Minneapolis, Minn., is handling Minnesota and North and South Dakota; S. C. Steinharter, 2353 Greenfield Street, Grand Rapids, Michigan, is handling Michigan and Ohio; Martwell Sales Company, Inc., 1501 Broadway, New York, N. Y., is handling the metropolitan area of New York with a special concession covering furniture, musical, and departmental stores in certain other territories.

SUPREME: A new model of their set tester has been announced by the Supreme Instrument Corp. It will be known as the Model 400-B. This model does not differ fundamentally from the former model, No. 400-A, but there have been incorporated in the new tester certain refinements which will prove advantageous to the serviceman. The model 400-A will be continued so the 400-B constitutes an addition to the line. The new 400-B is designed particularly to take care of all the new receiving sets, many of which will use higher voltages and screen-grid tubes. The 400-B can be used for making all types of tests on all receivers including those using screen-grid tubes. With this instrument it is possible to measure the full output of filament-type rectifier tubes. It is also equipped with a modulated oscillator, a tube rejuvenator for rejuvenating up to 12 tubes, and tube-testing features which make possible measuring the static characteristics of tubes as well as testing when they are oscillating. With the instrument it is possible to adjust to exact resonance the various tuned circuits of a receiver. For this test the modulated oscillator is used to supply a signal to the input of the receiver, and the output of the receiver is measured in either one of two ways; one method utilizes the low scale of the a.c. voltmeter which is connected across the output of the set, the other method can be found only in the 400-B which utilizes a thermocouple in conjunction with a d.c. voltmeter to indicate the a.c. output current of a special output transformer, the primary of which is connected across the loud speaker terminals. In adjusting the set, therefore, it is simply necessary to tune-in the signal from the modulated oscillator and then adjust the various condensers until maximum output deflection is obtained. Three meters used in the 400-B are as follows:

D.C. Voltmeter, 4 scales 0–750, 250,100, 10.

A.C. Voltmeter, 4 scales 0–750, 150, 16, 3.

D.C. Milliammeter, 3 scales 0–125, 25, milliamperes and 0–2.5 amperes.



The Supreme set tester, model 400-B.

CLAROSTAT: A line ballast Clarostat has just been announced. It is designed for use in the primary circuits of power transformers and maintains the input voltage of the set constant within about 5 per cent.

RADIO PRODUCTS: This company is manufacturing a number of instruments designed for use by dealers and servicemen in making measurements on tubes and receivers. The Flewelling tube-checker, model B, will test all of the following tubes 120, 199, 201A, 112A, 171A, 226, 280, 281, 250, 210,240, 245, 222, 224, Kellogg, and Cardon. The net price of this instrument to dealers is $22.75. The Flewelling Counter-Checker, model C, makes it easy to test all types of radio equipment at the time of sale. Among other things it will test batteries, B-power units, transformers, resistors, and tubes. Price: $26.25. The Flewelling Radio Set Analyzer and Tube Checker is a combination instrument which makes possible the complete testing of receiving sets and tubes. Price: $85.25.

RADIO-VICTOR: Reductions in the list prices of seven types of Radiotrons were announced June 12th by the Radio-Victor Corporation of America. The UY-227 was reduced from $3.00 to $2.50, the UX-226 from $2.00 to $1.75, the UX-222 from $6.50 to $4.50, the UX-280 from $3.50 to $3.00, the UX-112A from $2.50 to $1.25, the UX-201A from $1.40 to $1.25, and the UX-171A from $2.50 to $1.25. Large-scale production and improved tube manufacturing machinery were given by an official of the corporation as the reason why it has been possible to reduce prices.

DETROIT RADIO DEALERS ASSOCIATION: A special radio exposition to be held in the Olympia at Detroit, September 9th to 15th inclusive, is being sponsored by this association. It is the purpose of the Association to direct public interest to the radio industry in advance of the usual peak season. The executive management of the exposition will be in the hands of Corley W. Kirby, managing secretary, and Richard Dunn, general manager of the Olympic.

MEISSNER LICENSEES

B. F. MEISSNER, well-known inventor, has licensed the following companies under his patents:

All-American Mohawk
Bremer-Tully (including sets made for Brunswick)
Crosley Radio Corporation
Consolidated Radio Corporation
(Wells Gardner and Arborphone Divisions)
Electrical Research Laboratories, Inc.
A. H. Grebe & Co., Inc.
Howard Radio Co.
King Manufacturing Corporation
Kolster Radio Corporation
Splitdorf Radio Corporation (including its manufacture for Thomas A. Edison, Inc.)
Stromberg-Carlson Telephone Manufacturing Co.
U. S. Electric Corporation
Walbert Manufacturing Company

The royalty schedules show the cost to the average maker will run in the neighborhood of twenty to twenty-five cents. Mr. Meissner's patents and technical services are largely in relation to design of filters, and in the reduction of a.c. hum. Other patents pending and issued include No. 191,195 with broad claims covering the low-voltage, low-temperature, high-heat-inertia type of filament tube. It is said these claims cover the 226- and 245-type tubes. Patent No. 50,535 is said to cover the use of a tube having a cathode so designed as to generate small hum when energized with alternating current, preceding a tube having a cathode designed to generate large hum, and this, in order that the small hum can be used to neutralize the large hum of the preceding tube. This patent is said to cover any set using the indirectly heated type of cathode or 226 type of filament in the detector and first audio stage in advance of the 171, 245, 210 or 250 in the output stage.

A JOBBER LOOKS AT HIS DEALERS

(*Continued from page 194*)

his dealers, employs a younger assistant. The assistant is an expert serviceman, and incidentally a sales representative. When the salesman makes his weekly visit to a dealer, he asks him for the names and addresses of the dealer's new customers, whose sets have been installed recently. The junior salesman calls on them, settles any misunderstandings or questions they may have about the operation of the set, checks over the installation, and sees to it that they are thoroughly satisfied with their purchase. The practical result of the system is best described in Mr. Craddick's own words.

"Here's a concrete instance. A salesman and his junior called on a dealer in a New Jersey city and received the names of ten people who had just bought sets from the dealer. The junior made the ten calls, and brought back to the dealer the names of ten new prospects, given him by the customers. Out of those ten prospects, the dealer sold five within the next few days; the junior salesman made his calls on those five, and from them got the names of two new prospects, both of whom the dealer sold within a week of the junior salesman's first appearance at his store.

"There were seven sets sold as a result of the original ten sales and the junior salesman service. Now take the dollars and cents of it. The salesman has to pay the junior's salary. Suppose that he paid him, in that instance, sixty dollars a week flat salary. Seven sets were sold, which we'll put at an average price to the dealer of $200. That's $1400; the salesman works on a 5% commission, which brings him $70, or an added income to him of $10 for that week due directly to the hiring of the junior salesman. And that, of course, was just from one of the several dealers on his weekly visit list.

Furthermore, THE dealer is delighted. He's made staunch friends of 17 customers, who will give him, and the particular set, priceless word-of-mouth advertising in the community. And also, the junior salesman can make the more troublesome of the dealer's ordinary service calls. Many dealers now greet the junior salesman with a list of service calls from their customers, all of which are made by the junior at the regular fee.

"It's a novel scheme, I think. At first my salesmen didn't take to the idea of paying an assistant's salary. In every case, however, a trial has shown them that it means more business and so more money for them, and they're all strong for it now."

In addition, Mr. Craddick concluded, the dealers have seen the value of expert service work, of the "call-back visit after installation, and have been helped in building up their community clientele. Which is just what the junior salesman scheme was designed to do.

PROFESSIONALLY SPEAKING

(*Continued from page 203*)

reduced, not increased, that the public should be encouraged to listen for high frequencies and to appreciate the improvement in fidelity brought about by the use of better audio systems. We believe that those who talk of increasing the number of stations by reducing the channel width should spend their energy on reducing "man-made static" and thereby permit the full use of high-"quality" amplifiers. We laud the set manufacturer who continues to put the best possible audio system into his set, even though the listener in general is not yet educated to look for real fidelity. Receivers of fidelity of a high order may seem to be more noisy on "DX" but even now, some makers are including filters which can be switched on to cut down high-frequency response when the set is asked to "reach out."

CALCULATING DETECTOR OUTPUT

(*Continued from page 240*)

is employed. The data of Table I show the signal must be increased to 0.8 volt r.m.s. to obtain the same output as obtained with grid detection and a 0.20 volt r.m.s. signal. The ratio of signal input for the same output is then four to one.

Columns 3 and 4 of Table I show a comparison of the computed and measured d.c. component of the rectification. The agreement is close up to very large signal amplitudes.

An actual comparison of overall results obtained with grid leak and with plate detection shows less difference in sensitivity than is indicated here. The selectivity and the amplification in the stage feeding the detector are increased considerably by changing to plate detection. Plate detection is particularly advantageous when the signal input is large. Grid-leak detection is not used for inputs greater than a few tenths of a volt. Plate detection may be employed for any signal amplitude by the simple expedient of increasing both grid and plate voltage. It is possible to use inputs of several volts delivering sufficient output to operate the power tube without any intermediate audio stage.

Some data showing the a.f. output of several tubes used as detectors are given in Fig. 6. They show the superiority of the c-327 as a grid-leak detector.

To summarize the preceding, the object has been to illustrate the calculation of detector characteristics from the well-known static characteristics of a tube. It is hoped that the curves and relations given have illustrated the problem adequately so that detector theory will be applied more often to numerical solutions in approximating the performance of that stage. Many factors influencing the quantity and quality of the detector output have not been mentioned here. The discussion of these factors will be reserved for a later article.

SUMMARY OF RECEIVERS EXHIBITED AT THE CHICAGO TRADE SHOW

(*Continued from page 209*)

COMPANY	MODEL	PRICE	TABLE OR CONSOLE	SCREEN GRID TUBES	TUBES USED
United Reproducers Corp.	21 Peerless	$ 195.00	Console	Yes	3-224, 3-227, 2-245, 1-280
	22 Peerless	$ 245.00	Console	Yes	3-224, 3-227, 2-245, 1-280
	23 Peerless	$ 245.00	Console	Yes	3-224, 3-227, 2-245, 1-280, 1-201A
	24 Peerless	$ 375.00	Console	Yes	3-224, 3-227, 2-245, 1-280
	25 Peerless	$ 600.00	Phono-radio	Yes	3-224, 3-227, 2-245, 1-280, 1-201A
	65 Courier	$ 85.00	Table	Yes	3-224, 2-227, 2-245, 1-280
	651 Courier	$ 140.00	Console	Yes	3-224, 2-227, 2-245, 1-280
	652 Courier	$ 165.00	Console	Yes	3-224, 2-227, 2-245, 1-280
	653 Courier	$ 165.00	Console	Yes	3-224, 2-227, 2-245, 1-280, 1-199
U. S. Radio & Television Co.	36	$ 39.95	Table	No	1-226, 1-227, 1-171, 1-280
	50	$ 69.95	Console	No	1-226, 1-227, 1-171, 1-280
	55	$ 74.95	Console	No	1-226, 1-227, 1-171, 1-280
	60	$ 79.95	Console	No	1-226, 1-227, 1-171, 1-280
	70	$ 119.95	Console	No	2-171, 5-226, 1-227, 1-280
	39	$ 69.95	Table	No	2-171, 5-226, 1-227, 1-280
	54	$ 67.95	Console	No	5-201A, 1-171A
	22	$ 37.95	Table	No	5-201A, 1-171A
Zenith Radio Corp.	11	$ 100.00	Table	No	1-171, 5-227, 1-280
	12	$ 175.00	Console	Yes	1-224, 4-227, 1-210, 2-281
	39 A	$ 510.00	Console	No	6-227, 1-226, 1-210, 2-281
	10 A	$ 850.00	Phono-radio	No	6-227, 1-226, 1-210, 2-281
	English	$ 800.00	Console	No	2-227, 6-226, 2-210, 2-281
	Spanish	$2500.00	Console	No	2-227, 6-226, 2-210, 2-281
	Special 37 A	$ 625.00	Console Phono-radio	No No	5-227, 1-226, 1-250, 2-281

NOTES

Dynamic type loud speakers are used in all the console models with the exception of certain models made by the Acme Electric and Mfg. Company, Buckingham Radio Corporation, Federal Radio Co., Freed Eiseman Radio Corp., Chas. Freshman Co., and the United Reproducers Corp.

D.C. light socket operated and battery operated models are being made by Atwater Kent Mfg. Co., Day-Fan Electric Co., Freed Eiseman Radio Corp., Kolster Radio Corp., Sparks-Withington Co., Stewart Warner Corp., Radio-Victor Corp. of America, and the Crosley Radio Corp.

Radio-phonograph combinations are made by Radio-Victor Corp. of America, Zenith Radio Corp., United Reproducers Corp., Temple Corp., Steinite Radio Co., Sparks Withington Co., The Pierson Co., Kellogg Switchboard Supply Co., Grigsby-Grunow Co., A. H. Grebe & Co., Electrical Research Labs., Thos. A. Edison, Inc., Continental Radio Corp., Columbia Phonograph Co., Bush & Lane Piano Co., F. A. D. Andrea, Inc., Amrad Corp., and The A. C. Dayton Co.

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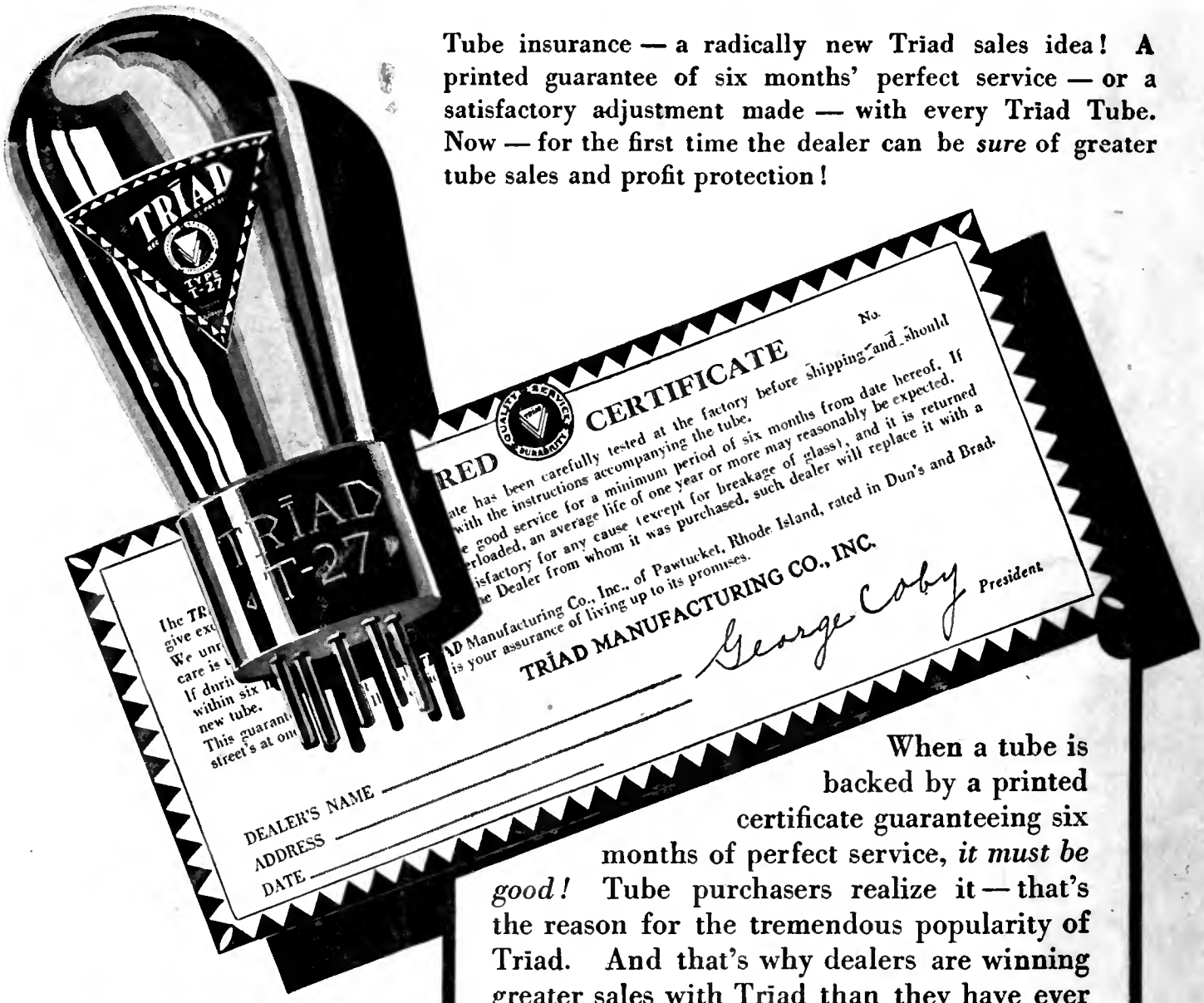
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