JANUARY · 1930

RADIO

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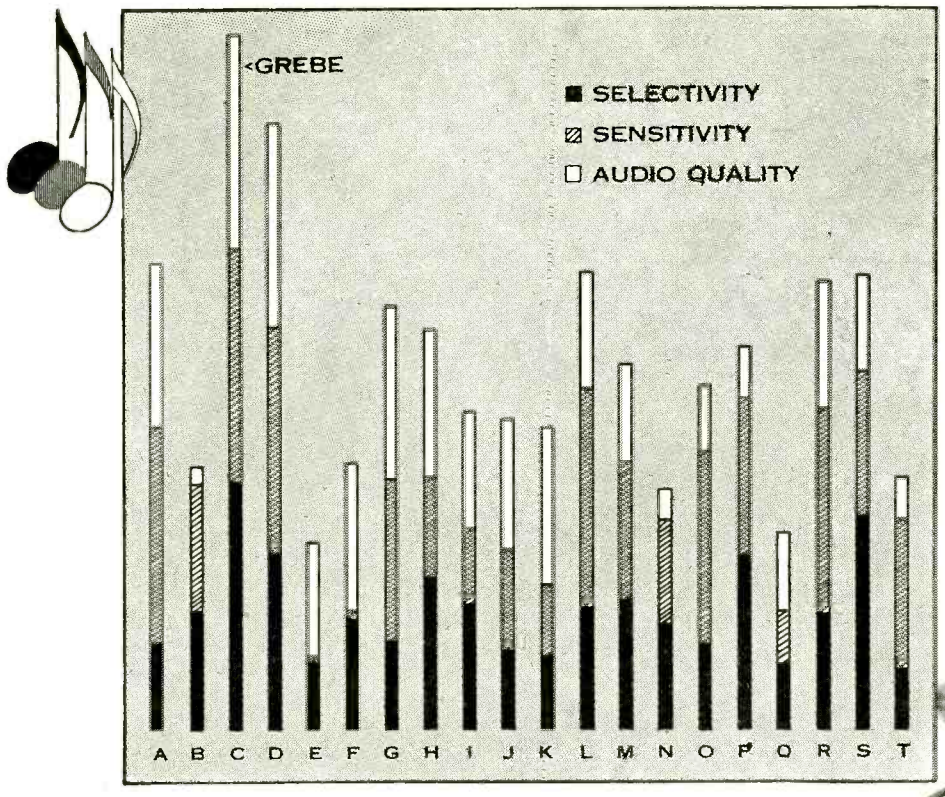


Cynic turns fan

TABLE the superlatives when he comes in; don't bear down with sales talk; this hardened cynic wants *evidence*. And on this chart he finds the facts that show him exactly what to expect of the Grebe—clear-cut comparisons that shatter his shell. Now let him listen to the set that is *newer* than screen grid and watch him turn fan.

He is critical but his demands are not unreasonable when put to the Grebe. This set satisfies them with plenty to spare for it is at least a *year ahead of the field.* Show him how sharply the Grebe separates one station from another. Thrill him by reaching out for weak, distant broadcasts. Close the sale with the lifelike tone that enables him to identify every instrument, every voice.

Then, after he has signed on the dotted line, be sure you deliver on time. You know how it is with this type of buyer; once you have sold him, you cannot get the set to his home quickly enough!

There is extra profit in the Grebe franchise. In addition to getting normal business, it sells those who would not otherwise be ready for another year.

Grebe radio

SUPER-SYNCHROPHASE

A. H. GREBE & COMPANY, Inc., Richmond Hill, New York
Western Branch, 443 So. San Pedro Street, Los Angeles, California

Alfred H. Grebe—"In the new folder being distributed to the public by our dealers we prove the uniformly high quality of this new set in every important characteristic of radio reception. We support the statement that Grebe prices will not be reduced with the pledge that Grebe *quality* will not be reduced. To franchise-holders this means that *profits* will not be reduced—that every sale will continue to yield a worth-while return."

Kylectron

in

1930

WITH one full season in the field, it is still that one new thing which fascinates the public. Kylectron has held the entire radio industry in a firm grasp of amazement and will surpass itself during the coming year!

New applications of Kylectron permit it even greater self expression, and Kylectron is an exclusive feature of—

The United Reproducers Corporation

SPRINGFIELD, OHIO

R. T. I. ANSWERS THE CALL

R. T. I. training is so closely linked with the development of Radio—past, present and future—that it deserves your consideration for what it can do for you or someone you know who wants to step up in the field. It is time-tested (being founded upon a course of training started early in 1922) and hundreds of successful Radio Servicemen, dealers, salesmen, etc., give the training full credit for their success.

Today, R. T. I. training constantly revised and amplified, is as near perfect as time, money, brains and experience can make it.

LET F. H. SCHNELL AND R. T. I. ADVISORY BOARD HELP YOU

Mr. Schnell, Chief of the R. T. I. Staff, is one of the ablest and best known radio men in America. He has twenty years of Radio experience. First to establish two-way amateur communication with Europe.

Former traffic manager of American Radio Relay League. Lieutenant Commander of the U. S. N. R. Inventor and designer of Radio apparatus. Consultant Engineer to large Radio manufacturers.

Assisting him is the R. T. I. Advisory Board composed of men prominent in the Radio industry.

SUPERVISED BY WELL KNOWN RADIO MEN

R. T. I. Training is practical and up-to-date. It is prepared by experts. Both lessons and training methods are continually supervised by a board of men who are actively engaged in Radio as executives with prominent concerns — manufacturing, jobbing, retailing, servicing, broadcasting, engineering, etc.

Complete Training for "SERVICE MEN"

The problem of training men for Radio servicing is solved by R. T. I. Everything that comes up in a service man's daily work is covered from the minute he rings the customer's door bell until he leaves her (or him) with a satisfied smile. It's the training that dealers want their men to have. It is practical, thorough and complete. An R. T. I. service man also receives a pocket size loose-leaf Radio Service Manual covering the sets of 25 prominent manufacturers—pictures—wiring diagrams—installation —"trouble-shooting"—repair, etc. It goes along with the course and is very valuable.

ALL BRANCHES COVERED

Television and Talking Pictures, Too

R. T. I. training is so complete there is hardly a subject that is not well covered. It includes the latest in Television, Talking Pictures, Public Address Systems, etc. The R. T. I. booklet gives complete informaiton.

LIFETIME CONSULTATION

Free of Extra Cost to Everyone Who Enrolls

In addition to the regular training Work Sheets which are constantly revised, every R. T. I. student is kept up-to-the-minute with bulletins of latest information right out of the world's laboratories, work shops, factories, etc. Consultation Service is also supplied on all problems of engineering, installation, etc. Answers promptly given by letter, wire or air mail by the R. T. I. engineering staff out of their own experience, their library or by outside personal investigation.

The Booklet tells how R. T. I. gives practical home training.

R. T. I. BOOKLET SENT FREE

Inquiries Invited

DEALERS
Jobbers
Manufacturers

We shall be glad to send you our booklet and answer any inquiries about the value of R. T. I. training for your men.

RADIO & TELEVISION INSTITUTE
Dept. 112, 4806 St. Anthony Ct., Chicago

THE R. T. I. ADVISORY BOARD of men actively engaged in the Radio Industry, supervises the preparation, revision and rendering of training service.

RADIO & TELEVISION INSTITUTE
Dept. 112, 4806 St. Anthony Court, Chicago.

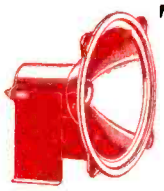
Send me Free and prepaid your booklet and full details of your three-in-one Home Training (without obligating me in any way).

Name.....

Address.....

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

Jensen Electro-Dynamic Speakers are now supplied to discriminating Europeans by the three leading manufacturers of Europe



THE superiority of Jensen Electro-Dynamic Speakers is not restricted to American recognition. In England and in Europe—among all these people with their appreciation of the finest and best in music and the allied arts—Jensen has won the same indisputable leadership held in this country.

Three of the leading manufacturers whose name and product rank at the very forefront of the radio art in Europe are today supplying discriminating buyers with speakers made in their own plants under agreements permitting the use of Jensen principles and design.

And as in this country, their selection of Jensen was only made after exhaustive laboratory tests and comparisons of every type of dynamic speaker of both American and European manufacture.

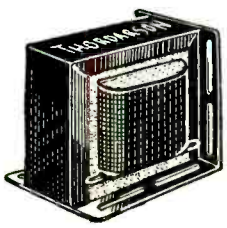
Jensen's world-wide recognition is an asset no manufacturer, dealer or jobber can overlook. Today, tone quality is the keystone in the successful sale of any radio receiver. Shrewd distributors and dealers will continue to prefer sets Jensen equipped—definite assurance of the best the industry has to offer.

Upon request we will be pleased to give you the names of both American and European manufacturers using Jensen Electro-Dynamic Speakers in their current models.

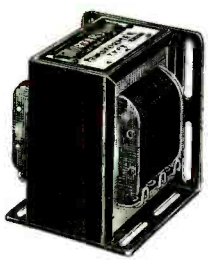
Jensen
ELECTRO-DYNAMIC SPEAKERS
LICENSED UNDER LEKTOPHONE PATENTS

JENSEN RADIO MANUFACTURING CO. · 6601 S. Laramie Ave., Chicago, Ill. · 212 Ninth St., Oakland, Cal.

NEW AUDIOS *for* OLD SETS



R-100
Straight Audio



R-101
Input Push-Pull

A profitable business for service stations is the installation of tone quality by replacing inferior units with THORDARSON REPLACEMENT TRANSFORMERS.

The chief difference between this year's sets and last year's, between high priced sets and cheap ones, is the difference in audio amplification. This is the difference which the set OWNER HEARS.

R-100 Straight Audio, $2.25
R-101 Input Push-Pull, 3.50

AT ALL JOBBERS

THORDARSON

THORDARSON ELECTRIC MFG. CO.
Huron, Kingsbury and Larrabee Streets ✕ CHICAGO, ILLINOIS

Wright De Coster Inc.

NOW there is a NEW

Wright-De Coster Reproducer

—for the Home—

YOU can bring to your radio the same fine tone quality and true reproduction as the finest theatrical sound equipment. The tremendously successful Wright-De Coster theatrical reproducer has been reduced in size and volume until it is ideal for homes or smaller halls.

"The Speaker of the Year"

AS a result of a flood of requests we have brought out a reproducer for home use that has all the attractive features of our theatrical reproducer. It is truly outstanding in purity of tone, volume and fidelity of reproduction.

Model 117 Jr. Table Style

Cabinets of Rare Beauty

CHARMING creations in walnut that will harmonize with the finest furniture. May be used as a table model or equipped with handsome legs of spinet design that impart the beautiful appearance of a console. This is the ideal speaker and cabinet combination.

Model 117 Jr. Consolette

Manufacturers
Jobbers
Dealers

Interesting information will be sent upon request

Write for Details

You will receive complete information about the Wright-De Coster speaker and cabinets together with location of nearest distributor.

WRIGHT-DE COSTER, INC.

2217 UNIVERSITY AVENUE ST. PAUL, MINNESOTA

What the Public Wants—

With the New 1930 Browning-Drake Screen-Grid Radio You Can Guarantee These Six Buying Factors 100 Per Cent

Buying Factors:

(As shown by the recent survey of Radio Retailing.)

1. **Tone**
2. **Price**
3. **Selectivity**
4. **Appearance**
5. **Reputation**
6. **Screen-Grid**

(See how Browning-Drake fits in this survey.)

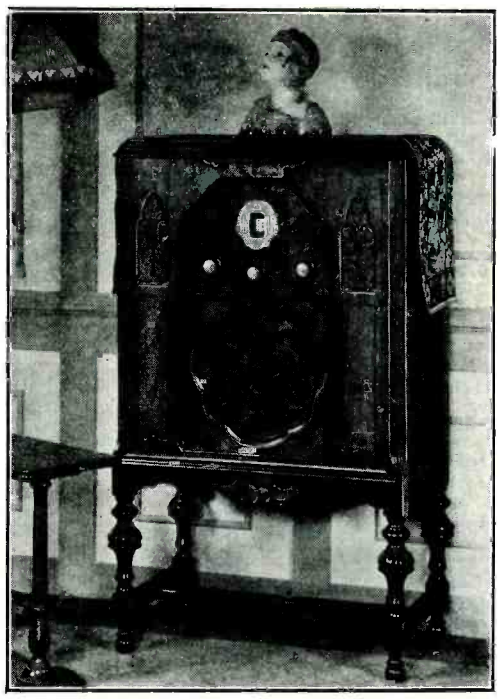
We also make the first modern battery set—console and table models.

IN THIS set you can offer a screen-grid radio whose tone quality, selectivity and appearance are unsurpassed by sets selling at nearly double the price. Behind it is the Browning-Drake reputation for quality—a sound construction which reduces servicing to a minimum.

Your sales resistance will be *nil*; your full profit assured.

Read These Twelve Major Selling Points

1. Semi-automatic tuning — both kilocycles and call letters on dial.
2. Five tuned circuits — nine tubes.
3. Tuned antenna.
4. Push-pull audio (245 power tubes).
5. Power detection (plate rectification) optional.
6. Band-pass filter effect 10 KC selectivity.



7. Mershon trouble-proof condenser.
8. Voltage regulation adjustment (manual).
9. Power unit integral part of chassis.
10. Special electro-dynamic speaker.
11. Selected walnut and American gum wood cabinet.
12. Hand-rubbed satin Duco finish.

You owe it to yourself to get the whole story and our unusually attractive franchise. Write for it now.

MODEL 56

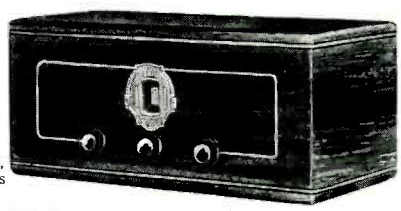
Screen-Grid, Small Console, 42x25x15, less tubes..$154.50

MODEL 66

Heater Type, Small Console, 42x25x15, less tubes..$149.50

Prices the same throughout the country

BROWNING-DRAKE CORP.
224 Calvary Street, Waltham, Mass.



MODEL 53

Table Model, A-C, Screen-grid, less tubes $102.50

Price slightly higher West of Rockies

Browning-Drake RADIO

Over 1,500,000 People Listen in on Browning-Drake Sets

Speed . . . . Accuracy

"Supreme" Features

The Supreme oscillation test gives the only dependable test on tubes; tubes tested under actual operating conditions.

The Diagnometer tests all tubes, *including screen-grid.*

Tests both plates of 80 type rectifier tubes; provides bias emission tests on tubes.

All tubes tested independent of radio. Locates unbalanced secondaries.

Reads both positive or negative cathode bias.

Provides D. C. continuity test without batteries.

Furnishes modulated signal for testing synchronizing, neutralizing, etc.

Aligning of condensers by Thermo-couple meter or A. C. meter.

Neutralizing with tubes used in the set.

Tests gain of audio amplifiers.

3 precision meters; one 4 scale D. C. Voltmeter 0/750/250/100/10 volts, resistance 1000 ohms per volt. One 4 scale A. C. Voltmeter 0/750/150/16/4 volts. One 3 scale Mil-ammeter 0/125/25 mills. 0/2—1/2 amps.

External connection to all apparatus. Universal analyzer plug.

Thermo-couple meter for varied uses.

Measures resistances in three ranges, 150 to 30,000 ohms (calibration curve furnished) 10—200 ohms .1 to 25 ohms.

Makes all analysis readings.

Screen-grid socket analysis without producing oscillation.

Measures capacity of condensers .1 mfd. to 9 mfd.

Tests charger output by meter.

Bridges open stages of audio for tests.

Contains 500,000 ohm variable resistor, 30 ohms rheostat and .001 mfd., .002 mfd. and 1 mfd. condensers for testing.

Detects shorted variable condensers without disconnecting r.f. coil.

Provides low resistance measurement for rosin joints.

Provides simultaneous plate current and plate voltage readings and the customary readings of A. C. and D. C. filament voltage, grid voltage, cathode bias, screen-grid voltage, line voltage, etc.

The Supreme laboratory test panel is equipped with a variable condenser for varying the frequency of the oscillator.

Provides many other tests, readings and functions.

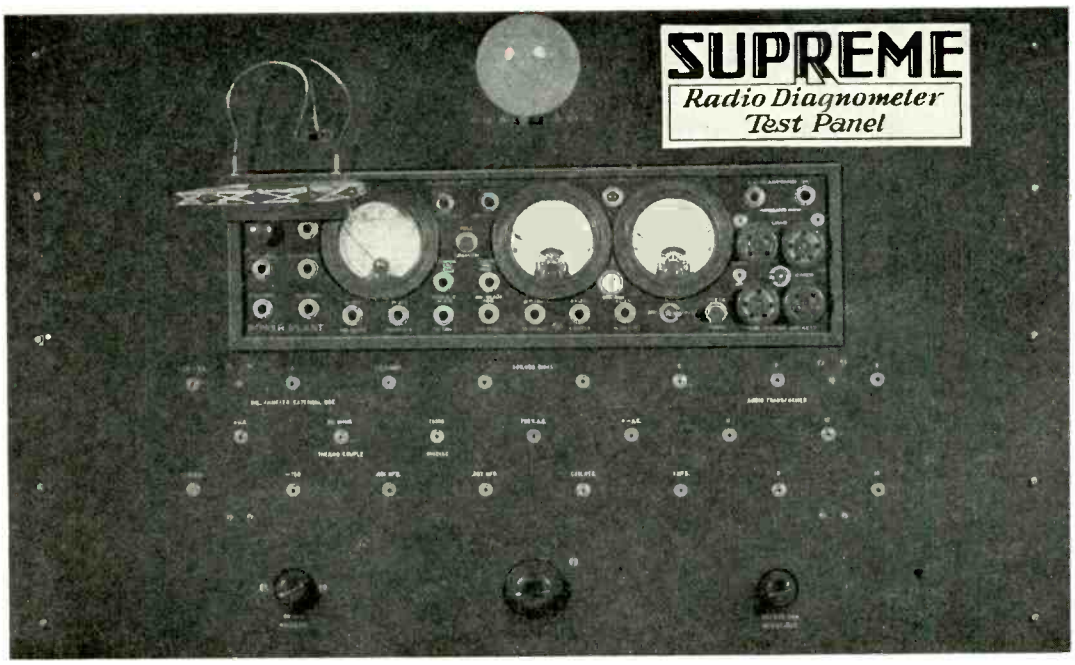
"AMAZING!" That's the way radio technical men speak of the SUPREME DIAGNOMETER. Its numerous remarkable qualities have brought the complete facilities of the laboratory to the home of the set-owner—adding speed and accuracy to the skill of the service-man. No other device approaches it in flexibility, completeness and range. Set testers check only 29%-40% efficient in comparison with its capacity.

By equipping your Service Department with the SUPREME DIAGNOMETER you assure 100% service satisfaction which closes the sale and wins enthusiastic customer good will.

Comes in handy carrying case providing compartments for all tools and spare tubes, or at the option of the purchaser, in an even smaller case, for the service-man who does not wish to carry tools and tubes in same unit.

. . . . Skill . . . . .

. . . . . in trouble-shooting



and now the most practical laboratory test panel produced

In keeping with SUPREME standards, unquestionably the most advanced test panel ever produced. Of heavy re-inforced Bakelite, it adds to the trim workmanlike appearance of laboratory or shop and assures sturdy service. Makes the DIAGNOMETER a dual purpose instrument—shop or portable service—instantly disconnectable.

Most good distributors stock the Supreme. If yours cannot supply you, address, for full information, without obligation,

Supreme Instruments Corporation

357 Supreme Bldg. Greenwood, Miss.

RMA RADIO MANUFACTURERS ASSOCIATION MEMBER

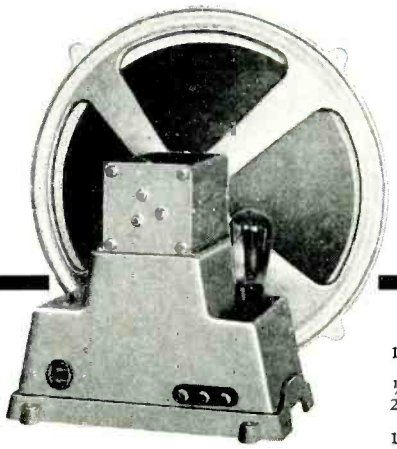
MEMBER SUPREME SERVICE LEAGUE A GUARANTEE OF EFFICIENT SERVICE

Symbol of a higher type of radio service. Cash in on the prestige of the Supreme Service League and the benefits to its members. Write for information.

SUPREME

Radio Diagnometer

Makes every conceivable test on any Radio Set-



16 INCH VICTORY GIANT

Specifications

16" cone (inside)—(19" outside).
½" top plate.
2" movable coil—½" wide.
1—280 rectifying tube for field excitation.
Net weight complete with input and rectifying transformers, 38 lbs.
Neutralizing coils and filters are not used on Victory Speakers.
LIST PRICE, $95.00 (Less Rectifier Tube).

Victory manufactures a complete line of electro-dynamic speakers, ranging in price from $22.50 to $25.00 for DC models and from $35.00 to $95.00 for AC models. Special theatre models with 90-volt field for use with generators.

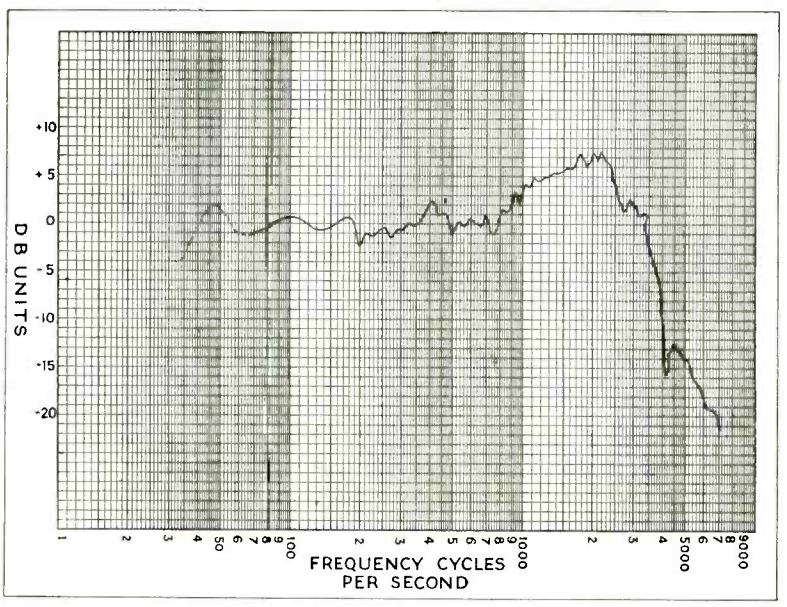
Each Demonstration Means a Sale!

THE largest—the most rigidly constructed and the most efficient electro-dynamic speaker yet developed. The VICTORY GIANT cone has *twice* the area of any other. The cone angle *spreads* the sound waves. Exclusive method of energizing the field. More sensitive and more powerful drive. The ideal theatre speaker—yet equally suitable for the home. Hear it—and you, too, will be convinced.

FACTORY AGENTS and Jobbers Wanted

Territory is now being alloted to factory representatives and to jobbers. Production is under way. Write immediately for territory. Victory Speakers, Inc., 7131 East 14th St., Oakland, Calif.

CURVE SHOWING PERFORMANCE OF VICTORY GIANT SPEAKER
Showing that this speaker is as nearly perfect as can be made

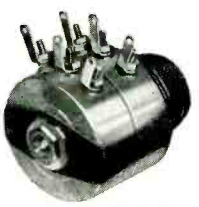


VICTORY—SPEAKERS, INC.

7131 East Fourteenth Street
OAKLAND, CALIFORNIA

FROST-RADIO

FOR UNITS THAT ARE PARTICULARLY ADAPTED TO A. C. AND SCREEN GRID CIRCUITS SELECT FROST RADIO YOU SHOULD SEND FOR THE LATEST EDITION OF OUR CATALOG BEFORE YOU SELECT ANY PARTS FOR YOUR NEW RECEIVER



No. 280-280. Combination metal shell wire wound and composition elements. Wire wound up to 15,000 ohms. Composition, 5,000 to 1 megohm. Rheostat or potentiometer type in either unit. Units insulated from each other. Diameter, 1 11/16 in. Depth of shell, 1 3/8 in.

As the world's largest manufacturers of high grade variable resistors, we are singularly well equipped to supply your requirements, no matter what they may be.

Write us in detail regarding your variable resistor problems, and have us advise you as to the best type for your needs.

Would you like a copy of the latest edition of our catalog? If so, just fill out and mail the coupon below, and our catalog will be sent free and postpaid.

No. 890. Double depth metal shell unit in rheostat or potentiometer type. Rotors in same electrical connection. Composition elements, 5,000 ohms to 1 megohm in each unit. Diameter, 1 7/8 in. Depth of shell, 1 3/16 in.

HERBERT H. FROST, *Inc.*
Main Offices and Factory
ELKHART, IND.

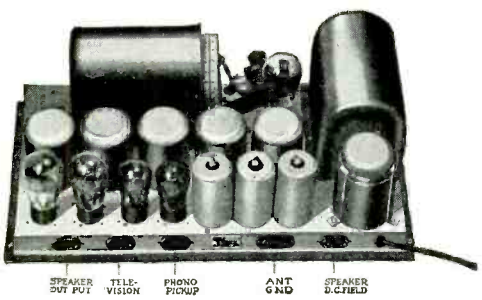
HERBERT H. FROST, Inc. R-1
160 North La Salle St.
Chicago, Ill.

Send me the latest edition of your catalog of Frost Radio Units and Combinations suitable for A. C. and Screen Grid use.

*Name*_____
*Address*_____
*City*_____ *State*_____

Dealers
Welcome the Acme Plan as a Sure Profit Builder

New 1930 Models Now Available



Acme 88 SG—Screen-Grid Chassis

FEATURES

Eight Tubes—
3—224 2—227
2—245 1—280

Four Stages Tuned

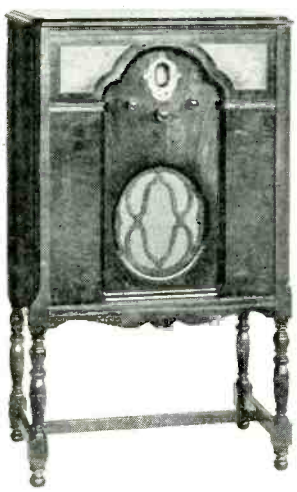
A-C Screen-Grid

Push-Pull Power Tubes

Complete Shielding

Wired for Phonograph Pick-up and Television

Apartment Antenna Built-in



We have arranged with manufacturers for a wide choice of consoles at very attractive prices from which you can make your selections if you desire; this, however, is optional with you.

THE enthusiastic reception accorded the Acme Sales Plan testifies to the completeness with which it meets the Radio retailers' needs. This is natural, as it is made to assure the dealer a surer, better profit.

There are three major points to this Acme policy.

. . . . a screen-grid chassis incorporating real sales features, sold to the dealer at a rock-bottom price.

. . . complete freedom for the dealer in buying his consoles and speakers.

. . . selling price fixed by the dealer himself, to meet his needs of trade, overhead and profit.

This allows you to select a model or a number of models to fit your customer's requirements; to build trade and reputation for your own establishment; and to sell at a price which gives you a reasonable, certain profit.

The coupon will bring details, without obligation on your part. Send it today!

ACME RADIO & ELECTRIC, Inc.

1441 Hamilton Avenue Cleveland, Ohio

ACME RADIO & ELECTRIC, INC.
1441 Hamilton Avenue, Cleveland, Ohio

Send us details of the new Acme Screen-Grid chassis and of the Acme Sales plan; also prices.

Name_____

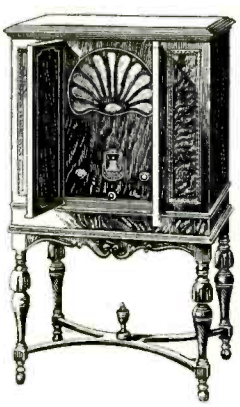
Address_____

THE CHOICE OF THE EXPERTS

FADA Radio

Introducing VIBRA-CONTROL

FADA leads again with the new Vibra-Control receivers—the most revolutionary achievement of radio engineers since the introduction of the all-electric sets. Vibra-Control . . . the complete control of all vibrations . . . the perfect co-ordination of chassis, speaker and cabinet to suppress all unwanted vibrations and permit reproduction of programs exactly as broadcast.



Vibra-Control
Fada 35 Series

For either one, two or three screen-grid tubes—new 245 tubes in push-pull amplification with full power dynamic speaker and console cabinet of walnut.

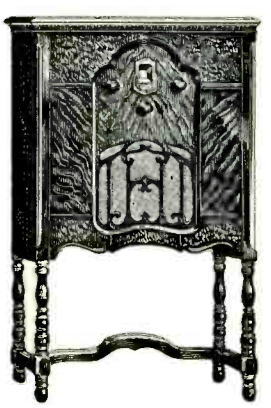
$220 $245 $255

Prices higher west of the Rockies and for export

VIBRA-CONTROL was proved and demonstrated at the Radio World's Fair with the aid of a stroboscope. This is a scientific instrument that permits seeing vibrations ordinarily invisible to the human eye. It played a prominent part (with many other precision devices) in the development of Vibra-Control in the Fada research laboratories.

What does Vibra-Control mean to you? What will it do for you? It makes your selling job easier and customers ready satisfied—permanently. The public has instantly recognized the difference between just ordinary radio and Fada screen-grid Vibra-Control reception. Marvellously faithful reproduction with the New Fadas. Get your share of this business now! If you are not already a Fada dealer, write or wire to

F. A. D. ANDREA, INC.
Long Island City, N. Y.



Vibra-Control
Fada 25

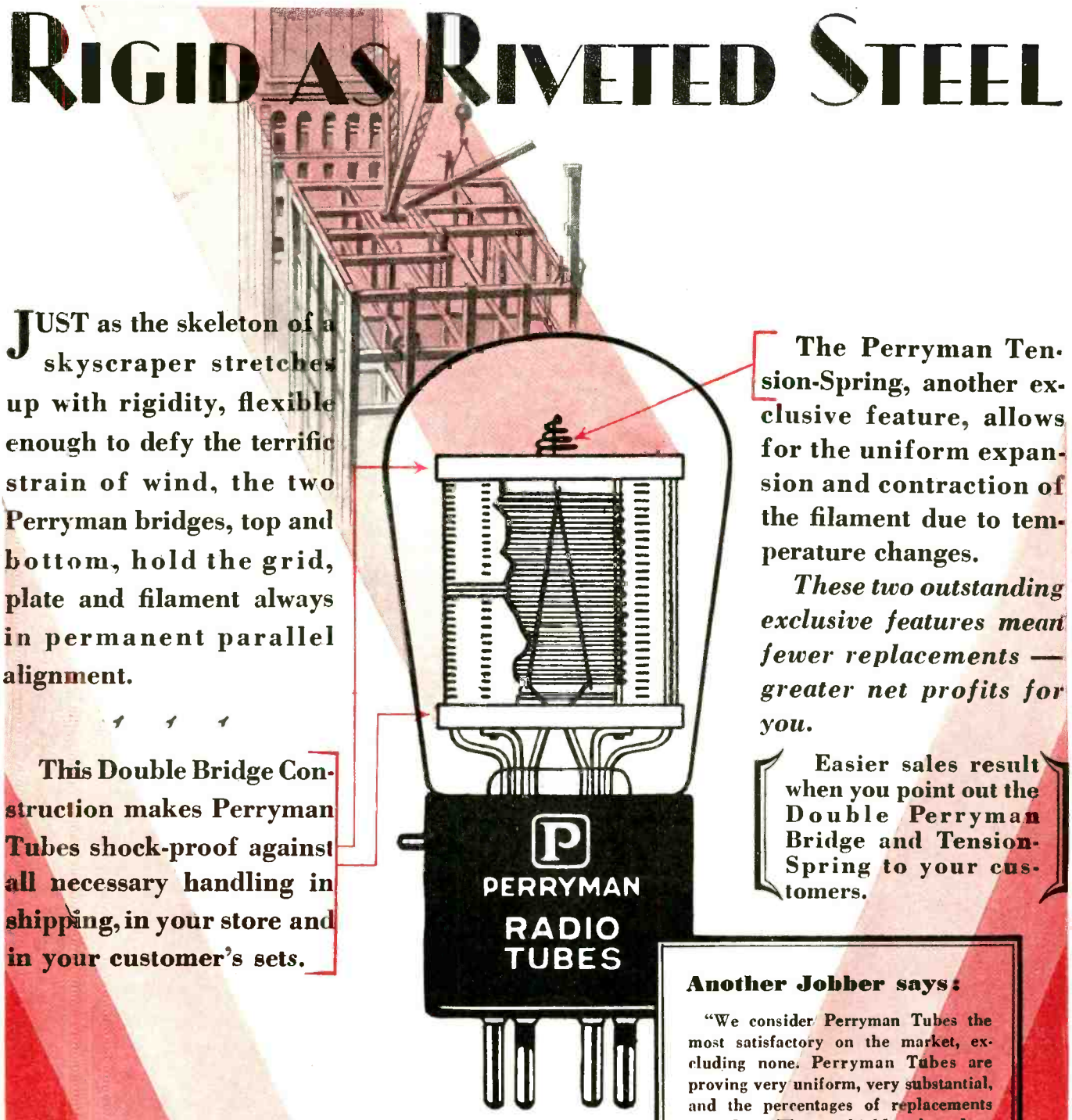
Screen-grid and heater tubes —245 power tubes in push-pull amplification — full power dynamic speaker and cabinet of walnut with full vision front panel.

$165

Prices higher west of the Rockies and for export

For Permanent FADA PROFIT!

RIGID AS RIVETED STEEL



JUST as the skeleton of a skyscraper stretches up with rigidity, flexible enough to defy the terrific strain of wind, the two Perryman bridges, top and bottom, hold the grid, plate and filament always in permanent parallel alignment.

This Double Bridge Construction makes Perryman Tubes shock-proof against all necessary handling in shipping, in your store and in your customer's sets.

The Perryman Tension-Spring, another exclusive feature, allows for the uniform expansion and contraction of the filament due to temperature changes.

These two outstanding exclusive features mean fewer replacements — greater net profits for you.

Easier sales result when you point out the Double Perryman Bridge and Tension-Spring to your customers.

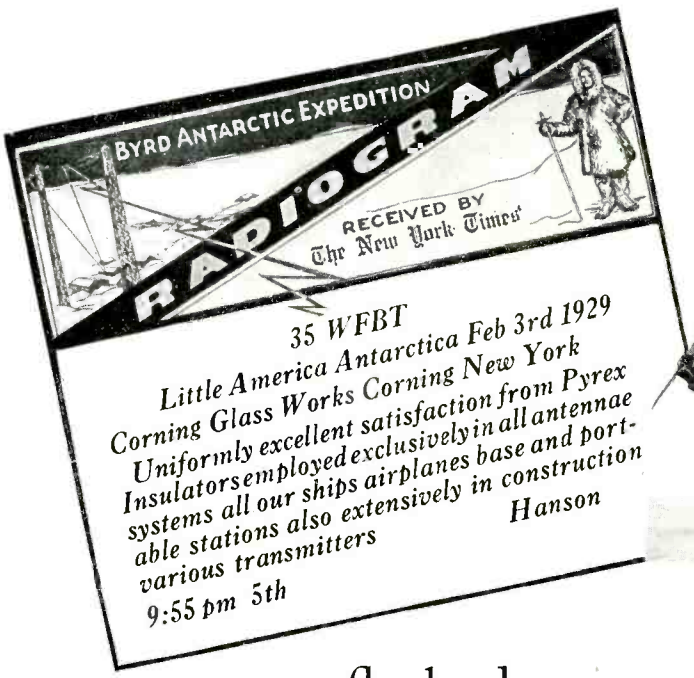
Another Jobber says:

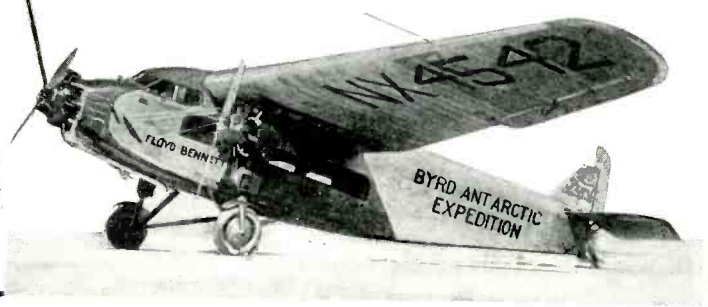
"We consider Perryman Tubes the most satisfactory on the market, excluding none. Perryman Tubes are proving very uniform, very substantial, and the percentages of replacements very low. We are highly pleased to represent the Perryman Company."

THE PERRYMAN ELECTRIC CO., Inc.
4901 Hudson Blvd. North Bergen, N. J.

PERRYMAN RADIO TUBES

All Byrd Radio Messages from the Antarctic and the First Radio Message from the South Pole

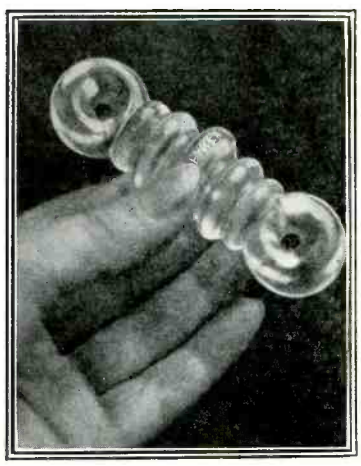




Airplane Floyd Bennett, which carried the Byrd party safely to and from the South Pole.

---flashed over antennae equipped with PYREX Insulators

"Radio made this expedition possible," **says Commander Byrd.**



Four PYREX Insulators like this are used on the antennae of the Floyd Bennett.

TRIUMPHANT at last, after months of preparation, Commander Byrd has flown over the South Pole. From his airplane, the Floyd Bennett, he flashed the news by radio while flying directly over the Pole.

On all his base ship, airplane, and portable stations, Commander Byrd uses PYREX radio insulators, exclusively. They have well earned his confidence. The Commander's radio message that he was flying over the North Pole, his distance record for low-wave-length signals, his reports from the transatlantic airplane, America — all were sent over PYREX insulator-equipped antennae.

Broadcasting stations, marine and stationary radio communication systems and critical amateurs all over the world find that PYREX insulation preserves maximum strength and clarity of radio impulses.

PYREX Radio Insulators are but one of the many Corning Glass Works' achievements that contribute to human safety, comfort and industrial progress.

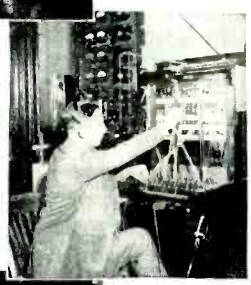
CORNING GLASS WORKS, Dept. 65
Industrial and Laboratory Division
CORNING, N. Y.

World's largest makers of technical glassware

T. M. REG. U. S. PAT. OFF.
PYREX
A MARK OF RNING GLASS WORKS
RADIO INSULATORS

LET RCA INSTITUTES START YOU ON THE ROAD TO . . . . SUCCESS IN RADIO

Radio Mechanic and Inspector $1800 to $4000 a Year.



Broadcast Station Mechanic $1800 to $3600 a Year.

Land Station Operator $1800 to $4000 a Year.

Broadcast Operators $1800 to $4800 a Year.

Radio needs you . . . That's why the entire Radio industry is calling for trained men . . . That's why thousands of men who answered these advertisements are now earning from $2,000 and up a year. Radio is thrilling work . . . easy hours, too, vacations with pay and a chance to see the world. Manufacturers and broadcasting stations are now eagerly seeking trained RCA men . . . Aviation and radio in the movies also provide innumerable opportunities . . . Millions of sets need servicing . . . thousands of ships require experienced operators . . . Never before was there an opportunity like this.

This is the Only Course Sponsored by Radio Corporation of America

RCA sets the standards for the entire Radio industry . . . The RCA Institutes' Home Laboratory Training Course enables you to quickly learn all the secrets of Radio . . . In your spare time, in only an hour or so a day, you can obtain a thorough, practical education in Radio . . . You get the inside information, too, because you study right at the source of all the latest, up-to-the-minute developments. RCA, the world's largest Radio organization, sponsors every single detail in this course.

You learn Radio by actual experience with the remarkable outlay of apparatus given to every student. You learn the "How" as well as the "Why" of every Radio problem, such as repairing, installing and servicing fine sets. That's why every graduate of RCA Institutes has the experience, the ability and the confidence to hold a big-money Radio job.

For the added convenience of students who prefer a Resident Study Course, RCA Institutes, Inc., has established Resident Schools in the following cities:

New York	326 Broadway
Boston, Mass.	899 Boylston St.
Philadelphia, Pa.	1211 Chestnut St.
Baltimore, Md.	1215 N. Charles St.
Newark, N. J.	560 Broad St.

Graduates of both the Home Laboratory Training Course and the Resident Schools receive exactly the same training and enjoy the same privileges so far as jobs and salaries are concerned. And every Home Study graduate may also attend any one of our resident schools for post-graduate instruction at no extra charge.

Graduates of RCA Institutes Find It Easier to Get Good Jobs

They are closest to the source of Radio's greatest achievements because the progress of Radio is measured by the accomplishments of the great engineers in the huge research laboratories of the Radio Corporation of America.

Students of RCA Institutes get first-hand knowledge, get it quickly and get it complete. Success in Radio depends upon training and that's the training you get with RCA Institutes. That's why every graduate who desired a position has been able to get one . . . That's why graduates are always in big demand.

Study Radio at the Oldest and Largest Commercial Training Organization in the World

Send for our Free Book . . . or step in at one of our resident schools and see how thousands of men are already on the road to success in Radio. Remember that you, too, can be successful . . . can speed up your earning capacity . . . can earn more money in Radio than you ever earned before. The man who trains today will hold down the big-money Radio job of the future. Come in and get our free book or send for it by mail. Everything you want to know about radio. Forty fascinating pages, packed with pictures and descriptions of the brilliant opportunities in this gigantic, world-wide money-making profession.

See for yourself why graduates of RCA Institutes now occupy thousands of well-paid positions. These positions are usually available in from 3 to 10 days after graduation for men who can qualify. RCA Institutes will back you up to the limit. Our catalogue is yours free . . . SEND FOR IT TODAY!

Clip this Coupon *NOW!*

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RCA INSTITUTES, INC.

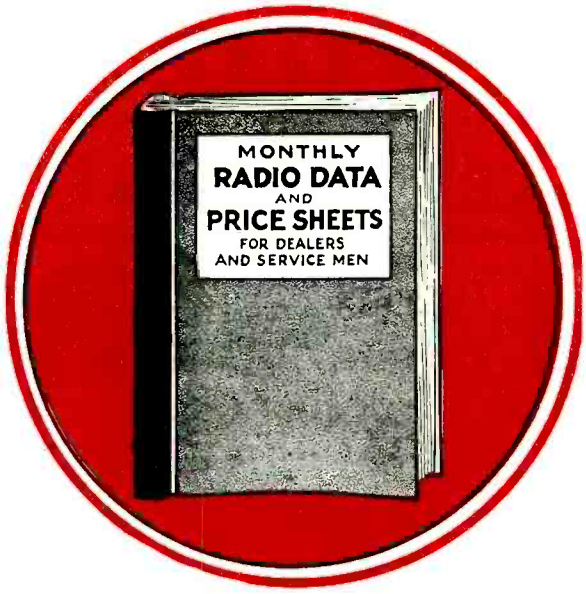
Formerly Radio Institute of America

RCA

RCA INSTITUTES, Inc.
Dept. R-1, 326 Broadway, New York, N. Y.
Gentlemen: Please send me your FREE 40-page book which illustrates the brilliant opportunities in Radio and describes your laboratory-method of instruction at home!

Name .....

Address .....



ON JANUARY 30 THE PRICE OF "RADIO" AND THE MONTHLY LOOSE LEAF SERVICE GOES UP TO $5.00 PER YEAR

SAVE $3 BY SUBSCRIBING NOW

PRESENT SUBSCRIBERS CAN EXTEND THEIR SUBSCRIPTION FOR ANOTHER YEAR FOR $2.00

RADIO merchants by the THOUSANDS are subscribing each month to "RADIO" and its monthly loose leaf price and data sheet service. Popular demand has forced us to DOUBLE the number of loose leaf pages. Consequently the price must be increased to $5.00 per year on January 30. If you subscribe now it only costs you $2.00 per year, saving you $3.00. Or subscribe for two years ($4.00) and save $6.00.

WE will be grateful to you for telling your radio business friends about this opportunity to save $3.00 by getting their orders to us before January 30. Show this advertisement to some dealer, jobber or service man. Show them your copy of "RADIO." Let's all pull together to double the circulation of "RADIO," thereby enabling us to give you a bigger and better magazine.

"RADIO,"
428 Pacific Building,
San Francisco, California

Here is $ _____ in FULL PAYMENT for a one-year subscription to "RADIO," the monthly loose leaf price and data sheet service and a loose leaf binder.

(Note: Subscription rate, one year, $2.00. Two years, $4.00. If two subscriptions are sent at same time, the rate is also $2.00 per year per subscriber.)

Name _____

Street and No. _____

City _____

State _____

"RADIO,"
428 Pacific Building,
San Francisco, California

Here is $ _____ in FULL PAYMENT for a one-year subscription to "RADIO," the monthly loose leaf price and data sheet service and a loose leaf binder.

(Note: Use this coupon only if two subscriptions are sent at one time. Use other coupon if only one subscription is being sent.)

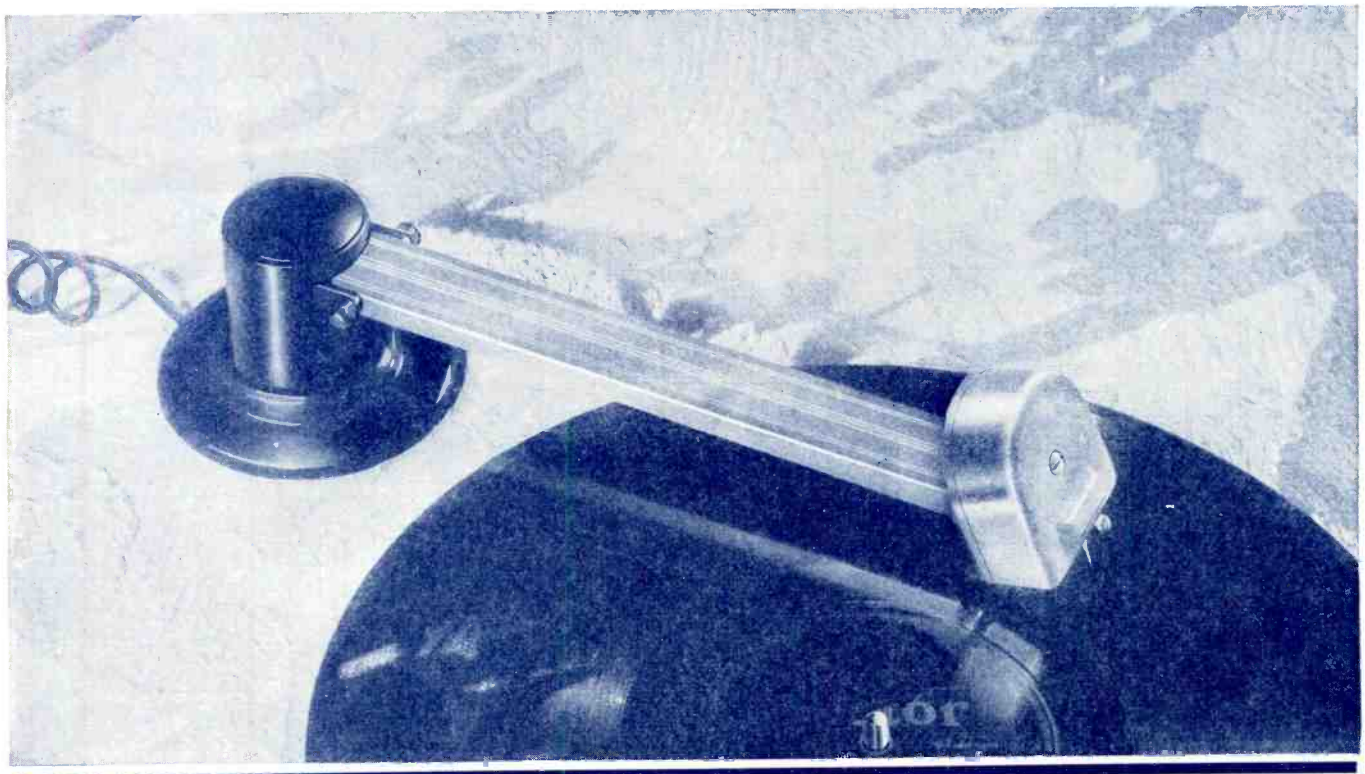
Name _____

Street and No. _____

City _____

State _____

NEW POWER AND BRILLIANCE in Record Reproduction



Presto *Electro-magnetic* Pick-up

Newer--Better--Faster Selling!

UNSURPASSED brilliance and power in record reproduction has been brought about by the new Presto Electro-magnetic Pick-ups. Attractive—structurally, mechanically and electrically correct—sensitive—a delight to hear—these instruments are creating new standards in the electrical reproduction of records.

Dealers and Jobbers everywhere *will* profit by handling this fast selling line. Get busy—read the exceptional features—stock now for the busy Winter Season ahead. Three Models—Premier, Projectionist and Auditorium. Also Presto Pick-Up Units—Universal and Tone Arm Models.

DEFINITE FEATURES OF SUPERIORITY . . .

1. Increased output—approaching the theoretical ideal volt generation.
2. Extreme sensitivity.
3. Vibratory flexibility, increasing volume and minimizing record wear.
4. Clarion-like definition established by use of highly specialized materials in magnetic-circuit.
5. Elimination of sharp resonance peaks by correct balance of oscillating member; freedom from excessive needle scratch without sacrifice of tone quality.
6. Distinctive circuit and construction free from exposed wires and dangling leads.
7. Magnetic permanence assured by use of highest grade cobalt magnet.
8. All-steel construction in ball-bearing arm base.
9. Arm vertical motion controlled by rugged pivotal bearing in closest practical plane to needle point, minimizing record wear and possibility of jumping grooves.
10. Straight-line cord construction permitting unimpeded arm movement in all directions and avoidance of insulation breakages.
11. Custom-built, highest-grade finish.

PRESTO MACHINE PRODUCTS CO., INC.

72 WASHINGTON STREET BROOKLYN, N. Y.

Eastern List Prices of Heater and Filament Tube Sets

NOTE: RECTIFIER TUBES ARE NOT COUNTED IN LISTINGS BELOW.

MAKE	No. of Tubes	LIST PRICE
A-C DAYTON		
Batt. 98	7	79.00
AC-98	8	108.00
AC-9960	8	148.50
AC-9970	8	165.00
AC-9980	8	185.00
AC-9990	8	188.00
AC-99100	8	234.00
***ACME**		
77	6	115.00
88	7	139.50
***ALL AMER "LYRIC"**		
94-T10	9	145.00
95-T10	9	175.00
96-T70	9	147.00
***APEX** (with tubes)		
100-NU	7	95.00
140-NU	7	140.00
160-NU	8	160.00
60 Table	7	60.00
45 Battery	6	45.00
***AUDIOLA**		
8430	7	95.00
BALKEIT		
"C"	8	175.00
BRANDES		
B-10	6	56.00
B-15	7	97.50
B-16	7	136.50
***BREMER TULLY**		
80	6	60.00
81	8	124.00
82	8	149.00
***BROWNING DRAKE**		
63 Table	9	98.00
666 Console	9	149.50
***BRUNSWICK**		
14	7	119.00
21	7	144.00
31 Phono. Comb.	7	239.00
BUSH & LANE		
20	7	125.00
21	7	169.50
30	7	169.50
32	7	179.50
40	7	179.50
50	7	197.50
60	7	199.50
70	7	207.50
90	7	217.50
10-C	7	250.00
11-C	7	290.00
12-C	7	297.50
COLUMBIA		
C-11	7	155.00
940 Comb.	7	297.50
CONTINENTAL "Star Raider"		
R-20	9	435.00
R-25	9	475.00
R-30	9	525.00
R-105	9	1,000.00
***CROSLEY**		
31	6	52.00
31, with Legs	6	57.50
41	7	70.00
41, with Legs	7	75.00
32	7	99.50
42	7	125.00
82-H	7	150.00
***DAYFAN**		
66	8	85.00
68	8	129.50
69	8	195.00
72	8	135.00
EDISON		
R-1	6	260.00
R-2	6	225.00
R-4	7	205.00
R-5	7	174.00
Comb. C-2	6	395.00
Comb. C-4	7	305.00
***EVEREADY**		
31 Tbl.	7	115.00
32	7	157.50
42	7	157.50
33	7	195.00
43	7	195.00
34	7	225.00
44	7	225.00
***FADA**		
Tbl.	7	99.50
FREED Induct. Dyn.		
55 Batt.	7	55.00
56 Tbl.	7	75.00
NR-55	7	99.50
NR-56 Tbl.	7	75.00
NR-78	7	119.50
NR-79	7	145.00
NR-95	8	162.50
FREED Electro. Dyn.		
NR-79	7	169.00
NR-95	7	225.00
NR-95	8	235.00
NR-79	7	174.00
NR-79	9	169.00
***GRAYBAR**		
300	8	98.00
MAJESTIC		
91	7	116.00
92	7	146.00
101 Comb.	7	245.00
181 Comb.	7	265.00
***MANDEL**		
Chassis	8	100.00
***PHILCO**		
LoBoy	7	129.50
HiBoy	7	149.50
DeLuxe HiBoy	7	205.00
***PREMIER**-Chas. only		
601	6	45.00
771-M	7	66.00
745-D	7	70.00
845-D	8	74.00
PT-771-M	7	74.00
***RCA**		
33-AC, with Legs	6	54.00
33-DC—110-V, with Legs	6	64.00
18	6	80.25
60	8	98.00
64	8	550.00
66	7	225.00
***SONORA**		
A-30	7	190.00
A-32	7	250.00
A-40	7	375.00
A-36	7	470.00
A-44	7	695.00
***STEWART WARNER**		
35—900	7	142.50
58—900	7	165.50
Ensemble	7	123.25
Table	7	95.00
47—900	7	154.50
SPARTON		
49 Batt.	9	76.00
931	8	179.50
301	8	284.50
110	10	395.00
111	10	395.00
Comb. 101	11	795.00
Tubes included in all Sparton models.		
***STEINITE**		
Comb. 102	8	250.00
***TEMPLE**		
8-60	8	149.00
8-80	8	169.00
8-90	8	269.00
VICTOR		
R-32	8	155.00
R-52	8	215.00
Comb.	8	275.00
RE-75 Comb.	8	350.00

*Denotes this manufacturer also builds screen-grid models.

Western List Prices of Heater and Filament Tube Sets

NOTE: RECTIFIER TUBES ARE NOT COUNTED IN LISTINGS BELOW.

MAKE	No. of Tubes	LIST PRICE
A-C DAYTON		
Batt. 98	7	Not car'd
AC-98	8	Not car'd
AC-9960	8	154.40
AC-9970	8	175.00
AC-9980	8	192.50
AC-9990	8	197.50
AC-99100	8	260.00
***ACME**		
77	6	115.00 Plus frt.
88	7	139.50 Plus frt.
ALL AMERICAN "LYRIC"		
94-T10	9	158.00
95-T10	9	190.50
96-T10	9	160.00
***APEX** (with tubes)		
100-NU	7	104.50
115-NU	7	124.50
140-NU	7	149.50
160-NU	8	169.50
60 Table	7	64.50
45 Batt.	6	49.50
***AUDIOLA**		
8430	7	95.00 Plus frt.
BALKEIT		
"C"	8	185.00
BRANDES		
B-10	6	56.00
B-15	7	97.50
B-16	7	136.00
***BREMER TULLY**		
80	6	60.00
81	8	124.00
82	8	149.00
***BROWNING DRAKE**		
63 Table	9	105.00
666 Console	9	149.50
***BRUNSWICK**		
14	7	119.00
21	7	144.00
31 Phono. Comb.	7	239.00
COLUMBIA		
C-11	7	155.00
940 Comb.	7	297.50
CONTINENTAL "Star Raider"	(Add	Freight)
R-20	9	435.00
R-25	9	475.00
R-30	9	525.00
R-105	9	1,000.00
***CROSLEY**		
31	6	57.00
31, with Legs	6	62.50
41	7	73.00
41, with Legs	7	78.50
32	7	105.00
42	7	130.00
82-H	7	155.00
***DAYFAN**		
66	8	95.00
68	8	139.50
69	8	205.00
72	8	145.00
EDISON		
R-1	6	260.00
R-2	6	225.00
R-4	7	205.00
R-5	7	174.00
Comb. C-2	6	395.00
Comb. C-4	7	305.00
***EVEREADY**		
31 Tbl.	7	115.00
32	7	167.50
42	7	167.50
33	7	205.00
43	7	205.00
34	7	235.00
44	7	235.00
***FADA**		
Table	7	104.50
FREED Induct. Dyn.		
NR-55	7	99.50
NR-78	7	119.50
*NR-79	7	145.00
*NR-95	8	162.50
*Latter two have electro. dyn. spkrs.		
***GRAYBAR**		
330	8	98.00
MAJESTIC		
91	7	116.00
92	7	146.00
101 Comb.	7	245.00
181 Comb.	7	265.00
***MANDEL**		
Chassis	8	100.00
***PHILCO**		
LoBoy	7	139.50
HiBoy	7	159.50
DeLuxe HiBoy	7	215.00
***PREMIER**	(Add	Freight)
Chassis only.		
601	6	45.00
771-M	7	66.00
745-D	7	70.00
845-D	8	74.00
PT-771-M	7	74.00
***RCA**		
33, with Legs	6	54.00
33-DC-110-V, with Legs	6	64.00
18	6	80.25
60	8	98.00
64	8	550.00
66	7	225.00
***SENTINEL** See Screen Grid Data Sheets. Other sets discontinued.		
***SONORA**		
A-30	7	190.00
A-32	7	250.00
A-40	7	375.00
A-36	7	470.00
A-44	7	695.00
SPARTON		
49 Batt.	9	Not st'kd
931	8	189.50
301	8	294.50
110	10	415.00
111	10	415.00
Comb. 101	11	845.00
Tubes included in all Sparton models.		
***STEWART WARNER**		
35-900	7	147.00
47-900	7	159.25
58-900	7	170.50
Ensemble	7	128.50
Table	7	97.50
***STEINITE**		
102 Comb.	8	268.00
***TEMPLE**		
8-60	8	159.00
8-80	8	179.00
Comb.	8	289.00
VICTOR		
R-32	8	155.00
R-52	8	215.00
Comb.	8	275.00
RE 75 Comb.	8	350.00

*Denotes this manufacturer also builds screen-grid models.

EASTERN LIST PRICES OF SCREEN-GRID SETS

NOTE: RECTIFIER TUBES ARE NOT COUNTED IN LISTINGS BELOW.

MAKE	No. of Tubes	LIST PRICE
*ACME		
78	6	130.50
88-SG	7	77.00
*ALL AMERICAN LYRIC		
94-SG	7	153.00
95-SG	7	183.00
96-SG	7	155.00
AMERICAN BOSCH		
17	6	230.00
18	6	240.00
19	6	280.00
"L"	6	230.00
"R"	6	280.00
Table 48	6	119.50
Table 48-A	6	168.50
"J"	6	240.00
AMRAD		
Aria	7	198.00
Serenata	7	245.00
Symphony	7	295.00
Duet (Comb.)	7	495.00
Minuet	7	158.00
*ANDREA FADA		
15-M Chass.	7	115.00
15-MZ Chass. (25-40 cycle)	7	115.00
25	6	165.00
35-C	7	220.00
35-B	7	255.00
75	7	360.00
77 Comb.	7	675.00
*APEX (with tubes)		
11	6	124.50
14	6	149.50
ATWATER KENT		
55-C, Chassis	6	64.00
55 Table	6	68.00
25 Cycle Chassis	6	64.00
25 Cycle Table	6	68.00
60 Chassis	7	76.00
60 Table	7	80.00
66 Chassis	7	110.00
Chass. DC, 61-C	7	76.00
Table DC, 61	7	80.00
Batt. Chassis 67	7	58.00
Batt. Table 67	7	62.00
AUTOMATIC TOM THUMB PORTABLES		
B	4	57.50
DeLuxe	4	65.00
DC	4	87.50
AC	4	95.00
BALDWIN		
Chassis	6	On req'st
Low Boy	6	198.00
High Boy	6	219.00
*BREMER-TULLY		
S-81	7	134.00
S-82	7	159.00
*BROWNING DRAKE		
56	9	154.50
53 Table	9	102.50
*BRUNSWICK		
S-14	7	129.00
S-21	7	154.00
S-31	7	249.00
COLONIAL		
Cavalier	7	175.00
Picadilly	7	175.00
Modern	7	235.00
COURIER		
650 Table	7	85.00
651	7	140.00
652	7	165.00
653	7	165.00
*CROSLEY		
30-S Chassis	6	62.00
31-S	6	56.50
33-S	6	112.00
34-S	6	116.00
40-S	7	80.00
41-S	7	65.85
42-S	7	126.00
82-S	7	160.00
*DAY-FAN		
93	6	159.50
94	6	210.00
ERLA "TROPHY"		
31	7	150.00
30	7	169.50
32	7	145.00
AR-3	7	134.50
EVEREADY		
52	7	157.50
53	7	195.00
54	7	225.00
FIRST NATIONAL		
Table	7	75.00
*GRAYBAR		
330 Table	8	98.50
330-F-45	8	175.25
500 Table	4	75.00
550	4	130.00
600	7	225.00
GREBE		
21950-A	6	219.50
270-C	6	270.00
285-A	6	285.00
Comb. 450	6	450.00
GULBRANSEN		
291	8	139.50
292	8	149.50
200 (Comb.)	8	235.00
HOWARD		
Consolette	6	185.00
Puritan	6	210.00
Hepplwth	6	245.00
Florentine	6	275.00
Gothic	6	275.00
KELLOGG		
523	8	175.00
524	8	225.00
525 Comb.	8	395.00
*KENNEDY		
220	7	159.00
320	7	189.00
KOLSTER		
K-43	7	175.00
K-44	7	260.00
K-45	9	500.00
PEERLESS		
21	9	195.00
22	9	245.00
23	9	245.00
24	9	375.00
25 Comb.	9	600.00
*PHILCO		
65	5	67.00
LoBoy	5	119.50
Hiboy	5	139.50
HiBoy DeLuxe	5	195.00
SCREEN GRID PLUS" LINE		
Table 95	8	92.00
LoBoy	8	149.50
HiBoy	8	169.50
DeLuxe	8	225.00
*PREMIER		
724	7	On Request
*RCA Radio Victor		
44	4	75.00
46	4	130.00
21 Batt	5	69.50
22 Batt	5	135.00
Comb. 47	4	275.00
Comb. 67	8	690.00
SILVER		
60	7	160.00
Concrt Grand	7	173.00
95	7	195.00
*STEWARTWARNER		
Cabin't 35, M'd 950	7	142.50
Sher'tn 58, M'd 950	7	165.50
Consolette Ens'ble	7	123.25
Table Model	7	95.00
Model 47—950	7	154.50
*STEINITE		
70	6	118.00
80	6	149.50
*STERLING		
Troubador	7	129.50
Serenader	7	149.50
Imperial	7	187.50
STROMBERG CARLSON		
641	5	155.00
25 cy. 641	5	155.00
642	5	259.00
25 cy. 642	5	247.50
846	8	347.50
*SENTINEL		
444	6	89.50
666	8	99.50
Comb. 666-C	8	149.50
*SONORA		
A-31	6	149.50
A-33	6	179.50
A-35	6	240.00
*TEMPLE		
8-61	8	149.00
8-81	8	169.00
8-91	8	269.00
TRAV-LER (Portable)		
Standard	5	65.00
DeLuxe	5	75.00
Aristocrat	5	100.00
WARE		
Trianon Chass.	5	125.00
Table	5	135.00
*ZENITH		
52	8	175.00
53	8	250.00
54	8	370.00
55 Comb.	8	700.00
57	8	495.00
62	8	185.00
64	8	370.00
67	8	495.00
563-DC	11	250.00
Super Midget	8	145.00

*Denotes this manufacturer also builds non-screen-grid models.

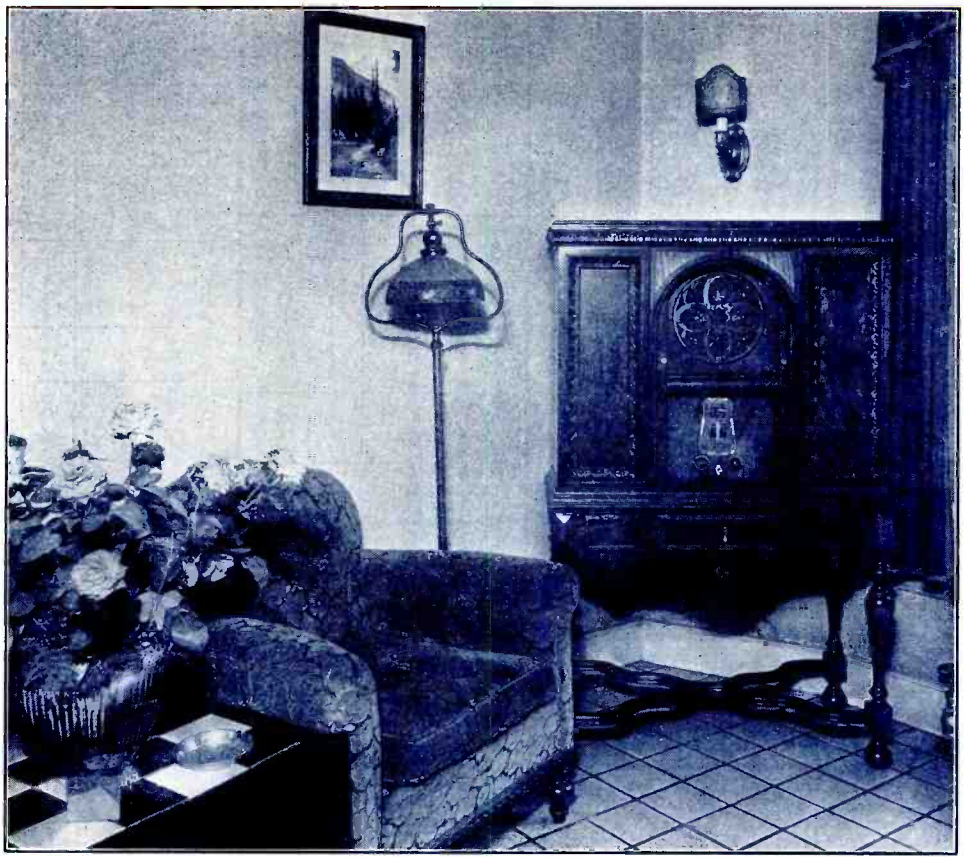
WESTERN LIST PRICES OF SCREEN-GRID SETS

NOTE: RECTIFIER TUBES ARE NOT COUNTED IN LISTINGS BELOW.

MAKE	No. of Tubes	LIST PRICE
*ACME		
78	6	130.50 Plus frt.
88-SG	7	77.00
*ALL AMER"LYRIC"		
94-SG	7	166.00
95-SG	7	198.50
96-SG	7	168.00
American BOSCH		
16	6	205.50
17	6	237.00
18	6	248.00
19	6	290.00
"L"	6	238.00
"R"	6	290.00
Table 48	6	122.50
Table 48-A	6	172.50
"J"	6	248.00
WESTERN CONSOLES		
140	6	174.50
141	6	154.50
149	6	194.50
AMRAD		
Aria	7	213.00
Serenata	7	260.00
Symphony	7	310.00
Duet (Comb.)	7	520.00
Minuet	7	163.00
*ANDREA-FADA		
15-M Chassis	7	120.00
15-MZ (25-40 cy.)	7	120.00
25	6	172.00
35-C	7	227.00
35-B	7	265.00
75	7	370.00
77 Comb.	7	695.00
*APEX (with tubes)		
11	6	124.50
14	6	149.50
ATWATER KENT		
55-C, Chassis	6	67.00
55 Table	6	71.00
60 Chassis	7	81.00
60 Table	7	84.00
66 Chassis	7	115.00
Chass.DC. 61C	7	61.00
Tbl D C. 61	7	65.00
ARCO		Plus frt.
Chassis	8	75.00
*AUDIOLA		
Chassis	6	85.00
AUTOMATIC TOM THUMB PORTABLES		
B	4	60.00
DeLuxe	4	67.50
DC	4	90.00
AC	4	99.00
BALDWIN		
Chassis	6	On req's
Low Boy	6	198.00
Highboy	6	219.00
*BREMER-TULLY		
S-81	7	134.00
S-82	7	159.00
*BROWNING DRAKE		
56	9	154.50
53 Table	9	109.50
*BRUNSWICK		
S-14	7	129.00
S-21	7	154.00
S-31	7	249.00
COLONIAL (Add Freight)		
Cavalier	7	175.00
Picadilly	7	175.00
Modern	7	235.00
COURIER		
65 Table	7	88.00
651	7	148.00
652	7	175.00
653	7	175.00
*CROSLEY		
31-S	6	94.00
33-S	6	108.50
34-S	6	119.50
41-S	7	106.20
42-S	7	129.50
43-S	7	118.50
82-S	7	149.50
*DAY-FAN		
93	6	169.50
94	6	220.00
*ERLA "TROPHY"		
31	7	158.50
30	7	179.50
32	7	152.50
*EVEREADY		
52	7	167.50
53	7	205.00
54	7	235.00
GILFILLAN		
Console	8	156.50
Console	8	175.50
Console	8	187.00
*GRAYBAR		
330 Table	8	98.50
330-F-45	8	175.25
500 Table	4	75.00
550	4	130.00
600	7	225.00
GREBE		
21950-A	6	223.50
270-C	6	274.00
285-A	6	292.00
Comb. 450	6	465.00
GULBRANSEN		
291	8	149.50
292	8	159.50
200 Comb.	8	235.00
HOWARD		
Consolette	6	195.50
Puritan	6	220.50
Hepplwth	6	255.50
Florentine	6	285.50
Gothic	6	285.50
KELLOGG		
523	8	190.00
524	8	240.00
Comb. 525	8	415.00
*KENNEDY		
220	7	159.00
320	7	189.00
KOLSTER		
K-43	7	188.00
K-44	7	275.00
K-45	9	522.50
PEERLESS		
21	9	207.00
22	9	260.00
23	9	260.00
24	9	400.00
25 Comb.	9	635.00
*PHILCO		
65	5	72.00
LoBoy	5	129.50
HiBoy	5	149.50
HiBoy DeLuxe	5	205.00
"Screen Grid Plus" Line		
Table 95	8	102.00
LoBoy	8	159.50
HiBoy	8	179.50
DeLuxe	8	235.00
*PREMIER		
724	7	On Request
*RCA Radio Victor		
44	4	75.00
46	4	130.00
Batt 21	5	69.50
Batt 22	5	135.00
Comb. 47	4	275.00
Comb. 67	8	690.00
*SENTINEL		
444	6	89.50
666	8	99.50
Comb. 666-C	8	149.50
SILVER		
60	7	170.00
Concert Grand	7	183.00
95	7	210.00
Special Cabinets for Coast only.		
"Princess"	7	170.50
"Aristocrat"	7	195.00
"De Luxe"	7	216.00
*SONORA		
A-31	6	154.50
A-33	6	186.50
A-35	6	245.00
*STERLING		
Troubador	7	139.50
Serenader	7	165.00
Imperial	7	201.00
*STEWARTWARNER		
Cabin't 35, M'd 950	7	147.00
Sher't'n 58, M'd 950	7	170.50
Consolette ens'ble	7	128.50
Table Model	7	97.50
Mod. 47-950	7	159.25
*STEINITE		
70	6	125.00
80	6	157.50
STROMBERG CARLSON		
641	5	165.00
25 cy. 641	5	165.00
642	5	277.00
25 cy. 642	5	272.50
846	8	377.50
*TEMPLE		
8-61	8	159.00
8-81	8	179.00
8-91	8	289.00
*ZENITH (with tubes)		
52	8	225.00
53	8	300.00
54	8	425.00
55 Comb.	8	750.00

*Denotes this manufacturer also builds non-screen-grid models.

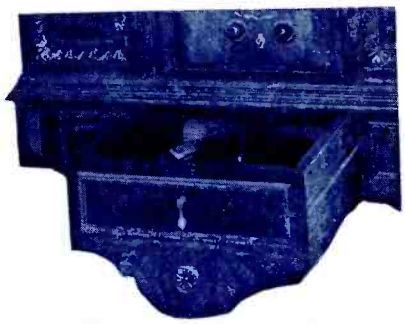
LEUTZ



Above: Leutz "Seven Seas" Radio Phonograph Combination

Three Screen-Grid Tubes
12-in. Dynamic Speaker
Electric Phonograph
Adjustable Selectivity
Push-Pull 2–250 Tubes
Single (Split) Dial
Panel Illumination
Unit Construction

All LEUTZ QUALITY



Close-up of Phonograph

Write, Wire or Cable Today

C. R. LEUTZ, Inc.

ALTOONA, PA., U. S. A.

Cables Experinfo, Altoona, Pa.

WEST COAST
B. J. HOWDERSHELL
Detwiler Building
412 West Sixth St.
LOS ANGELES, CALIF.

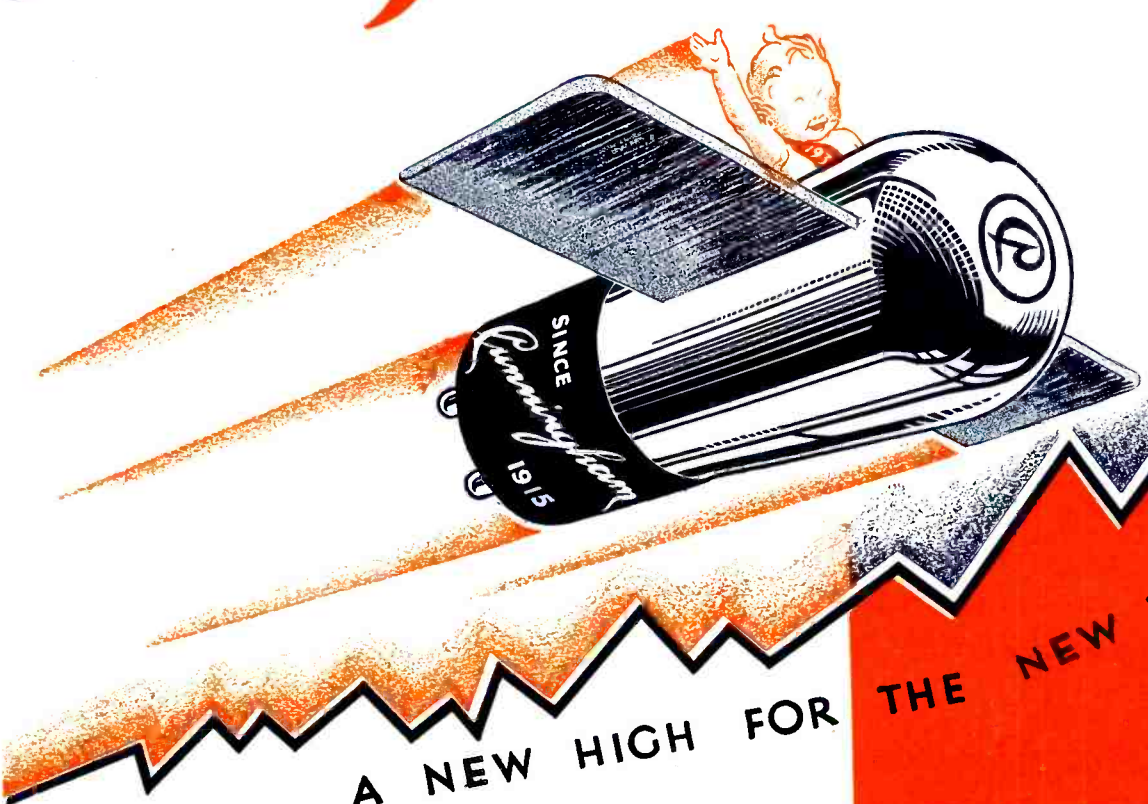
NEW YORK
Suite 628
112 West 42nd St.
NEW YORK CITY

FRANCE
BALDWIN M. BALDWIN
1 Boulevard Haussmann
PARIS, FRANCE
Cables Experinfo Paris

SEVEN SEAS

Cunningham RADIO TUBES

off to a FLYING START *for* 1930 *tube sales*



A NEW HIGH FOR THE NEW YEAR

Cunningham RADIO TUBES

Service–
the Keynote
of 1930 Sales

As the New Year unfolds, there are numerous ways in which the alert dealer can increase his radio sales and at the same time prove a valuable asset to the community which he serves.

National events cast their shadows in advance and most important happenings are broadcast throughout the land. An intelligent canvass of the radio sets in the territory he serves can be conducted by the dealer at little cost that will be rich in results.

E. T. CUNNINGHAM INC.

NEW YORK CHICAGO SAN FRANCISCO ATLANTA DALLAS

Cunningham RADIO TUBES

Our Sixteenth • Successful • Year of Sales and Merchandising

Each week during the ensuing year we propose to continue to build consumer demand for Cunningham tubes by keeping before the nation thru newspapers and magazines our story of in-built tube quality.

Entering upon our sixteenth successful year of sales and merchandising, we renew our pledge of *tube reliability* and remind you of the importance of the name Cunningham in your tube selection and recommendations to consumers for initial equipment and renewal sales.

E. T. CUNNINGHAM INC.

NEW YORK CHICAGO SAN FRANCISCO ATLANTA DALLAS

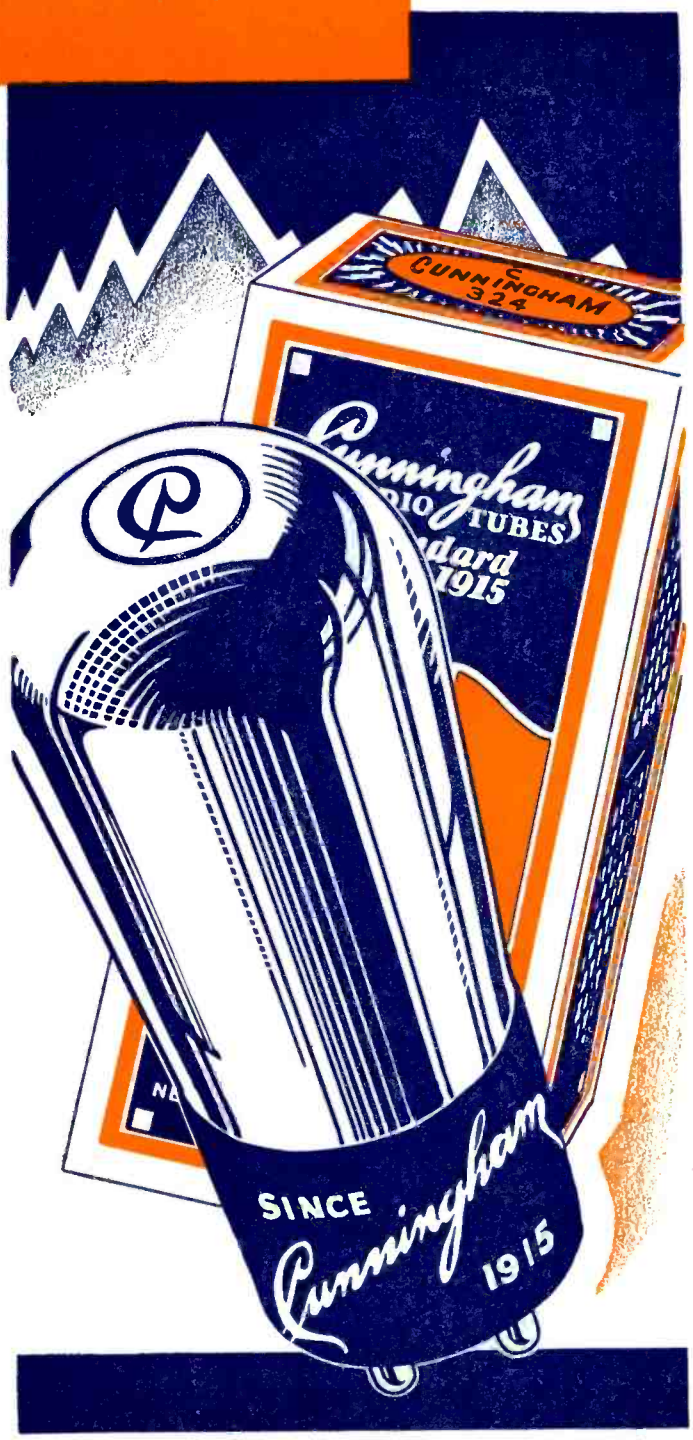
Cunningham RADIO TUBES

We Forecast–

That 1930 like 1929 will be the biggest year in Cunningham Radio Tube Sales.

A product backed by many years of public acceptance--the one great endorsement--is safe merchandise to tie to.

A product of uniformly high quality, nationally known, is the one to use in your equipment and renewal market for 1930.



E. T. CUNNINGHAM INC.

NEW YORK CHICAGO SAN FRANCISCO ATLANTA DALLAS

FORECAST OF FEBRUARY ISSUE

Louis Soloman, general manager, Albert Groesfeld, Inc., tells how to identify the period design of a radio set. Heckert L. Parker continues his discussion of personality. Earle Ennis contributes a humorous slant on a trade subject. Keyhole George gives another leaf from his diary. Earl N. Borch tells how line hum can be eliminated. Circuit analyses and performance curves to be presented include the Stromberg-Carlson, Zenith and Baldwin receivers. Boris S. Naimark describes methods to be used in servicing batteryless d-c sets. Arthur Hobart explains the care of storage batteries. J. Garrick Eisenberg has a comprehensive article on "Engineering The Public Address System." In "Finding What's the Matter with a Defective Tube," P. S. Lucas describes the construction and use of a mutual conductance meter.

CHANGES IN "WHO MAKES IT"

The following changes should be made in the list of manufacturers and their products as published in December, 1929, RADIO and omitted from this issue:

Change address Automatic Radio Manufacturing Company, Inc., to 112 Canal Street, Boston, Mass., list under public address equipment. List Fisch Radio Company, 1283 Hoe Ave., N. Y., under headsets, loudspeakers, switches, units, phonograph. Cary Cabinet Corporation, 1427 N. 15th St., St. Louis, Mo., to Cabinets; Concourse Electric Company, 294 East 137th Street, New York City, to fixed condensers, paper, choke coils, r-f transformers, audio transformers, power; Eastern Coil Company, 56 Christopher Avenue, Brooklyn, N. Y. to coils, r-f; Inca Manufacturing Company, Fort Wayne, Ind., wire; Mueller Electric Company, 1583 East 31st Street, Cleveland, Ohio, to clamps, ground; clips, battery; The F. W. Sickles Co., 191 Chestnut Street, Springfield, Mass., to chokes, r-f; coils, r-f.

Delete Argus Radio Corporation, 257 17th Street, New York City.

Errata—In the wiring diagram of the test kit designed by B. E. Estes, page 58, December, 1929 issue, the *C* plus terminal should be connected direct to the *F-* battery post instead of through the pole changing switch as shown.

The formula for finding the circumference of any groove on a phonograph record as given by Clinton Osborne in the December issue should have been twice the radius times 3.1416 instead of the square of the radius times 3.1416.

RADIO

Established 1917 — Reg. U. S. Pat. Office

PUBLISHED ON THE FIRST OF EACH MONTH
AT 428-430 PACIFIC BLDG., SAN FRANCISCO, CALIF.

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BRANCH OFFICES—

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for January, 1930

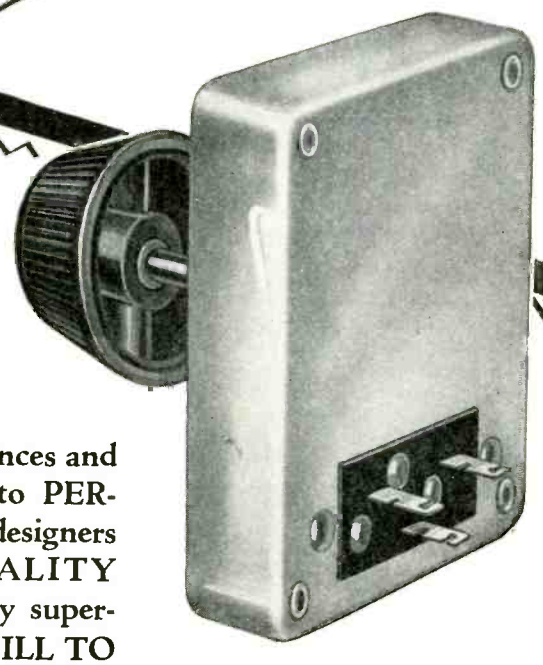
A Suggestion to the Reader:

After reading this January number of RADIO give it to some one else in the trade who might be interested in it. Even if he is your competitor, remember that the safest competitor is an educated one. RADIO is teaching better sales and service methods. But if you want to keep this number yourself, send the name of the man whom you think it would help and the publishers will send him a free sample copy.

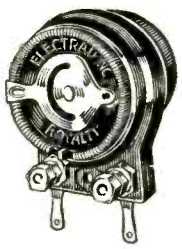
There's a Reason For ELECTRAD Superiority

Built for Reliability
Famed for Performance

Licensed by Technidyne Corp., under U. S. Pats. 1593658 1034103-04



USE and recommend Electrad Radio Resistances and Voltage Controls because they're built to PERFORM. Manufacturers and Custom-Radio designers use them because they MUST HAVE QUALITY when their own reputations are at stake. Ably supervised manufacture, COUPLED WITH THE WILL TO WORK CONTINUOUSLY FOR IMPROVEMENT—that's why Electrad superiority is definite and real—that's why the name "Electrad" is respected the world over by men who KNOW radio values.



Licensed by Technidyne Corp., under U. S. Pats. 1593658, 1034103-04

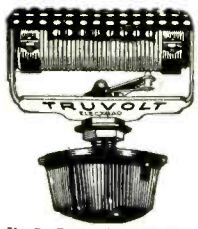
ROYALTY

Variable High Resistance

Widely used for voltage controls in circuits requiring variable resistors with low self-inductance.

Due to unique construction, variable contact is made INDIRECTLY with the resistance element, resulting in a more positive control and absolute freedom from variations due to wear.

Made in 11 types with all usual resistance ranges and curves. Potentiometers, $2.00. Other types, $1.50.



U. S. Pat. 1676869 and Pats. Pend.

TRUVOLT

All-Wire Resistance

TRUVOLTS are the radio engineer's choice for eliminators and power packs because of their patented air-cooled winding resulting in more stable operation and longer life. Variable TRUVOLTS *(illustrated)* have metal shield and knob control. Ideal for experimental power supply banks where quick variation is desired. Last longer owing to *end-wise* travel of contact over wire. 22 stock sizes, $2.50. Fixed models have adjustable sliding clip for accurate setting at exact value desired. No other similar resistance has this feature. All usual sizes.

Licensed by Rider Radio Corp. Pat. 5/2/16, 7/27/26 and Pats. Pend.

PHASATROL

The Universal R-F Balancer

The PHASATROL offers a simple, yet thoroughly effective means of eliminating oscillation and distortion in radio frequency amplifying circuits—tuned or untuned. Can be quickly installed without experience. One PHASATROL is required for each R-F stage.

Handsome, totally enclosed Bakelite case can be mounted anywhere. Complete instructions for installing in various popular receivers is packed with each PHASATROL. List price, $2.00 each.

SUPER-TONATROL

The ELECTRAD Heavy Duty Volume Control

This new ELECTRAD volume control is the first device of its kind that offers builders of modern power receivers a smooth, accurate control of high voltages *combined with unusually long life.* Easily dissipates 5 watts.

Its new type resistance element is *permanently* fused to an enameled metal plate. A pure silver floating rotor *with multiple* contact, gives stepless variation that is revolutionary.

Practically all-metal construction, with riveted cover. Bakelite insulation. Handy, slotted soldering lugs. Made in seven types, with resistance values and curves for all usual volume control purposes, including output from electrical phonograph pick-ups. List price, $2.40 to $3.50.

Western Representatives
UNIVERSAL AGENCIES
905 Mission Street
San Francisco

ELECTRAD INC.

ELECTRAD, Inc., *Dept. PRI*, 175 Varick Street, New York, N. Y.
Please send data on products checked.
☐Super-TONATROL ☐TRUVOLTS ☐PHASATROL ☐All Products
Name
Address

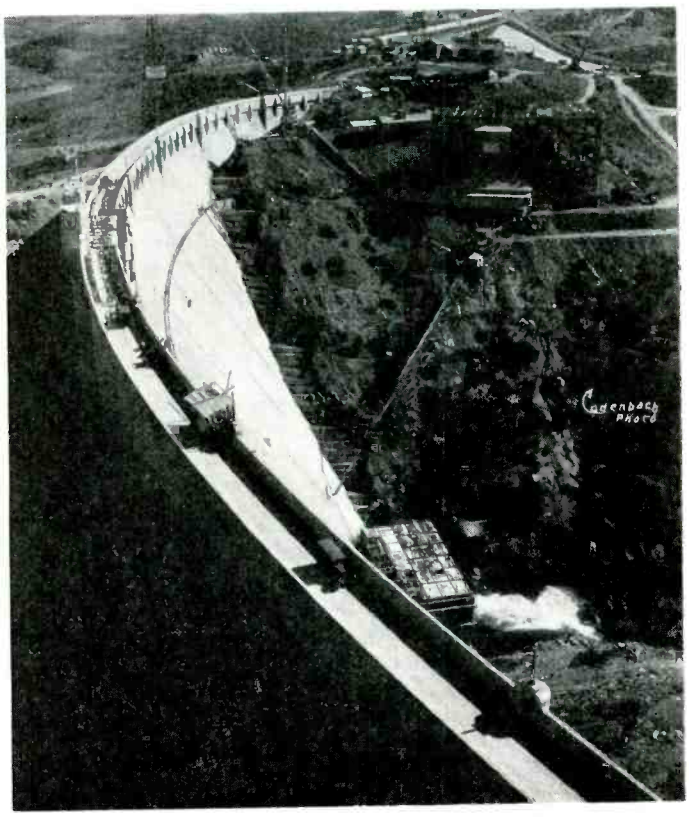
RADIO
for the profession

VOL. XII JANUARY, 1930 No. 1

Tips On *Merchandising* Sound *Equipment*

Some unusual public address installations which suggest overlooked opportunities for the live salesman.

By **H. L. WILLIAMS**



Public Address Installation at Pardee Dam

PUBLIC ceremonies of all kinds, such as in the dedication of new buildings, public institutions, memorials, etc., offer opportunities for the sound equipment specialist. At the dedication ceremony of the new Foshay Tower in Minneapolis recently, speakers were mounted at intervals all around the building, and when the speeches and music were amplified through them the traffic was stopped for blocks around. Of course in such cases it is advisable to make arrangements with the police before disrupting traffic, or the consequences may be embarrassing.

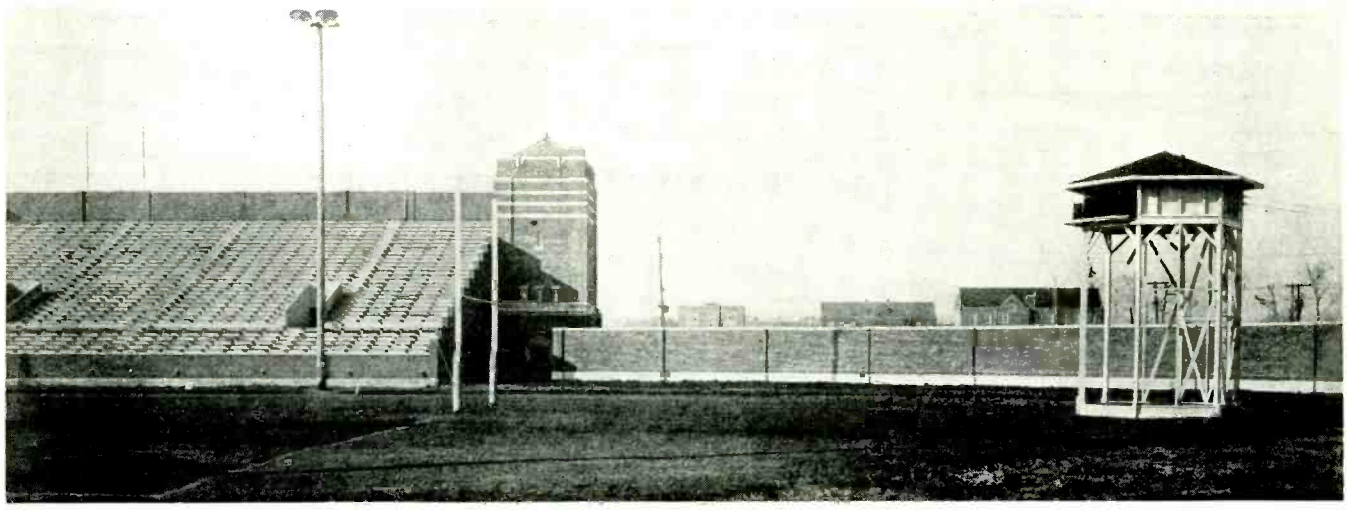
Such dedication ceremonies will no doubt become more popular with their sponsors as they become educated to the fact that sound amplification provides them with opportunities that did not heretofore exist. Formerly, if one man could talk to a hundred people without straining his voice he was lucky. If people cannot hear clearly what is being said they soon lose interest. Today, with good amplifier equipment and reproducers, one person can make himself heard by many thousands, and a large proportion of those thousands can actually see the one who is addressing them. Amplification brings the individual to the multitude as never before.

These facts are appreciated by those engaged in the selling of sound equipment but it is remarkable how few business men are acquainted with the potentialities of such equipment as applied to their own purposes. Their education must be continuous and persistent, and that is one important job of the equipment dealer, and of the jobbers and manufacturers behind him.

One interesting dedication ceremony that would have been very flat indeed without amplified speech and music took place recently at the Pardee Dam, Valley Springs, California. This concrete dam stands 300 ft. above the water on the upstream side, and has a roadway about 20 ft. wide along the top of it. At the center of the dam the roadway opens out to 30 ft. for a distance of about 100 ft. This open space was the scene of the dedication ceremonies, and tables were erected therein for the luncheon, as the picture shows.

During the luncheon, music was provided by a phonograph working into a 3-stage amplifier and reproducing through two dynamic speakers with 4-ft. horns. This music, being more or less directional, was not objectionable to those nearest the reproducers although it could be heard clearly two miles away at the limits of the construction camp. Speeches also were transmitted in the same manner after the luncheon and not only heard by the guests but by the workmen in the camp some distance away. Without this amplifier equipment, it is doubtful whether half the guests would have been able to distinguish the speakers' words in this exposed position. Certainly they would not have been able to enjoy the music.

A GREAT deal of argument has centered around the use of speaker equipment on football fields and in stadiums. Those who know their football and their players object to being told what they can see for themselves. A consensus of opinion indicates, however, that most people appreciate the authori-



Speaker Installation at North Dakota Stadium

tative statements regarding plays emanating from someone who is in a more advantageous position than themselves. Players' numbers become dirty and the men themselves unrecognizable. Opinions differ on what has taken place; many spectators do not understand the game as well as they should. The amplifier equipment helps all these.

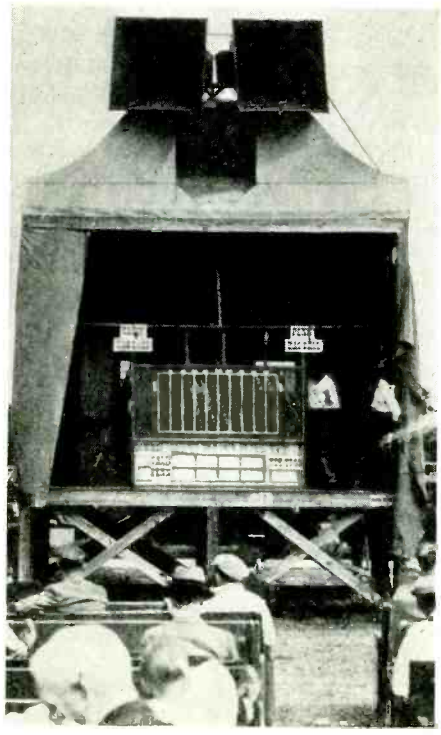
These are some of the reasons why the managers of playing fields and stadiums will usually give earnest consideration to proposals for the installation of sound equipment. Some of them also appreciate the fact that musical entertainment also can be provided at very little extra expense. The equipment which was originally installed at Stanford University for the Hoover inaugural is now used for announcing athletic contests.

A recent installation of this kind was made at the University of North Dakota in their Memorial Stadium. A special stand was built, 20 ft. high, to accommodate four dynamic speakers with 5-ft. horns. This installation is successfully used not only for speeches and entertainment before the game and between halves, but also during the football game for reporting, play by play, the names of players, number of downs, yards gained, etc. Each speaker is fed by a 3-stage amplifier having a pair of type 250 tubes in the last stage.

Reporting football games at points distant from the scene of the conflict is a very successful method of attracting crowds. The type of listener it is desired to interest can usually be segregated by the surrounding and circumstances of the re-broadcast. For example the average radio store, with a receiver in its doorway is never very successful from a business standpoint because its audience is generally largely made up of bums and undesirables. On the other hand, the reporting installation installed by the Isle of Dreams Broadcasting Co. at Miami, Florida, was productive of exceptionally beneficial results. As the picture shows, a special booth was erected in the park with a score board and gridiron diagram, surmounted by a couple of powerful speakers. Seats were arranged to accommodate several hundred listeners, with standing room for the balance.

Not only does this installation attract thousands of people to the Royal Palm Park, but the parking concessions reap a rich harvest. It does not take much imagination to visualize the value of a permanent installation of this kind. All kinds of sports can be reported and various forms of entertainment provided in practically every season of the year.

THE last place in which one would expect to find public-address equipment is in a burial park, yet the success of an installation at Cleveland, Ohio, suggests that before long there may be standard equipment in many others.



Speaker Booth at Miami, Florida

This is but another example of the extraordinarily universal application of sound equipment in human activities, and demonstrates the exceptionally wide market that exists for this class of radio-electrical apparatus.

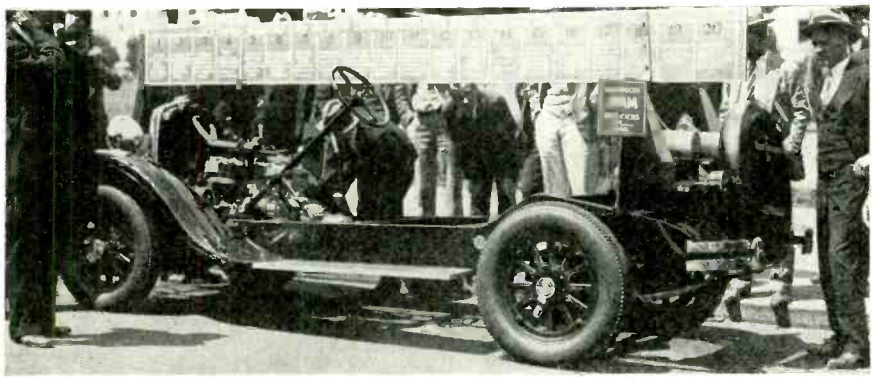
Crown Hill Burial Park is the cemetery referred to above, located 17 miles from Cleveland. At the entrance to the park, which is a 256-acre tract, is a chapel containing a $40,000 pipe organ. In the center of the park is a watch tower, in the top of which a watchman is constantly on duty. This man is on the look-out for funeral processions, and as soon as the cortege arrives at the gates to the park, he puts an organ music record on the phonograph. The music from this is amplified and fed to dynamic speakers located at different points throughout the grounds.

On special occasions the organ music may be broadcast instead of the phonograph. In any case the music is heard throughout the entire cemetery, and continues until the cortege arrives at the grave. It is then stopped until after the burial service, when it is again continued until the mourners have left the cemetery.

Speakers, with semi-directional horns attached, are located at intervals throughout the park, and these are carefully arranged so that there is not undue volume at any one point. The result is marvelous tone quality at a volume level in keeping with the solemnity of the occasion and surroundings.

If desired it can be arranged to cut out only the speakers near the point of interment during the final ceremony, so that a background of distant music would be provided.

A CLEVER and unusual adaptation of loud speakers to automobile advertising was made use of recently by a San Francisco car distributor. When a new model chassis was introduced, he had the twenty leading features indicated by numbers painted on the chassis. These numbers were explained on a board sup-



Loudspeaker Demonstration of Automobile

ported above the chassis, as shown in the picture.

At the rear of the chassis, over the gasoline tank, was constructed a platform supporting two big dynamic speakers and a two-hole baffle board facing forward. The chassis, without a driver, was trailed behind a panel-bodied car in which the phonograph, microphone and amplifiers were installed. The field supply and voice wires passed along the tow-bar and under the chassis to the speakers.

As the two vehicles moved along the streets, announcements were made through the speakers, interspersed with music. At convenient points the cars were stopped so that the chassis and the signboard could be studied by pedestrians. At these times music was played at moderate volume to attract attention to the exhibit. According to the distributor, this "stunt" was an unqualified success.

MORE and more uses are being found for motor vehicles equipped with speech amplifiers, particularly where such machines have a self-contained source of current supply such as a motor-generator. For some classes of work it is of course entirely practical to use battery operated amplifiers, but, judging by the growing numbers of portable a-c amplifiers coming into use these are rapidly superseding the battery type.

An interesting installation was recently worked out for the noted football coach, Knute Rockne of Notre Dame. During his illness, Rockne was unable to actively coach his men, so his automobile was fitted up with a portable amplifier and a microphone. The amplifier fed a dynamic-type speaker on the practice field, and from his bed in the car Rockne was able to watch the play and give his instructions with practically no effort.

IN the Yosemite Valley is an eminence known as Glacier Point which rises 3480 ft. above the floor of the valley. This point dominates the whole valley, and is the scene of an awe-inspiring spectacle known as the fire-fall. It consists of building a huge bonfire on top of the peak and pushing the blazing embers and red-hot ashes over the cliff. The fire falling that enormous distance is a sight never to be forgotten. In itself it is wonderful enough, but when it is combined with appropriate music it is even more thrilling.

Music was supplied for the first time recently, and proved such a success that efforts are being made to establish it as a permanent feature of the entertainment. On this occasion, two dynamic speakers with 4 ft. paper horns were mounted on the rocks as shown in the picture. They were pointed downward at such an angle that there would be no echo from the cliffs on the opposite side of the valley.

Power was obtained from the lighting lines for the a-c amplifiers, which were of the 3-stage push-pull type, using two pairs of '50's in parallel. Despite the fact that the full volume of the equipment was never used, the music, provided by a phonograph, was distinctly heard at points five miles distant. It was not possible to check up speech reception at that distance but speech was clearly distinguishable at a distance of one mile. This was proved by the announcer talking to people bathing in a pool one mile away. The bathers did as the announcer requested them to and so indicated that they could fully understand everything that was being said to them.

Inventorying Customer Contacts

By FRED E. KUNKEL

EACH year brings its business problems to the radio dealer, and standing at the threshold of a new year, it is only just and fitting that he read the tale of business won and lost; that he study his ledgers from the angle of customer contacts, and that he analyze his relations with the public so that he may build up on enduring sales a pyramid of success for the new year out of the ashes of past experience.

At least so believes one aggressive radio dealer who tried this inventory analysis plan last year with creditable success. He took an inventory of his past experiences from the human side of his business relations rather than from the merchandise on hand and equipment side of the ledger, analyzed his contacts with people in terms of business won and lost, the whys and wherefores of new and repeat business, and dissected his contact methods for the purpose of building up a larger business for the new year.

This radio dealer figured, and figured wisely, that the month of January and the New Year would be a fitting moment in which to review the twelve months which had just passed from the angle of what the public thought of his radio business—a survey of his activities from both a personal and a business angle, by placing himself in the shoes of his customers and viewing his business as they saw it, from service phases, the personal attention that each customer wanted and why, their peculiarities and eccentricities, with a view to arriving at a better understanding.

(Continued on Page 71)

Loudspeaker Installation at Yosemite Valley Fire-fall

A Debate: Radio Sales at the *Prospect's* Home

By WM. R. PHILLIPS

TO PUT the question of an abolition of home demonstration to a vote, would bring forth an equally divided chorus of "ayes" and "noes," for experience has proven that each side has its evils and each its favorable features. Some dealers find home demonstrations to be inconvenient, a very evident cause of lost sales, and productive of "joy-riders" who amuse themselves during the long winter evenings by inviting an innocent and unsuspecting radio dealer to "demonstrate" his wares to them.

This sort of thing has happened. It has happened in the history of every conceivable product, from tooth-paste to automobiles. It is an interesting situation and, with very little embellishment and exaggeration, becomes a lively topic for conversation at a dealers' meeting. Furthermore, it makes a very handy excuse for lost sales. Indeed, the majority of these catastrophes is due not to lack of merchandising quality or sales ability, but to that hazy something in the back of the prospect's wife's head that tells her that it is a wonderful and beautiful radio, but—. In other words, it just doesn't "click." So hubby has to try again and the disgusted salesman, knowing he has a good product and that his sales talk was well up to par, goes back to the shop muttering something about "joy rider."

NEVERTHELESS, there are four good reasons why radios should be sold through home demonstration rather than in the store:

(1) A home is quieter than a store.

(2) It is the best place to prove that the appearance of a set harmonizes with the furnishings.

(3) It offers the best opportunity to interest other prospects.

(4) It enables the dealer to capitalize on the manufacturer's advertising.

A brief consideration of these reasons should convince any dealer that the buyer's home is the most effective place to sell a radio set.

Store locations are notoriously liable to radio interference which will spoil the first audition. Disturbances are radiated from elevators, sign flashers, oil burners, street cars and other electrical devices in the vicinity. The stock excuse that "the noise here in the store is terrible" creates doubt and skepticism. Furthermore, two or three loudspeakers that are run at high gear so that they can be heard above the click of the typewriter and the noise of the street add to the confusion. All this noise brings an unquietness to the customer and certainly does not make him want to buy.

Although nine out of ten radio sets will harmonize with the furniture in nine out of ten homes, not one out of ten women will believe it until she has seen it with her own eyes in her own home. Furthermore she wants to decide as to the set's proper placement in a room, whether it should be opposite the piano or against the wall or where not. The home is the only place to make these decisions. Finally the acoustics are likely to be better in a furnished home than in a bare store.

The enterprising dealer can induce a customer to invite a number of friends to hear the demonstration in the home and help decide. He thereby obtains a number of good prospects who often can be sold without the expense of special demonstrations for each one. This method has been particularly effective in selling aluminum ware and other domestic devices.

No matter how much a dealer may be opposed to home demonstrations, he cannot gainsay the fact that manufacturers are advertising that "your nearest dealer will give you a free demonstration in your home." If one dealer refuses, the customer may seek another who is willing. The dealer who "plays ball" with the manufacturer is more likely to succeed than the man who is a law unto himself.

ANOTHER advantage of a home demonstration occurs when an old set is to be taken as a "trade-in." It is easy to compare the new with the old when they are side by side! How much more easily the new set can be tuned; how much more selective and sensitive it is, and how superior its tone quality. The value of the "trade-in" can then be agreed upon and made part of the contract, since the buyer is satisfied that an actual appraisal has been made instead of having a price quoted from a book.

If a purchaser insists upon getting long distance, the home is the only place for the demonstration. Not only are receiving conditions usually better but also the actual demonstration at the place where the set is to be used is proof positive of its capabilities.

Finally it is easier to get the unanimous decision of a family in its home than of one or two representatives in a store. All such foolish questions as to the imminence of television can be answered once and for all. There can be no excuse for a change in mind, as so often occurs after a store demonstration.

The past few months have seen a decided change from a seller's to a buyer's market. Since the supply has become greater than the demand, folks no longer have to beg or wait for a set. Intensive selling methods are necessary to meet the changed conditions. Millions of radio sets were bought in the early days. Now they have to be sold. Home demonstration is a part of the job of intensive selling.

A policy which features home demonstration enables a material saving to be made in the costs of overhead. Store demonstrations require lots of extra space and that means higher rent. They also call for an expensive retail location, fine furnishings, and additional light. In order to provide service and to keep customers from waiting too long, there must be several salesmen on the job all the time, yet they are busy only a part of the time. By making appointments for home demonstrations in advance, every hour of a salesman's time can be profitably employed.

In fact a dealer who is unable to "get by" in a retail location can make a good living by concentrating on home demonstrations. He can make closer and more friendly contact with his buyers and can establish relations for a profitable and permanent business.

Home demonstrations mean hard work and much sacrifice; long hours and discouraging failures. These things should be weighed in the balance before a man makes up his mind to throw his hat in the ring. For, as the old song said, "Everybody's doing it"; even those who are most bitterly opposed to the idea of it. And they do it purely and simply because they know they have to.

Should Be Made

at the *Dealer's* Store

By E. R. NASH

WHAT is a radio store for, if not a place to sell radio sets? In the last analysis, what is a dealer in business for, if not to make a profit from selling radio? Radio *can* be sold more profitably in a store than by any other means yet devised. The dealer who falls for the bunk about selling exclusively by home demonstration might just as well cancel his lease now, before he has lost the shirt off his back, as six months from now, when he has lost not only his own money but also the money of his creditors.

Now that radio is sold not on the basis of "distance" but of selectivity and tone quality, as well as appearance, these qualities can be better demonstrated in the average store than in the average home. There are many reasons, both practical and theoretical, why store demonstrations are better than home demonstrations.

In the first place, the average man buys a radio set by mentally comparing it with some other set. He usually selects a set because it sounds better or looks better than another. He can confidently make this selection in a store where he can hear and see half a dozen sets, one after the other, until he gets the one he wants by a process of elimination.

Live dealers are recognizing this buying propensity by showing as many as six different lines of about the same price in one display room instead of putting complete lines of one brand in each room. That a more reliable judgment can thus be made should be carefully explained to the buyer, emphasizing the facts that but few people can accurately remember tone and pitch for more than five minutes. The customer will appreciate that this is the safest way to buy a set.

In fact, "the safe way to buy a radio" could be made the subject for a good advertisement. Picture the advantages of a large stock from which to select, the opportunity to compare all the well-known makes, and the convenience of deciding at one time and place without having to shop around. Furthermore, any noisy disadvantage of a store location means that a set would sound even better in the quiet home.

A store also lends itself admirably to the demonstration of the tone quality of different sets by means of phonograph records. This can be done less obviously and more conveniently in the store than in the home. The phonograph "set-up" is always ready for instant use in the store and the same record can be repeated on a half-dozen different sets if necessary.

BUT the real point for the dealer to consider is not whether he can sell more or less sets in his store but whether he can sell them at a profit. A few sets sold at a fair profit mean more cash at the end of the year than many sets sold at a small profit or even at a loss. Almost invariably a customer will want to try several other makes after having had one in his home for one or two days. He asks the dealer to take it back, promising that it may be returned to his home if the others are not better. For some reason it never returns to his home. All this costs money.

Every home demonstration costs at least five dollars. Delivery of a console requires two men and a truck. A temporary aerial is often necessary. If half the demonstrations are converted into sales, a very high percentage, $10 is the demonstration cost of each sale. This is one-seventh of the gross profit on a $175 set which the dealer buys at 40 per cent off. Adding this 14 per cent margin to a 10 per cent gross selling cost leaves a 16 per cent margin on a 40 per cent gross profit. After rent, salaries and other overhead items are paid this 16 per cent will look like thirty cents, even in a low rent neighborhood.

In order to deliver new merchandise on every sale, the dealer must either maintain a duplicate stock of sets to be used as demonstrators or he must deliver a new set for the demonstration and install a new set of tubes if the set is sold. The demontrators can be sold only at reduced prices, and tubes are expensive.

In a home demonstration the dealer can only pray that the set or cabinet will not be damaged. He has no tangible collateral upon which to collect damages, or at best would have difficulty in collecting. The finish of more than one set has been ruined by an upset glass of hospitable "bootleg."

THESE arguments do not mean that a dealer should absolutely refuse to send out a set for demonstration. There are exceptions to every rule. But when the service man has installed a demonstration set and is satisfied that it works properly, he should remove the detector tube. When the salesman calls he should take a detector tube with him and put it in when he is ready to operate the set.

Many a sale is lost because the customer tries to operate the set before the salesman calls. Interference may be bad or the prospect may not know how to operate the set properly. This builds a sales resistance which can not be overcome. But if the set is first operated only in the presence of the salesman, any difficulties can then be explained by him.

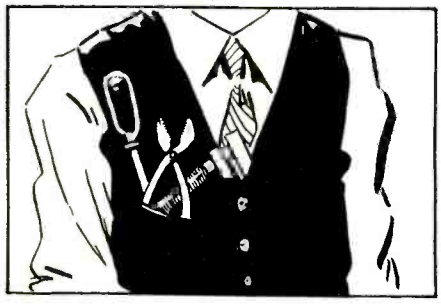
If a customer is told, when he requests a demonstration, that this is contrary to the policy of the house but that the set can be sent on approval if he likes its tone, he will generally agree to take it. He signs the contract and makes the first payment on the understanding that if there is any particular circumstance that prevents satisfactory operation the set may be returned within four days and the money refunded or applied on the purchase of another set.

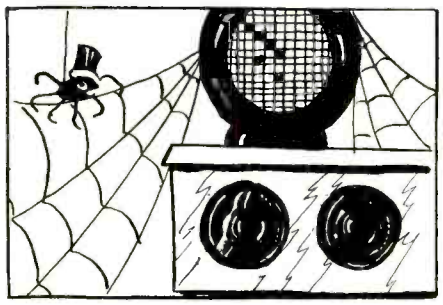
Thus the customer is caused to show his good intentions to buy. Furthermore he regards the transaction, not as a demonstration, but as an effort to please and guarantee that the equipment will work satisfactorily in his location.

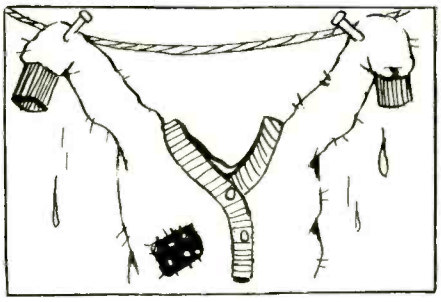
If the dealer will stress the set's tone quality and appearance while explaining this plan, experience has shown that there is only one chance in twenty-five of the set's coming back. The tone will sound as good or better in the home and the woman will find that the set will match some of the furniture in her living room.

This plan eliminates the radio "joy rider" and the giving of "radio parties" at the dealer's expense, such as too frequently occurs when home demonstrations are freely given. It is one way to sell radio *at a profit*. It is one way to combat the effect of insidious propaganda not to buy a radio set in any store.

Finally it is not consistent with the vaunted stability of the radio business that its product should be sold by men whose business is all in their hats. Radio is rapidly becoming one of the biggest businesses in the country. Its continued growth depends upon well-displayed stocks in attractive stores. There is a sufficient margin between the dealer's cost price and his selling price to justify the maintenance of high-grade stores where the public can make its purchases intelligently and comfortably. This can best be done by store demonstration.







Pocketless Pants, *a Spider* and an Old Undershirt

By EARLE ENNIS

WASSETT peered at me over the bowl of his pipe. "If," he said, "you called on your fiancee, and found her all propped up with sticks so she wouldn't fall down, would you marry her?"

"Oh, come," I said. "That's an absurdity."

"It's the same idea exactly," said Wassett, flipping a match out of the window on the head of some luckless pedestrian. Wassett owns two motor-cars, and lives in a roof-top bungalow, where he can inhale pure soot and city dust for the price of a queen's ransom. Incidentally Wassett sells radio sets—more sets perhaps than any one man living.

"I don't follow you," I said, returning to the argument.

"I'll explain," said Wassett. "You go into a store to buy a fine set. You want something that will give satisfaction and never get out of order. You find the place full of fancy cabinets. And then—up comes the boss. In his pocket he has a screw-driver, a hammer, a pair of pliers and a soldering-iron. What is your reaction?"

"That he is a busy man," I said flippantly.

"Bunk," said Wassett. "You figure right away that he has to carry those tools around with him to keep his sets tinkered up. Your natural conclusion is that the set has to be tinkered with all the time—even in the store. You may not be conscious of it, but the sight of all those tools has destroyed your confidence in the set. You are prejudiced against it before you hear it. Just like the bride—if she can't stand up without all those braces—what good is she?"

"But there are adjustments to be made aren't there?" I put the question weakly, for Wassett is always right.

"Sure. They ought to be made in the shop—not out where the customer gets the impression that everything in the joint is falling to pieces. Would you buy an automobile if the salesroom was full of motors being repaired? Not you. You'd go where the machines seemed to hold together."

I helped myself to some more of Wassett's illegal Scotch. It warmed me—made me talkative. I took another fling at Wassett's logic.

"Granted you may be right on that point," I said, "a few tools lying around won't kill a sale and you know it."

"I don't know any such a thing," said Wassett. "The tools are a symbol. Lots of radio dealers have one or two sets in their places working. The others have either a tube out, or a power line disconnected, or a speaker missing. Customers wander around, snapping them on and off and most of them never work. That, added to the tools, will discourage even an optimist. A wise guy never tries to make a sale with a machine shop in his clothes."

Useless to argue with Wassett. I probably never should, if it wasn't for that decanter. I took another—to keep out the winter's chill.

"All right," I said magnanimously. "Grant you, tools in the pocket is bad practice. What else?"

Wassett fairly beamed at me, the silly ass, because I had agreed with him. He is fairly daffy over a victory. And he wins so often, when we argue, that it disgusts me—positively.

"Not having a spider in the store!"

I jerked myself back from the contemplation of amber liquid against fire-light. Where were we? Oh yes. . . .

"A spider! My word! What's a spider got to do with radio?"

Wassett knocked the ashes out of his pipe and refilled it from a teakwood bowl.

"Just this," he said, waving a match at me. "A spider will always build a web from one object to another. Every woman knows that if she keeps her house clean a spider will not build a web. Sometimes it takes a web to tell a woman her house is dirty. In a radio store, if there was a spider, he'd built webs from one heap of junk to another and then perhaps the owner would notice that his store needed cleaning up. A spider would be a good thing for his business.

"You mean a lot of stores are dirty?"

"Dirty and full of junk. Not neat. Not attractive. Just dumping grounds for this and that. A customer comes in, looks around, figures that what he sees is about what it is—junk, and prepares to pay a junk price. When he hears the real price, he walks out. He might have paid the true price—if the place had looked fit to house that kind of a set."

I regarded Wassett solemnly. A bride propped up with sticks. And now a spider. Odd fellow—Wassett, but a good judge of liquor.

"What else," I asked recklessly.

"An old undershirt," said Wassett, jabbing his pipe stem at me. "Every radio store needs at least one old undershirt."

The lights in the room spun around. A stone dragon in the corner leered at me, but I gripped the arms of my chair. This would never do. I must find out about the undershirt.

"Lesh have it," I urged. "Lesh hear 'bout 'th' unnershirt."

"To wash windows with," said Wassett, grinning diabolically. "Dirty windows. Get me? Dirty windows—fingermarks, nose-marks. . . . dust inside, dead flies . . . .Cuts down the sales. Retards profits. Take the undershirt, wash the window—there you are."

Wassett took the glass from me and put my hat on my head.

"And now old top, you head for home. I'll tell you more the next time."

I regarded Wassett with foggy interest.

"Wassett," I said sincerely, "You have horns—two l'il red horns sticking up on your head."

Wassett laughed.

"That's because I'm a devil of a good salesman," he said, and thrust me into the elevator.

Downstairs I tried to give the elevator man the benefit of what I had learned.

"Don't marry a woman with sticks under her, get spider and save your undershirt," I told him.

"Why?" he said.

"Finger-marksh, nose-marksh, dead fliesh." I said. "Retardsh profitsh. . ."

"Atty boy," he said and went upstairs. Silly ass!

Personality In Radio *Salesmanship*

The second in a series of articles on selling radio wherein the elements of individual success are analyzed and interpreted.

By HECKERT L. PARKER

When a prospective purchaser of a radio set reaches the point where decision must be made between two different makes of sets handled by two different dealers, there is not likely to be enough difference in the price to swing the decision from one set to the other. The fact that the prospect still remains unsold further indicates that there is not much difference in the performance of the two sets. There may be some difference in cabinet design, or possibly something in the history and reputation of the manufacturers to cause indecision but the determining factor will always rest with the individual salesman for each dealer. Slight differences in price, performance, appearance, factory and dealer reputation are not obstacles to a salesman with a pleasing personality.

Furthermore, retail radio selling is largely "one time selling." Wholesale selling is different in that the contact with the customer covers a long period during which the salesman has an opportunity, by frequent contact and long acquaintance, to impress his personality on the customer. The retail salesman has not the opportunity of long time acquaintance but must make his personality felt by the customer in one, or a very few contacts and obtain immediate results. One often hears the remark, "Oh so and so is a fine fellow *when* you get to know him." That *"when"* is very important for successfully selling radio at retail.

Everyone has a personality. Some are pleasing and some not so pleasing. Personality is made up of a multiplicity of characteristics or traits which are the result of environment or associations, starting almost at birth and continuing until death. These traits are constantly changing and shifting during life, now one trait and now another trait dominating the person, but hardly ever will any one or two traits determine a personality. Observations made by large insurance mercantile, and industrial organizations point out what tendencies or traits are shown by successful salesmen, or successful engineers for instance. These will be discussed in this lesson but it must be remembered that they are only general and any individual may lack a majority of the traits shown desirable for a successful selling career and still rank high as a salesman. A useful grading chart is also given so that individuals may check up on themselves by the assistance of their families or friends and thereby learn what traits should be encouraged in order to become better salesmen.

This discussion is not concerned with personality, as such, but merely with the traits which successful salesmen are known to possess and are therefore desirable for a selling vocation. Such traits or characteristics as loyalty vs. disloyalty; decision vs. indecision; selfishness vs. unselfishness; courage vs. fear; personal habits, moral habits, etc., all go to make up the individual no matter what kind of work may be done, but there is not space here for their detailed discussion.

However, on the subjects of habits and morals, the more or less widespread idea that an employee's time is his own after hours is rapidly changing in the business world. It is mentioned here because a salesman is often the only contact a firm may have with the public. Many a sale is lost to a firm because of the actions of the firm's salesman, observed by the public or by possible prospects for merchandise sold the firm, at a time when the salesman is not on duty. It does not do a retail radio firm any good to have a reputation for employing habitual flirts and neckers or booze hounds, who make themselves conspicuous at the local road houses and cafes. No sales employee can take the attitude that his time after hours is strictly his own unless he so conducts himself after hours that there will be no reflection on the firm. Smoke all you want to at a time when it is not objectional to others. Take a drink if you must but don't forget to be a gentleman. Suit yourself about religion or church but leave that out of your

SALESMAN'S PERSONALITY CHART

The Impression You Make on Other People

POSITIVE TRAITS	%	VERSUS	NEGATIVE TRAITS	%
1. Personal Appearance Pleasing			Personal Appearance Unpleasing	
2. Audible Impression Pleasing			Audible Impression Unpleasing	
3. Friendliness			Unfriendliness	
4. Tact and Diplomacy			Thoughtlessness	
5. Optimism			Pessimism	
6. Socially Able			Unsociable	
7. Present-Mindedness			Absent-Mindedness	
8. Perseverance			Quitter	
9. Dependability			Undependability	
10. Special Ability			Special Inability	
TOTAL			TOTAL	

Six free copies of this Chart will be sent to any RADIO subscriber upon request

discussions with prospects. If you must be naughty, be nice about it and do not let any more people than possible learn about it. Your employer has every right to expect this of you.

The Salesman's Personality Traits

THE amount of time spent at school has little to do with sales success, outside of the general effect of such educational advantage on the general alertness of the individual. The intelligence possessed by salesmen in general has been referred to by some authors as "social intelligence." That is the type of intelligence used when we work with people, or against people. It is made up of personality traits, character, temperament traits and physical traits. The following table shows a few of the differences between socially minded and mechanically minded people. The traits listed are the extremes toward which the two groups tend. (Ref. Snow. Psychology in Personal Selling.)

Distinguishing Personality Differences

Salesmen are:	*The mechanically minded are:*
Credulous	Assured in beliefs and attitudes
Not self-conscious	Self-conscious
Not conceited	Conceited
Adaptable	Not adaptable
Self-confident	Lack confidence in their abilities
Open hearted and talkative	Reticent and close mouthed
Quick to make friends	Slow to make friends
Neat in dress	Absent-minded
Good-natured	Glum
Present-minded	Careless in dress

It must be remembered that these differences are comparative only as to tendencies. For instance, salesmen tend toward talkativeness more than toward reticence. It does not mean that a salesman must be extremely talkative to be successful but extreme reticence would be very undesirable in a salesman.

One cannot see himself as others do. For practical purposes it is desirable to know what people *think* you are. If you know that, and know what you should be like to meet success in selling, it will be easier to correct faults or shortcomings and develop traits which are desirable in a salesman. The quickest way to learn how one appears to other individuals is to have others tell you. This is done by having several people who are associated with you, grade you on the accompanying chart. However, the grading will not be of any value unless each person reads this article for himself and learns the definitions for the traits listed.

First grade yourself. Then have your wife or sister grade you on a separate sheet. Then hand four copies of the chart to some friend who in turn will give one chart each to four persons who know you and who have read this article. You are not to know who the four persons are to whom your friend gave a copy of the chart for grading. These four persons grade you individually and hand the chart, graded, back to your friend who gave it to them. The friend then passes all the charts, unsigned, to you. Take an average of the six or more charts. You will be surprised to learn that your opinion of yourself will differ much from the opinion of others. It is a certain and quick manner of showing up your personality traits which may need improvement. If desirable, the general personality traits mentioned early in this article may be added so that a grading on general personality may be secured in addition to showing a standing in traits particularly desirable in a salesman. It is a lot of fun anyway. Try it.

How to Mark the Chart

THE person who is to do the grading should carefully read the following explanation of the positive and negative major traits in the chart. After consideration of the factors determining each trait, mark some part of 100 per cent in the positive column and the remaining part of the 100 per cent in the negative column. Example: If Trait 3, Friendliness, is marked 65 per cent in the positive column, then on the same line across, Unfriendliness must be marked 35 per cent. Add the marks in the positive column and divide them by ten (10). Add the marks in the negative column and divide by ten (10). Subtract the smaller number from the larger. The result is a figure which is some indication, for comparative purposes, of the general fitness and ability as a salesman.

Naturally the traits given a low score indicate where the person is weak in the opinion of the judges. Remember that it is not what the individual believes about himself, but what other persons think about him. The prospective salesman or the old time salesman can learn in this manner, where improvements can be made with the assurance that effort to improve the traits showing a low score will result in making the individual a better salesman.

1. Personal Appearance. Health and physique inspire a feeling of pleasantness in others. Poor health, poor physique, a general run-down feeling physically, can weaken directly most of one's powers of personality as well as produce in others a vaguely unpleasant feeling. Persistent poor health, or an inferior physique, leads to the development of an inferiority complex.

Wholesome food and plenty of exercise work wonders.

The physical factors of age, height and weight, so far as they are factors in personality, seem to have a bearing upon sales success. Color of eyes or complexion does not matter. Good salesmen are found among brunettes as well as blonds.

Age does not seem to be much of a factor, but more men seem to make notch sales records who are between the ages of 30 and 45 than men who are younger or much older than the figures given. Age should not be considered very much in the grading chart, because a young man of 22 may grade high on social ability and special ability, but fall far short on tact, present-mindedness and perseverance. A 50-year-old man might so excel in the last three traits that outstanding success is obtained in selling.

The average height of males in the United States is about 5 ft. 7½ in. Generally a height of two or three inches above this average is desirable in a salesman. Unusual height may make prospects feel at a disadvantage. Unusually short stature is a disadvantage in a salesmen, though the latter may possess other traits which make their personalities outstanding.

Weight likewise may make no difference, but successful salesmen tend to be slightly heavier than the average for their age and height. Excessive fat as well as extreme leanness is not desirable for the same reason that any peculiarity of countenance may cause a feeling of annoyance to prospects. This is illustrated by the history of a very good salesman who did not prove himself until he removed two large gold-covered front teeth and replaced them with inconspicuous porcelain-covered teeth.

Cleanliness has never lost a sale, but the lack of it loses many. Dirty hands, finger nails in mourning, baggy trousers, soiled collar and dusty shoes may never be noticed by a hard-boiled city truck driver or a rich but wholesome farmer. Any one of these little careless habits loses sales to many other prospects. Inexpensive but well brushed and pressed clothing, inconspicuous linen, clean face and hands, inoffensive breath are a real requirement for a successful salesman, but a loud-colored necktie on an otherwise spotless person can produce a detrimental feeling instantly. Salesmen should be neat and clean, but not overdressed or freakish.

Carelessness of personal appearance gives an impression of laziness and incompetence, and freakish dress is bad taste. People distrust both kinds. Dress for business and do not let anything such as baggy trousers and dirty fingernails on the side of laziness, or a loud-checked suit or a flaming necktie on the side of bad taste, detract from the business of selling. It is only among friends that "clothes do not make the man." Friends have an opportunity to know the individual behind the clothes, but remember that, as you approach a stranger, your clothing, cleanliness, height, weight and general personal appearance are usually taken, consciously or unconsciously as some index of your character. Dress and appearance are important, and the radio salesman cannot wait for a long acquaintance to make the prospect understand what fine fellow he is.

(To be continued)

As The Trade Thinketh . .

MANTON M. WYVELL:
Attorney, Washington, D. C.

"The most important development in radio during the last year has been the fact that the Federal Radio Commission in Washington, which was established by Congress in 1927, has brought order out of chaos, so that radio broadcasting now proceeds in an orderly and efficient manner with a minimum of interference."

K. R. SMITH:
Engineering Department of Brunswick-Balke-Collendar Company.

"Brunswick experimental laboratories have spent considerable time upon experimental television and find that any reports that have been brought before the public from time to time have been unfounded, and that many of the other experimental laboratories who have been reported as having found a solution to television, have in fact acknowledged that they are as far as ever from a perfected television receiver for the home as they were in the bginning."

W. I. JACOBY:
President, Kellogg Switchboard & Supply Company.

"Present values in radio receivers give the householder more for his dollar than he can obtain from the purchase of any other type of equipment for home entertainment or education."

MICHAEL ERT:
President, N. F. R. A.

"When books are balanced at the end of the year, it will show that the legitimate radio wholesaler and retailer who has been on his toes throughout the past year and who has been an active, energetic business man devoted to common sense principles will have prospered greater this year than ever before."

E. A. TRACEY:
National Union Radio Corp.

"If the radio industry is to continue its steady growth, it must stage and broadcast several spectacular sports events each year. This involves raising a large fund to create the events and guarantee the costs, with a possible reimbursement from gate receipts."

ERNEST KAUER:
President, CeCo Mfg. Co.

"Radio manufacturing is in a magnificent state of technical development. There is little excess of merchandise in warehouses or on dealers' shelves. The industry starts with a clean slate in 1930, and with economies in merchandising and distribution, which are being brought forward continually, this new year should be a profitable one."

EDGAR H. FELIX:
Radio Consultant, National Electrical Manufacturers' Association.

"The most desirable number of tubes for a radio receiver is the minimum number which will give satisfactory sensitivity and quality of reproduction. Every additional tube increases the background of noise, increases the current drain, and reduces the life of the rectifier tube."

ROBT. H. MARRIOTT:
Consulting Engineer, Federal Radio Commission.

"The demand for more stations may not result in many more stations, but it may result in continuous and comparatively rapid improvement of the stations that are permitted to broadcast. In other words, it may work out that the broadcaster will be required to make his station as good as possible, or get off the air, and let somebody on who will make a good station."

A New Field for Radio Manufacturers and Dealers In

THE IDEA of installing a radio receiver in an automobile is as old as radio itself, but not until recently has it shown signs of coming into general use. A year or so ago the Heina Corp. contracted to equip Stutz cars with radio and has been doing so to some extent ever since, until today, under its new name, the Automobile Radio Corporation, its products are available to all automotive manufacturers as well as to automotive jobbers and dealers.

Another company that is well known in the automotive industry, and that has recently entered the radio field, is Delco-Remy. This firm is equipping some of the General Motors' cars, namely Cadillacs and LaSalles, and also is offering its product for distribution through automotive jobbing houses. The Sonora Products Corporation also announces a compact power radio reproducer for installation in automobiles. Their factory is now being equipped for quantity production. Both the Automobile Radio Corporation's "Transitone" and the Delco-Remy radio receivers list for $150 to $185 complete and installed.

With the arrival of the Transitone-equipped Dodge Senior Six, the Delco-Remy equipped Cadillac and LaSalle and those that are sure to follow suit within the ensuing twelve months, comes the stage of much "pink sheet" publicity; Nancy and Emma of the "Follies" enjoying a breath of fresh air and a tuneful serenade between rehearsals, a party of explorers in the California jungles 40 miles from civilization keeping track of the stock reports or the ball game as they "explore," or the auto-radio family combining the pleasures of an evening's drive into the country with their favorite program. Such publicity will be (and *is*) designed to sell automobiles. It will sell automotive radio sets as well. Therefore it should be capitalized by the jobber and dealer.

Dodge Senior Dashboard with Transitone Radio

Cadillac Dashboard with Delco-Remy Radio.

The sets may be installed in any open or closed car, the installation involving the insertion of a screen antenna in the car's top, the substitution of a new dash board in the case of the Transitone, and the application of spark suppressors on all spark plugs and sparking contacts in addition to the comparatively simple proposition of hanging the receiver proper under the dash and fastening the speaker in its position, wherever that may be.

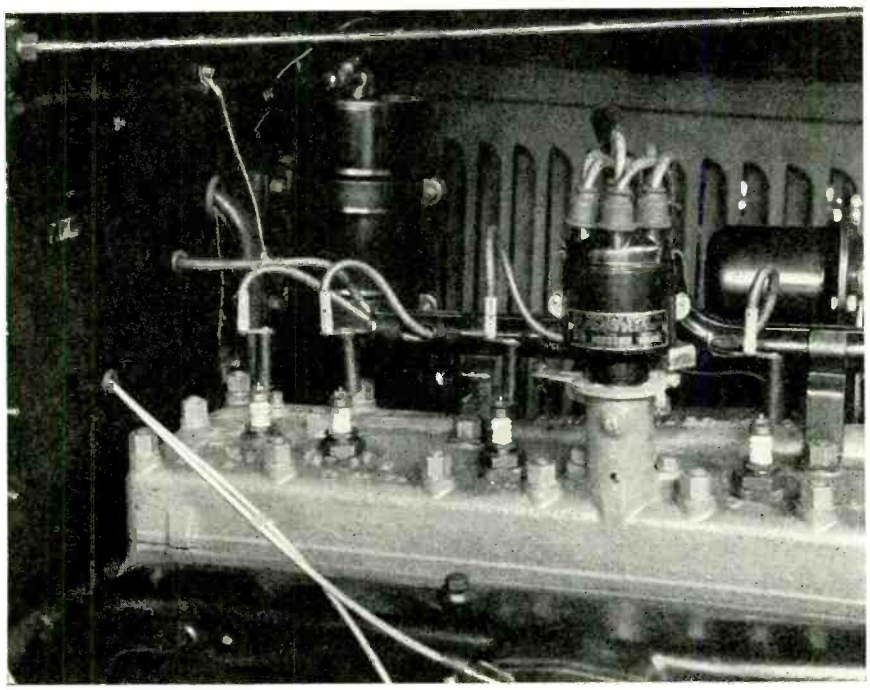
The installation of the antenna requires the services of an upholsterer. This type of work may be "farmed out" by the dealer unless he has a top man in his own organization. The substitution of a new dashboard is not the Waterloo it would seem due to the fact that the Automobile Radio Corporation has templates available for drilling them out, and supplies its dealers with the necessary plants for making these panels. Those dealers who do not care to turn out their own dashboards may order them from the manufacturer of the Transitone receiver. Very shortly these will be available for the dealers' shelves, should he wish to stock them.

This field not only offers the dealer a new accessory to sell but gives the automobile mechanic a chance to broaden his scope of activities. Although installing and servicing radio sets is out of the line of his usual endeavor, he will find his job a more lucrative one if he masters the intricacies of radio service. Especially during the first couple of years after the advent of the automobile radio, dealers are going to find most mechanics disinclined to "monkey" with something out of their line. Hence the far-sighted mechanic will doubly profit by making himself more valuable to his employer.

The Transitone is a six-tube receiver having three tuned r-f stages using '01-A tubes, detector employing a '00-A,

Sets More Work for the Service Man

Automobiles



Dodge Senior Ignition System Showing Spark Suppressors and Bonding

first audio with a '01-A, and power stage using a '12-A tube. Two controls are used, each operating a two-gang condenser, although it is understood that a single control job is in the process of development at the present time. The tubes are suspended top down and mounted on cushion sockets in order to absorb the jar, the old type UV bases being used to keep them from falling out.

The storage battery of the car supplies the filament voltage while a box containing three 45-volt dry B batteries is either mounted under the seat or suspended under the chassis. The speaker is of the magnetic horn type, although a cone or even a dynamic may be used. In closed cars the horn is usually mounted above the windshield or in the rear compartment or both. A jack is provided for an extension speaker which may be taken off to a distance of 100 feet or more for picnics or beach parties. The set is turned on by means of a key which locks the set when removed.

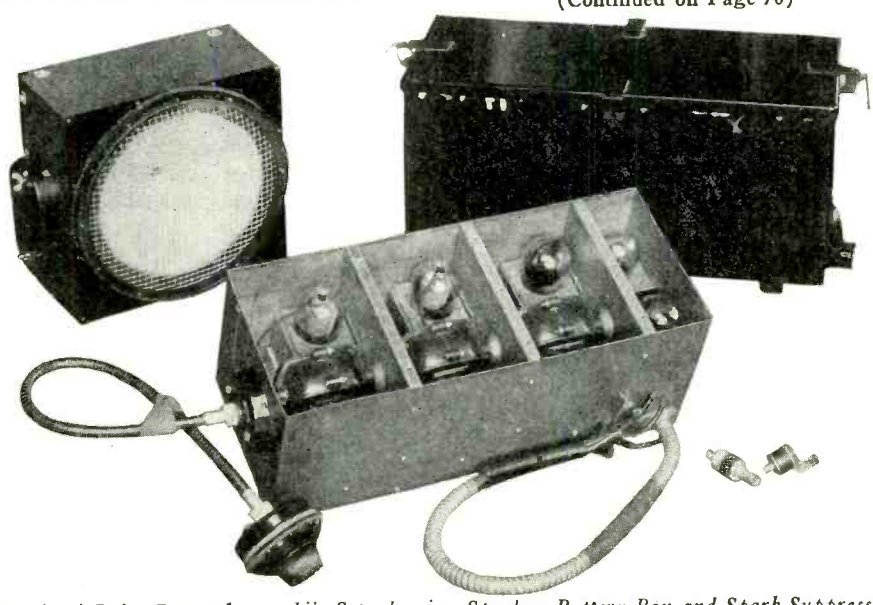
The Delco-Remy employs two tuned r-f stages in which type '24 a-c grid tubes are used. The detector is a '12-A, the first audio a '27, and the second audio a '12-A. The three a-c tubes are connected with their heaters in series so that the total current drain of the three is 1.75 amperes. Why d-c tubes were not used remains a mystery.

Tuning is accomplished by three variometers, all mounted on the same shaft, and a very clever arrangement of a dial and a speedometer cable makes it possible to mount nothing but the dial and the volume control on the dash board, putting the set proper wherever there happens to be room. The speaker furnished with this set is a small cone, protected by a box and a heavy screen across its front, which is usually mounted somewhere below the dash. The battery box is similar to that of the Transitone.

In installing either set it is necessary to eliminate the electrical disturbances caused by spark discharges in the motor. Therefore spark suppressors have been designed to be mounted on each spark plug and on the distributor-to-coil lead. A by-pass condenser is mounted across the generator contacts. These suppressors are merely high resistance units that tend to halt the flow of frequencies in the audio range and they have no effect whatsoever on the operation of the ignition system of the car. All wires in the ignition system should be enclosed in armored cable or copper tubing and all such cable and tubing should be carefully grounded. In modern cars this is usually pretty well cared for.

If the mechanic will put the following few rules for servicing these sets in his mental notebook he should soon become able to cope with any service problem that might arise. 1. If there is no signal or click in the loudspeaker when the key is turned on, first see if the tubes light. If not take a look at the fuse and the fuse contacts, see that the connection to the storage battery is neither loose nor corroded, and that the polarity is correct. To test this put a voltmeter

(Continued on Page 70)



Chassis of Delco-Remy Automobile Set, showing Speaker, Battery Box and Spark Suppressor

Radiotorial Comment

By the Editor

RADIO has failed to loosen the stranglehold of its old-man-of-the-sea, the Federal Radio Commission. Congress has given it a new lease on life and President Hoover has recommended that it be reorganized with the abolition of the zone method of selecting the commissioners. Thus the industry will be burdened with this non-essential for at least another year. When the terms of the present commissioners expire on February 23, it matters little whether they are reappointed or whether new men are put in their places.

Federal Radio Commission

For it is not the personnel which is criticized so much as it is the system which continues a body after it has outlived its usefulness. Since its allocation of wavelengths in 1928 it has performed no duty which could not have been done as well or better by the Radio Division of the Department of Commerce.

This Division, so far as broadcasting is concerned, is functioning merely as a traffic policeman without much authority or responsibility. Yet within its poorly paid personnel are many men who are better qualified by education, training and experience to do the Commission's work than are their superiors, the Commissioners.

And now it is proposed that the Commission be made "self-supporting" to the tune of $840,000 a year by the imposition of fees for applications and permits for the erection and operation of stations. But what about the broadcasters, whose businesses are most certainly not self-supporting even without the payment of the proposed fees? It's all wrong, sister, it's all wrong.

THE grid of a vacuum tube is the traffic cop who stands in the one-way street between the filament and plate. Electrons are the automobilists who, on a hot summer day are fleeing from the heat of the filament to the attractiveness of the plate. More and more of them leave as the filament gets hotter and hotter. More and more of them arrive as the plate gets more and more attractive, or positive. Their number determines the amount of plate current. This is regulated by the traffic-cop grid. It stops them, it slows them, it speeds them by its degree of negativeness; it even detours some of them by becoming positive. If this crude word picture aids in an understanding of the fundamental action of a vacuum tube, its purpose is accomplished.

Electron Traffic

THE National Better Business Bureau justly criticizes the radio industry for its circus style of advertising. Their impartial survey of radio advertising discloses an almost incredible parade of such superlatives as "greatest," "finest," "clearest," and "most." The Bureau points out that such unsupported claims do not create confidence in the mind of the buyer and that an industry which seeks full value for its advertising investment must give due consideration to facts and rational statements. It is suggested that radio manufacturers, in particular, express their willingness to voluntarily abandon "pure bunk" in an endeavor to correct this unhealthy condition. Those advertisers who do not exaggerate their claims for performance are conspicuous in contrast to those who do.

Exaggeration in Radio Advertising

THE ancient Romans had a two-faced god called Janus, one of whose faces looked back and the other looked forward. The month of January was named for him. Thus at the beginning of a new year it has become customary to look backward over the old and forward over the new, taking stock as it were. The backward view of radio accomplishment during 1929 is wide and varied. The forward view, though dimmer, is equally promising, especially if some of the lessons learned in hindsight are applied in foresight.

The Year in Retrospect

Practically speaking, it was a screen-grid year for the r-f circuit, these tubes partly replacing the three-element heater tube, and both of them almost forcing the filament type of a-c tube out of use. The first result of this displacement was the production of practically humless reception. Furthermore screen-grid tubes made some sets so sensitive that the sounds of interfering noises became as loud or louder than the sound of the desired distant programs. For the average location greater sensitivity is not wanted.

Great progress was also made in improving the selectivity of receivers, especially in the use of bandpass tuning. Greater selectivity than is now attainable would seriously cut the sidebands and thus spoil the fidelity of reproduction.

For the first time, plate detection has been more generally used than the grid-bias and resistance method. The trend toward unnecessary loudness of reproduction was stopped by the widespread use of

intermediate power tubes. The lower plate voltages thus required enabled a notable reduction in the cost of the power supply equipment.

Electro-dynamic speakers were the favorite, with magnetic speakers a poor second, and condenser type hardly recognized. Relatively few sets were equipped for automatic tuning, remote control, or automatic regulation of volume, these selling points still being largely left for use next year. Great strides were made in the practical minimization of interference to radio reception.

Comparatively little publicity has been given to any technical developments during the year. The less said about radiovision the better, for a while. Steady progress was made in the application of radio to aerial navigation. Much was learned about the vagaries of wave propagation, especially in the short wavelengths. The screen-grid tube was used as a detector and audio amplifier to some extent and considerable experimenting was done with five-element tubes.

Late in the year Loftin and White announced successful amplification without distortion by directly coupling the plate of a detector-amplifier tube to the grid of a power tube. The Bell Telephone Laboratories developed a practical crystal-controlled oscillator unit with temperature control that will enable a broadcast station to maintain a frequency within 50 cycles of that which it has been assigned.

From the sales standpoint, 1929 showed the greatest business in the industry's history, over 3½ million sets being sold, as compared with 2½ million sold in 1928, and 1½ million in 1927. But as more than 4½ million sets were made in the factories, there was an over-production of nearly one million sets. The year was profitable for most radio concerns although earnings were far below those anticipated. Due possibly to the development of the talking moving picture, there were unprecedented sales of power amplifying equipment.

The Year in Prospect

THE future of the radio industry is not quite so dubious as was painted at the time of the big slump in the stock market. While there will be storms to be weathered during 1930, and the shorn lamb must beware, manufacturers have given assurance that production will be limited so as not to again exceed a reasonable demand and that they will play fair with the dealer. There will be considerable carry-over of distress merchandise which must either be absorbed in a cut-price market or sold in foreign fields where last year's American product is still new.

The probable curtailment of production during the early part of 1930 may have somewhat of an adverse effect on the makers of parts and accessories. But their decreased sales do not necessarily mean smaller profits, either for them or the manufacturers who use most of their output. Even with a production schedule of one-fourth less than that of last year, there should be a reduction in selling costs which should allow at least the same net profit. Much of the high cost of selling has been due to the tremendous effort to sell excess production.

The greatest market during 1930 should come from the replacement of old battery-operated sets with new a-c receivers. While this was counted upon for 1929, owners were not satisfied that the new screen-grid sets gave sufficiently improved results to justify the change. New models whose circuits more efficiently utilize the greater amplification of screen-grid tubes will be necessary to junk the old ones. Since, once a radio owner almost invariably means always a radio owner, each old set which is no longer serviceable calls for a new one to replace it.

Then again there is the two-set family market yet to be fully developed. Two sets in different parts of the house are the only means for satisfying a family whose younger members want dance music while the old folks want lectures or semi-classical music. And even where two sets cannot be sold there is a demand for an extra loudspeaker with remote control of the set which operates it.

From present indications there are no revolutionary changes in sight. The periodic flare-ups of publicity about radio vision do not mean that satisfactory receiving equipment can be put in the hands of the consumer during 1930 at least. Under any condition the most promising research is being done along lines which will require a specialized receiver entirely distinct from that used to receive speech and music.

A number of new battery-operated sets will be introduced for use in places where alternating current is not supplied, including country homes, automobiles and motorboats. Many sets will be equipped for remote control, with the possibility that some will be so half-baked as to give a black eye to all of them.

One disturbing factor in the general situation is the delusion on the part of some manufacturers that all sales obstacles can be surmounted by additional selling pressure, thus expanding the market at will. This delusion usually becomes apparent in efforts to force more sets upon dealers than can be sold without price cuts. The dealer has little or nothing to say about policies which are dictated by the factory and too often has been left to hold the bag. Too many receivers forced into the hands of the dealer will force the dealer in the hands of the receiver.

When distribution is accomplished through the jobber he can do much to create a strong, profit-making organization for the manufacturers if given the right kind of help and if consulted before any drastic change is made in policy. This should include a cleanup or takeup of old models before new models are introduced. Furthermore new models should not be featured unless they contain enough mechanical improvement and laboratory design to justify the change. The factory's biggest problem is to build dealer confidence and satisfaction.

For that Hard-to-Sell Customer—SILVER RADIO

THE CONCERT GRAND, illustrated, is of beautiful and unusually substantial construction. Four-way matched butt walnut, carefully selected oriental walnut side panels, birds-eye maple center panel. Priced complete, less only tubes, $173. West of the Rockies, $183.

Also Sliding Door Highboy, $195.00. West of Rockies, $210.00.

You know, as well as we, that the customer who now buys from you a good radio at a stable price is going to be far better pleased, with it, with you, and with himself, than if he buys a piece of distress merchandise on which you make much less money and run far greater risks of service troubles—but how to convince that hard-boiled customer! That is the question which has been so conclusively answered by SILVER RADIO and its "4 Amazing Tests"—tests you can perform anywhere—irrespective of antennas and atmospherics.

Truly, SILVER RADIO is the sledge-hammer in the hand of the aggressive dealer who demolishes obstacles and builds for the future.

SILVER *Radio*

. EXTRAORDINARY .

MODEL 60 LOWBOY is built of antique-finished, hand-rubbed and polished walnut, and exemplifies the beautiful Colonial period in furniture design. Its eight-tube screen-grid radio and speaker are identically the same as in the Concert Grand—making the Model 60 a value absolutely without precedent. Complete, less only tubes, $160. West of the Rockies, $170.

SILVER RADIO, designed by McMurdo Silver and manufactured by Silver-Marshall, has four screen-grid tubes and needs no antenna for local or distance reception. It embodies band-selector tuning, as well as the famous Overtone Switch which reduces static and achieves unprecedented brilliance of tone reproduction.

AMERICA'S · FIRST · MAKERS · OF · SCREEN-GRID · RADIOS

DEMONSTRATING A RADIO SET WITH RECORDS

By E. F. BALDWIN

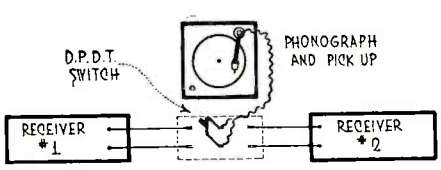
SINCE the public has been awakened to the fact that true reproduction of original sound is a good basis for deciding what radio set to buy, the successful radio merchant should try to sell a set by comparing its tone rendition with that of other sets. The public ear is becoming surprisingly alert and intensely critical so far as tone values are concerned. The buyer wants true-pitched natural speech and music with all the glorious tones, the delicate colors and the subtle shadings of the original production.

Nor is it sufficient that a set merely reproduce all audible frequencies uniformly. True reproduction also requires that the pitch of the radio music be the same as the original. How often do you hear a piano selection that is two or three octaves off pitch? How many people object to the boom-boom of the bass or the blasting of the treble.

Although there are few musical instruments on the market which have sufficient range to cover the full possibilities of the audio-frequency amplifier in a good radio set, a simple demonstration of the brilliant fanfare of a full orchestra, the singing of strings, the roar of tympany, the blare of brasses and the chanting of woodwinds, either separately or in combination, may easily be made with phonograph records.

A record is better for this purpose than a broadcast program which, once heard, is not again available for comparison from another set, which is the only satisfactory test whereby a critical buyer may judge relative merits. Furthermore many a sale has been lost because of poor daytime programs or poor receiving conditions.

Among the records which the writer has found best suited for such a demonstration are the Victor records "In a Clock Store" and "Piccolo Pete," as well as the Columbia "Blue Blowers' Blues." These contain many notes not heard from ordinary records and cover a frequency range that but few sets can reproduce. Of course a good pick-up unit is essential.



Arrangement for Demonstrating Two Receivers With One Unit

"Blue Blowers' Blues," Columbia 1442-D, low and high notes.

"In a Clock Store," Victor 35, 792-A, high notes.

"Piccolo Pete," Victor 22, 037-A, has one high note which few sets will reproduce.

The Retail Parts Business

By JOHN R. CARSON

ONCE upon a time the retail parts business was the mainstay of the industry; today the survivors are battling for the remnants of a sadly attenuated market. In recent months several of the principal parts manufacturers have gone into the set business, and parts with them is now a secondary consideration. What of tomorrow?

During the present season, some of the country's leading radio parts mail order houses have gone out of business; the remainder, with the surviving parts manufacturers, are studying ways and means of maintaining profits from a declining market. The general trend is to cut the jobber's 50 and 10 to a straight 40 per cent, with a maximum retail discount of 30 per cent. Others are ruthlessly switching their policy to limit the number of wholesale outlets, dealers are diminishing, and jobbers are cutting into the retail business.

These are all straws that indicate the path of the wintry blast that has stricken the parts business. Where is the retail market of the future? The retail parts business has been dwindling in proportion as the factory-built receivers have improved in quality and fallen in price. The home setbuilder has become of less and less importance, and while there are still several thousands of professional setbuilders scattered throughout the country, these are turning more and more to service and installation work, which takes less selling.

For a time it looked as though these men would turn seriously to power amplification and public address work. The custom-built amplifier, however, especially where three or more stages of amplification were involved, was too big a problem for the average setbuilder. Coincidentally the factory-built amplifier became a practical commercial proposition, and so another prospective market melted away overnight. At the moment, the setbuilder, who should be the mainstay of the parts retailer, is making a precarious living bringing old-type sets up-to-date by the addition of medium-powered audio amplifier stages, and adapting them to use dynamic speakers.

But even that class of business is very spotty and can not be relied upon to continue through another season. Some of the receiver kit manufacturers are making noble efforts to keep the professional setbuilder in business, but the latter is working under the handicap of having to educate his prospects into believing that the tone quality of factory models is inferior to that of custom-built jobs to the tune of quite a few dollars. And that is an increasingly difficult job.

On the other hand, to inject a little optimism into the picture, we have the experimenter who, like the pauper, will always be with us, and the tyro—principally the schoolboy. These will in all probability always exist in sufficient numbers to comprise an appreciable market for parts other than those used for transmission purposes. Should television—properly radiovision—become a practical proposition within a reasonable period, or some other form of radio application be developed, the parts business will take on a new lease of life. Till then there can hardly be any improvement in the matter of demand.

Some manufacturers think that the parts market today is at its lowest ebb; that the demand will not, for a very long time, fall below what it is today. If that is so, there is a nice volume of business for a few in the parts field. The next development is the shrinkage in the number of retail outlets, as it is very clearly not economically possible for them all to survive on parts alone. It is solely and purely the business in accessories that has saved the day for them so far. And that is another angle of the situation. For how long will there be a substantial demand for accessories?

More and more sets are being sold complete with the tubes specified by the manufacturer. More and more manufacturers are buying up or obtaining a controlling interest in tube factories. Sets are being retailed fully equipped. There are fewer and fewer accessories adaptable to them. Many do not even require aerials or grounds.

Taken all in all then, it seems that the retail parts business will very soon see a weeding out of the weaker brethren. The jobber will be no more, and the surviving dealers will be few in number and doing a nice volume of business without any fortunes being made. Most of them will get further and further into the receiver business, others will be caricatures of drug stores, carrying a little of this and a little of that—electric appliances, cameras, clocks, and what not. That, at least, is the writer's opinion, but he is open to correction.

Audio-Frequency *Amplification* With *Screen Grid* Tubes

How it may be satisfactorily accomplished with transformer, auto-transformer, resonated primary transformer, or impedance coupling.

By **FREDERICK EMMONS TERMAN**
Stanford University

"It is probable that, as time goes on, screen-grid audio-frequency amplification will be used more and more, and may ultimately displace the three-element tube for this purpose."

THE screen grid tube has played a very important part in the general field of radio frequency amplification within the last two years, but at the same time has hardly been considered for audio frequency amplification until recently. There are good reasons for this situation, especially since the plate resistance of the screen grid tube is tremendously high in comparison with the plate resistance of three-element tubes. As a result, while a screen grid tube will satisfactorily amplify a narrow band of frequencies in which the ratio of highest to lowest frequencies is nearly unity, it gives very uneven amplification where the ratio of highest to lowest frequencies is very large, as is the case in audio amplifiers.

To attempt to secure a-f amplification by inserting an ordinary transformer in the plate circuit of a screen grid tube, just as would be done with a three-electrode tube, gives an amplification characteristic like that shown in Fig. 1. The principal feature of this characteristic is that the quality is something worse than terrible, since the amplification is large but extremely uneven. For purposes of comparison the dotted curve in Fig. 1 has been added to show the characteristic that would be obtained with the same transformer operated in the usual way in conjunction with a three-element tube. The reason for the difference between the two tubes with the same transformer lies in the extremely high plate resistance of the screen grid tube.

In ordinary a-f amplification a flat characteristic is obtained by making the primary impedance of the transformer greater than the plate resistance of the tube over the essential band of frequencies to be amplified. This results in a flat characteristic as shown dotted in Fig. 1. In the screen grid tube, on the other hand, the plate resistance is high and the amplification is proportional to the impedance at the primary terminals of the transformer. This impedance changes greatly with frequency, giving the resonance type of amplification characteristic shown in Fig. 1. As long as the impedance across the primary of the transformer is greater than the plate resistance, the flat characteristic will be obtained irrespective of the excess value of the primary impedance. There is no possibility of the screen grid a-f amplification obtaining the flat characteristic in this way because of the high plate resistance of the tube, and it is necessary to resort to some other device.

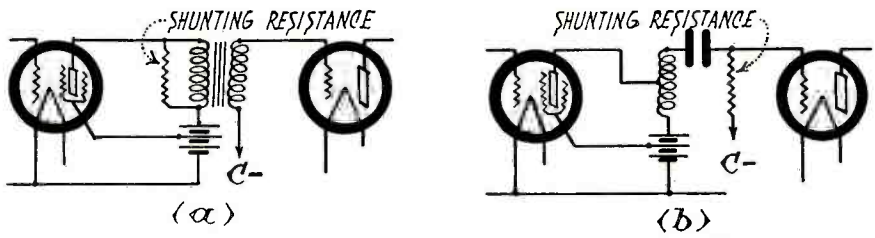


Fig. 2. (a) Circuit for Transformer-Coupled A-F Amplifier; (b) Circuit for Auto-Transformer-Coupled A-F Amplifier

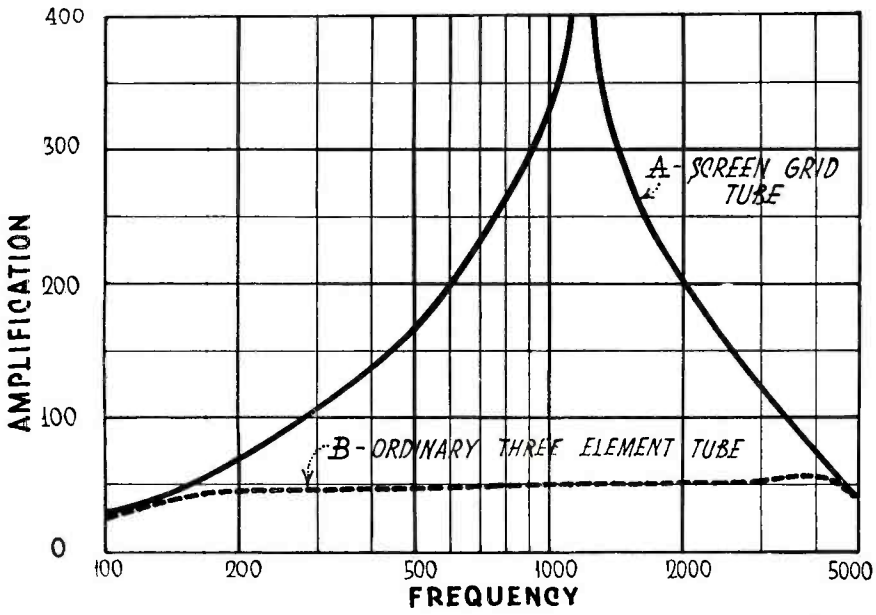


Fig. 1. Comparison of A-F Amplification Characteristics Given by Same Transformer: (a) Screen-Grid Tube without a Shunting Resistance in the Plate Circuit; (b) Three-Element Tube

Amplification With Transformer Coupling

IN ORDER to obtain a flat amplification characteristic when the plate resistance is extremely high the impedance across the primary of the transformer must be substantially constant for all frequencies that are to be amplified. This can be accomplished by shunting a resistance across either the primary or the secondary of the transformer as shown in Fig. 2a. The impedance at the transformer terminals can then never exceed the value of this resistance, no matter how great is the impedance of the transformer primary. In this way it is possible to obtain a flat characteristic at all frequencies for which the transformer impedance is at least as great as the shunt resistance. If a resistance is placed across the secondary it has the same effect as a different and somewhat smaller resistance across the primary.

The proper value of resistance to use across the transformer of the screen grid

a-f amplifier can be determined by a very simple rule: When a resistance R is connected across the primary of a transformer the amplification characteristic with a screen grid tube is exactly the same as the characteristic which would be obtained when the same transformer is used in the usual way in a three-electrode tube having a plate resistance of R. The general rule then is to shunt the primary of the transformer with a resistance equal to the plate resistance for which the transformer is designed when used in connection with a three-element tube. This generally means a resistance of 10,000 to 15,000 ohms. If it is desired to place the resistance across the transformer secondary instead of the primary the proper value to use is the value that would be put across the primary *times* the square of the turn ratio of the transformer.

The amount of amplification that can be obtained from a screen grid a-f amplifier with shunting resistance is equal to the shunt resistance *times* the mutual conductance of the tube *times* the turn ratio. With a mutual conductance of 1,000 micromhos, a shunt resistance of 10,000 ohms, and a turn ratio of 4 to 1, the amplification will be

$$10{,}000 \times 1{,}000 \times 10^{6} \times 4 = 40.$$

It will be noticed that the amount of amplification available will be increased by increasing the shunt resistance, but this in turn gives the effect of using a high plate resistance with a three-electrode amplifier, and results in correspondingly poor reproduction of the low notes. When one compares the amount of amplification that can be obtained from screen grid and three-element tubes it is found that the ratio of amplification in the two cases is equal to the ratio of the mutual conductances. Therefore the transformer-coupled screen grid a-f with a shunt resistance is better or poorer than amplification with ordinary three-element tubes in proportion to the higher or lower mutual conductance of the screen grid tube. Inasmuch as the screen grid tubes have mutual conductance of about 1000 micromhos compared with 500 for the type '27 tubes, screen grid tubes will give somewhat greater amplification when the quality is kept the same in the two cases.

In screen grid amplifiers it is necessary to be sure that the rather large plate current does not saturate the core of the a-f transformer. The usual transformer will stand at least 4 to 6 milliamperes, and so trouble will not ordinarily result from this cause, although it is a point that should always be kept in mind.

Amplification With Auto-Transformer Coupling

Instead of connecting the transformer as shown in Fig. 2a, it would be possible to use the auto-transformer connection shown in Fig. 2b, which is obtained by connecting the primary and secondary in series. This circuit is essentially equivalent in its electrical properties to the case where separate primary and secondary are used. In order to obtain uniform amplification with this arrangement, it is necessary to use a shunt resistance across either primary or secondary as in Fig. 2b.

The auto-transformer already shown in Fig. 2b has the advantage over the regular transformer circuit in an extra amount of amplification, the ratio for the two cases being $(N + 1)/N$ where N is the turn ratio. This shows that with a ratio of 3 to 1 the auto-transformer connection will give 4/3 as much amplification as the same transformer used in the ordinary way. This gain is not large but is still appreciable.

A disadvantage of the auto-transformer coupling is that it requires the use of a grid leak and grid condenser to keep the high plate voltage off the grid of the succeeding tube. Grid leak and grid condenser arrangements are apt to give trouble because of the leakage current through the condenser. By using a high quality condenser and giving the grid leak a resistance that enables it to act as the shunting resistance, it is possible to obtain satisfactory results with this circuit.

A proper value of leak to use is equal to the plate resistance that would be used if the transformer were associated with a three-element tube in the usual way, *times* $(N + 1)^2$. The grid condenser should have a capacity of 0.1 μf or more.

Resonated Primary Amplifiers

It is possible to use the Clough system of resonated primary amplification with both the transformer and the auto-transformer-coupled screen grid amplifier. The circuits for these two cases are shown in Fig. 3a and 3b respectively. The effect of the resonated primary is the same here as with three-element tubes and has the effect of increasing the amplification at the lower audio-frequencies. The shunt resistance must be across the condenser and transformer primary as shown in the figure in order to allow for the passage of the plate current, and must have a value just the same as though the resonance principle were not used. With three-element tubes the Clough system uses a high shunt resistance that is a number of times the plate resistance of the tube, but a lower resistance is best where the plate resistance of the tube is extremely high, as in the case of the screen grid tube.

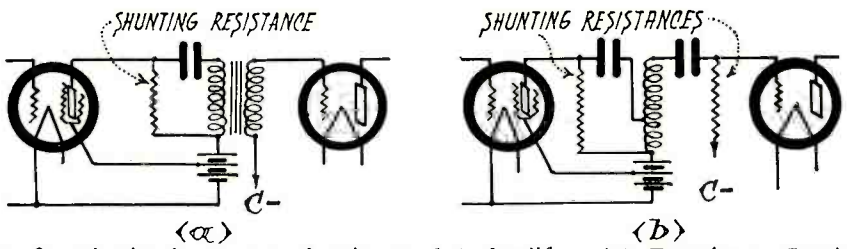


Fig. 3. Circuits for Resonated Primary A-F Amplifier: (a) Transformer-Coupled; (b) Auto-Transformer-Coupled

The advantage of using the resonated primary system of amplification is in the better reproduction of the low notes that is obtained. It is possible by this means to obtain a flat characteristic down to a frequency that is only 70 per cent of that at which the flat characteristic ends when using the same transformer in the usual way. That is, when the transformer would ordinarily begin to give lower response below 100 cycles, the resonated feature will cause the amplifier characteristics to be flat down to about 70 cycles. This is a real gain and is worth getting under any circumstances. The disadvantage of the resonated primary amplifier is that the plate current must flow through the shunt resistance and it is therefore necessary to use a higher battery voltage than is required on the plate. With the usual screen grid tube the shunt resistance will consume about 60 volts, which requires an added voltage of this amount from the B battery.

Amplification With Impedance Coupling

The circuit for this type of amplification is shown in Fig. 4a, where L is a very high inductance. It is possible to obtain this inductance by connecting the primary and secondary of an ordinary a-f transformer in series aiding, which will give a total inductance $(N + 1)^2$ times the primary inductance of the transformer. The coupling impedance must employ a grid leak resistance of

(Continued on Page 74)

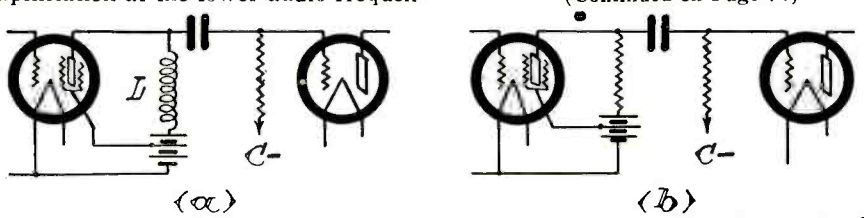


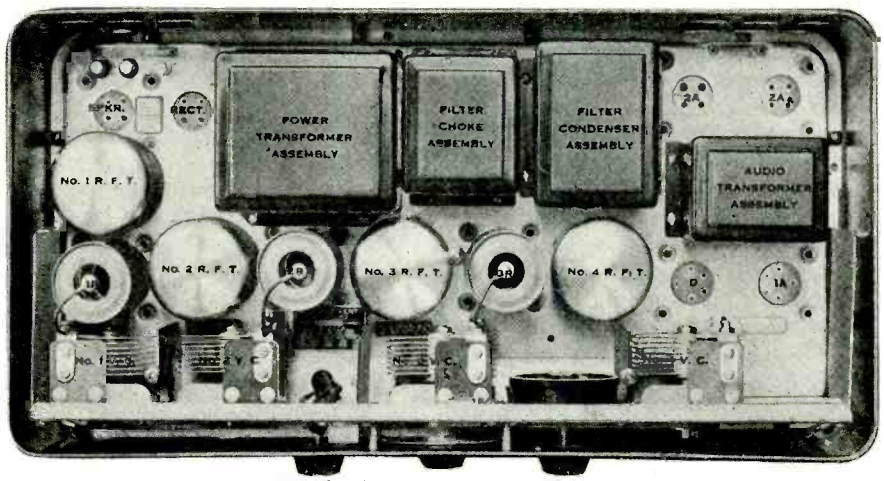
Fig. 4. (a) Circuit for Impedance-Coupled; (b) Circuit for Transformer-Coupled A-F Amplifier

ATWATER KENT MODELS 60 & 60-C

THE Atwater Kent 60 has evolved from an inductively coupled tuned r-f receiver to the capacitively coupled tuner shown in Fig. 1. The changes, which will be pointed out later, have been made gradually since the advent of this set; not all at one time.

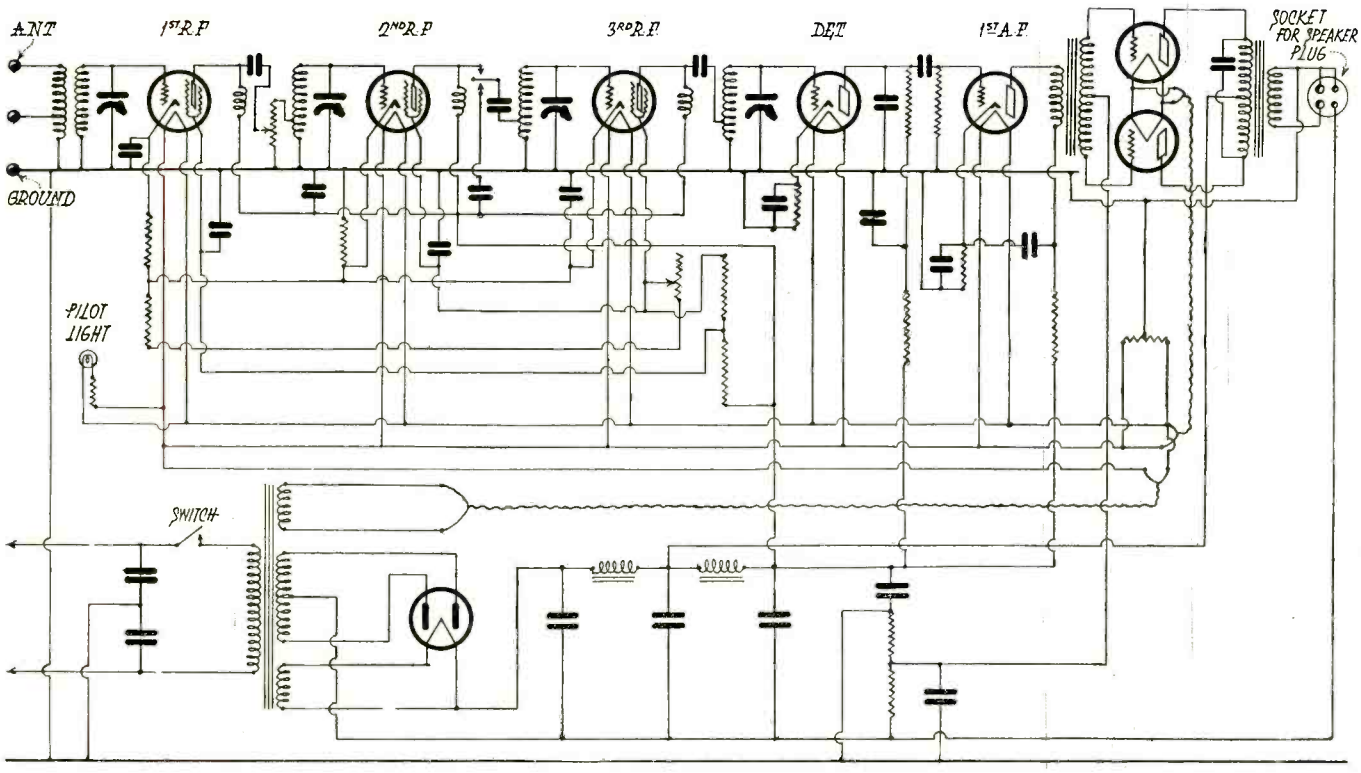
This receiver contains three tuned r-f stages in which '24 tubes are employed. The detector is a '27, as is the first audio tube, and the two push-pull power tubes are '45s. The antenna is conductively coupled to the grid circuit of the first r-f tube, the primary of this autoformer being tapped for use with a long antenna. The grid bias for the first tube is supplied from the voltage drop through the resistor which connects the first cathode to a bleeder resistor and the drop through another resistor which connects the second and third cathodes to ground and furnishes bias for the second and third grids. The bleeder resistor, the variable volume control resistor, and the two resistors which separate the moving arm of the volume control from the positive line, constitute a voltage divider which delivers, in order from positive to negative, plate voltage for the three r-f tubes, screen grid voltage for the first r-f tube, screen grid voltage for the second and third r-f tubes, and grid bias for the second and third r-f tubes. Reduction of the resistance in this section of the volume control allows more current to pass through the used portion and the other bleeder resistors, increasing the voltage drop through the cathode to ground resistor, hence the grid bias.

The three r-f plates are fed through individual r-f chokes, which are extremely critical as to their position in the chassis, the size of the bolts which secure them, and whatever other mechanical gadjets that happen to lie within the boundaries of their magnetic fields. By-pass condensers are used on



Chassis of Atwater Kent Model 60

CIRCUIT DIAGRAM OF ATWATER KENT 60



ATWATER KENT MODEL 60--Continued

the first r-f cathode lead, the first screen grid lead, the second and third screen grid lead, the second and third cathode lead, and the common r-f plate lead.

The output from the first r-f tube is coupled to the second grid circuit through a fixed condenser and one variable section of a potentiometer located between a tap in the grid coil and ground. This potentiometer comprises the other section of the dual volume control, increasing the amount of signal energy allowed on the second grid simultaneously with the bias on this grid. A "local-distance" switch in the output circuit of the second r-f tube connects the tap in the third grid coil through the coupling condenser to the plate of the second tube for strong reception, and to the high potential side of the choke through a fixed condenser for local reception. The sensitivity curve shows a great differential between the gain of the two systems. The coupling between the third r-f stage and detector is identical to the "distance" coupling in the previous stage except for the switch.

Plate rectification is used in the detector, grid bias being supplied from the drop through a cathode to ground resistor. The latter is by-passed to ground. An output filter in the plate circuit blocks the passage of any r-f component to the coupling condenser in the resistance-coupled a-f stage which follows. An a-f by-pass condenser and a filter resistor are used in the detector plate lead to isolate the audio frequencies from the power supply.

The first audio tube is biased with a cathode-to-ground resistor of its own and is equipped with an audio filtering arrangement in the plate lead similar to that of the detector, except for the fact that the audio frequencies reach ground through the cathode resistor by-pass condenser as well as the by-pass condenser used to filter the output circuit. Transformer coupling is employed between the first and second a-f stages. The grid return of the final push-pull stage goes to the negative high potential lead through the grid bias resistor for this stage, another resistor going to ground in order to provide a path for current flow. The output transformer is mounted in the chassis.

The power unit contains a four-winding transformer, the primary of which is shunted by a pair of condensers in series, center-tap grounded. One filament secondary serves all tubes, with the exception of the rectifier. The filter system consists of two chokes in the usual double π circuit.

For the service man who might happen onto one of the earlier models of the Atwater Kent 60 it might be said that the only differences from the set just described were in the r-f unit. Inductive transformer coupling was used between each stage, plates being fed direct through the primaries with one by-pass condenser on the common plate lead. A single volume control was used, this being similar to the bias control in the later model, but being a potentiometer between the positive high voltage line and ground, the moving arm going to the three screen grids. The theory is fundamentally the same.

The voltage readings shown herewith will prove to be very handy for the service man who is not equipped with the Atwater Kent service manual with which Atwater Kent dealers are supplied. Terms *G1R, P2A, CD, —F2A* or *—F2Aa, G3R*, etc., indicate, respectively, cathode 1st r-f, plate 2nd a-f, cathode detector, negative filament (as marked on socket), 2nd a-f, grid 3rd r-f, etc. A high resistance d-c voltmeter should be used to measure plate and grid voltages.

Voltage Readings on Atwater Kent Model 60, 60-C Receiver (60 Cycle)

	Measure Across	Approx. Voltage 110 V. Line	Approx. Voltage 120 V. Line	No Reading Indicates‡
Filament Voltages	—F to +F Contacts On each Receiving Tube Socket. F1 to F2 on Rectifier Tube Socket.	2.2 4.5	2.4 4.9	Open filament winding or connection.
Plate Voltages	C1R to P1R.	156	170	Open high voltage winding, open speaker magnet coil, open filter choke, open primary No. 2 R.F.T., †† open R.F. bias resistor, or open 1st R.F. bias resistor.
	C2R to P2R.	160	175	Open primary No. 3 R.F.T.††
	C3R to P3R.	160	175	Open primary No. 4 R.F.T.††
	CD to PD.	101	110	Open detector filter resistor, coupling resistor, R.F. choke, or det. bias resistor.†
	C1A to P1A.	69	75	Open 1st A.F. filter resistor, primary of A.F. input transformer, or 1st A.F. bias resistor.
	—F2A to P2A.	230	250	Open primary of output transformer.
	—F2Aa to P2Aa.	230	250	
Grid Voltages	C1R to G1R.	7.3	8	Open secondary No. 1 R.F.T.
	C2R to G2R.	3.7	4	Open secondary No. 2 R.F.T.
	C3R to G3R.	3.7	4	Open secondary No. 3 R.F.T.
	CD to GD.	11	12	Open secondary No. 4 R.F.T.
	C1A to G1A.*	1.8	2	Open 1st A.F. grid leak.
	—F2A to G2A.	44	48	Open 2nd A.F. bias resistor No. 2 or secondary of input A.F. transformer.**
	—F2Aa to G2Aa.	44	48	
Screen Voltages	C1R to S1R.	119	130	Open connection to slider of volume control, open volume-control resistor, or open bleeder resistor.‡‡
	C2R to S2R.	83	96	
	C3R to S3R.	83	96	

* This is the measured voltage, not the actual operating voltage.

** If 2nd A.F. bias resistor No. 1 is open, the grid voltage will be approximately 85.

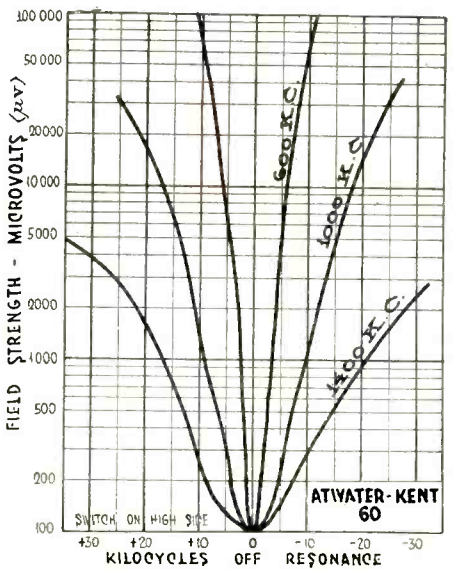
† The detector plate voltage will be low, and the detector grid voltage high, if the "phone" condenser is shorted.

†† In later Model 60 and 60-C, the primaries of No. 2, 3 and 4 R.F.T. are replaced by R.F. choke coils mounted under the chassis.

‡ Low plate, screen, or grid voltages may indicate a partially shorted by-pass or filter condenser.

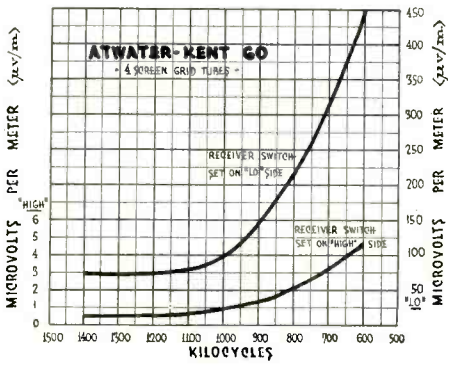
‡‡ In early Model 60 and 60-C, incorrect voltage on 1st R.F. screen may be caused by defective screen-grid resistor No. 1 or 2.

PERFORMANCE CURVES OF ATWATER KENT 60



Atwater Kent Selectivity Curves

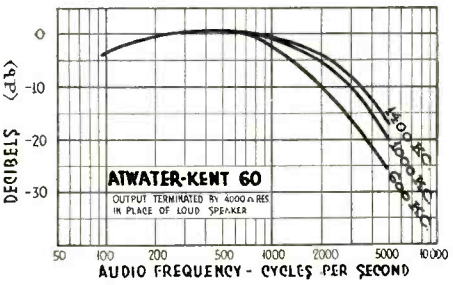
Selectivity is a good talking point in the Atwater Kent Model 60. Although the extreme sharpness at 600 kc denotes a serious cutting of the sidebands; or, to put it in another way, a reduction of the high audio frequencies, it indicates that even a strong local station would do very little interfering with the reception of a weak distant station. Coupled with the excellent sensitivity of this receiver the Dx hound, if such still exists, should be perfectly satisfied. Selectivity at 1400 kc, while not nearly as good as at 600 kc, is also well above average. These curves were taken with the receiver switch on the HIGH side in order to show the receiver's selectivity when tuned to a weak station.



Sensitivity Curves of Atwater Kent

The upper sensitivity curve of the Atwater Kent 60 shows only the maximum sensitivity possible when the receiver switch is set for local reception. As such it does not indicate anything particularly useful. When the switch is set on the high side, however, the sensitivity curve almost drops off the graph paper; so low, in fact, that a different scale had to be used to keep the curve from mingling with the zero line.

Only one-half of one microvolt per meter antenna height, or, in this case, a total field strength of 2 microvolts is required from a broadcast station to enable the receiver to energize the loudspeaker with 50 mw. If the antenna were higher, even a smaller field strength would be requird. In any case the gain is so great that room volume may be secured with a very minute signal strength.



Atwater Kent Fidelity

The sudden drop in the Atwater Kent fidelity curve is due in part to the extreme selectivity and in part to the audio apparatus. The high frequencies are rather seriously attenuated on all radio frequencies which results in a lack of brilliance as well as the loss of the harmonics which give fullness to a tone.

THE SCREEN GRID PRINCIPLE

By J. EDWARD JONES

As THE first screen grid season reaches its peak, the concensus of opinion appears to be that the much heralded obsolescence of all other types of receivers is failing to materialize. Among the most successful manufacturers are those that are producing both screen grid and non-screen grid models. One or two producing only screen grid are finding their gross considerably below last year's figure, while some that have never put on the market anything but a non-screen grid job are enjoying a successful year.

To what does this condition point? Not to the failure of the screen grid principle, for the tube itself is admittedly a success. Circuit development is the limiting factor. Years of circuit development were necessary to utilize the full efficiency of such tubes as the '99, '01-A and the '26.

The '24 screen grid tube introduces characteristics so different that during the limited time since its advent no circuit has been devised that can make use of even one-fifth of its potential efficiency. Nevertheless, sets have been produced using only three screen grid tubes that compare favorably in every respect with sets using eight or nine '27's or '26's.

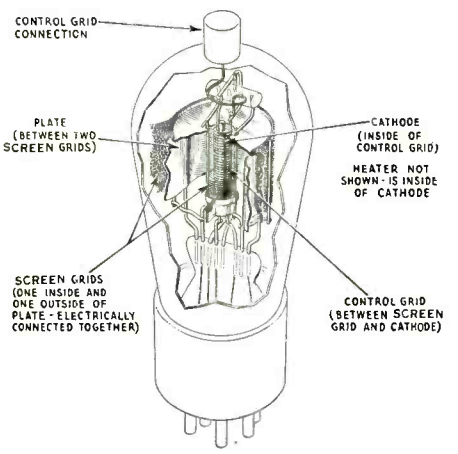


Fig. 1. Construction of Screen-Grid Tubes

The '27 tube, with its a-c heated cathode, its control grid and its anode or plate, has three elements which give it its name of triode. The '24, in addition to these three elements, has a fourth or screen grid, and hence is called a tetrode.

In the triode each element acts as one plate of a small condenser. At broadcast frequencies the capacities between cathode and grid and between cathode and plate have little effect on operation except that they tend to increase the capacity between grid and plate. This varies in different triodes from 3 to 10 mmf and has a marked effect on the tube's performance at radio frequencies, especially in a coupling of the input and output circuits. This causes energy to be fed back from the output to the input circuit and even absorbs energy from the input circuit. The voltage impressed across this capacity increases with the amplification constant.

Various methods have been used to nullify this detrimental parasite, the best two probably being the Rice and the Hazeltine methods of neutralization. But they are only makeshifts as they merely neutralize the effect and not the capacity itself. Thus this capacity limits the transfer of energy from one circuit to the next. It therefore limits the gain per stage regardless of amplification factor.

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In the '24 tetrode, the plate is shielded from the control grid by a screen placed around the plate. Remember, the plate is shielded by an additional screen grid. This arrangement reduces the effective grid-plate capacity to approximately 1/100 mmf, a value 1/300 less than that of the '27, which in turn is the most efficient tube in the triode class. This low inter-electrode capacity removes gain limitation from the tube itself. The limits are now in the circuit, coupling between different parts, and the necessity for selectivity, etc.

The amplification factor of the '27 is 9, while the '24 has a value of 420. Why this enormous difference? What is the amplification factor? Simply, it is the ratio of the voltage change in the plate circuit to that impressed on the grid. The amplification factor is expressed by the Greek letter *mu* and equals the mutual conductance times the plate impedance. The mutual conductance is also called grid control factor, and is expressed by the letter G_m; the plate impedance is the plate resistance to alternating currents and is expressed R_p. As *mu* equals G_m times R_p, any increase in one or both will increase the *mu*.

There is a region of dense space charge near the heated cathode. Shielding this charge from the electric field of the plate increases the plate impedance in the triode; placing the grid as close as physically possible to the cathode and the mesh made as dense as possible, increases the mutual conductance. However, increasing density of grid mesh construction for given spacing and applied voltages beyond a certain value, the value of G_m falls rapidly. Therefore, a definite maximum *mu* is found which cannot be exceeded on account of the decrease in G_m, the grid control factor, that eventually accompanies any change in tube construction that would tend to increase R_p.

The '24 screen is a fairly dense mesh insulated from the plate but covering both the inside and outside surfaces. The screen is brought to the usual control grid connection in the base. The cathode and plate are brought to the same terminals as in the '27. The plate is very thoroughly screened from the control grid; even the leads are separated, the control grid being brought to the cap on the top of the tube.

The two factors of *mu* in the triode are increased by the control grid, its shielding effect increasing the plate resistance while its mesh controls the mutual conductance and the plate current. The tetrode, or '24, is merely a tube in which these two functions are separated, the control function being retained by a grid placed close to the cathode and the shielding function being assigned to a second grid which is interposed between the control grid and the plate. An assisting field is created between the control grid and the plate by impressing a substantial positive bias on the screen grid.

For the same value of the control factor that is obtained in the best triode, the plate resistance may be increased almost indefinitely by proper spacing and biasing of screen grid. The amplification factor of any one electrode with respect to a second electrode is determined by the relative effect of the two electrodes upon the space charge at the surface of the terminal. In the '24 form of tetrode, the relative effects on the screen grid and the control grid define one partial amplification factor, which corresponds to the amplification factor of a single triode. The relative effects of the plate and the screen grid upon the space charge define a second partial amplification factor. The over-all factor, namely, plate to control grid, is actually the product of these two, so the tetrode could really be called two tubes in one.

Shielding the plate by an additional

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screen allows an extremely high value of plate impedance, at the same time decreasing the inter-electrode capacity to a value practically negligible at broadcast frequencies. It must be remembered that to obtain this high *mu* the tube must work into an excessively high load impedance.

Fig. 2 shows the percentage of the *mu* obtainable with a given ratio of load to plate impedance. As the plate impedance under normal conditions is 400,000 ohms, it will be seen by the curve that to obtain 80 per cent of *mu*, or 336, requires a load impedance of four times the plate impedance, or 1,600,000 ohms. To obtain this high load impedance, even sufficient to get a *mu* of but 50 per cent and still retain reasonable selectivity in a tuned r-f circuit is one of the principal difficulties that have faced the manufacturer.

However, development may take a new trend. The set of the future will be screen-grid, or better. Perhaps all tuning between antenna and first tube will be in some "band-pass" arrangement, with several tubes following in some form of untuned amplifier, similar to resistance coupling, although the inter-electrode output capacity would manifest itself and limit gain. The applied voltage would also have to be very high as the voltage drop in a resistor equal to the plate impedance of the tube, with normal plate current, would be in the neighborhood of 1200 volts.

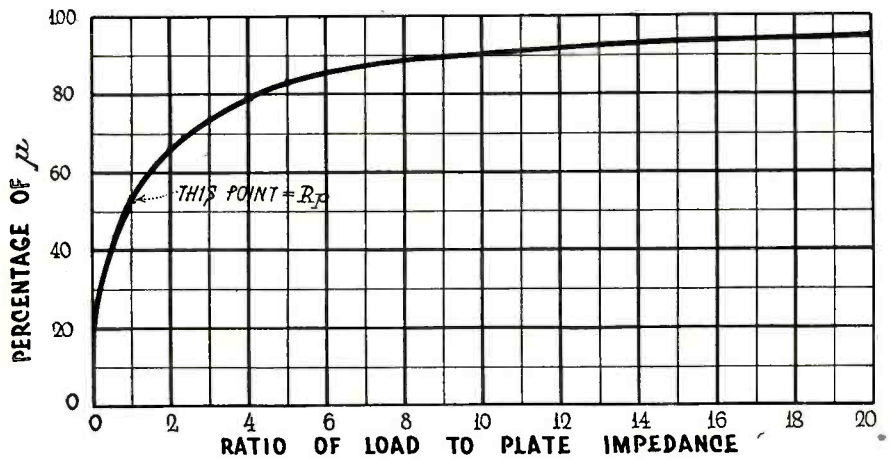


Fig. 2. Voltage Amplification of 24 Tube with mu of 420 and R_p of 400,000 Ohms

Yet the tube has many known possibilities. It can be used as a space charge grid tube, very useful in resistance-coupled audio. By this method it is possible to get a gain of about 60 per stage where only low applied plate voltage is available. It can also be used as a two-grid tube for reflex and also in various forms of oscillators. Considerable interest may be shown in a type of oscillator using the '24, developed from what is called the Pliodynatron principle. Suffice it to say this oscillator uses none of the feed-back principles, but utilizes a phenomenon known as secondary emission.

The screen-grid principle is also entering the transmitting field, where development will bring out many advantages, not the least of which will be screen modulation.

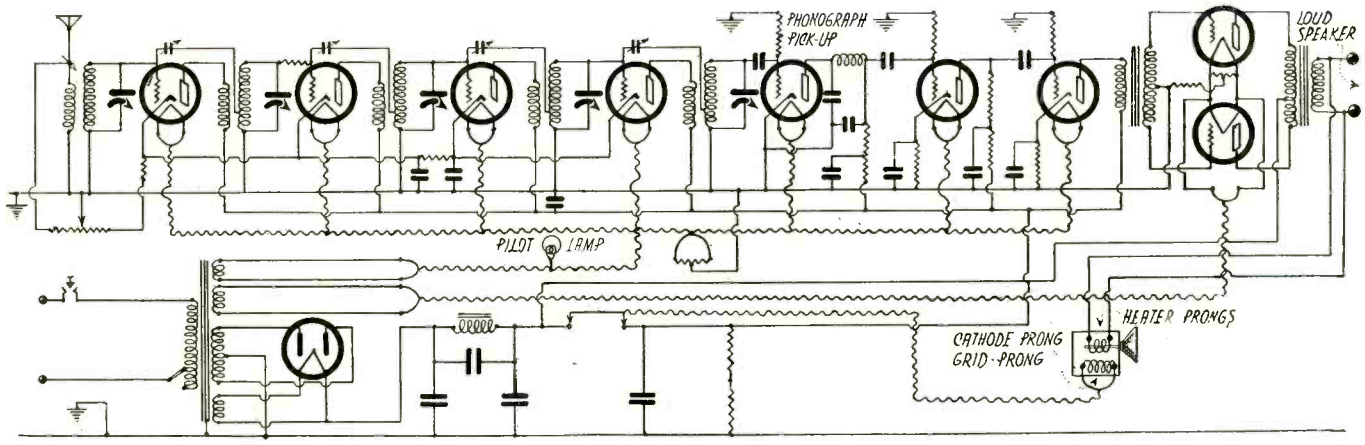


Fig. 1. Circuit Diagram of All-American Lyric Receiver.

TUBE VOLTAGE AND CURRENT READINGS OF THE LYRIC A-C NO. 90 RECEIVER

Type of Tube	Position of Tube	Tube Out A Volts	Tube Out B Volts	Tube in Tester A Volts	Tube in Tester B Volts	Tube in Tester C Volts	Cathode-Heater Volts	Normal Plate	Plate MA Grid	Plate Change MA
227	1 R-F	2.45	120	2.40	114	6.5	6.5	5.3	8.5	3.2
227	2 R-F	2.45	120	2.40	115	6.5	6.5	4.6	8.6	4.0
227	3 R-F	2.45	120	2.40	113	7.5	7.5	5.8	7.9	2.1
227	4 R-F	2.45	120	2.40	113	7.5	7.5	5.9	8.0	2.1
227	Det.	2.45	84	2.40	16	.5	.0	.7	.7	.0
227	1 A-F	2.45	94	2.40	30	.5	2.5	1.0	1.2	.2
227	2 A-F	2.45	128	2.40	106	1.5	7.0	3.6	4.7	1.1
245	P.P.	2.55	256	2.45	232	45.0		23.0	26.0	3.0
245	P.P.	2.55	256	2.45	232	45.0		23.0	26.0	3.0
280	Rect.	5.30		4.90				78.0		.0

ALL-AMERICAN LYRIC MODEL 90

THIS is a nine-tube receiver employing '27 tubes in the four r-f stages, detector and first and second a-f stages. The final power stage uses a pair of '45s in push-pull. Each of the r-f stages is tuned and neutralized by the Hazeltine method. Autoformer coupling is used between the antenna circuit and first grid circuit while the following stages are inductively coupled.

The volume control consists of a 10,000 ohm potentiometer, one section of which is connected across the primary of the antenna coil, the other section separating the four r-f cathodes from ground. By this method of volume control the primary of the antenna coil is shorted out as the grid bias of the r-f tubes is increased to a degree where blocking occurs.

When the volume control is on full the correct value of grid bias is supplied by means of a 390 ohm fixed resistor in series with the potentiometer. This is slightly added to for the third and fourth tube grids by the voltage drop through another 100 ohm resistor between the third and fourth cathode lead and the first and second cathode lead, the object for this being the theory that bias should be increased with an increase of signal voltage.

An r-f filter circuit is connected around this 100-ohm resistor, having the effect of by-passing each of the two cathode leads separated by the latter. The second r-f tube is provided with a grid suppressor resistor of 1500 ohms.

The plates of the four r-f tubes are fed through their respective primaries from the common plate lead which supplies, besides the r-f plates, the detector and the two resistance coupled a-f stages. This lead is by-passed by one .5μf condenser and tapped onto the positive line at the low potential end of the speaker field winding.

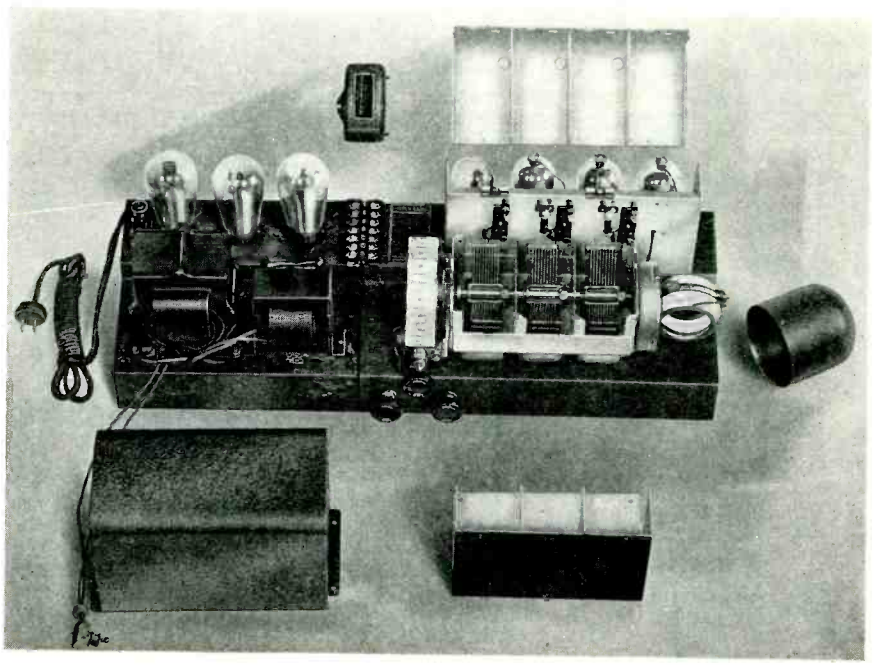
Grid condenser-grid leak detection is used, a 2 megohm and a .5 megohm grid leak being used in series across the grid circuit so that the phonograph pickup may be hooked in between them. The detector output circuit is filtered through a π section comprised of two .001μf condensers and an r-f choke. Resistance coupling is used between the first two a-f stages, 140,000 ohms being used in the plate circuit of the first stage. This resistor consists of two units, the junction of which is by-passed to ground. A .01μf coupling condenser is used and is followed by a .5 megohm grid resistor. Bias is supplied the first a-f tube by means of the voltage drop through a 2400 ohm resistor between cathode and ground.

The second stage is similar except that the plate resistor units are of 70,000 ohms and 25,000 ohms. The coupling condenser, grid resistor and bias resistor are the same. Transformer coupling is used between the second and third audio stages, partially for the purpose of establishing the phase difference necessary to push-pull amplification. The grid return in this stage is grounded, picking up the bias for the grids from the drop through a 1000 ohm resistor, the negative end of which is also grounded. The output transformer is located in the chassis, the mid-tap of the primary being connected to the positive lead at the junction between the first a-f choke and the speaker field winding which constitutes the second choke.

The primary of the power transformer is tapped for voltage regulation. One low voltage secondary supplies all the '27 tubes while another is used for the two '45s. One supplies the '80 rectifier while the fourth provides the high voltage to the rectifier plates. The filter system consists of two π sections, the second of which employs the speaker field winding. A 12,000 ohm bleeder resistor is connected across the line at the low voltage end of the speaker field winding.

BOSCH MODEL 48

THIS is a six-tube receiver having three tuned r-f stages with screen grid tubes, a power detector using a '27 tube, and one push-pull audio stage employing a pair of '45s. The antenna circuit varies from the other tuned stages in that it is tuned by a variometer which is connected across the grid and ground and which is mounted, through a gear arrangement, on the gang condenser shaft. The signals picked up by the antenna are fed into this circuit through the movable arm of a potentiometer, one end of which goes to ground and the other to a junction between a fixed condenser and a small variable trimmer condenser. The potentiometer serves as one section of the volume or sensitivity control.



R-f transformers are used to couple the following three stages, plate voltage to the three r-f tubes being supplied directly through the primaries. Each cathode is connected to ground through an individual resistor which supplies the grid bias voltage and each of these resistors is grounded. The screen grid of the first r-f tube is supplied from a voltage divider in the power pack, through one section of a second potentiometer, one end of which is grounded. This

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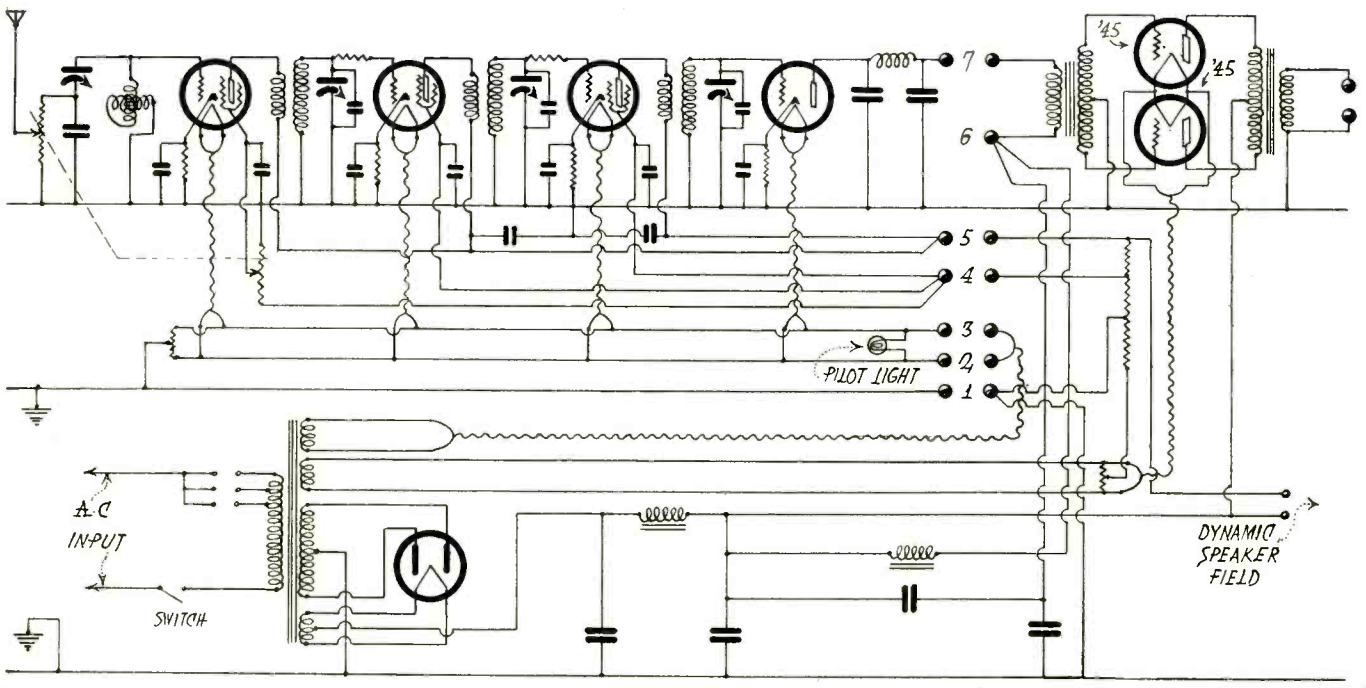
CIRCUIT DIAGRAM OF BOSCH MODEL 48



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potentiometer serves as the second half of the dual volume control, reducing the screen grid voltage and the gain of the tube in proportion to the reduction in input signal current as controlled by the antenna resistor.

The second and third screen grids are fed from the same tap in the voltage divider that supplies the maximum voltage to the first screen grid. Each screen grid lead, each cathode resistor and the second and third r-f plate leads are bypassed to ground. A grid suppressor resistor is connected between the secondaries and the grids in the second and third stages.

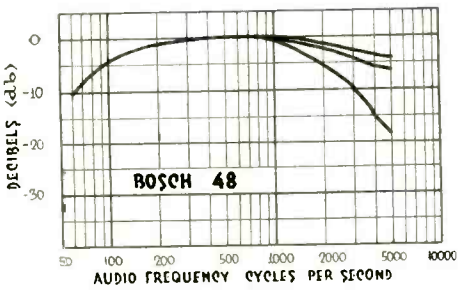
Plate rectification is used in the detector circuit in which the '27 tube employed may be considered a power detector in the true sense of the term. A voltage of practically 300 is applied between plate and ground and a relatively high value of resistance between cathode and ground gives an automatic variation of the grid voltage, depending upon the strength of the modulated input. Plate detection is usually considered freer from distortion at high percentages of modulation than grid detection, and linear detection (the type of plate detection used in this receiver) has the advantage of giving a greater output voltage per input voltage than the anode-bend type of plate detection. It is, therefore, possible, when using linear detection, to supply enough voltage direct from the detector to overload a pair of '45s in push-pull, thus making it possible to eliminate one stage of a-f amplification. The one requirement for the successful operation of a detector of this type is a high input voltage in the detector grid circuit.

The output of the detector circuit is filtered through an r-f choke with a condenser bypassing it to ground on each side. It is coupled to the a-f stage through an a-f transformer, the detector plate voltage flowing through the transformer primary. The center-tap of the secondary of this transformer goes to ground, the grid bias resistor for the '45 tubes being connected between the center tap of a resistor shunted across the filament winding and ground. This resistor forms a part of the voltage divider which supplies the screen grid voltage and r-f plate voltage. The output transformer is incorporated in the receiver proper instead of the speaker, and the center-tap of the primary is connected to the low potential side of the first a-f choke. The speaker field winding acts as a second choke, reducing the voltage as well, to meet the requirements of the r-f plates. Another filter choke is used in the detector plate lead, being connected between the junction of the first a-f choke and the speaker field winding and the primary of the a-f transformer. Filter condensers are connected before and after the first choke and after the detector choke. The latter is also bypassed.

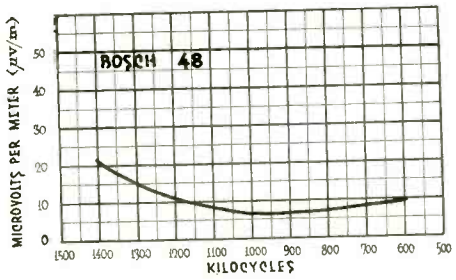
Four secondaries are wound on the power transformer—one for the '80 filament, one for high voltage, one for the '45 tube filaments and one for the r-f and detector heaters. The latter supplies the pilot light and is shunted with a center-tapped resistor, the center tap being grounded. The primary of the power transformer is supplied with taps for voltage regulation.

The three screen grid tubes and the '27 tube are shielded in a box of four individual compartments, upon which are mounted the condenser trimmers which are accessible by means of three small holes in the rear. Another can fits over the condenser gang, shielding each individually, and a round can is fitted over the variometer at the end of the condenser gang. The power unit is also carefully shielded.

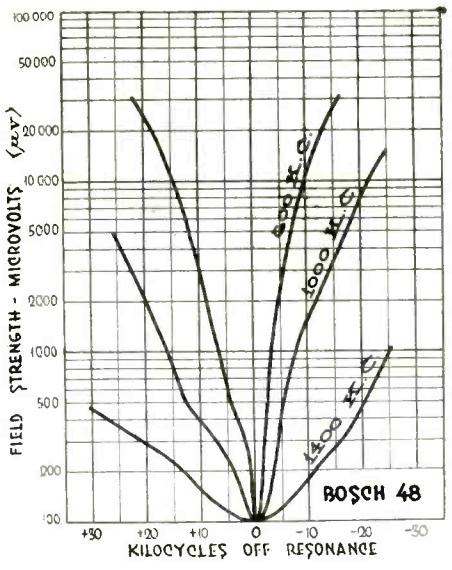
PERFORMANCE CURVES OF BOSCH MODEL 48



The sensitivity curve of the Bosch receiver shows that this set is most sensitive at 1000 kc, being very slightly less so at 600 kc and only dropping to a third of the maximum value at 1400 kc. This is good sensitivity, and indicates that the Bosch will pick up any signal with a field strength of from 26 microvolts to 84 microvolts to give a 50 mw output from the receiver.



The Bosch fidelity curve is good, especially on 1000 and 1400 kc. The attenuation of the highs on 600 kc is due to slight sideband cutting in the r-f circuits as shown in the sharp peak of the 600 kc selectivity curve. The latter, it will be noticed, peaks too sharply and flares at the top.



Selectivity cannot be considered the "long suit" of the Bosch receiver, especially on the high frequencies. According to the 1400 kc curve an interfering signal at a frequency which differs by 20 kc from the signal to which the set is tuned will be reproduced with from one-third to one-fifth the power of the latter, provided the field strength of each station at the receiving location is the same. This, however, is not a fair basis for judgment, due to the fact that no two stations in the same area, therefore with anywhere near equal field strengths, are separated by only two channels. It would be better to say that a station 20 kc away would have to have a local field strength of from three to five times the field strength of the signal to which the set is tuned. All of which indicates that the reception of the stronger of the two stations would be unhampered by the weaker while the reception of the weaker would be ruined by the stronger. Distance reception, of which the receiver is capable as far as its sensitivity is concerned, would be greatly dependent upon the strength of other stations within 30 or 40 kc of the frequency to which the receiver is tuned.

The 600 kc curve, while appearing much better by contrast, is also too broad for good distance reception, for the high-powered, heavily modulated broadcast stations usually found on the lower frequencies often set up a field of 30,000 microvolts, more or less, at a distance of ten or fifteen miles from the station. An interfering signal of 30,000 microvolts would play havoc with a 100-microvolt station, 20 kc away. It is of course well known that such standards of selectivity are necessary only in a congested area, in the midst of several high-powered stations. It is also understood that selectivity greater than that shown in the above curves is a talking point only when distance reception is a requirement.

A STANDARD CONTINUITY TEST

By B. E. ESTES

WHEN a bench man gets a set for which he has no service manual containing charts for tests of continuity, shorted condensers and resistors, he can readily test it by following the procedure here outlined. Fig. 1 is the fundamental circuit of most of the receivers now being made for heater type tubes. With a few variations it may be used as a guide in testing nearly any standard chassis with an ohmmeter.

Inspection of the circuit shows that the grid terminals of all tube sockets are connected through their respective secondary windings to negative *B* or ground which is also the metal frame of the receiver. The one exception is the detector circuit where the grid condenser breaks the continuity of the circuit to ground.

The plate terminals of all tube sockets are connected through their respective primary windings to the voltage dividing resistor and from there, through the filter choke coils to one side of the filament terminals of the rectifier tube socket. The filament terminals of the tube sockets connect through the wiring of the receiver to the filament winding of the transformer and from the center tap of the transformer, or in some cases, a center tapped resistor through a grid bias resistor to the metal frame of the receiver. The detector tube is again an exception as the center tap of the filament winding for this tube connects directly to the metal frame, omitting the bias resistor. The cathode terminal of the detector tube socket connects directly to the ground or frame.

By keeping these three main circuits in mind it is a simple matter to test the continuity of the complete receiver by testing from the grid terminals of the sockets to the ground, and in the case of the detector circuit, from the ground to the stator plates of the variable condenser which tunes it. The plate circuits test from the filament terminal of the rectifier tube to the plate terminals of all the rest of the tube sockets. The filament terminals of the tube socket test across each set of filament terminals and to the ground or frame of the receiver. The cathode of the detector tube tests directly to the ground.

Condenser Tests

THE test for shorted by-pass condensers is a little more complicated. Plate by-pass condensers are connected from some point in the plate circuit of a tube to ground and may be tested by taking a reading from the plate of the tube to the ground. If the condenser is shorted, the ohmmeter will indicate zero ohms, while the normal reading will be between 5,000 and 10,000 ohms, which is the resistance of a voltage dividing resistor from that point to the ground.

Grid bias resistor by-pass condensers connect from the ground to the center tap of the filament winding of the tubes to which the resistor is supplying *C* bias. The test is from the ground or frame to one of the filament terminals of the tube socket. The correct reading will vary from 400 to 2,000 ohms, depending upon the number and type of tubes the resistor is supplying. A shorted condenser will show up as a zero ohms indication on the ohmmeter.

In testing the circuit, consideration must be taken of the comparative resistance of the windings of the r-f and a-f transformers. The r-f secondary

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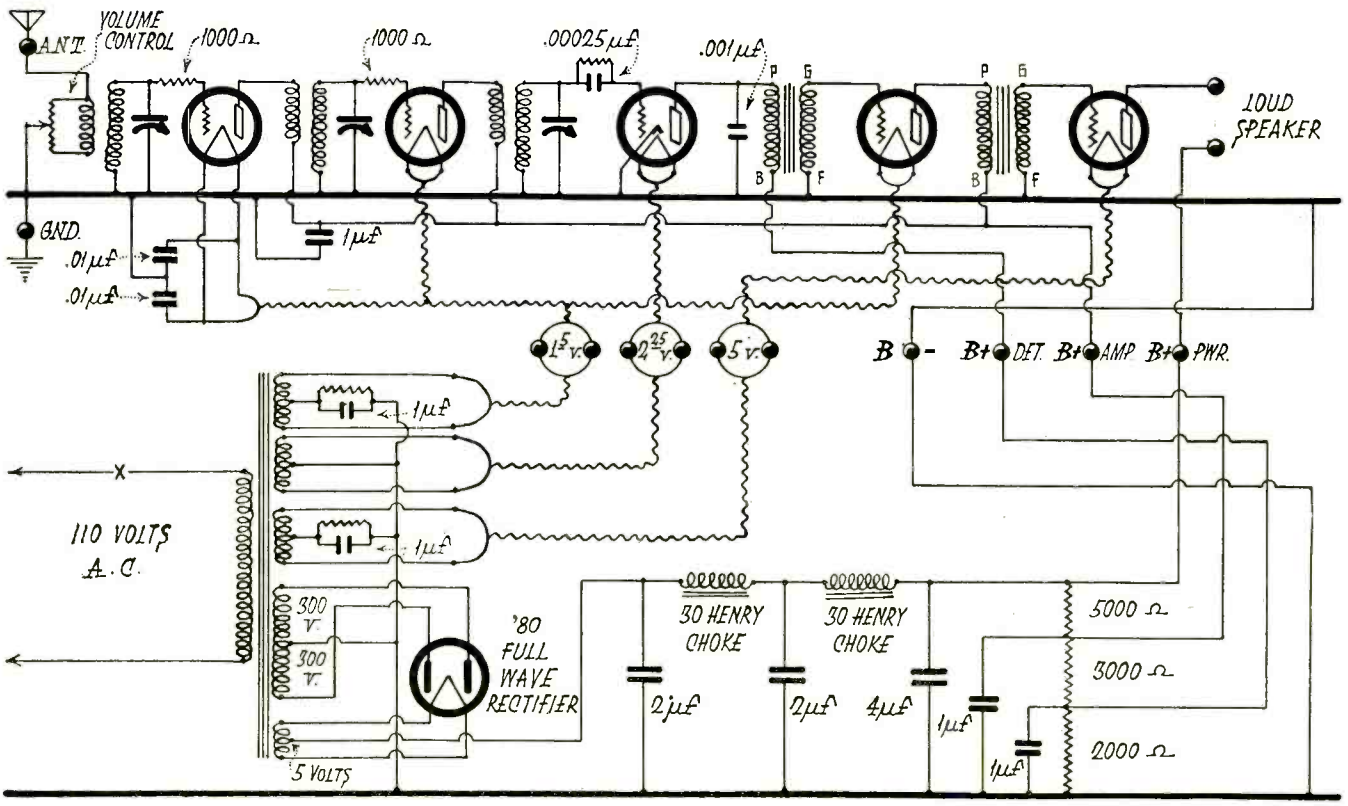

Fig. 1. Fundamental Circuit of Standard A-C Receiver

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windings, where no grid resistors are employed, will be practically zero ohms, while the a-f secondaries will indicate a resistance of about 3,000 ohms. The reading to the plate terminals will be the drop through the filter choke and voltage dividing resistor plus that of the resistance of the coupling transformer's primary, which will be much higher in the case of the a-f circuit. The reading to the plate of the detector will be much higher than the others on account of the greater resistance of the voltage dividing resistor necessary to give the proper detector voltage. This difference in reading may be used to advantage in identifying the different tube sockets in a receiver with which the service man is not familiar.

Power Pack Tests

THE last test is the check of the power pack. Inasmuch as the continuity of the voltage dividing resistor and the filter chokes were tested in the plate circuit test and the by-pass condensers in the condenser test, it is only necessary to check the large filter condensers for shorts and the primary and secondary windings of the power transformer for continuity.

The large filter condensers are checked by testing from the filament terminal of the rectifier tube to the ground and from the plate terminal of the power tube to the ground. If the reading from the rectifier filament terminal to the ground is zero, the first filter condenser next to the rectifier tube is defective. If the reading from the plate terminal of the power tube to the ground is zero ohms, the filter condenser next to the voltage dividing resistor is defective. If both tests show a reading of around 300 ohms, the filter condenser at the junction of the two chokes is defective. The normal reading will be the resistance of the entire voltage dividing resistor, which is around 12,000 ohms.

The high voltage secondary windings are tested from the ground to the grid and plate terminals of the rectifier tube socket. The normal reading in this case will be around 100 ohms. The primary of the power transformer may be tested by checking across the lugs on the attachment plug of the receiver's power cord.

Isolation of Defective Parts

AFTER the receiver has been completely checked and the faulty circuit determined, that circuit should be thoroughly checked so as to isolate the particular piece of apparatus which is defective. For instance, say that the plate circuit of the first audio circuit is open. The chassis should be either opened or turned over so that the ohmmeter test clip can be fastened to the plate terminal of the first audio socket and the test prod touched to the plate terminal of the second audio transformer. If this test, which should show zero ohms, is satisfactory, the *B* terminal of the same transformer should be touched with the prod. In this case the ohmmeter will show the d-c resistance of the transformer plate winding. This *B* lead is now traced or checked to the voltage dividing resistor. The next test is from the resistor to the filter choke and then to the filament terminal of the rectifier tube. Somewhere in one of these tests the trouble will show up and as the test involves a progressive test of the various pieces of apparatus used in the circuit, it is comparatively easy to determine which particular piece is defective.

While these tests are simple, it will take some time to become proficient so that a number of receivers can be handled with the dispatch which is expected of the modern service man. The best way to become familiar with them is to take the tests on some receiver for which the circuit diagram is available and trace the circuit diagram as the readings are noted. After this has been done a few times, testing will become such a simple routine that the diagram of the receiver and all continuity charts

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may be discarded with the added advantage that the service man will have an idea of the circuits which he is testing so that it will be possible to work much faster than by the old method of "testing from point 1 to 6 which should read closed, and from 2 to 5 which should read closed" and so forth.

In this method it is necessary to be able to positively identify the grid, plate, cathode and filament terminals of a tube

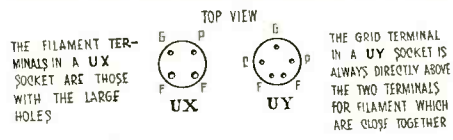

Fig. 2. Standard Socket Markings

socket without hesitation. The markings are shown in Fig. 2 and should be thoroughly memorized.

Screen-Grid Circuit Tests

AFTER the simpler circuits are an open book, the more advanced circuits, such as the commercial screen grid circuits should be tested. An analysis of the test on a Philco screen grid receiver will probably be useful in obtaining an idea of the procedure involved.

The grid and plate circuit tests are made in the same manner as just described with the exception of the screen grid r-f tube sockets, where the grid test is made from the control grid terminal (wire with the cap) to the ground. The detector is of the plate rectification type so the grid will test to the ground.

The plate circuit tests are identical with the standard receiver except that there will be less indicated resistance to the plate of the detector tube on account of the higher voltage employed with the power detector.

With the exception of the power tubes, all of the tubes are of the heater type with a cathode, so that the *C* bias resistor continuity from the ground to the filament will in this case be made from the ground to the cathode terminals of the tube sockets. The resistance indicated from the ground to the cathode of the detector tube will be exceptionally high on account of the high value of *C* bias voltage used on the grid of the power detector tube.

The center tap of the filaments of the heater tubes connects directly to the ground and should indicate zero ohms to that point. The resistance from the ground to the filament terminals of the push-pull '45 tube sockets is the value of the *C* bias resistor used to supply *C* bias for these tubes.

The screen grid terminals, which are the regular grid terminals of the r-f tube sockets, connect to the voltage dividing resistor through the movable arm of a potentiometer and from there to the filter chokes and the filament terminals of the rectifier tube socket. When testing for continuity in these circuits, the volume control should be turned from maximum to minimum, which varies the reading of the ohmmeter.

The by-pass condensers from the screen grid terminals to the ground may be tested at the same time that the plate by-pass and detector by-pass condensers are tested. The reading from the plate terminals of the tube sockets should be only the value of the voltage dividing resistor to the ground. The reading from the screen grid terminals to the ground should be the resistance from the 80 volt tap of the voltage dividing resistance to the ground only when the volume control is at the maximum volume position. Any reading less than 5,000 ohms would show that there was trouble with the circuit.

If the test indicates a shorted by-pass condenser, it is somewhat difficult to locate the defective condenser as there are a number of condensers from the different stages in parallel with each other. The most practical solution is to connect the ohmmeter so that it indicates the short and then to open each condenser in turn until the short disappears.

The test for the filter condensers of

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the power pack and the continuity of the power transformer windings is the same as the first example, except that the test from the plate terminal of the power tube will show the test on the middle section of the filter condenser and the test from the plate terminal of the radio frequency tubes will give the test for the last section of the filter condenser.

The same principles of the tests outlined above may be applied to any receiver with success, and in cases where the receiver circuit varies from standard construction, it is only necessary to note in what manner it varies instead of having to learn an entirely new circuit test. The table given below will serve as a general outline for a test on practically any receiver.

STANDARD CIRCUIT CONTINUITY TEST TABLE

From	To	For	Approx. ohms	Remarks
	Grid	Continuity	R-F zero A-F 3000	R-F with grid suppressors 400 to 1000 ohms.
	Stator det. var. cond.	Continuity	Zero	Used only when grid-leak condenser detector used.
	Filament	Continuity	400 to 2000	Test for grid bias resistor.
	Cathode	Continuity	400 to 2000	Test for grid bias resistor in set using heater type tubes.
	Cathode of Det.	Continuity	Zero in grid-leak cond. det.	Resistance around 10,000 ohms in power detector circuit.
Ground	Control Grid	Continuity	Zero	
	Screen-Grid	Shorted bi-pass cond.	8000	Only when volume control is at maximum. Zero ohms show def. condenser.
	Plate	Shorted bi-pass cond.	10,000	Zero ohms shows defective bi-pass condenser.
	Grid & Plate Rect. tube	Continuity pwr. trans.	100	This test for continuity of high voltage windings.
	Fil. of Rect. tube	Shorted filter cond.	13,000	If zero ohms the first section of filter condenser defective.
	Plate of pwr. tube	Shorted filter cond.	12,000	If zero ohms the last section of filter condenser is defective.
Fil. of Rect. tube	Plates of all tubes	Continuity	R-F 3000 A-F 4000	These figures vary considerably with different circuits and with detector tubes and audio systems.

NOTE: All of the above figures are approximate and should not be taken as conclusive, as they will vary in different receivers.

A SIMPLE DISTORTIONLESS AMPLIFIER

By HARRY S. LYMAN
Crocker Research Laboratories

THE construction of an amplifier which will give true reproduction of voice and music requires a circuit which introduces no distortion or change in either frequency or phase. Although phase distortion is seldom considered, it is fully as troublesome in preventing true reproduction as is frequency distortion. Both are caused by circuit reactances due to various combinations of inductance and capacity.

Consequently an ideal amplifier would either contain no reactances or be equipped with compensating distortion correctors. The latter is difficult to accomplish unless the full manner and type of distortion be known. The former can be accomplished, except for the reactance due to tube capacity which can be made negligible at audio frequencies.

The circuit is shown in Fig. 1. It is direct coupled and uses push-pull in the detector and two audio stages. One bypass condenser is used to keep the filament circuit of the two '45 tubes at ground potential. Even this may not be necessary.

Each filament circuit is fed from a separate secondary in the common power transformer. Plate current at 600 volts is secured from a General Radio half-wave transformer and rectifier filter with an '81 tube. As the transformer has no center tap, two resistors are placed in series across the output so as to feed the plate. Due to the difference in the size of these resistors, some direct current flows through the primary and is used to adjust the impedance of the whole apparatus. The transformer in the output circuit might cause distortion were it not for the fact that the output is power-operated and not voltage-operated.

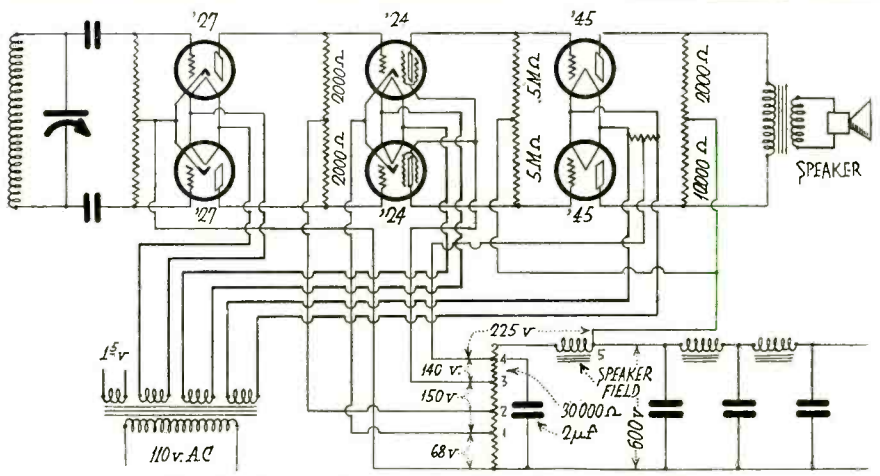


Fig. 1. Circuit Diagram for Distortionless Amplifier

The values of resistors and voltages given in the circuit diagram are approximate and may be slightly altered so as to secure the best results. The voltage drop in the '24 plate circuit is so great that its feed may be placed at *5* when the '45 plate feed is tapped. The adjustment of tap *4* on the voltage divider stabilizes the '45 tubes by automatically adjusting the grid bias and plate voltages. Tap *3* can be set roughly and then *1* and *2*. The voltage for the r-f tubes is taken from tap *2*.

This amplifier unit is very stable in operation.

Radio Pickups

Items of trade interest from here, there, and everywhere, concentrated for the hurried reader.

Sonora Products Corporation recently demonstrated at Chicago a combined radio and talking motion picture machine for use in the home. This device is housed in a console and embodies a projector with a synchronized sound reproducer and a screen-grid radio set. It is announced that quantity production has been started on a popular-price outfit.

R. E. Smiley, sales manager of the Bremer-Tully Manufacturing Company, has established offices at 625 South Wabash Avenue, Chicago, Ill.

The Pacific Radio Trade Association, with the assistance of local power companies, is maintaining radio interference investigators in San Francisco and in Alameda County. These men are handling nearly five hundred complaints a month.

National Better Business Bureau has published a bulletin which discredits the claims made for "Electex," a compound advertised to revive storage batteries. Analysis shows that it consists primarily of Epsom Salts which accomplish no useful purpose.

The Radio Service Managers' Association, 324 W. 42nd St., New York City, is providing for the organization of branches in other cities. Such branch offices will be provided with complete sets of examination questions and answers as well as all forms necessary for the certification of the competency of men who pass the examinations. The association is publishing a magazine for members.

Ralph Manley of Anderson, Illinois, has adapted a motor car for use with a Crosley 21 radio set by using a copper screen in the top for an aerial and grounding the set to the frame of the car. The car storage battery was used for *A* supply, and dry batteries for *B* and *C* voltage. A 25,000-ohm resistance was put in series with each spark plug and a 30,000-ohm resistor in series with the center wire on the distributor cap. Generator noise was eliminated by shunting a 25 mfd. condenser from the relay box to ground.

The convention of the Western Music and Radio Trades Association, of which Ernest Ingold is president, will be held at San Francisco June 24-26. The Trades Preview conducted by the Pacific Radio Trade Association, of which Al Meyer is president, will open on the afternoon of June 25 and all day June 26. The convention will be held at the St. Francis Hotel and the Preview probably at the Palace Hotel.

All litigations between the American Bosch Magneto Corporation, of Springfield, Mass., and the Robert Bosch interests in Germany and America, have been settled, the former having the sole right to the use of the single word "Bosch" and the latter to "Robert Bosch" in America. Elsewhere the products are to be respectively identified as "American Bosch" and "Bosch."

The National Union Radio Corporation, makers of Sonatron tubes, have supplied their salesmen with "The Book of Facts," to give them a complete working knowledge of all the processes involved in making tubes. It answers every question that might be asked by a jobber or dealer regarding the construction of Sonatron tubes. This is supplemented by a working tube factory on a small scale for the instruction of salesmen when they visit the Newark plant. A series of Friday night lectures on the principles, construction and operation of radio tubes is also being given by Prof. E. Gordon Taylor at the company's New York office.

The Powerizer electro-dynamic speaker, which was originally designed for use with Powerizer public address and theater sound systems, is now available as an independent unit. It handles 10 watts undistorted output and has an effective frequency response from 40 to 6000 cycles.

CeCo Manufacturing Company announce the CeCo 227 tube to replace the N27 as a high-vacuum detector-amplifier. It uses two mica spacing members and a doubly supported grid to maintain uniformity of electrical characteristics and to prevent prolonged howling. It has a short cathode, longer glass stem, and shortened distance from glass stem to electrode.

Bushnell and Raynor, manufacturers' representatives, Chronicle Building, San Francisco, want quotations on ply-wood cases or other types of cartons or containers suitable for packing radio cabinets for shipment.

Dr. Vladimir Zworykin, research engineer of the Westinghouse Electric & Manufacturing Company, has applied the cathode ray tube instead of a scanning disc for the experimental reception of visual broadcasting. The scheme is somewhat similar to that employed by Philo T. Farnsworth of the Crocker Research Laboratories at San Francisco. It marks one more forward step in the endeavor to broadcast movie films by radio.

Complaints have reached Sylvania Products Company, regarding short life of '27 and '24 tubes in Brunswick and Bremer-Tully receivers. Extensive investigation has proven that in most cases where this has occurred a voltage regulator Type 105 or Type 110 has been employed and the heater voltage has usually been higher than 2.6 volts and thus shortened tube life. The Brunswick Company are now recommending a Type 98 voltage regulator. The same applies to the Bremer-Tully receiver. Replace the present voltage regulators with Type 98 and your tube difficulties will end.

Zenith Radio Corporation has informed manufacturers that Zenith patents on automatic tuning completely cover the movement of the tuning condensers to a pre-determined position by electric motor, spring motor, solenoid, hand pressure or other mechanical means, Zenith is ready to consider the granting of licenses to certain manufacturers, but none have yet been granted.

De Forest Radio Company has secured a permanent injunction against the Radio Corporation of America from enforcing licensed set manufacturers to use only RCA tubes. This follows a temporary injunction which was sustained by the Supreme Court. The remaining question is the amount of damages which may be assessed by the jury.

At a recent trade practice conference called by the Federal Trade Commission it was agreed that the name "walnut" can be used only for wood from the genus Juglans. The names "American walnut" and 'black walnut" were approved for the native walnut which is in general use for lumber and veneers in the United States and Canada. When and if this nomenclature has the approval of the Commission, firms calling Australian and African woods "walnut" will be subject to court action and cease and desist orders.

NEW RADIO CATALOGS

Leaflet CL-1 from the Polymet Manufacturing Corporation, is a constructional booklet containing various new hookups with discussion thereof. Included is the circuit of a screen-grid superheterodyne for motor car use.

Electrad, Inc. have published a folder regarding the use of '45 tubes in the Radiola 41.

Letters to the Editor

DISCOUNTS

Sir: I notice the article on Public Address Installations in your December issue advocates that dealers take up this branch of radio work under a separate organization. We are dealers in sets and accessories and have been considering taking up this class of work for some time, but there are some drawbacks that are not mentioned in your article. These principally refer to the question of discounts.

As dealers, we retail a very small quantity of this type of apparatus on which we get the usual dealer discount of 40 per cent. As sound equipment engineers we would buy our apparatus from the jobbers at the same dealer discount. This would therefore not benefit our dealer business, but would rather be in competition with it. This, however, is a very small matter compared with another problem that faces us. We find that the local jobbers of sound equipment are also going into the business of supplying and installing public address equipment. From inquiry we find this to be a common practice. How then can the dealer, with his measly forty off compete with the wholesalers' fifty and ten?

This is quite a serious problem, for the said jobbers are not only selling direct but are allowing trade discounts in some instances on equipment that they install, or, in other words, retailing at wholesale prices. Why do the manufacturers permit their distributors to compete with their own dealers and with the engineering specialists who use their products. How can this new and thriving industry forge ahead as it should when such conditions exist? It seems to us that the manufacturers should take a firm stand in this matter and limit their jobbers to their own legitimate business. Jobbers who form a separate organization to handle public address installations should not be allowed to buy the equipment direct from the factory at jobbing discounts, thereby introducing unfair competition for the organizations whose sole business it is to create the markets and pioneer the use of this type of apparatus. To allow them to do so is a shortsighted policy that will result in little short of chaos in what should be a thoroughly stabilized and healthy industry.

MILLER & MILES,

Cleveland, O.

Sensitivity

Sir: Since you have been publishing data on standard receivers, which is very interesting reading in view of the claims that some of the manufacturers make, I have been somewhat puzzled in regard to what to tell my customers. Buyers of radio sets appear to be getting more critical every day, and some of them seem to pick up a knowledge of certain factors, without being technical, which, when sprung in the form of a question, often proves embarrassing.

For example, a well-known set manufacturer in his literature claims "a sensitivity of *a few tenths of a microvolt* per meter." Some of the curves you give of receivers that are generally accepted as being good show a sensitivity as high (or is it low?) as 20 mv per m. Another manufacturer recently stated that the maximum permissible sensitivity that would provide good tone quality was around 5 to 8 microvolts per meter. Who is right and what are you going to do when your prospective customer calls your bluff on a point like that? In most cases, of course, the buyer doesn't realize what he is talking about. Like a customer I had the other day who insisted on my installing a "screen and grid" in the set he wanted to buy, because he figured the resale value would be higher with this latest development.

I notice in practically all manufacturers' advertising they claim a combination of features, such as extreme selectivity and perfect tone, which the engineers tell us is an impossibility. The public are quick to pick on these things and it is we dealers who have to do the explaining. A little coöperation from the factories on this angle of merchandising would at least be helpful.

CARL BRUNDAGE.

Chicago.

Printed Broadcasts

Sir: The information given on page 55 of RADIO for November may be a garbled report of the equipment developed by the Sleeper Research Corporation to provide an auxiliary means of broadcast reception. We have developed a system of communication which employs a typewriter keyboard and selector mechanism to be connected to any broadcast station, and a simple and compact printing device, operating from the output of any standard receiver.

The same transmitter and receiver can be used for type or voice communication, by switching from keyboard to microphone, and from printer to loudspeaker. The range for the printer is somewhat cruder, since less output is required than for good speaker volume. Also, the printer is hardly affected by static interference strong enough to blanket speech or music.

The printer broadcasting will not be confined to news flashes, but will include a very complete information service both for the home and for the business office. Subsequently this will be expanded to provide special market reports and weather forecasts as well as educational programs for farmers. In the beginning these programs will be transmitted only during the day, sent out through established broadcast stations.

This development will introduce an entirely new radio advertising technique. Much broadcasting to women is of too small value unless it is copied. Much of the valuable daytime broadcasting is lost because women cannot devote to the radio enough direct attention to copy what is broadcast. Much of the present advertising produces only the effect of annoyance, but with the new system things that are not acceptable to the ear will be acceptable to the eye.

Another thing—men are not reached by radio advertising in the daytime, and they do not want to hear it at night. However, radio information brought silently to offices and seen at times convenient to the individual, will be welcomed most enthusiastically.

Daytime transmission for women will include chain and department store announcements, recipes and menus from food products companies, news, theatre programs, announcements from the boards of health and education, and similar information. Transmission for offices will include business news, reports from the department of commerce and chambers of commerce, stock reports, news flashes and baseball and racing results. It would be quite impractical to receive such things in a business office from a loudspeaker, but this useful information can be recorded silently by the printer.

M. D. SLEEPER.

New York City.

Book Reviews

"Transmission Networks and Wave Filters," by T. E. Shea, 470 pp. 6x9 in., published by D. Van Nostrand Company, Inc., New York City; price $6.50.

This text embodies the results of the work of the Bell Telephone Laboratories, of whose technical staff the author is a member, in the calculation and design of telephone networks and wave-filters. It gives a full explanation of the mathematical and electrical theory involved, together with the general characteristics and formulas of various types of networks and network aims. This material is of especial value to the radio engineer who is concerned with wire transmission of chain programs. It should also be of help to the mathematically equipped designs of rectifier and filter systems.

"The Fundamentals of Radio," by R. R. Ramsey, 372 pp., 6x9 in., published by Ramsey Publishing Company, Bloomington, Ind., price $3.50.

"Experimental Radio," by R. R. Ramsey, 225 pp., 5x7 in., published by author at Bloomington, Ind., price $2.75.

The author of these two books is professor of physics at Indiana University. The first comprises the material that might be included in a series of classroom lectures for sophomore students. The second is a laboratory manual to supplement classroom instruction.

The "Fundamentals" begin with an explanation of d-c and a-c electricity. Then follows an explanation of the resonant circuit, condensers, coils, radiation and detection. A thorough discussion of vacuum tubes is followed by a brief explanation of coupling, aerials, and r-f measurements. The various types of transmitters and receivers are described, as well as audio amplifiers, loudspeakers and rectifiers. The entire treatment is unusually clear and logical but requires a knowledge of mathematics for a thorough understanding.

The laboratory manual contains detailed directions for making 128 experiments, mostly concerned with measurements of resistance, inductance and capacity of all parts of transmitting and receiving installations. Full instruction is given on the calibration and use of wave meters and instruments used in measuring field intensities, amplifier performance and vacuum tube characteristics. The book contains but little theory and should be of great value to the service man who is called upon to make unusual tests and measurements.

TUBES

THE ONE THING IN RADIO

THAT EVERYBODY USES

YOU CAN SELL MORE TUBES IF THE TUBES YOU SELL ARE BETTER

EVEREADY
RAYTHEON

Trade-marks

4-PILLAR TUBES

ARE A NEW AND

REVOLUTIONARY IMPROVEMENT

TELL YOUR CUSTOMERS TO PUT A NEW EVEREADY

TELL your customers not to miss the full enjoyment that radio can give in these winter months. Programs are at their best. The air is clear and free from static. Distant stations come in like locals when receiving tubes are new Eveready Raytheons—packed with power.

Have your service man put a new Eveready Raytheon in each socket of your customers' receivers and note the vast improvement. You can profit from this better performance. More power, increased distance, better tone and quicker action—these are reported by people everywhere, using Eveready Raytheons in their present receivers.

Improved performance means more sales for you, quicker stock turn, more pleased customers. Push Eveready Raytheons in complete sets for replacement.

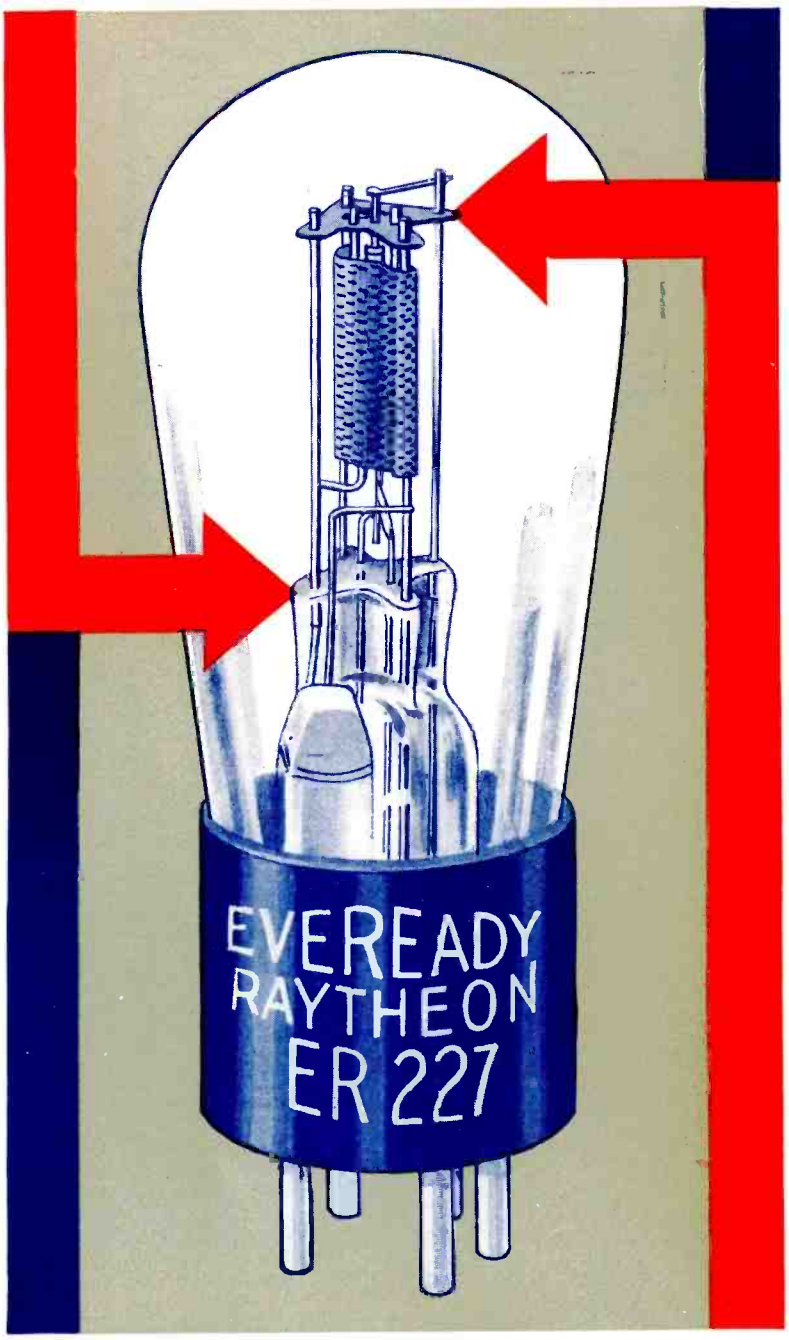
EVEREADY RAYTHEON 4-PILLAR TUBES

RAYTHEON IN EACH SOCKET OF THEIR PRESENT RECEIVERS

YOU can *hear* the difference with Eveready Raytheons—and *see* the reason. Look at the diagram on this page. See the solid, four-cornered glass stem, supporting the four rigid pillars which hold the elements. Notice how this *4-Pillar construction* is braced at the top by a stiff mica plate.

Eveready Raytheons give better reception because they are stronger . . . immune to the hazards of shipment and handling which endanger the performance of ordinary tubes. The unusual precision with which Eveready Raytheons are built is safeguarded by their *4-Pillar construction.* With Eveready Raytheons only can you get all the advantages of this superior construction, for it is patented and exclusive.

Eveready Raytheons come in all types, for A.C. and battery-operated receivers.



EVEREADY RAYTHEON 4-PILLAR TUBES

WRITE FOR THESE STRIKING EVEREADY RAYTHEON DISPLAYS

YOU can have this helpful counter display by writing to the nearest branch of the National Carbon Co., Inc. There is also a five-piece window display which tells your customers that you sell better tube performance — Eveready Raytheon performance. There is a muslin wall chart showing the characteristics of various types of tubes, and a tube register showing types of tubes required for various sets. You can hang this chart in a prominent location where it will help both you and your customers.

Eveready Raytheon Tubes are selling fast with distribution through a selected number of jobbers, conveniently located. Ask your jobber or write us now for the names of our jobbers near you.

NATIONAL CARBON COMPANY, INC.
General Offices: New York, N. Y.
Branches: Chicago, Kansas City, New York, San Francisco
Unit of Union Carbide UCC *and Carbon Corporation*

EVEREADY RAYTHEON

Trade-marks

4-PILLAR TUBES

TOBE Filterette

JANUARY, 1930

ENTIRE NATIONAL CARBON DISTRIBUTION ORGANIZATION CIRCULARIZED ON INTERFERENCE

Endorse Tobe Service

THE National Carbon Company, through its advertising and sales promotion division, has requested 6000 Tobe circulars on Radio Interference, to send to its entire distribution organization.

Authorities on radio interference prevention have long felt that successful prosecution of this cause, if it is to be achieved, must come through coöperation of all who have the interests of radio at heart, whether manufacturer, jobber, dealer or listener.

Hitherto the business of merchandising electric sets, for which the market is still far from exhausted, has caused dealers to lose sight of the saturation which inevitably looms in the future. But already there are signs that the novelty is beginning to wear off. We hear complaints—that the programs, after a few weeks or months, become monotonous, the same thing, night after night; that the set is of no use except for a very few hours during the evening when programs of any comparative worth are available; that on Sunday, the one day in the week when the average man is at home and wants a little music while he reads his daily paper, the radio is cluttered with sermons, hymns and sectarian squabbles; that the set owner is asked to listen to yards and yards of dull advertising, if not outright misrepresentation, for radio advertising has hardly been adequately censored; that the patronizing and affected tone of the effeminate announcers causes many people to turn off their sets in disgust, and that you have to sit through so much to hear so little.

Is radio a fad of the moment of which a fickle public is already tiring? We

(Continued on Page 66)

Perry S. Graffam, Secretary and Treasurer

AGAIN A PIONEER

If you were to go up to any radio fan who remembers the days of "one-tube regenerative DXers" and "cat's whiskers" and ask him to name the men from whom he got his inspiration, one of those named would be Perry S. Graffam.

Always on the alert for original and startling new circuits, Mr. Graffam published countless articles in the leading radio sections and magazines of the world. One of his inventions, the short-wave plug-in adapter, has been reprinted in so many publications all over the world that it would be difficult to keep track of it. Every now and then it bobs up again in a Russian or Japanese newspaper.

It was this very progressiveness that at once attracted his interest in the work of radio interference elimination. Foreseeing at once the possibilities and future of this at that time infant industry, he

(Continued on Page 66)

AT LAST—AN AUTHORITATIVE INTERFERENCE MANUAL

Tobe Deutschmann Booklet Most Comprehensive

FROM the time when public attention was first directed to interference through the advent of the electric set, it has awaited eagerly an authoritative work on the subject. Such pamphlets as have appeared from time to time have been either incomplete, inaccurate, or both.

Now a pioneer in the field, the Tobe Deutschmann Corporation comes forward at last with a work which their years of engineering experimental work in this subject makes highly accurate. The Tobe Filterette Manual is the most modern and complete booklet on this subject which has so far appeared.

The engineers of this corporation, in planning this book, devoted no little thought to the readers for whom it was intended. They early saw that if the book was to have a popular appeal, *it must be written in language that anybody could understand.* Too often, skilled technical men, yielding to the temptation of displaying their personal erudition in the subject, have turned out books which to the man in the street were practically unintelligible. Tobe engineers decided, in planning their book, that not only would they avoid the fault of having their book too technical, *they would make it interesting as well,* so that the man who knows nothing about radio could still pick up this booklet and find out what was wrong with his set.

With this purpose in mind, their first move was to include as many pictures as possible. Photographs, diagrams and illustrations of all sorts were carefully prepared with an eye to making the book as clear and as interesting as possible.

The next step was to prepare the material in such form that it could be

(Continued on Page 65)

Radio *Interference* from Farm *Lighting* Plants

{ Two Distinct Electrical Apparata in a Single Unit }

By **R. L. HASKINS**
Engineer, Director of Laboratory

OF ALL those to whom radio means much, there is no one, unless it be the mariner himself, to whom it means more than to the farmer. Isolated, often, in the foothills of a vast, sparsely settled region, miles, perhaps, from the nearest neighbor; virtually imprisoned when winter's storms and sleet have piled the roads into impassable drifts, his unfailing contact with the outside world is the radio. There, warm and snug in the simple furnishings of his home, sitting before the leaping flames of a crackling log fire, (perhaps with a jug of hard cider, too, because some of those farmers don't have it too tough) he lies back in his favorite chair and turns on the finest talent of Broadway.

How important, then, is it that there should be nothing which will break the link between him and civilization, nothing which will impair the clarity of his reception; for it is not for pleasure alone that the farmer relies on his radio. He must get, also, the market quotations on which his livelihood depends.

What, then, is his quandary when he finds that the one appliance which it is impossible for him to shut off if he is to use his radio—the power plant itself, is directly responsible for the bedlam which makes the programs from his speaker well-nigh unintelligible!

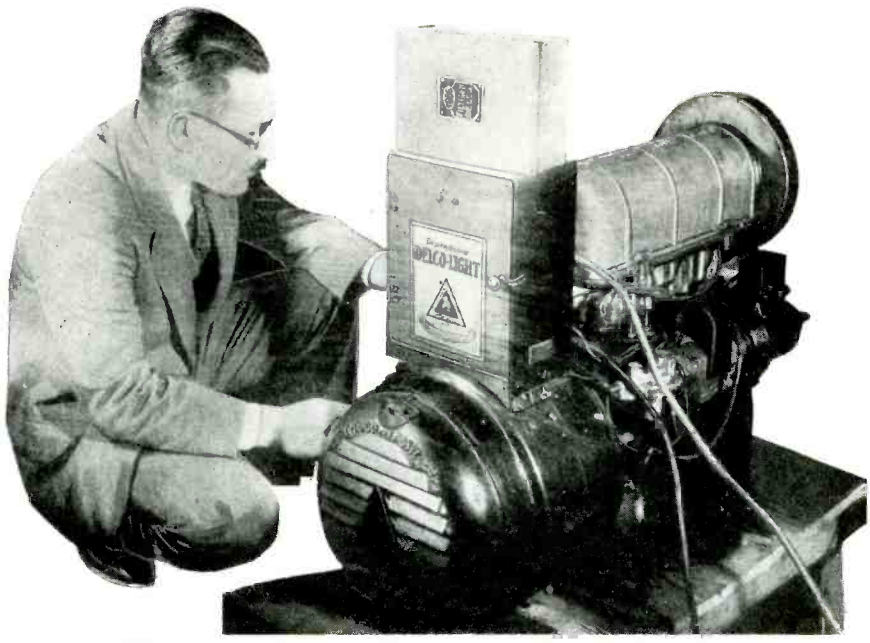
The Tobe Deutschmann Corporation, realizing well, from its voluminous correspondence, the plight of the thousands of farmers who had written in pleading for relief, instituted, with the hearty coöperation of the Delco Lighting Company, a laboratory research on the problem of ridding farm lighting plants of interference. It is the successful results of this research that they are happy to publish in this paper.

Investigation discloses that the farm lighting equipment in most common use today is of the 110-volt, 1500-watt d-c type, and it is the radio interference from this which will be discussed in the body of the report.

In order to clarify the explanation as much as possible, we shall take up the question under three general heads:

First: What is the source of the interference? (Where does it originate, and how is it transmitted?)

Second: What is the nature of the interference? (How many kinds of interference are transmitted, and what portions of the machine are responsible for the various types of noises heard?)



Filterette Installation on Typical Delco Farm Lighting Plant

Third: What are the steps which must be taken to eliminate completely all traces of interference? (How many different parts of the machine must be shielded, how many filtered, how must filters be installed, how wires run? etc.)

Examination discloses that the equipment consists of two integral parts, working together to produce or generate electrical power. But each of these parts, the gasoline engine and the generator, is a distinct electrical apparatus, and must be considered separately in solving our problem.

Now both of these pieces of electrical apparatus, the gasoline engine and the generator, prove, on investigation, to be sources of radio interference. In the engine, the starting and ignition systems are electrical, starting power is furnished by a 32-volt storage battery and the ignition system, which is of the magneto type, employs the usual timer and distributor circuits.

From the ignition system, therefore, we have two sources of radio interference—direct radiation from the high-tension leads running from the distributor head to each spark plug, and the common lead of the distributor head running to the magneto.

If the antenna of the radio set is not too near the high tension leads, the interference will not be noticeable. When the radio sets are installed in automobiles, however, the antenna is in the field of interference from these leads and it is necessary to take further precautions. While the former condition generally obtains with farm lighting plants, and despite the fact that laboratory tests show that neither shielding nor filters placed in the spark plug leads are necessary, it is advisable, nevertheless, to shield these leads.

It is possible to place filters in series with each spark plug, in order to do away with the necessity for shielding the leads. But, as a general rule, it is preferable to use shielded leads in place of filters wherever it can be done conveniently.

We have found that the common lead coming from the distributor head is the chief source of radio interference. We can eliminate this ignition interference by placing a special filter in series with this lead directly at the distributor head. This filter also prevents interference currents from feeding back into the generator circuit. This can be easily seen when the other side of the circuit is at ground potential to the frame. Although we have quieted ignition systems with the use of this filter, this does not necessarily mean that the filter has com-

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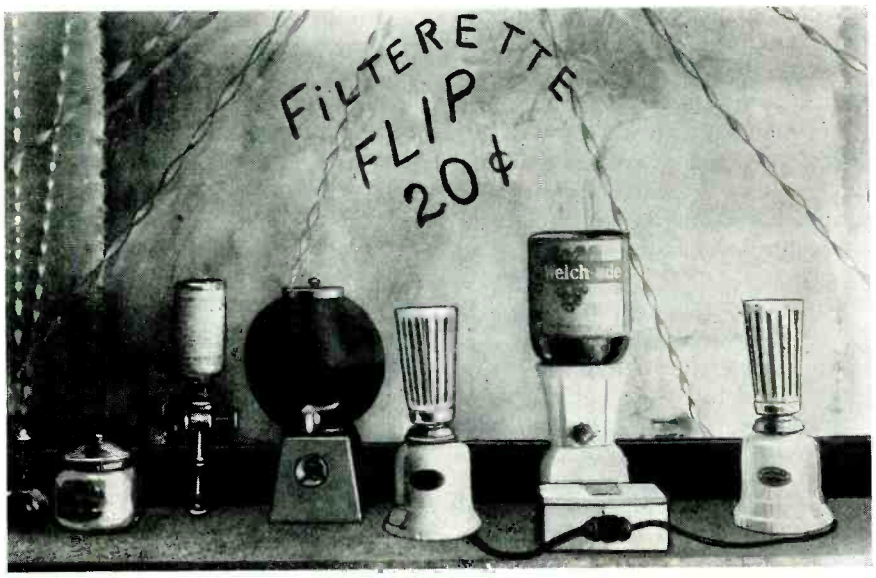


Single Filterette for Battery of Drink Mixers

pletely suppressed the interference. The load leads running from the generator will carry interference unless they are properly filtered before leaving the generator.

We now come to the question of eliminating the radio interference from the generator, the other essential part of the farm lighting plant. This has for its source of radio interference the sparking of the brushes of the generator. The only path by which this interference can travel or be transmitted is through the load leads leaving the generator. If we place a proper filter directly between these leads and the generator, it will prevent any interference from leaving by this source. Care must be taken not to run the leads leaving the filter near the unshielded leads of the ignition system. If it is impossible to place the filter near the generator, the leads running from filter to generator must be shielded and the shield grounded to the frame of the generator. The center-tap of the filter must be connected to the shield. It is always advisable, whenever possible, to run shielded leads. This does away with possible pick-up from the leads carrying interference.

To sum up our findings, then, we have established that for complete elimination of radio interference from the farm lighting plant, a special filter is required in the common lead coming from the distributor head, all ignition leads should be shielded, an inductive-capacitive filter placed in the load leads coming from the generator, and the connecting leads shielded with the shield grounded to the frame of the farm lighting plant. The Tobe Filterette Delco is the type commonly used.

INTERFERENCE MANUAL

(Continued from Page 63)

most easily assimilated. After some debate, it was decided that the simplest way in which this could be done was to put all information in question and answer form so that the reader could master one point at a time. Those who have read proofs of the book have complimented the authors on its clearness, evidence that they have achieved their object in this respect.

Examination of previous manuals of interference showed that practically all of these books were far too general. A man who, knowing nothing of radio, wanted to come home with a book of directions and put his finger right on the source of trouble, as well as fixing it without building a lamination-stamping and coil-winding department in his den, would have a hard time of it getting much relief out of the books whose erudite data on constants of filter circuits told him nothing.

The Tobe Filterette Manual tells you how to locate the cause, and, having verified it, how to correct it permanently. To ask a man who has never fooled around radio sets to go out and build an adequate filter circuit is inviting disaster. The average man will not think of bothering with so involved a task, the exceptional one who tried it, as often as not found that the device did not work, and even he had no way of knowing that the size of wire used, the lack of shielding in the apparatus, the length of leads employed, the erroneous grounding of his case might defeat the purpose of his whole day's careful building.

The matter of obtaining questions was, of course, extremely simple. In the course of a year the engineering department of the Tobe Deutschmann Corporation answers literally thousands of questions about radio interference, sent them by people who recognize their position as leaders in this field. It was a comparatively simple matter to take these questions, sort them into groups, and from these groups to select those inquiries which seemed most often to bewilder the radio listener. In this way a selection of questions was arrived at which included not only the most frequent causes of distress on the part of radio listeners, but also those other inquiries whose answer might be most helpful to the reader.

We shall give here a few examples of the type of questions that are answered in the manual:

In what way is interference from electrical ignition systems indicated?

How may interference from barbers' clippers be suppressed?

What apparatus used in a confectioner's store or on a soda fountain is likely to create interference?

Why does a cash register cause interference?

Would the construction of a metal housing surrounding the machine and embodying the line filter provide complete elimination of the interference?

What types of traffic control apparatus cause radio interference?

How may shielding be accomplished economically and safely?

But the editors did not stop here. Knowing well the nation-wide interest which has been manifested in every ramification of this engrossing subject, they decided to include, as well, excerpts from Federal Radio Commission findings, including two suggested ordinances for cities and towns contemplating restrictive legislation.

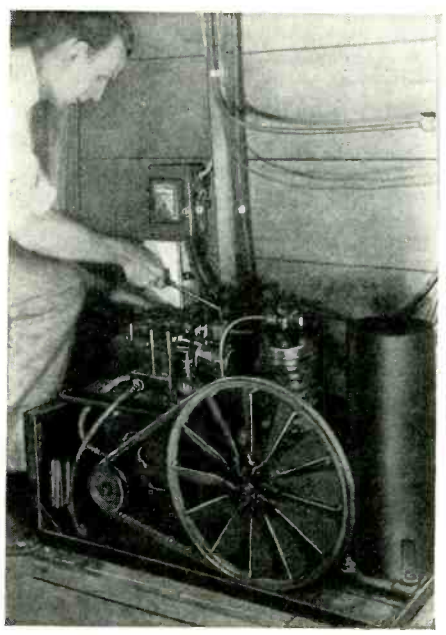
So controversial has been the fight over the constitutionality of radio interference legislation that two of the most able of the staff retained by the Federal Radio Commission, drew up these laws as models which should be followed by communities which did not wish to have legislation thrown out because of its having been declared unconstitutional.

Not all cases of radio interference require the use of filters. Not infrequently disturbances which ruin radio reception are caused by dirty, oily or defective electrical apparatus. The editors of the manual have emphasized particularly the necessity of inspecting carefully all contact parts of the apparatus under suspicion, in order that the reader may not go to the expense of installing a filter when correction might have been accomplished by simpler and more direct methods. In such cases, moreover, they have emphasized the unwisdom of covering up a fundamentally wrong condition by the use of a filter, when the only proper way to eliminate the disturbance would be to repair and clean the apparatus.

Much space has been devoted to the recognition and tracing of the various types and causes of interference by characteristic sounds. The reader, by determining the type of noise which is giving him trouble, and consulting the manual, may ascertain just what sort of apparatus is most likely to be the cause.

The subject of grounding has been discussed at some length. It is not generally known that grounding the case of the filter device not infrequently brings in more interference. The editors have devoted considerable space to this phenomenon.

Many people are under the misapprehension that it is necessary to use a separate filter device for each piece of apparatus to be corrected. This is by no means always so, and instances are given where the same device, by following hook-up directions, may suffice for several pieces of electrical apparatus at once.



Installing a Filterette on a Typical Commercial Refrigerator

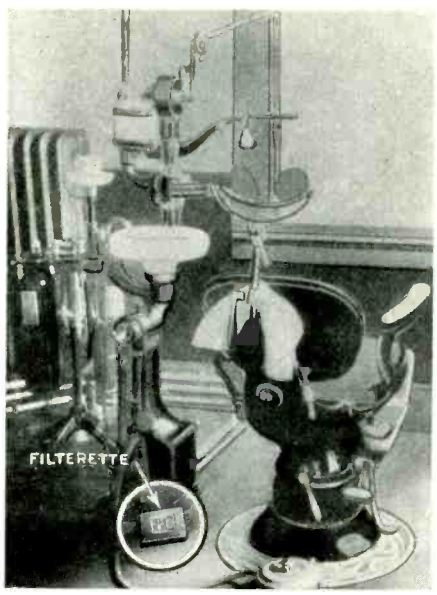
A complete and inclusive chapter on radio interference caused by electrical appliances in the home has been incorporated in the book. The home owner and housewife will find this chapter extremely helpful and enlightening.

The motor generator set, which comprises both alternating and direct current, is given a special chapter and the proper steps for filtering clearly outlined.

Occasionally the novice finds that after he has apparently followed directions carefully, the noise still persists after the filter has been installed. In this case additional precautions may sometimes be necessary, and the editors have devoted some time to a discussion of possible causes for the apparent failure of filter devices to work, with suggested methods for checking up and correcting this condition.

The photographs reproduced herewith are taken from the Tobe Filterette Manual, *"Radio Noises and Their Cure."* These and many others scattered through the sixty-four pages, make the book exceedingly easy and interesting reading, showing as they do, exactly the type of apparatus on which the filters are actually applied, and the simplicity of application.

No one who is at all interested in radio, whether he be jobber, dealer, service man, ham, or just out and out radio bug, can afford to be without this book. And when the extremely modest price of the manual is taken into consideration, "Two-bits, a quarter, the fourth part of a dollar," as the Coney Island barkers would put it, the reader will readily see that the book and the valuable information it contains is within reach of all.



Filterette on Ritter Dental Engine

TOBE BULLETIN TO BOOTLEGGERS

IT HAS repeatedly been called to our attention that various thermostatic equipment, stills, et cetera, used in the illicit profession of bootlegging, have been the cause of radio interference.

It has long been a mystery to many how Tobe got such a large mailing list. As a matter of fact, up to a short time ago, this list was of very modest proportions. Then, one day, the following notice was inserted in certain Tobe publicity:

REPORTED CAUSES OF INTERFERENCE: "One of the most prolific sources of interference in* is the use of thermostatic controls on stills used in the manufacture of intoxicating liquor."

*Name of town on request.

Shortly after the insertion of this item, the Tobe list attained its present proportions.

One of the largest bootlegging rings in the country was recently traced by means of decoded messages from an unlicensed transmitting station. We recently received a notification from a large city in the West, where interference legislation is in force, that a certain bootlegger had been accidently discovered through a report of radio interference from his still.

We cannot emphasize too strongly, at this time, the excellence of the Tobe orange-juice and malted-milk still filters. While we would be the last to aid or abet in the breaking of a law so highly respected by us all, we are forced, reluctantly, to admit that these filters, if applied to less innocent types of stills, completely remove all traces of interference. Regretting this, as we do, we wish to announce that our laboratories are at work on a Filterette which will work on every kind of still but one for those, vile, intoxicating liquors.

P. S. We also make Filterettes for other types of electrical apparatus.

NATIONAL CARBON CIRCULAR

(Continued from Page 63)

believe that it is not, but we believe also that the room for improvement is considerable. And at the first signs of a let-up in set buying, dealers will have to turn to new resources if they are to continue to market sets.

The National Carbon Company has not waited for this time. They can sell sets today—the Eveready name is no newcomer to the radio industry—but they are already taking steps to enlarge their field by approaching those prospective radio buyers who at the present time are deterred from buying sets because of some interfering annoyance which they may not know can be eliminated.

By selling the idea of intelligent service, by telling their customers how to rid themselves of their radio troubles, this company has taken a step in the right direction by cementing the confidence which the good name of their earlier products earned in the beginning.

AGAIN A PIONEER

(Continued from Page 63)

dropped everything to plunge himself into the work of acquainting the public with the coming importance of this work.

Today, as treasurer of the Tobe Deutschmann Corporation, he has the satisfaction of seeing his confidence in this industry borne out. And who knows, perhaps his work in this field will benefit radio even more than the eagerly-awaited circuits of five years ago.

ASSOCIATION NEWS

The radio industry has enrolled in the national movement initiated by President Hoover to remedy and stimulate business conditions. Meeting December 6th at Briarcliff Lodge, New York, coincident with the Board of Directors of the Radio Manufacturers' Association, a large group of radio producers conferred along the lines of those urged by President Hoover. Encouraging reports regarding the present and future of the radio industry were presented.

The meeting of the radio manufacturers was in open session and presided over by H. B. Richmond of Cambridge, Mass., President of the Radio Manufacturers' Association. Addresses were made by O. H. Caldwell of New York, former Federal Radio Commissioner; Frank D. Scott of Washington, legislative counsel of the Radio Manufacturers' Association, who represented the organization at the conference December 5 under the auspices of the U. S. Chamber of Commerce, and others.

President Richmond urged the radio manufacturers to do everything in their power "to carry out the broad principles outlined in these conferences" inaugurated by President Hoover. "As long as the nation's purchasing power is unimpaired," President Richmond said, "there is no need of fear in the radio industry. Its condition," he said, "is improving, although there was a recession both practical and psychological resulting from the stock market decline.

"The present general situation is unique in that over-production, which means unpaid-for merchandise, is in the hands of the consumer," said President Richmond. "We have both unpaid-for merchandise in the hands of the consumer and in our distributors' or our own warehouses as well. We also have a potential production much larger than current demand, causing part-time operation of plants.

"Conditions now are much improved," President Richmond said, "and the industry can look forward with confidence to the business of 1930."

Mr. Caldwell said that the situation was generally favorable and much improved over a few weeks ago. While there has been over-production, Mr. Caldwell said, at the same time this is radio's biggest year. The increase in radio business of dealers is reported to be forty per cent this year over 1928," said Mr. Caldwell. "It is the best year for dealers. The great middle classes have not been affected by the stock crash. Two homes in every street right now offer opportunity for the sales of radio sets. Prospects for 1930 will at least be equal to those of 1929."

Mr. Scott gave a report regarding the conference December 5 at Washington, and many other manufacturers gave encouraging views regarding the radio future.

The manufacturers' conference was a special meeting under the auspices of the Radio Manufacturers' Association to give the manufacturers an opportunity to discuss the problems now specifically before the radio industry. Many of the industry leaders were present.

The Board of Directors of the RMA, in separate meetings, also took action on many important industry problems. A comprehensive plan to secure reliable and frequent reports on production and radio stocks, and general industry statistics which have been lacking in the past, was presented by the RMA Statistics Committee headed by Mr. George Furness, Chairman, and adopted by the Board.

Increased work of the Credit Committee also led the RMA Board to increase its staff to handle the credit situation. A detailed report regarding the Credit Committee's operation was presented by Mr. Leslie F. Muter of Chicago, Chairman.

Preliminary plans for the handling of the RMA Convention, Trade Show and Banquet at Atlantic City next June also were adopted by the Board. Chairman J. B. Hawley of the Show Committee reported conclusion of a contract with the Atlantic City Officials, and RMA members will soon have the opportunity of subscribing to exhibit space.

Major H. H. Frost of New York, Chairman of the Merchandising Committee of the Association, presented and the Board adopted plans to enlarge the merchandising service afforded to RMA members.

Recent conferences regarding broadcasting of national sports were reported by B. G. Erskine, Chairman of the Broadcasting Committee. Assurances were given that adequate broadcasting of all national sport events was being planned by the chain companies.

The National Federation of Radio Associations is actively sponsoring local associations throughout the United States. Within the past nine months, nearly forty new local associations have been established in various points throughout the country and scarcely a day goes by that the executive offices do not receive requests for information on how to organize from all parts of the country. The services the National Federation of Radio Associations is rendering to local groups is of great value to them as it fully acquaints them with the activities of local associations and as to how they can best be pursued. Frequently four and five tradesmen in one community ask for information on local associations so that they themselves might be better posted individually and in that way assure the local group of greater success.

The names of delegates for the Fourth Annual Convention of the National Federation of Radio Associations are already being received. The Fourth Annual Convention will be held in Cleveland, Ohio, February 10 and 11 at the Hotel Statler. The day preceding the Convention will be devoted to Committee meetings and Board meetings in order to start the Convention in the business-like manner which it is to assume. Nearly the entire portion of the two days will be devoted to separate meetings by retailers and wholesalers for a discussion of the problems affecting their particular phase of the industry. Round table discussions on retailers' cost of doing business, cost accounting systems, finance plans, sales campaigns and many other items will be discussed by the leading retailers in the radio field present at the meeting and in exchanging advice and information. It is planned that these round table discussions will be under the direction of the retail members of the Board of Directors of the Federation headed by Mr. Henry M. Steussy of Milwaukee, Chairman of the retailers' group. The "Down-to-fact" program will be emphasized in the meetings of the Federation as well as the Radio Wholesalers' Association.

Monday evening, February 10, will be devoted to a banquet with short speeches and entertainment following. Tuesday evening will be the annual dinner and entertainment. The Ohio Radio Trade Association, who are the official hosts of the coming convention, are arranging some very elaborate plans for the entertainment of their guests during this period. The complete Convention plans will be available in the very near future and it behooves every radio tradesman to plan on being at the Convention on February 10 and 11, 1930.

The Accessories Committee under the direction of H. E. Richardson of Chicago is making a comprehensive study as to the definition of accessories, what they include and how they should be placed in the category of radio apparatus. The vice chairman, N. B. Williams, A. C. Forbes and A. A. Schneiderhahn, who are in charge respectively of Better Selling, Market Study, and Trade Relations, will report progress on their individual activities at the February convention.

The Tube Committee under the direction of J. N. Blackman of New York is studying conditions throughout the radio industry on the handling of radio tubes and will undoubtedly make a series of recommendations concerning this important matter.

The Set Committee, under the direction of Harry Alter of Chicago with the three vice-chairmen, D. W. Burke, James Atken and W. G. Pierce, are analyzing all phases which affect the merchandising of radio sets. They have formulated a comprehensive questionnaire which has been sent to approximately 900 radio wholesalers throughout the United States. The survey embraces such questions as "stenciled sets," broadcasting of sporting events, premature publicity, etc. Complete recommendations by the Committee will be made at the February convention.

RADIOADS

A Classified Advertising Section Read by Better Buyers

Discontinued Merchandise and Job Lot Advertising Must Be Plainly Indicated as Such

RATES: 8 CENTS PER WORD
$6.00 PER DISPLAY INCH
REMITTANCE MUST ACCOMPANY ALL ADS

Radioads for the February Issue Should Reach Us by January Twentieth

ENGINEERS WANTED

ENGINEERS—With considerable worthwhile Radio experience for Installation and Servicing of Talking Picture Equipment. Must have good personality, initiative, tact and willingness to assume responsibility. Applicant should be between 22 and 35 years of age and should state full particulars in replying. Normal hearing over entire musical scale essential and keen interest in music and quality reproduction of Sound very desirable. T. G. O'Brien, Engineer in charge. Research Products Engineering Dept., Northern Electric Co., Ltd., Postoffice Drawer 2850, Montreal, Quebec.

BUSINESS OPPORTUNITIES

Screw-holding screw driver. New patented invention! Removes, inserts screws inaccessible places. Factories, garages, electricians, mechanics, auto, radio owners buy on sight! Two sizes. Your profit 75c each. Exclusive territory. FREE trial offer. Jiffy, 1320 Winthrop Building, Boston.

MISCELLANEOUS

SERVICEMEN ATTENTION — Speakers rewound, magnetized, repaired. $2.00 to $2.75, guaranteed. Clark Brothers Radio Co., Albia, Iowa.

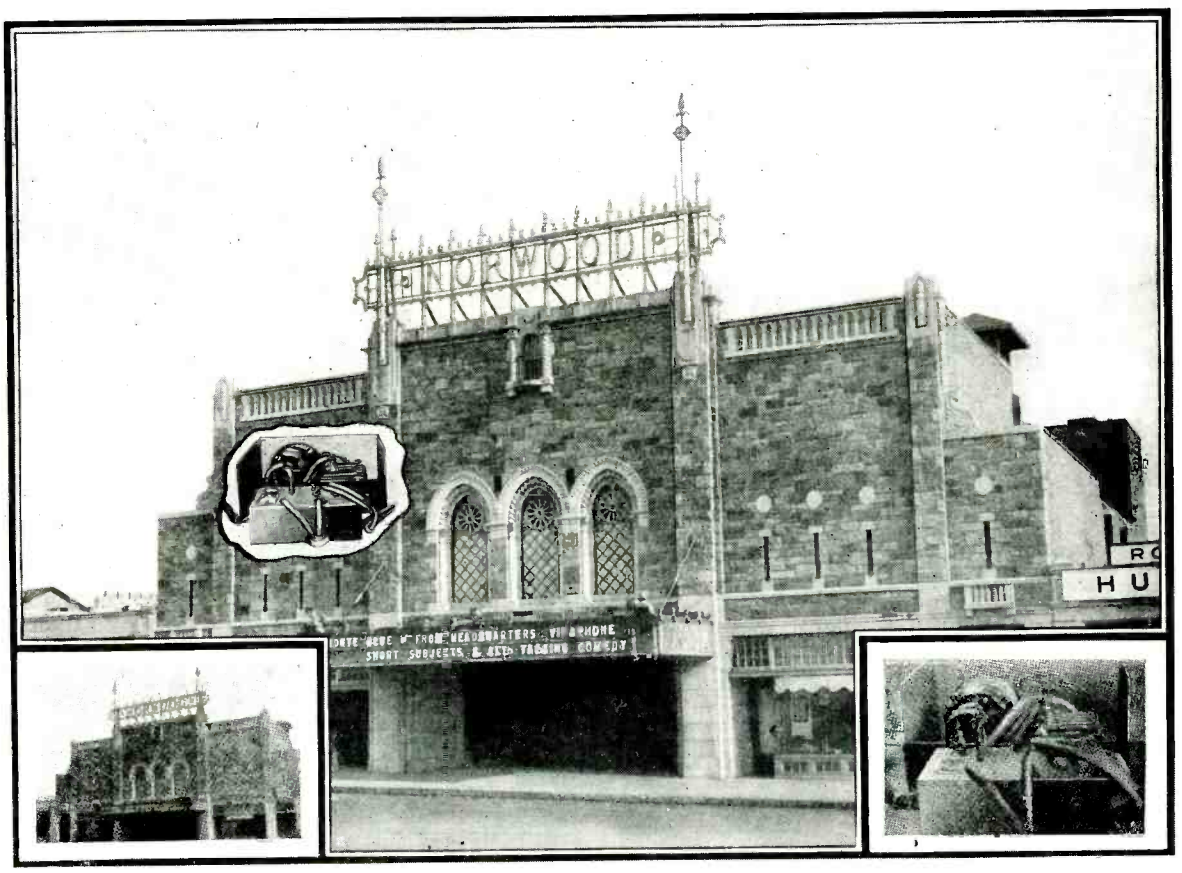
Esco fifteen hundred-volt, five hundred-watt direct current generator, fifty dollars. Compton Electric, 386 Eleventh Street, Oakland, Calif.

POWER-PACK SERVICE

WHOLESALE POWER-PACK AND AMPLIFIER SERVICE. Best equipped shop on the Coast. Lowest prices. Biggest dealers' discounts. Quick service. Write for price list. Dorival & Dorival, 129 W. Washington Blvd., Los Angeles, Calif.

TOBE RESEARCH SCORES AGAIN

Interference from Flashing Signs Positively Iminated



NEW TOBE FILTERETTE....

The Master Of Them All

Thanks to the coöperation of the New York Power and Light Corporation, the NYL-4 Filterette is now available for distribution. No longer need there be any complaints from dealers who cannot demonstrate radios during the evening hours. The NYL-4 Tobe Filterette is guaranteed to eliminate the trouble. This Filterette is capable of taking care of any flasher up to four contacts, carrying 40 amperes or less. Tobe Filterette Model NYL-4—Price, $38.00.

Tobe Deutschmann Corporation

FILTERETTE DIVISION

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Pioneer and Leader in Eliminating Radio Interference of Every Description

Please send me the forty-eight page book fully illustrated with circuit diagrams, questions and answers, extracts from Government reports, listings of towns now having interference ordinances and model ordinance suggested by Government. Enclosed find 25c, money order, or stamps for this book and separate complete catalog.

Name.....

Address.....

.....

RADIO SETS IN AUTOMOBILES

(Continued from Page 39)

across it and find out which side is grounded to the frame. If one tube does not light it is either burned out or the socket doesn't make good contact. In the latter case clean and scrape the prongs on the tube as well as the terminals of the socket.

If tubes light but the speaker gives no click, examine the B and C battery leads both at the set and at the batteries themselves. Then test these batteries with a voltmeter. If a *B* battery has dropped to 40 volts it should be replaced. If the batteries are o. k. try another speaker or a pair of headphones in order to determine whether or not the regular speaker is working. If the trouble lies in the speaker or the speaker cord it will be necessary to change speakers.

2. If set operates, but without sufficient volume, test the batteries as above and test the tubes with a tube tester even though the filaments light. If one of them is below normal it should be "rejuvenated" or replaced.

3. If reception is noisy, accompanied by crackling noises, hissing, etc., detune the set by setting one dial at a widely different figure than the other or disconnect the antenna. If the noise stops, the interference is due to radiation from a nearby electrical machine or atmospheric disturbances. If it continues it is probably caused by a noisy detector tube which should be replaced. If the crackling occurs only when the car is in motion it is probably due to a poor contact in one of the tube sockets.

The mechanic who intends to become an efficient service man would do well to equip himself with a portable set and tube tester, either a homemade one or a Weston, Supreme or Jewell. With this he may test and rejuvenate tubes right on the job, test the set for continuity, alignment of the condensers or variometers, correct voltages and circuit shorts and opens merely by putting the test plug in one of the tube sockets and poking the proper buttons on the test kit. RADIO carries articles on the construction and use of such equipment each month.

INVENTORYING CUSTOMER CONTACTS

(Continued from Page 31)

In scratching the archives of memory he jotted down point after point, which he analyzed and thought about constructively. He talked with people about these problems and got their viewpoints. He talked with customers and asked them for suggestions and what they most admired in window displays. He studied how to better improve his stock of merchandise and the appearance of his store. In general, he did a lot of figuring on how the bulwark contact points with the public might be strengthened.

It was a truly constructive moment, one pregnant with tremendous possibilities, if handled in just the right way, and so in going over those memorable ledger sheets of past experience he found ample food for serious reflection and constructive thought. Based on the experiences of the past he speculated on business-getting methods for the future. He tried to pick out all the weak spots in his organization, places where his employees had fallen down in the past, and how to prevent similar breakdowns in the future.

And so he jotted down point after point, analyzing complaints and noting them down in order, points that would appeal to the public, such as prompt deliveries, moderate prices, courtesy, dependability, etc., and of how he got business, through recommendations, fair price, convenience and accessibility, circulars, personal acquaintance, telephone directory, advertising, etc.

He found out how his employees handled customers and prospects over the telephone by keeping close tab on this for awhile, of how they reacted when a customer came into the store, what they said and what they did to satisfy and please the customer, and how those contact points could be improved upon.

He studied his advertising program and figured out just where he was spending money without getting adequate returns on his investment, and of ways and means of spending his advertising appropriation more wisely with a view to getting more customers for his dollars.

He reviewed his window displays of the past, made note of his best windows and decided to repeat them again at the appropriate time. He studied his color and night lighting effects, and developed ways and means of improving on them so as to make his windows more attractive than ever before and so attract more business from passers-by.

He ascertained what real knowledge his salesfolk had of the business and developed methods of improving their knowledge at conference meetings. He kept in closer touch with the public

(Continued on Page 72)

INVENTORYING CUSTOMER CONTACTS

(Continued from Page 71)

through having his employees make regular written reports to him daily of their contacts. He studied the attentiveness or degree of indifference of salesmen and pointed out their defects to them.

He made a careful inventory of his merchandise turnover, of swift and slow moving stock, and then standardized on certain articles, thus simplifying his inventory and cutting down on varieties stocked. He rearranged his entire stock to add zest to the buyer's spending proclivities, to get his merchandise out where the public could see it, handle it, and thus be influenced to buy.

He studied his service methods and figured out ways and means of promoting more friendly feeling between his customers and his business, how to confer little favors which didn't cost much, but gave customers the 'at home' feeling in his radio store and which made them feel like dealing with him exclusively, and recommending his store to other customers.

As a result of this inventory analysis he got a good bird's-eye view of the salient phases of his business as the public might view it, and so improved his contact methods considerably.

He worked up little publicity stunts which would help along that most profitable of all advertising stunts—word of mouth advertising, by using attractive little stickers with mottos and slogans on them, and one-page leaflets, which he wrapped up with merchandise and sent out with monthly statements, telling the public about his store and its service, thanking them for their patronage, giving them little facts about his business which could be absorbed and passed on.

In analyzing his salesmanship methods he found so much room for improvement, so many things that he couldn't exactly place his fingers on but which he knew were wrong, that he made a diligent study of all selling principles, and passed the result along to his salesfolk in the shape of "friendly tips," with the net result that his sales did jump perceptibly, simply by keeping his nose closer to the selling end of his business.

One standard principle of this radio dealer is to pay his bills promptly and to discount all purchases, for he believes in saving money and adding it to the profit side of the ledger, so he tightened up on his accounts. He doesn't believe, like he used to, in letting the customer take all the time he wants to in paying up, and then getting all "het-up" of a sudden-like when that customer didn't pay his bills promptly after sending him constant reminders. He now finds that by keeping continually after customers in a nice friendly way that he does not

have nearly so much trouble collecting his bills as when he used to let them run from month to month with only a monthly check up, for now he uses five and ten-day prodders which keep them stirred up and conscious about having to pay their bills.

And all of these ideas he pulled out of the cobwebbed cubby holes of past experiences, dusted them up and gave them an airing, with the net result that the year just closed proved one of the best in history, which he attributes solely to improved management methods as the result of his inventory analysis of studying human contacts in relation to his business.

A-F AMPLIFICATION WITH SCREEN-GRID TUBES

(Continued from Page 46)

$2\pi fL$ ohms where f is the lowest frequency that need be amplified substantially the full amount.

The impedance-coupled amplifier will give an amplification over the flat part of the characteristic equal to the mutual conductance *times* grid leak resistance. With a properly constructed impedance coil this will be about as much amplification as can be obtained with transformer coupling and the quality will be at least as good. The disadvantages of the impedance-coupled amplifier for use with screen grid tubes are that the rather large plate current of the screen grid tube will cause the core of the coil to saturate unless a very long air gap is used, such a gap reducing the inductance and lowering the possible amplification; and that the impedance-coupled amplifier requires a grid leak and grid condenser with the attending disadvantage discussed in connection with the auto-transformer.

Amplification With Resistance Coupling

THE circuit for a resistance-coupled screen grid amplifier is shown in Fig. 4b. Theoretically resistance coupling has the possibility of giving very satisfactory results both from point of view of amplification and also of quality. Unfortunately, however, resistance coupling is quite impractical under ordinary circumstances because of the fact that the plate current of the tube must flow through the resistance, resulting in a voltage drop that must be supplied from the B battery. If a large coupling resistance such as 100,000 ohms is used, this loss of voltage will amount to some 500 volts, which is too large to even be considered. When a small coupling resistance is used the voltage loss is small, but so is the amplification.

The general problem of a-f amplification with screen grid tubes can be summarized by stating that it is possible to use transformer, auto-transformer, resonated primary transformer, or impedance coupling to give very satisfactory results, both from the point of view of quality and amount of amplification. In general, where the same transformer or coupling impedance as employed with a three-element tube is used with the screen grid tube, the amplifications available in the two cases are proportional to the respective mutual conductances of the screen grid and three-element tubes. This assumes that exactly identical quality is being obtained in both cases. In view of the slightly higher mutual conductance generally found with screen grid tubes, it is apparent that the screen grid a-f amplifier with present transformers will give a slightly larger amount of amplification than can be obtained with three-element tubes at the same quality.

Stop A-C Tube Troubles at the Source

Every A. C. set owner is a prospect for the Vitrohm Unit. It saves A. C. Tubes and insures full tube life. Cuts costly service calls and customer complaints due to tube failure. Send your order today for twelve units packed in three color counter display carton.

WARD LEONARD ELECTRIC CO.
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Retails for $2.00

VITROHM 507-109
For sets using 65 watts or less
VITROHM 507-109A
For sets using more than 65 watts and less than 130 watts

AEROVOX
BUILT BETTER
CONDENSERS AND RESISTORS

Pyrohm Resistors
Accurate — Unchanging

REDUCED sensitivity, low volume, distortion and poor tone quality are the inevitable results of using inaccurate resistors which do not maintain their proper resistance values.

To be assured of satisfactory operation in power supply units and power amplifiers, be sure to specify and use—Aerovox Pyrohm resistors of the proper resistance values and current carrying capacities.

These units are made of the best grade of resistance wire wound on a refractory tube, and protected by a porcelain enamel against moisture, oxidation and mechanical injury.

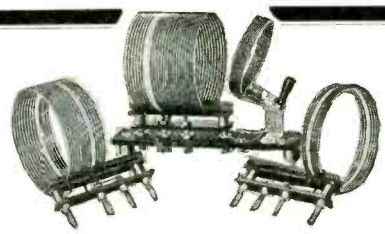
Send for Catalog

Complete specifications of all Aerovox Pyrohm resistors are contained in a complete catalog which will be sent free of charge on request.

The Research Worker

contains, each month, valuable information on radio design. It will be sent free on request.

AEROVOX WIRELESS CORP.
80½ Washington St., Bklyn., N. Y.
PRODUCTS THAT ENDURE



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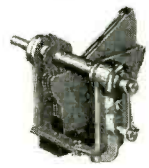
Build a Short-Wave Receiver

HAMMARLUND Short-Wave Coils and Condensers, built into a short-wave receiver or adapter, will let you in on world-wide reception.

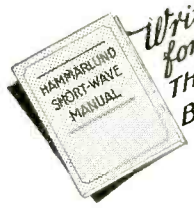
They represent the experience gained through 18 years of making precision telegraph, telephone and radio apparatus.

Hammarlund Plug-in Coils completely cover wavebands from 15 to 215 meters.



HAMMARLUND SHORT-WAVE CONDENSERS

Available in 5-, 7- and 11-plate sizes with either "Midline" or "SFL" tuning curve.



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Send 10c to Dept. PRI, for "Hammarlund Short-Wave Manual." Brimful of useful construction data and circuits.

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The Jewell Pattern 199 Set Analyzer locates set troubles instantly, also makes every essential radio service test.

You can save time and build profitable business by using a Jewell Pattern 199 to locate set troubles. Pattern 199 is the lowest price complete set analyzer on the market. Accurate and easy to use. Every service man should have one. Sold by leading radio jobbers.

Mail the coupon for a free copy of the Jewell Instruction and Data Book which contains data on 139 popular sets.

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Please mail Instruction and Data Book, also complete information on Pattern 199 Set Analyzer.

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AT LAST, a book covering practically every conceivable radio problem and question has been published! This book, just off the press, is crammed full of highly important *new* radio information. It will be invaluable to those who wish to take examinations for their Commercial, Broadcast, Radiotelephone or Amateur License. For this book is intended especially for students and operators who are about to take the government examination for a radio operator's license. It gives over four hundred actual examination questions and shows how they should be answered.

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REPLACEMENT TRANSFORMER FOR ALL BATTERY SETS AND EARLY MODEL ELECTRIC SETS

$1.50 Each
3 for $4.25

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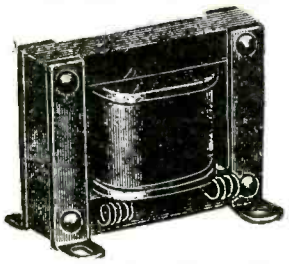

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Dealers Price $1.25 Each

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11 mfd.
Tapped at
2 mfd. 400V.
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Price $2.20

7.1 mfd.
Tapped at
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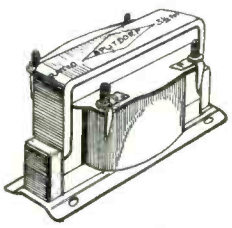
RAYFLEX SIGNS

They Burn Daylight — Size 8"x2"

65c

SPLITDORF REPLACEMENT Audio 3½—1 Audio Trans. For Kolster Sets



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Price 12c Each—$1.35 Dozen

Here are the sizes we have
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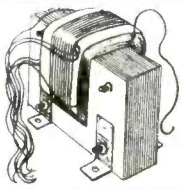

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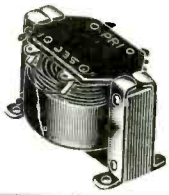

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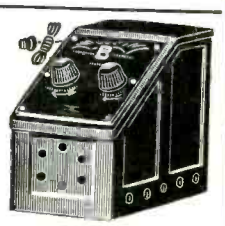
50-60 Cycle A.C.

With All B Voltage Taps, Variable Detector. Delivers 180 volts.

Price $5.75
Tube 90c



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Tapped at
2 mfd. 400V.
2 mfd. 400V.
2 mfd. 400V.
2 mfd. 160V.
1 mfd. 400V.
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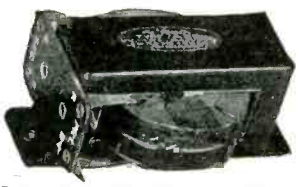

Heavy Duty Transformer, will take 400 volts, formerly priced at $10.00 and the best ever made by the old master De Forest. Ratio 3½ to 1. Excellent for sub-panel work.

Our Price $1.57

Wire Wound Resistance on Baked Lava Tube

Size 5¾"x1"

Total Ohms 6000
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For all Eliminator and electric set work.

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THE NEW IMPROVED AIREX POWER-PACK

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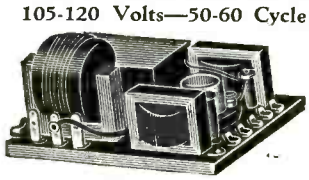

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Delivers over 70 Mils at 180 volts "B" power.
Wired Ready for Use
Built with high-grade parts

Two Dubilier choke coils—Latest Freshman Full-Wave Power Transformer—Shielded Condensers—Na-ald Compound Contact Bakelite Socket—Hart & Hegeman four-control Snap-Switch—Carborundum Co.'s non-changing Det. Volt. Reducer—Reducer for intermediate voltages—Three-ply Baseboard, Spring, Clips, etc.—All wires spaghetti or rubber covered — Approved five-foot cord and two-piece plug.

Our 280 Type Rectifier Tube 90c

"A.B.C." Power Transformer

As used in Edison Model C-5 Electric Sets

Supplies the following voltages:
2½ V. (C.T.) for 2—245 Tubes
2½ V. for 4—227 Tubes or 224's
2½ V. for 1—227 (Separate Detector) or 224 Screen-Grid
5 V. for 1—280 Tube
"B" and "C" voltages for all the above tubes—including the 2—245's.
Size 4"x4½"x5" high
Weight 12 pounds

Price $2.75

PUSH-PULL AUDIO

Use of these two Transformers in the last stage audio in conjunction with two 245 or two 171-A tubes will give maximum volume and clarity.

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Input and Output Finished in Bronze

Our Special 245 Push-Pull Kit Offer

The Modern Power Amplifier

Consists of	*Value*
1 Special 245 Power Transformer	$2.75
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1 Pair Push-Pull Airex Audio Transformers	3.00
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Total Value	$12.15

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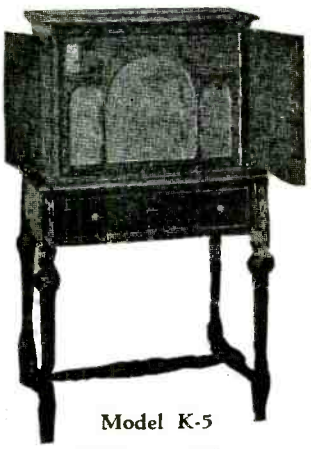
TERMS:—20% with order, balance C. O. D. 2% discount allowed for full remittance with order only.

Outstanding Profit-Making Headliners at *SPECIAL CLEARANCE PRICES*



Model K-5

Height ..... 42"
Width ..... 25½"
Depth ..... 19"

FEATURES

1. Electro-Dynamic Reproducer (10¼ in. diameter).
2. 210 Power Amplifier. Fine tone quality.
3. Supplies "B" voltage, if desired.
4. Can be used with any electric or battery set.
5. Complete A.C. Electric operation.
6. Beautiful pencil striped walnut cabinet.

Effective With This Issue

A desire to close out our remaining small stocks of these world-famous Kolster Reproducers and Receivers calls for still further drastic price reductions.

Hundreds of radio dealers fully appreciate the remarkable value these products represented before these new prices were decided upon.

Now the old special prices have been reduced more than 25%. Now greater value than ever is offered. Now you can feature two headliners that are sure to bring remarkable profit returns during the seasons ahead.

We are equipped to give your orders extra prompt attention to insure delivery for the coming season.

Don't delay, order now and rest assured that you have come in on one of the best buys ever offered of genuine nationally advertised radio merchandise.

Special
"Buy as you sell" Offer

Buy either item as needed at the top price but—if you order a total of 5 or more of one or the other within a period of 30 days from date of your first order, we will allow you the 5-lot price on all purchased and refund the difference in price on sets purchased.

Model 6-H

Height ..... 53"
Width ..... 27"
Depth ..... 18½"

FEATURES

1. Beautiful highboy console of burled walnut with maple overlay.
2. Kolster K5, Electro-Dynamic Reproducer with built-in 210 Power Amplifier included for fine tone quality (see opposite page).
3. Famous Kolster 6-tube T. R. F. circuit.
4. Hairline selectivity. Distance reception.
5. Single dial control simple to operate.

KOLSTER

ELECTRO-DYNAMIC REPRODUCER
Combined with 210 Power-Amplifier and "B" Supply Unit

LIST PRICE
$175.00
(without tubes)
Clearance Price
$24.50

LOTS OF 5 OR MORE
$21.50 ea.

This finely matched, rugged unit comprises a complete heavy duty Electro-Dynamic Reproducer, including a 210 Power Amplifier with "B" supply unit, all self-contained on a steel frame. It weighs 45 pounds without the cabinet. Cabinet itself is of pencil-striped walnut, beautifully designed with Cathedral grille. It is equipped with switch for control of house current to reproducer, power unit and amplifier. A pilot light indicates when the Reproducer is in operation.

If desired the 210 Power Amplifier will also supply 22, 67 and 90 volts "B" current, sufficient for any set using up to 8 tubes. An automatic voltage regulator tube, UX-874, maintains the "B" voltage silent and steady.

Reproducer can be used with any battery or A.C. set, replacing the last audio stage or be used with all tubes of the set. Whenever used, it will bring out every shading and range of tone; every note is reproduced with utmost faithfulness, pure and undistorted. It will modernize any radio receiver.

Following tubes are required for its operation: 2-UX-281 (for full-wave rectification); 1-UX-210 (for super power amplification); 1-UX-874 (for voltage regulation). For use with phonograph pick-up, one additional audio stage is recommended between the pick-up and this Reproducer. A 20-ft. cable is included with each instrument. Operates direct from 50-60 cycle, 110-120 volt A.C. current.

KOLSTER

SIX-TUBE CONSOLE RECEIVER
With Built-in Kolster Electro-Dynamic Reproducer

LIST PRICE
$295.00
(without tubes)
Clearance Price
$39.50

LOTS OF 5 OR MORE
$35.50 ea.

Entire set can be operated direct from the A.C. light socket, 50-60 cycle, 110-120-v., by simply adding any "A" supply unit and a small 4½-volt "C" battery. Built-in Electro-Dynamic Power Reproducer furnishes "B" supply current to set. A switch snaps receiver in or out of operation and a pilot light tells instantly when set is in operation. Single dial control makes this the simplest of receivers to operate.

Receiver employs the famous Kolster T.R.F. circuit. It operates on either indoor or outdoor antenna, using three stages of R-F, detector and two stages of A-F. Three point tap switch aerial adjuster operated from panel gives hairline selectivity. A loose coupled coil in conjunction with tap switch increases the distance getting value of the receiver. In addition, the 210 power amplifier built into the model K-5 Dynamic Reproducer achieves remarkable tone quality. In this receiver is embodied everything looked for in modern radio.

This combination Kolster Set and Electro-Dynamic Reproducer is housed in a beautiful console of burled walnut with maple overlay. Full swinging doors found only in the finest cabinets add to its beauty.

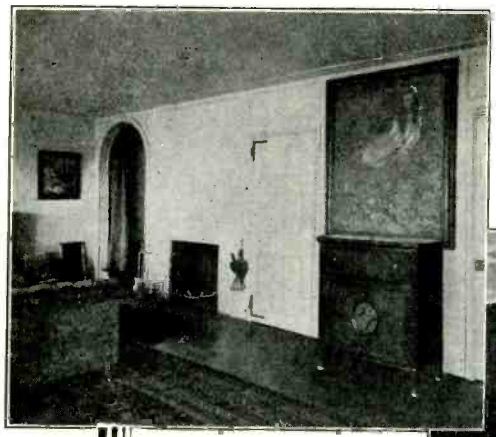
Receiver uses 6-UX 201-A tubes and Electro-Dynamic Reproducer uses 2-UX 281, 1-UX-210, and 1-UX-874 tubes.

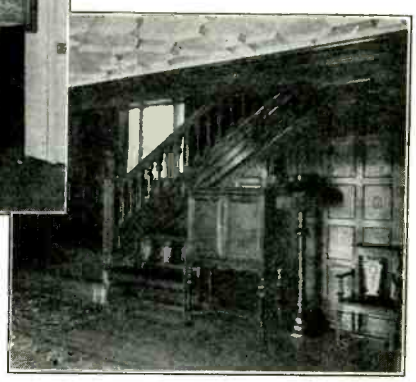
Licensed Under Patents of the Radio Corp. of America and Lektophone Corp.

TERMS: 20% cash with order, balance C.O.D., f.o.b., New York. (2% Discount for Full Remittance with order.)

American Sales Company, 19-21 Warren Street, New York

HERE IS THE PERFECT BROADCAST RECEIVER





The New Admiralty Super-10 is the very apex of Modern Research Engineering.

It is a brand new receiver for the radio connoisseur which we believe represents final superiority over any broadcast receiver now being manufactured or contemplated.

Strictly custom-built, this new model meets the requirements of those that want the best. It is, in fact, the Highest Class Receiver in the World.

SUPER FEATURES

10 Radio Tubes—Super Power—Complete self-contained electric operation—Exceedingly compact—Simplified controls—Full Vision Tuning Indicators—Uses Heater type A.C. Screen Grid and Power Tubes—Super Selective—Band Pass Filter Effect—Hum Eliminator—Line Voltage regulation—Scientifically correct shielding—Great range with sensitivity control—Minimum antenna requirements—Improved push-pull audio system—Perfect reproduction with great volume—Arranged for Electro-Dynamic Loudspeaker—Adaptable for short-wave television work—Universal wave-length range for use in any part of the world—Phonograph pickup connection—Special Weston Meters for voltage and tuning resonance—Protected against moisture for tropical and marine installation—Built strictly according to U. S. Navy Standards—Cabinets of finest selected Mahogany and Walnut Exquisite console combinations available—Entirely custom built—Thorough air test by receiving engineers on all classes of reception for range and quality of reproduction—Sold direct from factory and through selected franchise dealers in the principal cities of the United States and foreign countries—Unconditionally guaranteed against defects.

Attractive illustrated descriptive literature on request

THE NEW ADMIRALTY SUPER-10

Write, telegraph or cable today!

NORDEN-HAUCK, INC., *Engineers*

1 to 9 South Street

Cable: NORHAUCK **Philadelphia, Pa., U. S. A.**

SCREEN GRID...TONE TESTED

LOWEST PRICES

—*No wonder they're all buying*

CROSLEY!

THOUGH still demanding quality, the public has an eye to economy these days! That's why Crosley Radio is now more popular than ever! Everybody is asking for Crosley—thousands of brand-new sets are rolling out of the big Crosley plant each day.

National advertising in the leading magazines and farm papers is playing its part, too. The story of how the most noted musical artists in America were engaged to tone-test Crosley Radio and give Crosley engineers the benefit of their suggestions is spreading like wildfire.

But check the sets themselves . . . you'll see plenty more reasons why the Crosley line is so Red Hot! These sets embody *every* modern feature—and practically the entire line can be sold *complete with tubes* below the $150 price level!

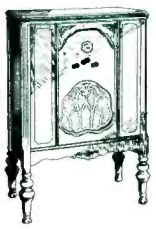
Your Crosley distributor has other facts to tell you, equally interesting and full of profit possibilities. Get in touch with him!

THE CROSLEY RADIO CORPORATION
Powel Crosley, Jr., Pres.
CINCINNATI, OHIO
Home of WLW—"the Nation's Station"

$56.50 *(without tubes)*

CROSLEY 31-S. *Table model, with a rich burl walnut finish on a metal backing, incorporates the 7-tube Crosley Screen Grid Monotrad.* **CROSLEY 41-S** *(similar to above), the 8-tube Crosley Screen Grid Unitrad, $65.85 (without tubes)*

CROSLEY 34-S. *This handsome cabinet model with double doors of diamond-matched panels, incorporating the 7-tube Screen Grid Set and Dynacoil Speaker. $116 (without tubes).* **CROSLEY 42-S,** *utilizing the 8-tube Screen Grid set in the same cabinet, $126 (without tubes)*



$112 *(without tubes)*

CROSLEY 33-S. *This graceful Crosley 7-tube Screen Grid cabinet model, with Dynacoil Speaker, is beautifully finished in two tones of satiny walnut veneer*

CROSLEY 82-S. *8-tube Screen Grid cabinet model, modern design, with Dynacoil Speaker. $160 (without tubes)*

Western Prices slightly higher

You're there with a

CROSLEY