

RADIO Dec 1929 6

Final Tests ... to assure *perfection*

Naturally — every TRIAD Tube is constantly, rigorously tested throughout the entire manufacturing process — a special test follows every individual operation. Yet TRIAD does *more than that!* When completed, each TRIAD Tube is subjected to nine *additional* and *final* tests for vital characteristics — tests so stringent that nothing short of absolute perfection can survive them! This infinite care in manufacture has won for TRIADS their reputation for superior quality — and has made possible that guarantee that goes with every TRIAD Tube — a minimum of six months' satisfactory service or a proper adjustment. You can rely on TRIADS — the tubes backed by an actual Insurance Certificate!

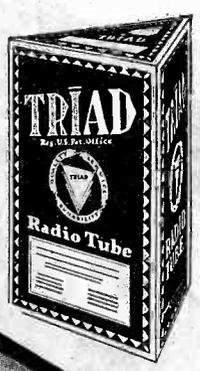
Call your jobber or write us direct for complete TRIAD information.

TRIAD MFG. CO., Inc., Pawtucket, R. I.

Tune in on the TRIADORS every FRIDAY evening, 8 to 8:30 Eastern Standard Time, over WJZ and associated NBC Stations.

TRIAD INSURED RADIO TUBES

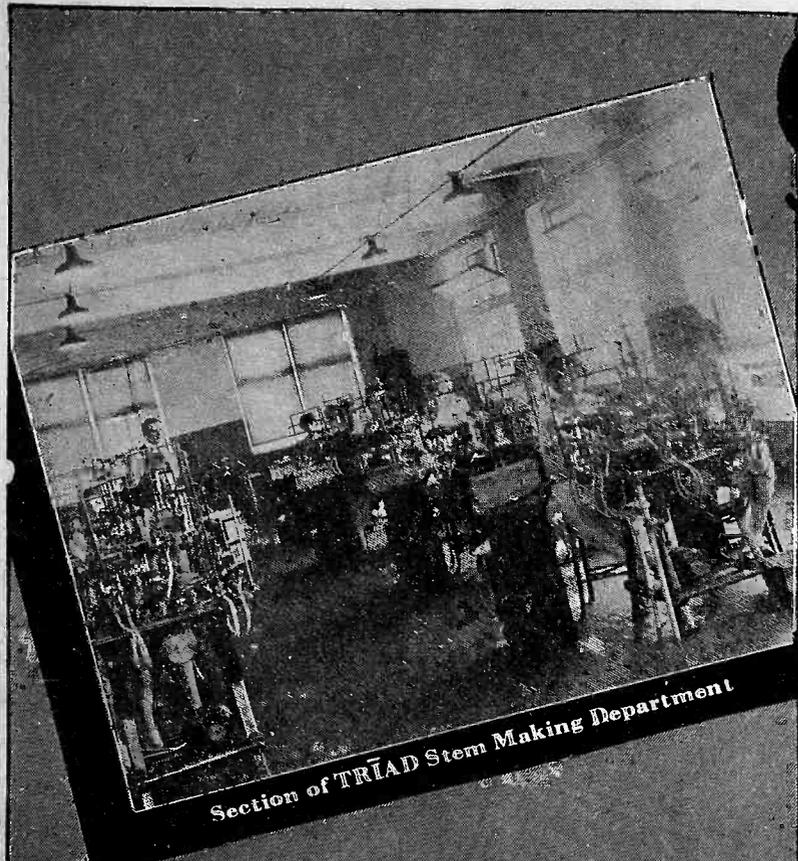
Ask for the tube in the black and yellow triangular box.



FINAL TESTS -

Below are listed the nine *final* tests for vital characteristics to which every TRIAD Tube is subjected.

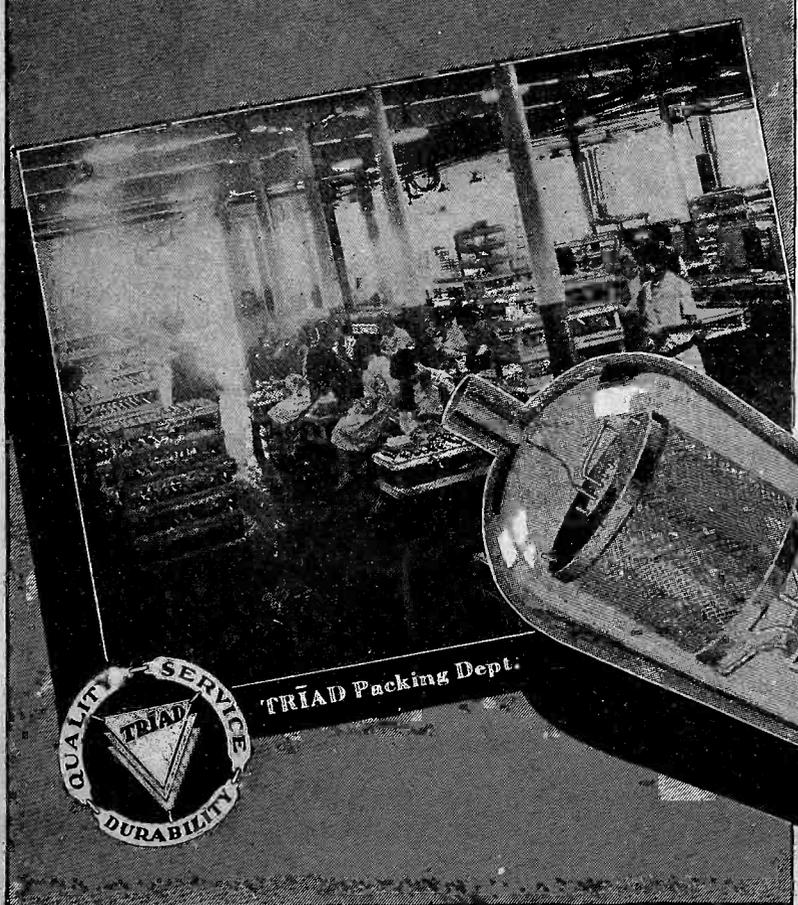
- 1 Gas
- 2 Emission
- 3 Filament Current
- 4 Plate Current
- 5 Oscillation
- 6 Grid Voltage
- 7 Mutual Conductance
- 8 Plate Impedance
- 9 Amplification Constant



Section of TRIAD Stem Making Department



Section of TRIAD Testing Department



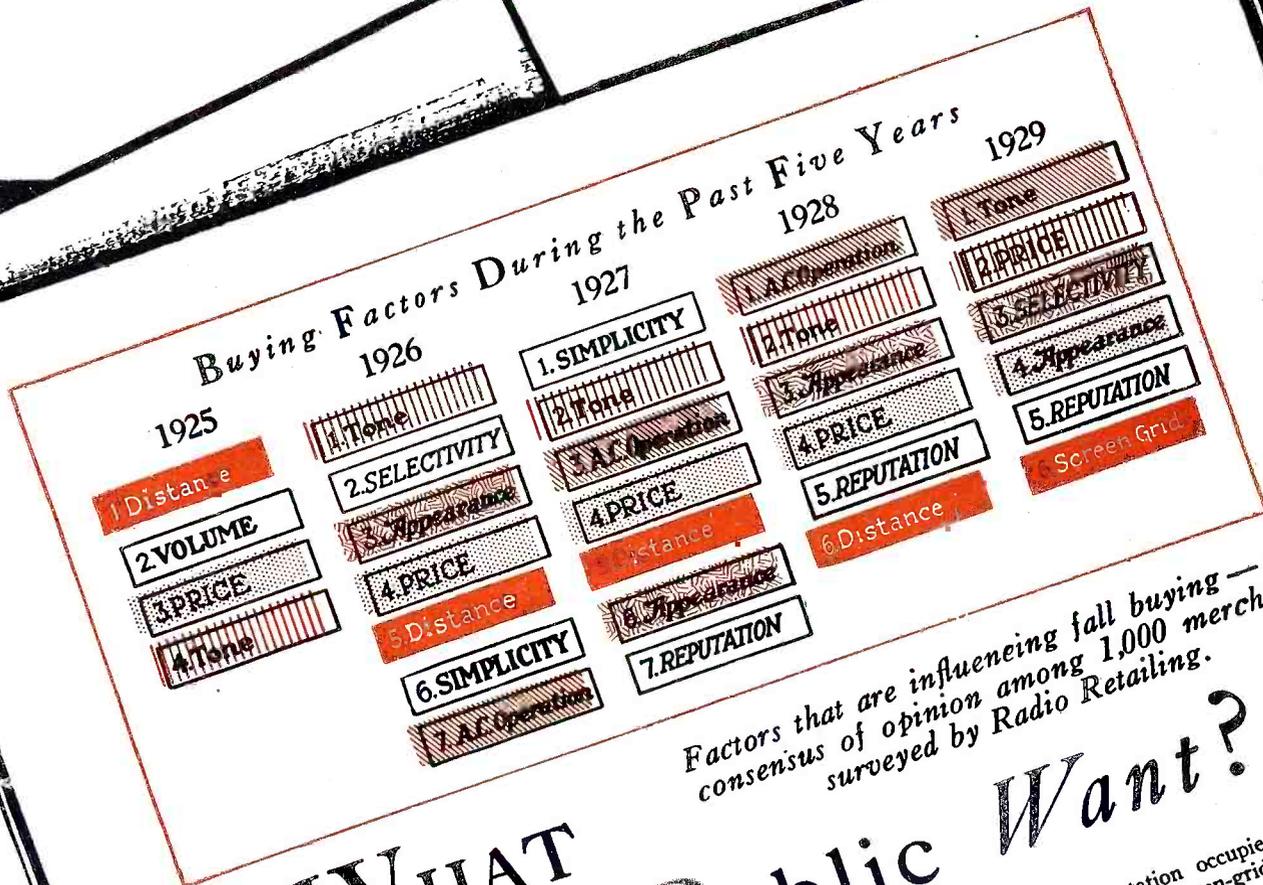
TRIAD Packing Dept.



West Coast Representatives
W. J. NOEL 508 Eddy St., San Francisco, Calif.
R. C. JAMES Pioneer Bldg., Seattle, Wash.

Tell them you saw it in RADIO

1000 Radio



Factors that are influencing fall buying — the consensus of opinion among 1,000 merchants surveyed by Radio Retailing.

WHAT Does the Public Want?

NOW that the public has been shown the radio manufacturers' fall offerings and inasmuch as the year's peak selling season will be crowded into the next three months, let us stop to consider for a moment the various factors that are influencing the buying public at this time.

To be sure there are many qualities that must be incorporated in receiving sets before they will find public acceptance. But each year we find there are several very definite qualifications that prospective purchasers are demanding when they enter the radio store to buy a receiver.

It has been the custom of *Radio Retailing*, each year, to ascertain by a direct survey of the trade, just what these public demands are. On this page we have the results of such a survey just completed, which is the consensus of opinion of over 1,000 merchants scattered throughout these United States.

Quality of reproduction or tone, which has always held a place near the top, is, this year, the primary requisite in any normal industry and reflects the stabilization of the radio industry with its concurrent keener competition among manufacturers. As with other products of necessity or utility, the first thought is to operation and then to cost.

Due to technical improvements in receivers resulting in greater sensitivity, selectivity is third choice. This factor has become a necessity in the present-day broadcast set-up with the great number of stations in operation. Appearance, although in fourth place, is highly important. Furniture design has been vastly improved during the past year in order to meet the critical eye of the housewife, who, more and more, is guiding the purchase of the radio receiver.

The manufacturer's reputation occupies fifth place. Surprising as it may seem, screen-grid comes sixth. Although we see it played up in advertising all around us, and hear it talked about, there is still a good deal of doubt in the public's mind as to just what it consists of. Many do not understand just what this development is, and in most cases the question is asked, "Does it improve the tone and operation of the receiver?" In other words, the public no longer is particularly interested in fancy names for circuits or in technical developments unless the result is made evident to the ear. Very little interest is shown in either remote control or automatic tuning as these developments are so new to the public that they are not as yet particularly concerned with them.

THE a.c. set, for which there was such a rush last year, has become a matter of fact and necessity today. The desire for deep, booming base notes at the sacrifice of the higher frequencies has gradually diminished. Today we find all audible frequencies represented but with balance and equality.

Other factors, such as simplicity of control, volume, and distance-getting ability have dropped out of sight so far as public demand is concerned. These are now considered fundamental and are found generally incorporated in all receivers.

It is therefore evident that dealers who have a line of receivers embodying good tone quality, an adequate price range and attractive cabinets can rest assured that they are in a position to satisfy Mr. and Mrs. Public whenever they step into the store. And if you believe that your stock has all these requirements, then redouble your efforts and for the next three months sell to the utmost of your ability.

Radio Retailing, October, 1929

Merchants

tell us we are right!

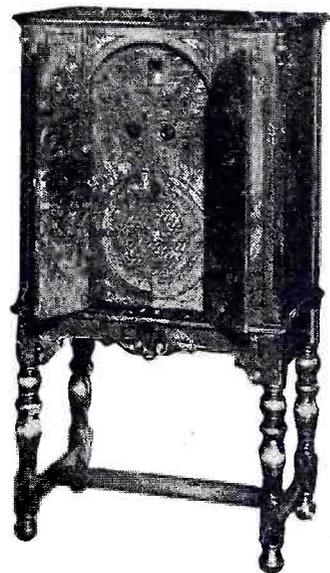
It's always more profitable to sell people what they want to buy. ¶ When you offer the Sterling Concertone Radio to your customers, you are sailing with the wind of popular taste and popular approval. ¶ Every Concertone advertisement features TONE. Every manufacturing process in the Sterling factories is planned to perfect and develop TONE. ¶ And now, through the October issue of Radio Retailing, a thousand representative radio merchants tell us that TONE is what the people want. ¶ Of course, Sterling Concertone has beautiful cabinets, selectivity, distance, volume, screen grid, and every other popular feature, but it is marvelous life-like TONE that puts the Concertone in a class by itself. ¶ If you want bigger sales and increased profits—now—see your nearest Sterling distributor—today.

THE STERLING MANUFACTURING CO., *Cleveland, Ohio*
ELECTRICAL MANUFACTURERS FOR 24 YEARS



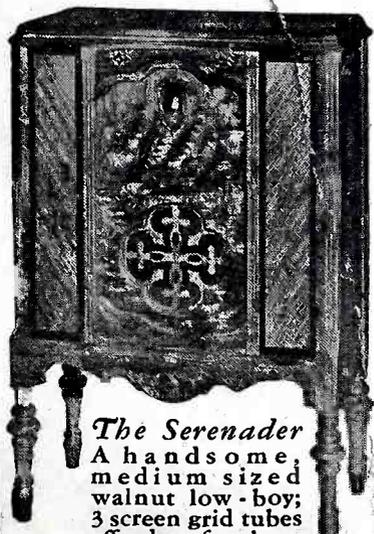
The Troubadour
The ideal set for small homes or apartments. 3 screen grid tubes—perfect for long range reception. \$129⁵⁰
Less tubes

Prices slightly higher in far west.



The Imperial
Beautiful walnut high-boy; 3 screen grid tubes with each stage completely shielded. \$187⁵⁰
Less tubes

Also supplied for operation on 25 cycle current, at no increase in price.



The Serenader
A handsome, medium sized walnut low-boy; 3 screen grid tubes afford perfect long range tuning. Less \$149⁵⁰
tubes

Tell them you saw it in RADIO

14 POINTS!

that make selling easy
and profits sure—

outstanding features of the

New
1930

Browning-Drake
screen-grid radio

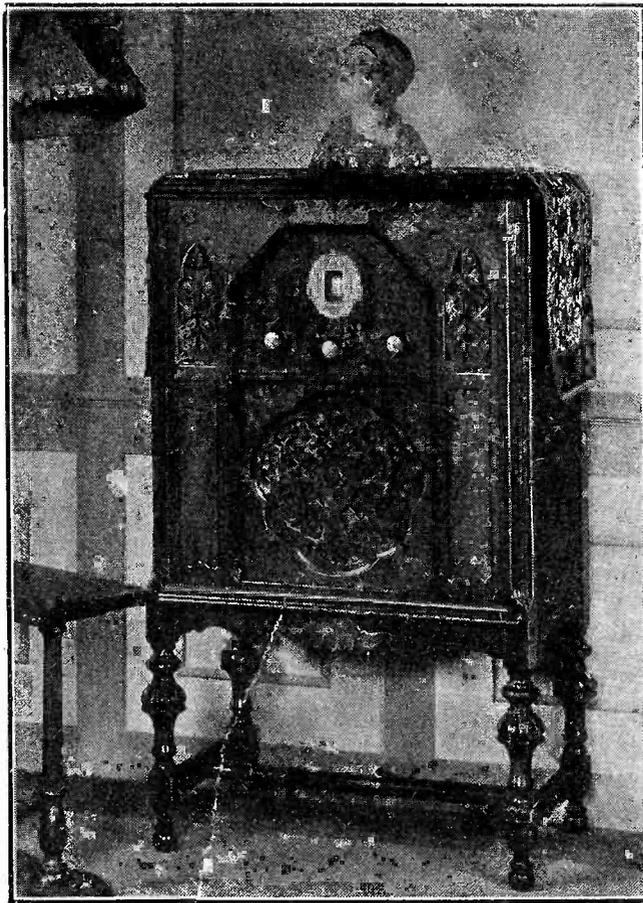
YOU'VE many convincing sales points to give your prospect when you offer the New 1930 Browning-Drake Screen-Grid Set. The fourteen below are just some of the many that make this set so satisfactory both to you and your trade. They insure the least possible servicing.

Here they are:

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. Hum eliminator.
7. Band-pass filter effect (10 KC. selectivity).



You ought to get the whole story about this set and our unusually attractive franchise. Write for it now.

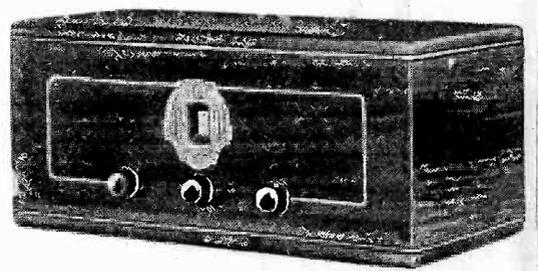


MODEL 56—Screen-Grid, Small Console, 42x25x15, less tubes..... \$154.50

MODEL 66—Heater Type, Small Console, 42x25x15, less tubes..... \$149.50

*Prices the same throughout the country
Eight models, table and console, heater
and screen-grid types.*

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



MODEL 53—Table Model, Screen-Grid Type, list, less tubes..... \$102.50

MODEL 63—Table Model, Heater Type, list, less tubes..... \$98.00

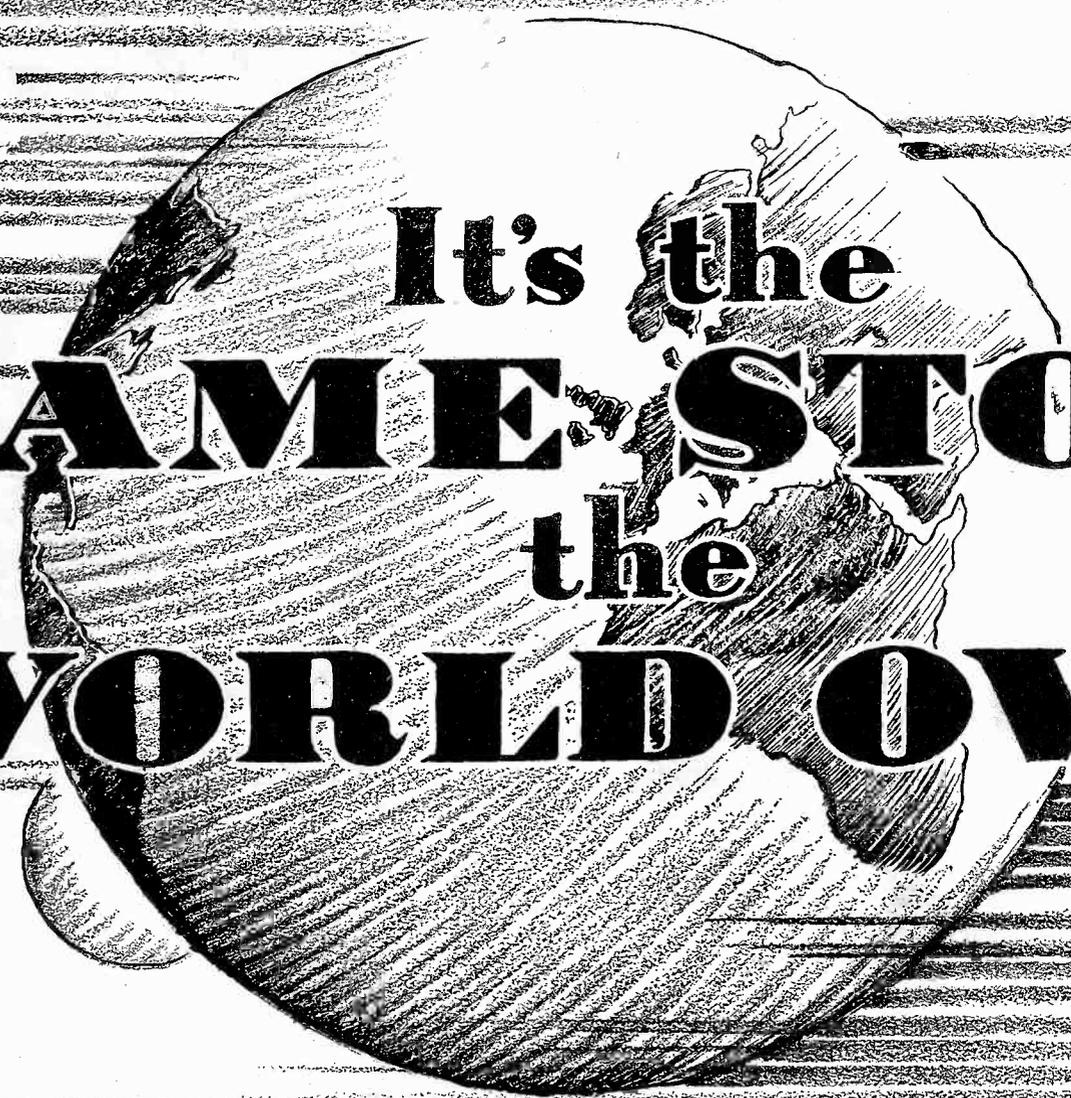
Prices slightly higher West of Rockies

BROWNING-DRAKE CORPORATION,

Builders of quality radio for five years

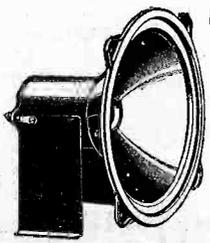
224 Calvary Street
Waltham, Mass.

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



It's the
SAME STORY
the
WORLD OVER

*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.

Jensen
ELECTRO-DYNAMIC SPEAKERS
LICENSED UNDER LEKTOPHONE PATENTS

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

Tell them you saw it in RADIO

Service Plus!

It's the plus that counts!

Like the "it" in personality, the knockout blow in boxing, or the crashing ace in tennis, it's the punch that counts!

The SUPREME DIAGNOMETER is full of *extra punch!*

Would you patronize a plumber who couldn't stop a leak?

A doctor who couldn't cure a cold?

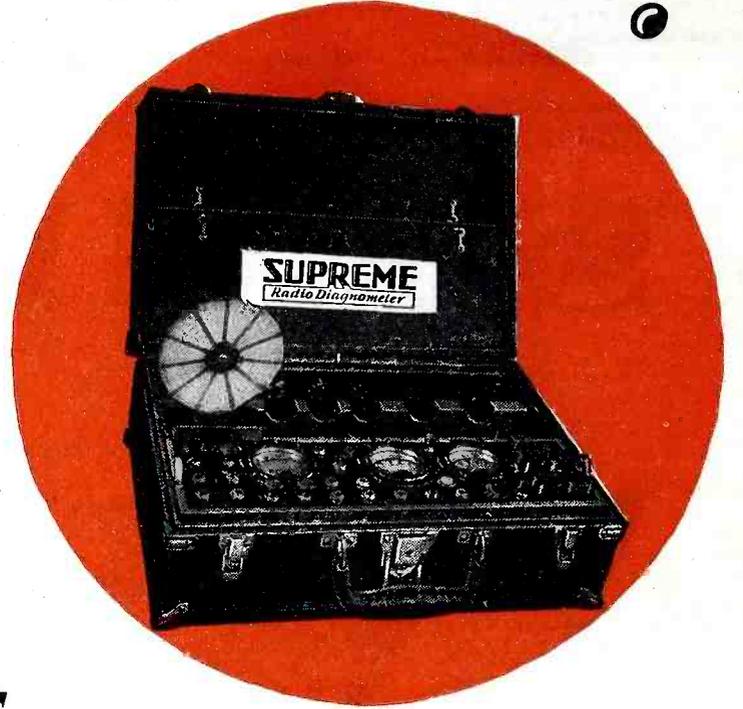
Then why use servicing equipment that doesn't fill your every need?

That doesn't provide for every test?

That doesn't do justice to your skill?

That doesn't enable you to give service *plus?*

Your customers expect and appreciate SUPREME LEAGUE SERVICE which is the Service *Plus* in radio. You can give SUPREME LEAGUE SERVICE with the SUPREME DIAGNOMETER.



"Set Testers" prove only 29% to 40% efficient in comparison with the SUPREME DIAGNOMETER

Thorough and complete, yet surprisingly simple. The SUPREME RADIO MANUAL gives full instruction and much valuable radio information.

The Only Complete Portable Radio Testing Laboratory

No other radio testing device can anywhere near approach the range, completeness and flexibility of the SUPREME DIAGNOMETER. Make any test you like. Send for ours, which is confidently called "A Test that Challenges Attention." Some of the outstanding features of the SUPREME are:

All tubes tested under actual operating conditions.

Screen grid socket analysis without oscillation.

750 Volt 4 scale A.C. and D.C. meters, 3 scale milliammeter.

Self-contained power plant.

Modulated radiator for testing, synchronizing, neutralizing.

External connections to all apparatus.

Tests both plates '80 type rectifiers.

All continuity tests without batteries.

Universal analyzer plugs.

and a request for complete specifications will reveal numerous other superiorities.

Handy carrying case providing compartments and space for all tools and spare tubes.

750/150/16/4 A.C. Meter.

750/250/100/10 D.C. Meter.

2/12 Ampere-125-25 Milliammeter.

Thermo couple meter for measuring output of a set.

Measures resistances.

Measures capacity of condenser 5 to 9 M.F.D.

Makes all analysis readings.

Supreme Service League



To Radio Owners: Look for this emblem in your radio shop, on the lapel button or card of your service man. It is your guarantee of dependable radio service. Cash in on the prestige the SUPREME SERVICE LEAGUE is building.



Order NOW

Present production permits immediate deliveries but the momentum of sales is such that buyers are cautioned to place their orders now. Reservations will be made against all orders placed for future delivery on specified dates. Make use of this plan to avoid disappointments.

Most good distributors carry the SUPREME DIAGNOMETER in stock. If yours cannot supply you, send order direct on form to right.

SUPREME

Radio Diagonometer

Makes every ^{conceivable} test on any Radio Set-

Supreme Instruments Corp.
344 Supreme Bldg.
Greenwood, Miss.

Please ship SUPREME DIAGNOMETER Model 400-B on basis checked below.

Net cash \$139.50.

Time payment plan—\$33.50 cash and 8 monthly payments of \$15.00 each.

All prices are F.O.B. Greenwood, Miss. No dealer's discount.

Date shipment desired

Signed

Firm Name

Street Address

City

State

Please give three or more bank or trade references and names of distributors from whom most purchases are made.

HERALDING



THE **NEW** LEADER IN REPRODUCTION

Amplifiers by an acknowledged leader in the audio field are indispensable where better quality, greater power output, or both, are required. Thordarson power amplifiers meet these requirements, combining all the features of design gathered by years of research and experience in Thordarson laboratories.

Special Features:

1. **Fidelity**—These amplifiers incorporate the best of Thordarson audio transformers, properly designed to give uniform amplification over the useful audio range.
2. **Output**—Maximum undistorted output 4650 milliwatts.
3. **Amplification**—Voltage amplification of 275.

4. **No Hum**—Hum has been reduced to absolute minimum.
5. **Design**—The work of many months by Thordarson engineers backed by years of experience.
6. **Adaptability**—Ingenious means for applying this amplifier to any problem in sound reproduction.
7. **Simplicity**—Self-contained, no outside terminals.
8. **Safety**—Completely fused and equipped with automatic safety switch.
9. **Workmanship**—In keeping with Thordarson products.
10. **Attractive Appearance**—Finished in gold lacquer.
11. **Guarantee**—Liberal 90-day guarantee.
12. **License**—Licensed by Radio Corporation, Bell Telephone, General Electric, Westinghouse and Thordarson.
13. **Price**—\$89.50.

DISTRIBUTORS

Boston, Mass.
Woodrow Radio Co.
166 Prospect Street
Cambridge, Mass.

Chicago, Ill.
Newark Electric Co.
226 W. Madison St.

Chicago, Ill.
Chicago Radio Apparatus Co.
415 S. Dearborn St.

Cleveland, Ohio
M & M Co.
500 Prospect Avenue

Dayton, Ohio
Burns Radio Co.
12-20 Jefferson St.

New York City, N. Y.
Graymore Radio Corporation
142 Liberty St.

THORDARSON

POWER AMPLIFIERS

DISTRIBUTORS

Philadelphia, Pa.
M & H Sporting Goods Co.
512 Market St.

Pittsburgh, Pa.
Cameradio
430 Wood Street

Minneapolis, Minn.
Findley Electric Co.
111 S. 6th St.

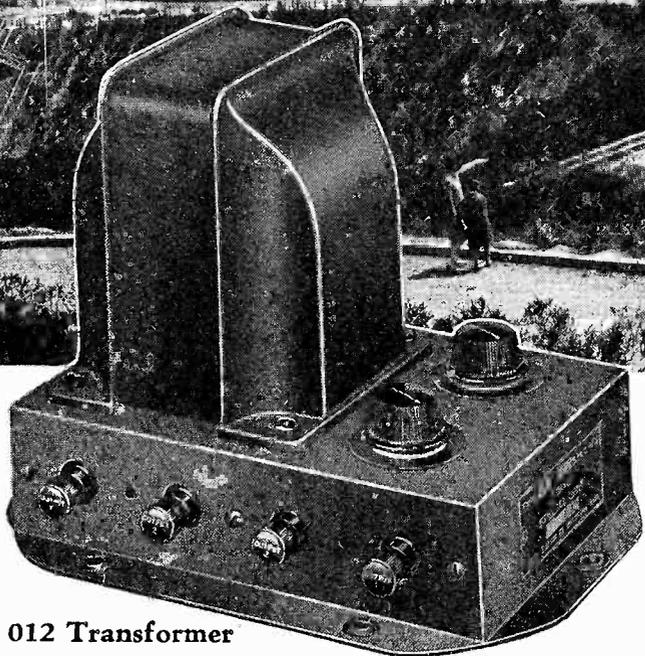
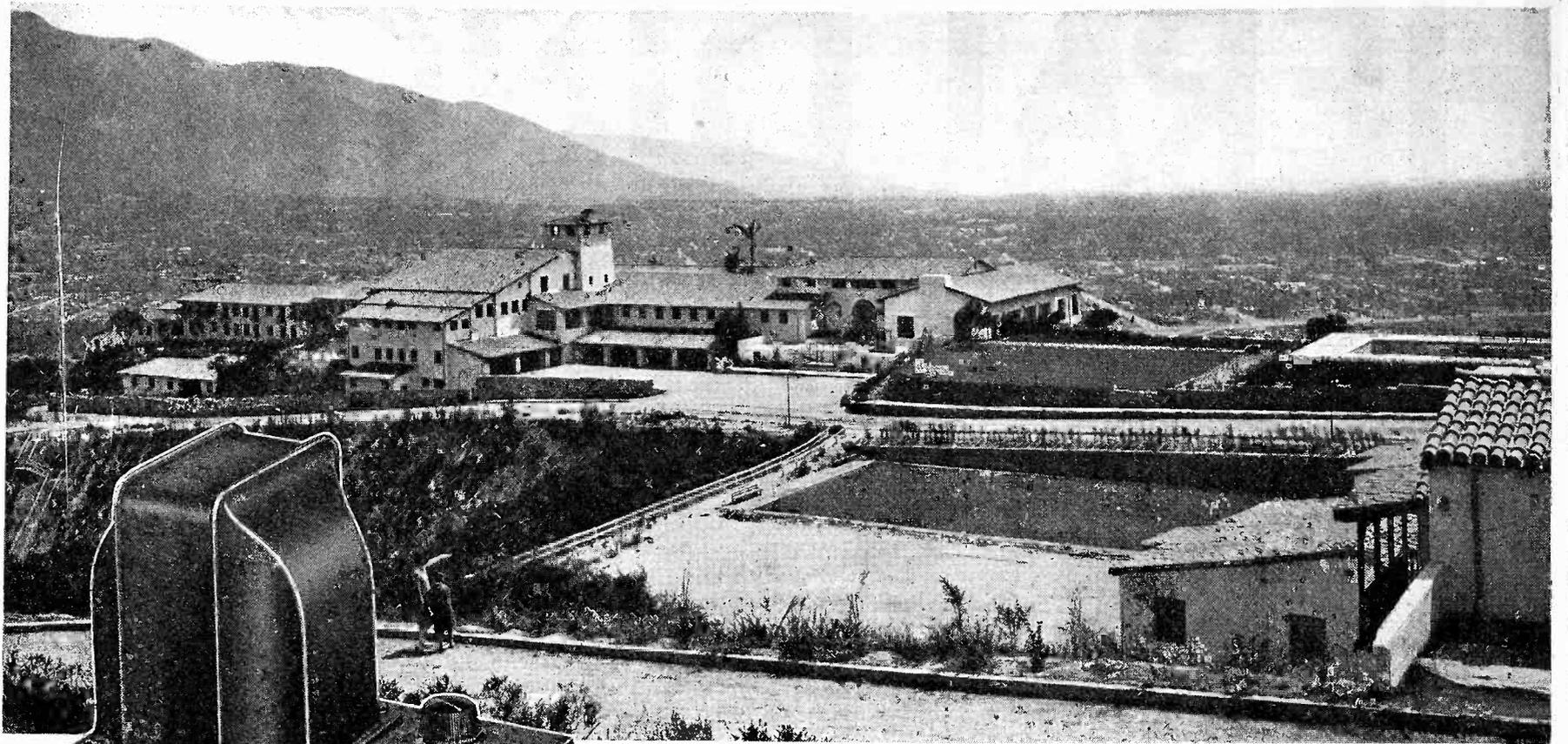
Minneapolis, Minn.
Jalisco Mfg. Co.
229 E. Hennepin Ave.

Seattle, Wash.
Wedel Co.
520 2nd Avenue

St. Louis, Mo.
Van Ashe Radio Co.
210 N. 10th St.
St. Paul, Minn.
Pioneer Electric Co.
137 E. Fifth St.

THORDARSON ELECTRIC MFG. CO., Huron, Kingsbury and Larrabee Sts., Chicago, Ill.

Tell them you saw it in RADIO



012 Transformer

PAM adds crowning touch to a famous hospitality

The lure of mountain grandeur, framed in sunset gold, is enhanced by PAM amplified music at the Flintridge Biltmore Hotel, near Pasadena, California.

Wherever people gather to enjoy nature's beauties, sport's keen competitions, or just the privacy of their rooms, PAM installations add pleasure and keep them in touch with the world.

There are many opportunities for such installations right in your vicinity and each will bring other orders.

The 012 Variable Impedance

A new 16-page bulletin, giving mechanical and electrical characteristics, representative installations and many new PAM Amplifiers, will be sent upon receipt of 10 cents in stamps to cover postage. When writing ask for Bulletin No. R-14.

Output transformer shown above has a primary which matches the output impedance of any of our PAM amplifiers or its primary may be reduced to 500 ohms. The secondary of this transformer may be varied in impedance from 8 to 1000 ohms to suit almost any condition. The 012 permits the use of two circuits of unequal impedance to be operated from the same PAM amplifier.

Main Office:
Canton, Mass.



Manufacturers Since 1882

Factories: Canton and
Watertown, Mass.

327 Tilden Sales Bldg.
SAN FRANCISCO, CALIF.

PACIFIC COAST OFFICES:
324 North San Pedro Street
LOS ANGELES, CALIF.

2607-11 Second Avenue
SEATTLE, WASH.

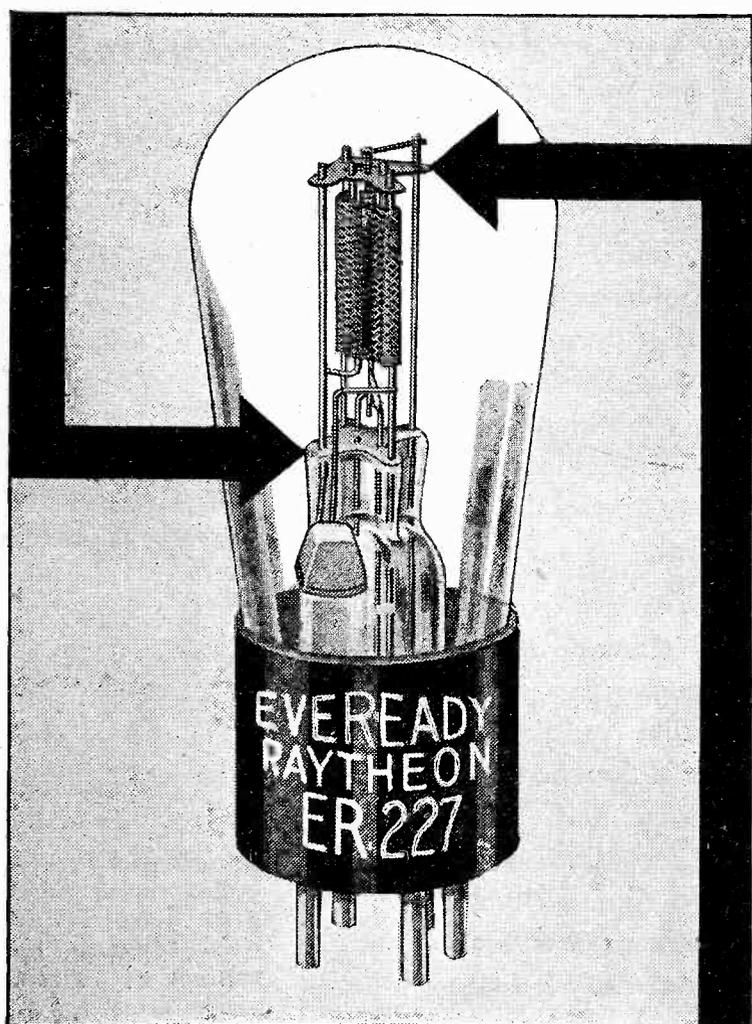
637 East Broadway
PORTLAND, ORE.



EVEREADY RAYTHEON

4-PILLAR TUBES

BRING OUT THE BEST THAT'S
IN ANY RADIO RECEIVER



Trade-marks

THE GREATLY superior performance of new Eveready Raytheon Tubes means the very best reception a radio receiver can give. People in all parts of the country report amazing results from their own receivers since installing these marvelous new tubes. Greater distance, more power, improved tone, quicker action!

Put a new Eveready Raytheon Tube in each socket of a receiver—and note the vast improvement. Then examine one of these tubes. Observe the solid, four-cornered glass stem at the base of the elements, supporting the four rigid pillars which hold the elements. Notice how the elements are anchored at both sides as well as at the ends. Note how this 4-Pillar construction is braced still further by a stiff mica plate at the top.

The jolts and jars all tubes receive in shipment cannot distort the elements in an Eveready Raytheon. Handling these tubes and installing them cannot impair their performance. For the elements are permanently held in their correct and accurate positions by the patented Eveready Raytheon 4-Pillar construction.

No other tube can give you all the advantages of this 4-Pillar construction, for it is patented and exclusive with Eveready Raytheon. These fine tubes come to you in the same perfect condition as when they leave our laboratory test room . . . all their superlative performance intact.

NATIONAL CARBON CO., INC.

General Offices: New York, N. Y.

Branches: Chicago Kansas City
New York San Francisco

Unit of Union Carbide  and Carbon Corporation

Tell them you saw it in RADIO

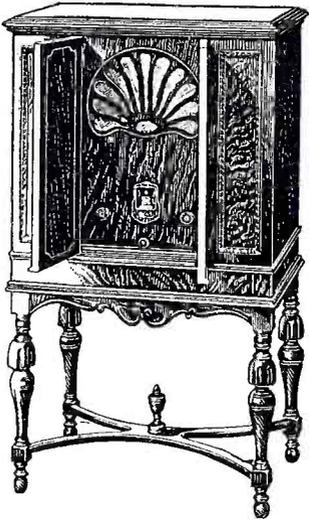
THE CHOICE OF THE EXPERTS

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 coordination 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.

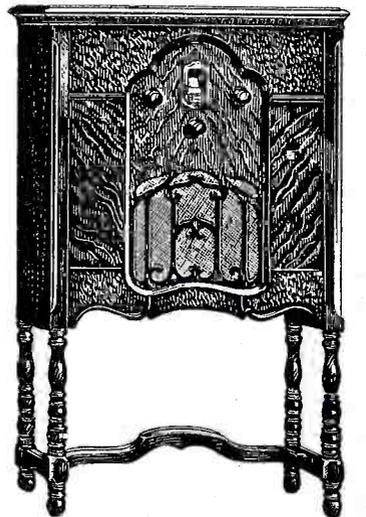
\$220 \$245 \$255

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

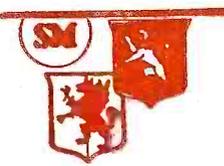
Prices higher west of the Rockies and for export

FADA

For Permanent

PROFIT!

NO PRICE CHANGE

SILVER
 *Radio*
• EXTRAORDINARY •

No Price Reductions
No Distress Merchandise
No Overproduction
No Stock Jobbing
No Trailing the Market
No Cessation of Advertising

And That's the Result of
Right Engineering
Right Performance
Right Planning
Right Pricing
Right Merchandising

SILVER RADIO—4 SCREEN-GRID TUBES—SO GOOD IT NEEDS NO AERIAL—
\$160, \$173, \$195

Designed by McMurdo Silver—Sold through Exclusive Distributors to Franchised Dealers

SILVER-MARSHALL, Inc.

6441 West 65th Street

Chicago, U. S. A.

SILVER RADIO

SILVER . ON . RADIO . IS . LIKE . STERLING . ON . SILVER

Now....

you can get into the **BIG MONEY!**

*Bigger sales units and bigger profits per unit . . .
Sell \$350 to \$1000 and MORE... Easy-to-handle
installations all over your neighborhood*

BIG BUSINESS! And it's easy for you to capture! Just imagine . . . every theater and dance hall, every hospital and apartment house in your district is a logical user of broadcasting entertainment. By simply stretching out your hands for it, you can secure your share of this big-unit, big-profit business. Get into Power Amplification! Sell the equipment . . . make the installations . . . get bigger advertising value . . . and keep your organization busy making real money for you all the year around!

Show the business men in your area how a modern system of A-C Power amplification will draw big crowds and make big money for them. We make the heart of the system, **POWERIZER** Amplifiers employing the new UX-245—UX-250 Tubes. Our new Control Panels and Amplifier Racks afford ideal flexibility in arranging audio-distribution to suit local conditions. Capitalize our years of experience. Consult us freely!

Send for Bulletin No. PR 1028

POWERIZER

Power and Super Power

AMPLIFIERS

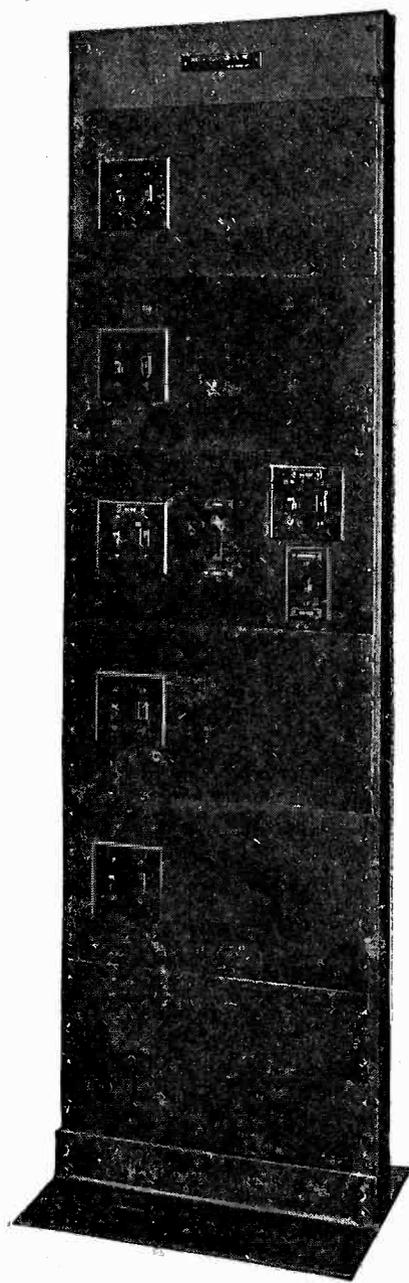
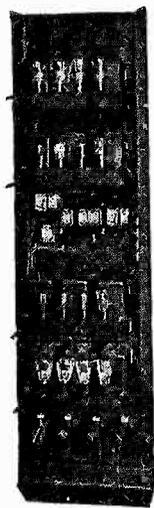
Licensed by Radio Corporation of America and Associated Companies

RADIO RECEPTOR COMPANY, Inc.

106 Seventh Ave.

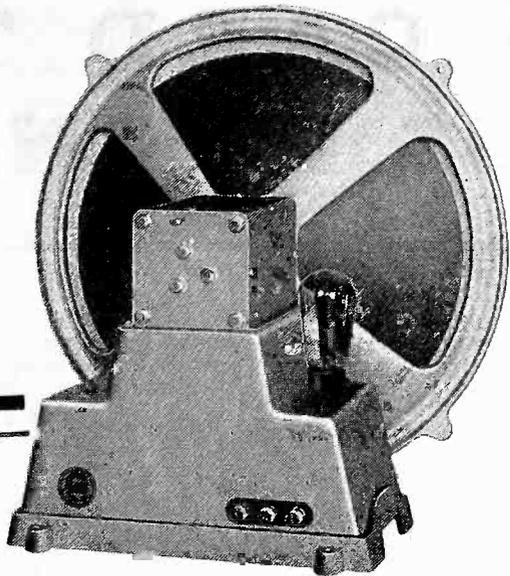
New York, N. Y.

Service agencies in important cities.



**POWERIZER 2-channel
amplifier panel, ideal for**

Amusement Parks	Dance Halls	Riding Academies
Aviation Fields	Factories	Sanatariums
Band Stands	Gymnasiums	Skating Rinks
Baseball Parks	Hospitals	Sporting Arenas
Camps	Hotels	Steamships
Churches	Playgrounds	Swimming Pools
Circuses	Public Parks	Theaters
Civic Centers	Race Tracks	Yacht Clubs
Convention Halls	Railroad Depots	
	Restaurants	



Not "Just Another"
Electro-Dynamic—

VICTORY SPEAKERS

—are Entirely **NEW**—
amazingly **DIFFERENT**
and **FAR SUPERIOR!**

ADVERTISING space for the announcement of a new electro-dynamic of *only ordinarily good attributes* would be valueless—but—the **VICTORY GIANT** *commands attention justifiably!*

Here is a speaker—the largest—the most rigidly constructed and most efficient ever developed. Its remarkable frequency curve, reproduced below, is the marvel of engineers. The Victory Giant cone has *twice* the area of any other and sets *twice* the air in motion, the cone angle spreading the sound waves, rather than making them entirely directional.

An exclusive feature concentrates energy of the field and intensifies magnetic flux at four hot points on the heavy top plate, giving more sensitive and more powerful drive to the movable coil, and the heavy top plate assures a more uniform cone drive.

This combination of new, exclusive features assures the unusually full, rich tone quality, clarity, and enormous volume of the Victory Giant, developed to a point unapproached in other speakers.

The "VICTORY" Curve

Here is the Frequency response curve of the Victory Electro-Dynamic Speaker, plotted by Frank C. Jones, eminent radio engineer. Note that the lower register—or **BASS**—frequency range is as near perfect as is humanly possible in any mechanical sound reproducing device. Note how evenly the frequency curve follows the scale, even at high frequency register. There are not many "highs." No shrill, piercing frequency hump. The Victory speaker curve proves that this speaker combines **ALL** of the good qualities of sound reproduction. Life-like, faithful, it is amazing. We guarantee each Victory Giant speaker follows this frequency curve.

◆◆◆◆
Neutralizing coils and filters are not used on
Victory Speakers.

SPECIFICATIONS

16" cone (inside)—(19" outside).
1/2" top plate.
2" movable coil—1/2" wide.
1—280 rectifying tube for field excitation.
Net weight complete with input and rectifying transformers 38 lbs.
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.

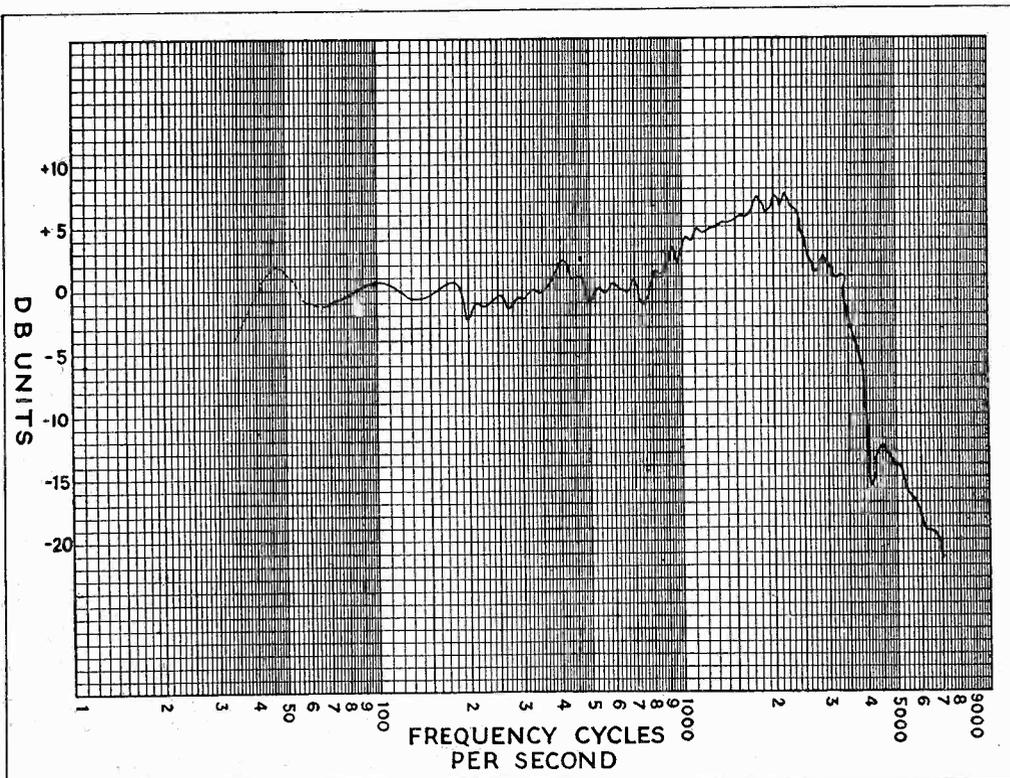
JOBBERS—AGENTS

Attractive Franchises for desirable territory are still available. Complete information upon request to responsible concerns.

VICTORY SPEAKERS

INC.

OAKLAND CALIFORNIA
7131 East Fourteenth Street



Tell them you saw it in RADIO

LET US SEND THIS CARD TO YOUR RADIO BUSINESS FRIENDS



A PRACTICAL SOLUTION OF THE CHRISTMAS PROBLEM

RATES 1 1 1
 For One Subscription
 TWO DOLLARS
 For Two Subscriptions
 FOUR DOLLARS
 For Three Subscriptions
 SIX DOLLARS

DEALERS: Your salesmen will welcome a subscription to "RADIO" from you as a Xmas gift. Send "RADIO" to all of them.

JOBBER: Your salesmen and service men will appreciate "RADIO" for one year as a Xmas gift from you. Nothing is more acceptable—more instructive. Rush your orders now!

AIR MAIL YOUR ORDERS BEFORE DECEMBER 21ST

We Will Do This For You—

1. Tell the recipients that YOU have subscribed to "RADIO" for them as a Christmas gift.
2. Send a card, like the one shown above, mailing it so as to arrive on December 24th.
3. We will also send them our monthly loose leaf price and data sheet service and a binder for holding the sheets.
4. We will start the subscriptions with our December (Christmas) issue, in which the first article on "SELLING RADIO" will be published.

Publishers of "RADIO" . . .

428 Pacific Building San Francisco, Calif.	415 Lexington Avenue New York City, N. Y.
86 St. Botolph St. Boston, Mass.	307 N. Michigan Ave. Chicago, Ill.

Send your Subscription to the Office of "RADIO" Nearest You.

Name _____
 Street and Number _____
 City and State _____

Send "RADIO" for one year to the names listed:

Name _____
 Street and Number _____
 City and State _____

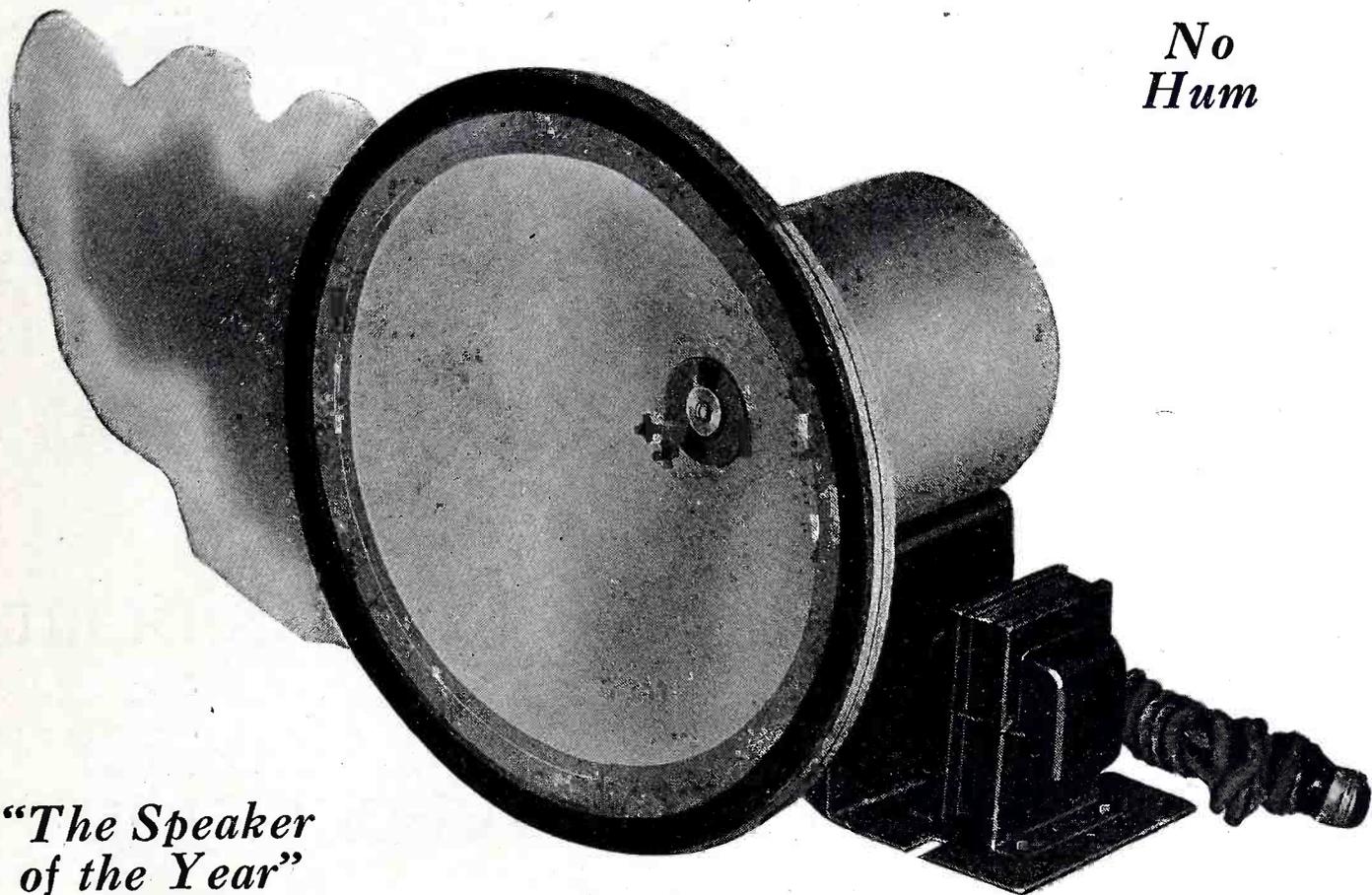
Name _____
 Street and Number _____
 City and State _____

Donor's Name _____

Address _____

(WRITE OR PRINT PLAINLY IN PENCIL OR TYPEWRITER. INK WILL BLUR ON THIS PAPER.)

*No
Hum*



*"The Speaker
of the Year"*

Your Radio Can Only Be as Good as Its Speaker

All the efforts of a radio manufacturer to produce a perfect receiving set are lost when a mediocre speaker is incorporated in the set.

INSTALL THE

Wright-DeCoster Reproducer

Here is a reproducer that has an almost uncanny way of projecting everything from the softest tone of the human voice to the blare of a brass band with absolute fidelity.

Charming Period Cabinets

In both design and finish Wright-DeCoster cabinets are so beautiful that they will grace any room no matter how handsome the furniture may be. Various models follow the style of the most outstanding examples of Early American and Old English craftsmanship.

Write for
DESCRIPTIVE
FOLDER OF CHASSIS
AND OF DIFFERENT
CABINET MODELS.

WRIGHT-DECOSTER, INC.

2217 University Avenue

St. Paul, Minnesota



YOU ARE WANTED

at the

Fourth Annual Convention

of the

National Federation of Radio Associations

and the

Radio Wholesalers Association

at the

Hotel Statler  Cleveland, Ohio

February 10 and 11, 1930

THIS INVITATION

is extended to all Individual Radio Dealers, Wholesalers, Manufacturers, Broadcasters and the Press, as well as to all State and Territorial Radio Trade Associations.

THIS WILL BE

a "down-to-facts" convention that will get at the vital problems of our industry. Retailers and Wholesalers will all have their round-table sessions at which problems pertinent to the group concerned will be discussed.

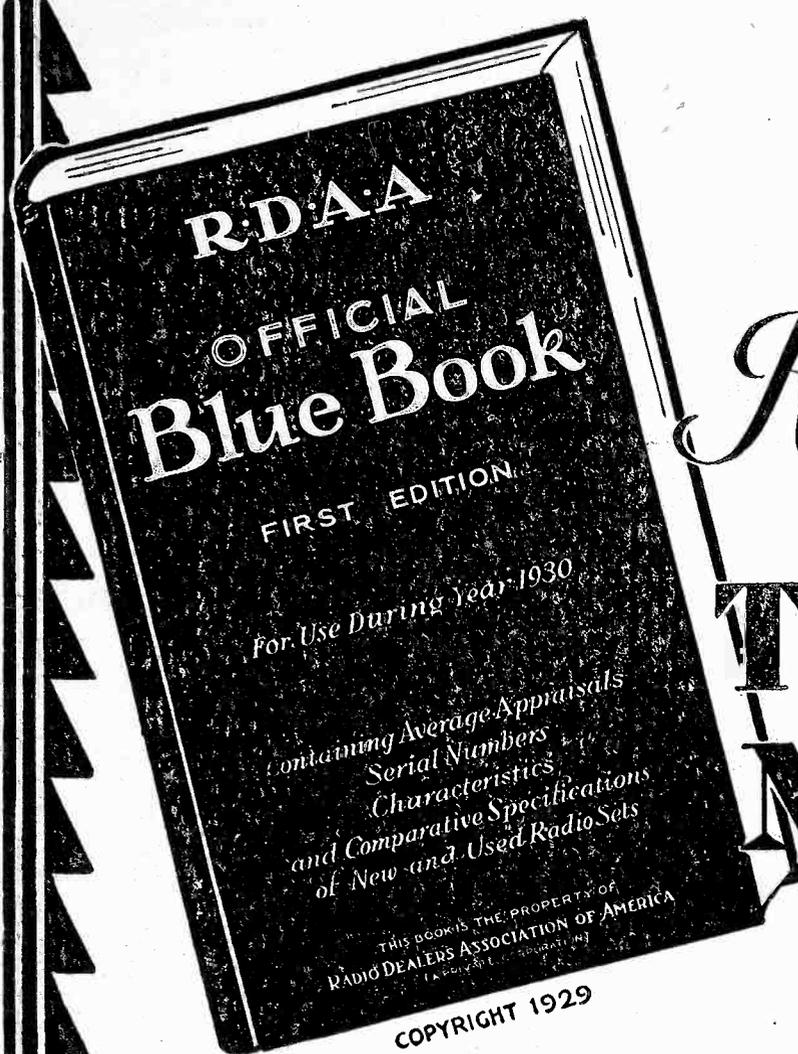
THE MEN WHO SET THE PACE

the very leaders of our industry will all be there. Do not miss this opportunity to meet them "man-to-man" and talk it over.



This space donated through the courtesy of "RADIO"

Tell them you saw it in RADIO

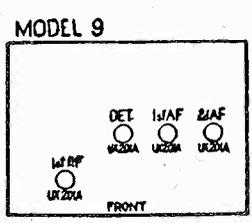


Radio Dealers-- This Book Will Make Money for You!

Your First Opportunity to secure under one cover a complete volume of reliable, authentic, dependable information on RADIOS.

THE R. D. A. A. BLUE BOOK, contains diagrams giving Comparative Specifications, Characteristics, Serial Numbers, List Prices, and identifying data with AVERAGE AMERICAN APPRAISAL on more than 700 MODELS OF RADIO SETS.

JUST THE INFORMATION YOU WANT AT YOUR FINGER TIPS



Model	Year	Type	Tubes	Serial Range	List Price	R.D.A.A. Appraisal	Screen Grid Tubes
Table 9	1923	Bat.	4 •	19000	70.00	3.50	
Table 5	1924	Bat.	5 •	40000	55.00	4.40	
Table 10A	1924	Bat.	5 •	50000	104.00	5.20	
Table 10B	1924	Bat.	5 •	250000	104.00	5.20	
Table 12	1924	Bat.	6 •	500000	105.00	5.25	
Table 20	1924	Bat.	5 •	400000	100.00	5.00	

(Our appraisals and comparative specifications cover models from 1920 to and including current sets.)

R. D. A. A. Service is Nationwide and Continuous

OUR SERVICE DEPARTMENT, under the supervision of recognized RADIO EXPERTS, keeps you continually advised of all changes in models and prices promptly as they occur through supplements and bulletins. In many instances we can supply advance information on such changes.

THIS SERVICE is approved and recommended by manufacturers, distributors and dealers alike. It visualizes the information, substantiates your statements, gives the absolute proof you need, saves your time and the customer's time, and above everything else, eliminates all possibility of ill feeling or misunderstanding.

CAN YOU AFFORD TO BE WITHOUT IT?

Radio Dealers Association of America

Chicago, Illinois

The R. D. A. A. Blue Book and Service is furnished Established Dealers Upon Lease Terms at a Price of

\$1.00 per month—
PAYABLE ANNUALLY IN ADVANCE.

(This price includes our entire service, supplements, etc.)

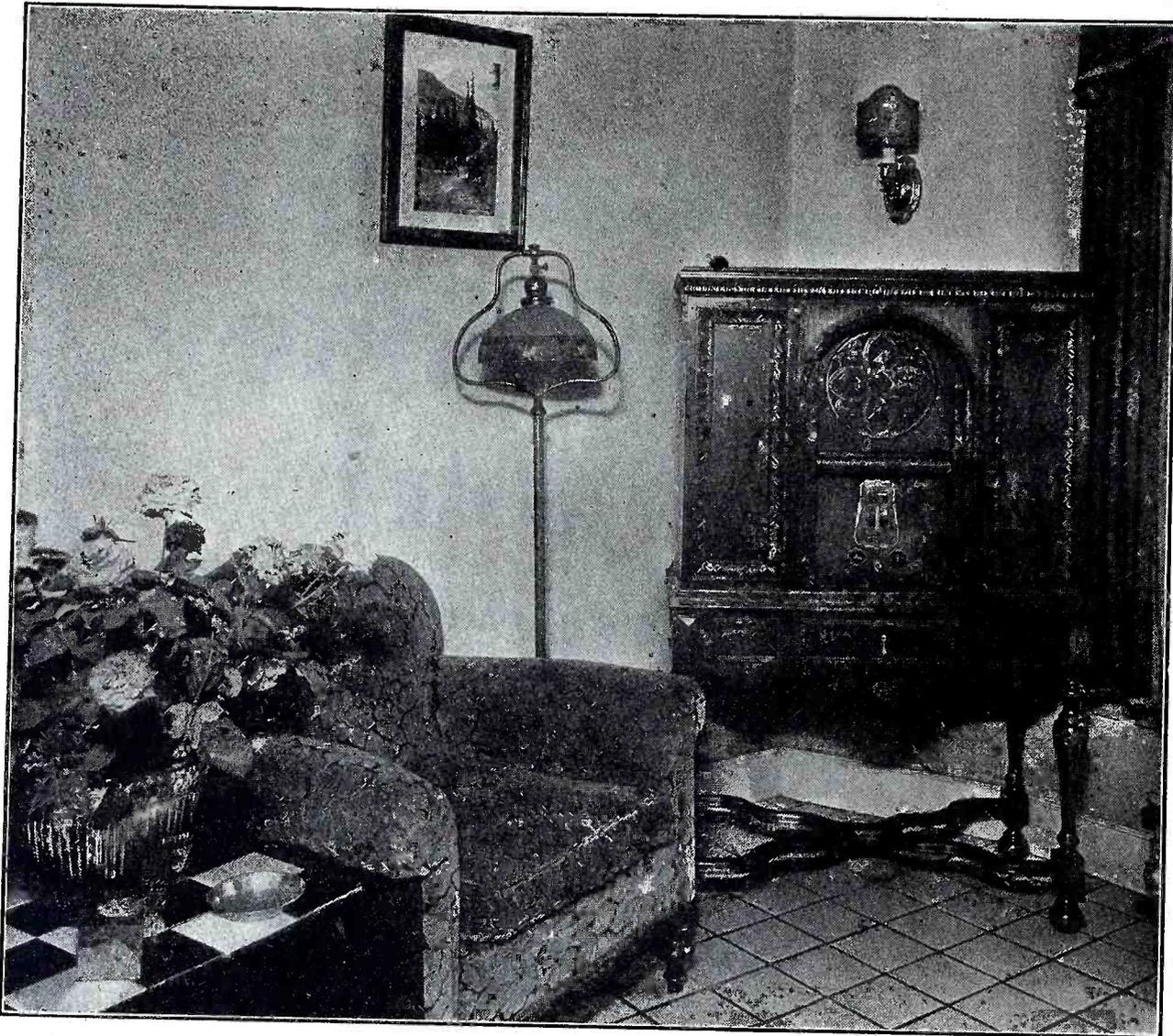
RADIO DEALERS ASS'N OF AMERICA
1929 South Wabash Ave.,
Chicago, Illinois

PLEASE ENTER OUR SUBSCRIPTION FOR R.D.A.A. BLUE BOOK AND SERVICE FOR A PERIOD OF ONE YEAR UNDER YOUR REGULAR TERMS. We are enclosing \$12.00 which we understand is full payment for your complete service, including supplements, bulletins and the use of the BLUE BOOK for one year. In the event we find the BLUE BOOK does not contain the information as stated by you we shall have the privilege of returning same promptly and receive our money back.

NAME _____
Dept. 'R' ADDRESS _____
CITY _____

Tell them you saw it in RADIO

LEUTZ



Above: Leutz "Seven Seas" Radio Phonograph Combination

Write, Wire or Cable Today

C. R. LEUTZ, Inc.

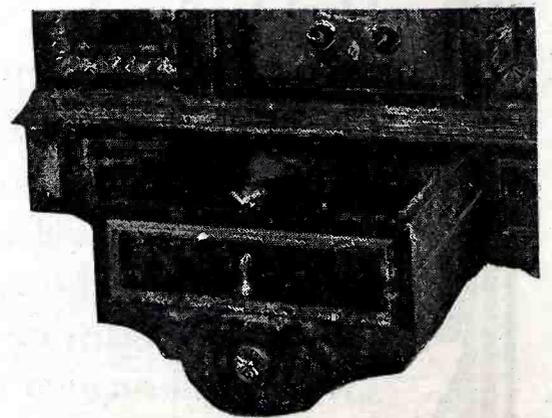
ALTOONA, PA., U. S. A.

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



Close-up of Phonograph

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

SEVEN SEAS

Tell them you saw it in RADIO

TRUTH IS STRANGER THAN FICTION



MR. ADVERTISER:

IN THE October issue of "RADIO" we told you that we expected to receive about 4000 new subscriptions from radio dealers, jobbers and service men EACH MONTH. Our estimate was too conservative. Now we are safe in announcing that 8000 new subscriptions will be received during the month of December. Within thirty days a representative of "RADIO" will bring to you . . . in person . . . 17 large scrap books, two feet long and two feet wide . . . each book containing a thousand or more letters, subscription order blanks and purchase orders from dealers, jobbers and service men who have recently subscribed to "RADIO." The big job of pasting these subscription orders into large scrap books is well under way. The subscriptions are in the subscribers' own handwriting. Each month similar books will be compiled. Each month we will bring these books to you.

Our net paid radio trade circulation will be large enough to convince you that practically all worthwhile radio merchants are reading "RADIO." Then we will be forced to make another increase in advertising rates. There's food for thought here.

Truthfully yours,

The Publishers of "RADIO"

for sale!

BY LARGE NATIONALLY KNOWN
RADIO SET MANUFACTURER . . .

2200 CHOKE COILS

2200—400 Ohm Choke Coils. Inductance of these chokes is 30 Henries at 120 Milliamps. Have extra size core made of Armco extra special transformer steel, Trancor finish, equipped with special terminal board.

1600 Power Transformers

1600 Power Transformers which will give ample power for filaments as follows:

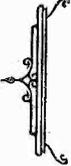
5—226 tubes

2—171A tubes

1—227 tube

1—280 tube

together with necessary plate voltage for the above tubes and extra power to energize the D.C. speaker field.

 The above items were made by a manufacturer of quality transformers, and represent the best engineering features. All parts made of best material and were tested at 1600 volts for breakdown, etc. 

SAMPLES WILL BE MAILED ON REQUEST

ADDRESS YOUR INQUIRIES TO

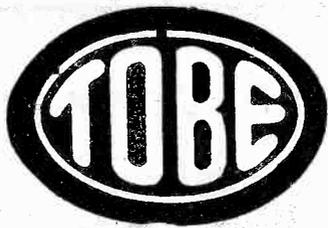
BOX 303

c/o Publishers of "RADIO"

512 Bell Building

307 No. Michigan Avenue

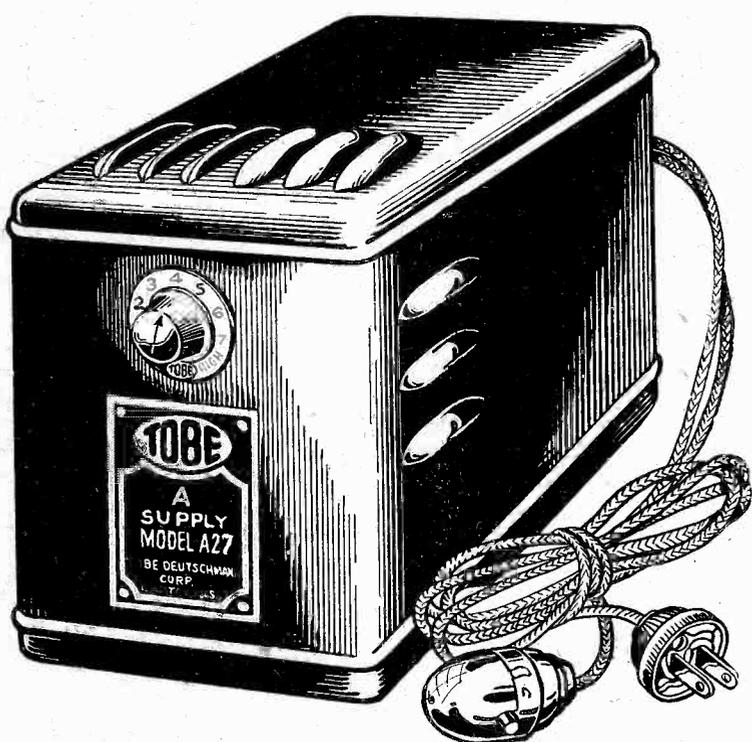
Chicago, Illinois



TOBE "A" SUPPLY

New Model at \$11.18

Dealers, you will find many a customer not ready for an electric set at any price, but he will consider discarding his messy A Battery for a new Tobe A—the best A Supply offered at any price. This is a broad statement but we are taking no chance in making it.



This Tobe A is perfectly dry with 12,000 mfd. of Tobe Condensers, delivers 2½ amps., small, compact and guaranteed to be humless. Should you purchase a sample A, and for any reason at all want to return it after three or four days' examination, we will refund your purchase price. This unit lists for \$24.75. Regular dealer's price is \$14.85.

TOBE DEUTSCHMANN CORPORATION
Canton, Mass.

Please send me one Tobe A Supply, new model. I am enclosing check for.....

My jobber is.....

THIS OFFER IS GOOD FOR ONE A SUPPLY BUT THE ONE PROVISION IS THAT YOU NAME YOUR JOBBER WHEN YOU FILL IN THE ORDER BLANK. THIS OFFER EXPIRES JANUARY 1, 1931.

Tell them you saw it in RADIO

THE OLDEST TUBE MANUFACTURER IN NEW ENGLAND



**HYTRON
TUBES!**

THE Hytron Tube Corporation of Salem, Mass., is the oldest manufacturer of radio tubes in New England. The prestige of Hytron's years of experience, plus unexcelled manufacturing and technical resources, is the best possible assurance to the purchaser that every Hytron Tube will fully equal his expectations for the purpose for which it was designed.

The Hytron Line gives the trade the utmost possibilities for profit. It comprises a tube for every purpose; guaranteed quality unsurpassed; the stability of an old established Company; attractive prices; big profit margin.

DISTRIBUTORS: Write for discounts and other information. Valuable territory still open. Hytron production assures a complete supply for your requirements.

THE BARSOOK CO.
202 S. State St.
Chicago, Ill.

HOUSTON CRANE
817 Norris Bldg.
Atlanta, Ga.

GRAY SALES CO.
611 Widener Bldg.
Philadelphia, Pa.

L. E. JAQUES
1248 Augusta Ave.
University City, Mo.

**WM. P. JOHNSON
ELECTRIC CO.**
43 South Third St.
Minneapolis, Minn.

**E. D. LILLY
SALES CO.**
Urban Building
Louisville, Ky.

H. C. POMMERENK
412 Arthur Bldg.
Omaha, Neb.

HYTRON



CORP.

KEELER, WHITE CO., Los Angeles—San Francisco—Seattle
SALEM, MASSACHUSETTS

THE FAMOUS

Super Phonovox

... now even better
than before



List Price
\$15⁰⁰

*Slightly higher west
of the Rockies*

ALERT DEALERS may anticipate even greater sales of the Super Phonovox . . . the fastest selling pick-up made . . . and the finest, too, regardless of price. For Pacent has developed wonderful new improvements for this famous pick-up.

Combination Switch and Volume Control and Phonotrol Adapter

The Phonotrol is a new combination switch and volume control. The first turn of the knob switches instantly from radio to records . . .

without disturbing any connections. Further turning increases phonograph volume.

With this is the Phonotrol Adapter . . . for use with screen grid tube sets such as Atwater Kent, Crosley and others. These devices, together with the regular Adapter, are furnished with the Super Phonovox *at no extra cost.*

LOW IMPEDANCE MODELS

Two new low Impedance Models 106-VA, 106-VB, especially designed for the new Victor Radio Sets and broadcasting stations.

List Price \$12.00 and \$15.00



List Price **\$25⁰⁰** *Slightly higher west
of the Rockies*

Complete with 12-inch turntable

Electric Phonograph Motor

In simplicity of design and construction, in power and in the smoothness and silence of its operation, the Pacent Induction-Type Motor has no rival. Completely insulated against noise. Dynamically balanced rotor makes it vibrationless. Operates on 110 Volts, 50 or 60 Cycles A. C.

*Dealers... get your orders in now...
see your jobber or write us direct.*

PACENT ELECTRIC CO., 91 Seventh Ave., N. Y.

Pioneers in Radio and Electric Reproduction for Over 20 Years

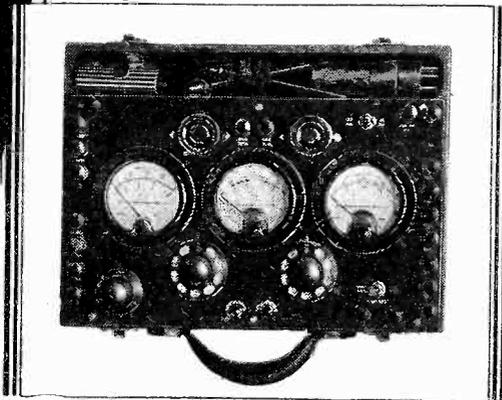
Manufacturing Licensee for Great Britain and Ireland: Igranic Electric Co., Ltd., Bedford, England — Licensee for Canada: White Radio Limited, Hamilton, Ont.

Tell them you saw it in RADIO



"Madam—Let Me
Introduce the
**Factory
Engineer**"

Take this
consulting specialist
with you on your
radio servicing calls



THINK what it would mean to your business if you were known to employ *factory engineers* for servicing radio sets—engineers familiar with every constructional feature! You would get every servicing call in your territory, because customers would have confidence that these men would know just what to do in every instance, and could promptly restore the set to perfect order.

That's exactly what the Weston Model 547 Radio Set Tester is in effect. It enables *your* servicing men to become as experienced and efficient as factory engineers. It helps the manufacturer make good his guarantee of performance; it helps you increase your servicing business with steadily increasing profits, and makes friends for your business and customers for your merchandise.

All told the Model 547 is an outstanding achievement of the year and no dealer or service organization can afford to be without one. Write for detailed instructions on the scope of this instrument.

PACIFIC COAST REPRESENTATIVES

Graybar Electric Company, Inc.
84 Marion St., Seattle, Wash.

J. H. Southard
San Francisco, Calif.

A. A. Barbera
Los Angeles, Calif.

Repair Service Laboratory
682 Mission St., San Francisco, Calif.

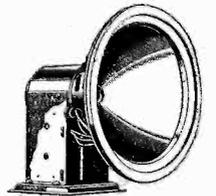


WESTON ELECTRICAL INSTRUMENT CORPORATION
600 Frelinghuysen Avenue Newark, N. J.

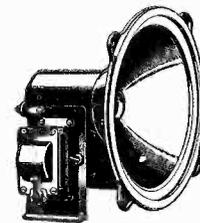
Jensen
ELECTRO-DYNAMIC SPEAKER
TO MEET
EVERY NEED

**JENSEN
Standard Speaker**

Has eight inch cone. Extremely fine tone quality and excellent volume. Used extensively for modernizing earlier model radio receivers. Unit, AC, \$32.50; DC, \$25.00. In Jensen Model 6 Cabinet with AC Unit, \$50.00, DC Unit, \$42.50.



**JENSEN
Concert Speaker**



Used by many of America's leading set manufacturers in their 1930 console model receivers. The standard of comparison for all reproducers. Ten inch cone. Unit, AC, \$35.00; DC, \$27.50.

**JENSEN
Auditorium Speaker**

Unequaled where tremendous volume is required. Used extensively for public address systems, talking movies, and in auditoriums and large halls. Twelve inch cone. Unit, AC, \$70.00 (less tube); DC, \$55.00.



The **IMPERIAL**



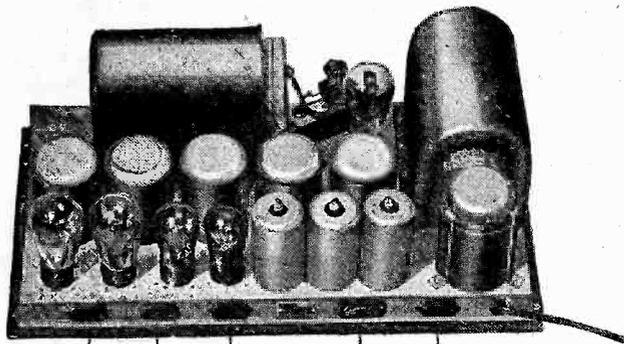
Acclaimed, upon its introduction, as America's finest and most beautiful reproducer. Equipped with either the Concert or Auditorium Units. Prices, with Auditorium AC Unit, \$100.00 (less tube); with DC Unit, \$90.00; with Concert AC Unit, \$80.00; DC Unit, \$72.50.

Jensen Electro-Dynamic Speakers are made in types to meet every present day need. Write for technical data and attractive trade discounts

JENSEN RADIO MFG. CO.
6601 S. Laramie Ave. — 212 Ninth Street
Chicago, Ill. — Oakland, Calif.
LICENSED UNDER LEKTOPHONE PATENTS

Dealers

Welcome the Acme Plan as a Sure Profit Builder

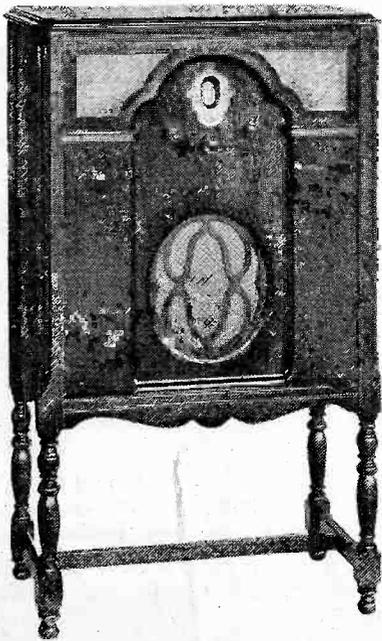


SPEAKER TELE- PHONO ANT SPEAKER
OUT PUT VISION PICKUP GND D.C.FIELD

Acme 88 SG—Screen-Grid Chassis

FEATURES

- | | |
|-------------------|---|
| Eight Tubes— | Push-Pull Power Tubes |
| 3—224 | 2—227 |
| 2—245 | 1—280 |
| Four Stages Tuned | Complete Shielding |
| A-C Screen-Grid | 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

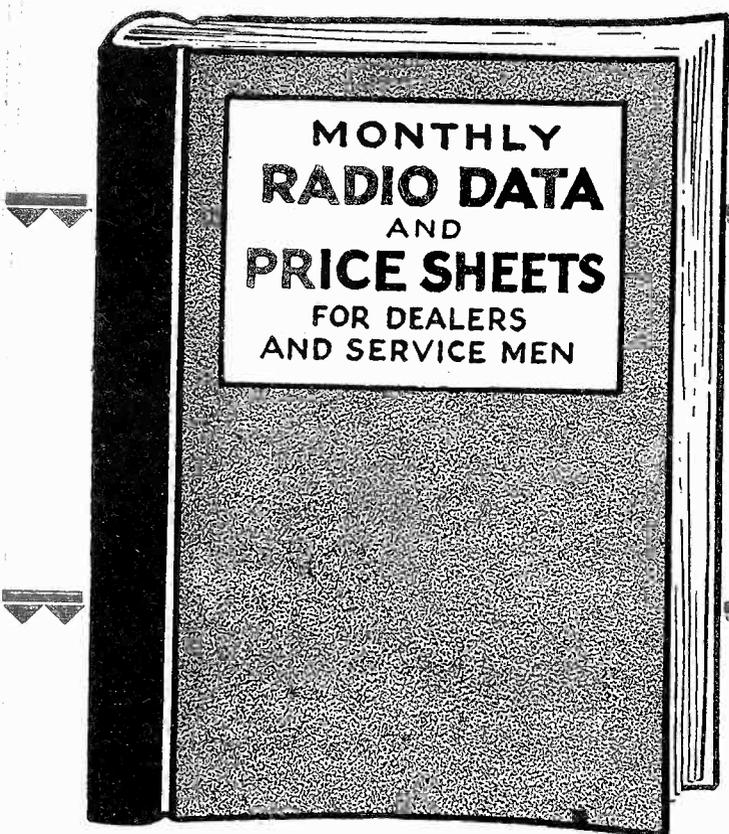
ACME RADIO & ELECTRIC, INC.
1441 Hamilton Avenue, Cleveland, Ohio

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

Name

Address

LAST CHANCE TO SUBSCRIBE TO "RADIO" AND THE MONTHLY LOOSE LEAF DATA SHEET SERVICE FOR \$2.00 PER YEAR. NEXT MONTH THE PRICE GOES UP TO \$5.00.



LOOSE LEAF BINDER
for "RADIO'S" PRICE SHEETS
FREE WITH YOUR SUBSCRIPTION
TO "RADIO" FOR ONE YEAR

**Here Is What We
Give You for \$2.00**

- 1** A SUBSCRIPTION to "RADIO" for one full year. The magazine will be mailed to you on the first of each month, starting December first.
- 2** A ONE year subscription service to the loose leaf monthly price and data sheets. These sheets are mailed to you separately each month for one year. Holes are punched in proper places for inserting these sheets into the loose leaf binder.
- 3** A HEAVY, durable loose leaf binder in green and gold, made especially for these price sheets. This binder is sent to you by parcel post, prepaid, upon receipt of your subscription to "RADIO."

... ALL THIS FOR ONLY \$2.00. Positively no further payments of any kind to be made.

THE REASON FOR
MAKING THIS
SENSATIONAL OFFER

THIS offer sounds almost too good to be true. The low price for the subscription to the magazine, loose leaf data sheet service and the loose leaf binder, is made for the purpose of increasing the net paid dealer and service man's circulation of "RADIO" to 50,000 copies, thereby giving "RADIO" a net paid circulation almost 100% greater than any other radio trade magazine.

**SPECIAL COMBINATION
OFFER FOR TWO SUBSCRIPTIONS**

TWO people can subscribe to "RADIO" for only \$4.00, a saving of still another dollar. The dealer and his service man can subscribe jointly. Each will receive the entire service—and the magazine—for one year. Each will receive a loose leaf binder. Or one individual can

subscribe for two years for only \$4.00. Or two dealers can subscribe for one year for \$4.00 for BOTH subscriptions. Tell your dealer and service men friends about this offer and ask them to subscribe at this special rate.

**SAVE \$\$\$ BY
Mailing the
Coupons Now!**

**REMEMBER—IT WILL
COST YOU \$5.00 NEXT
MONTH. Order Now!**

"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.

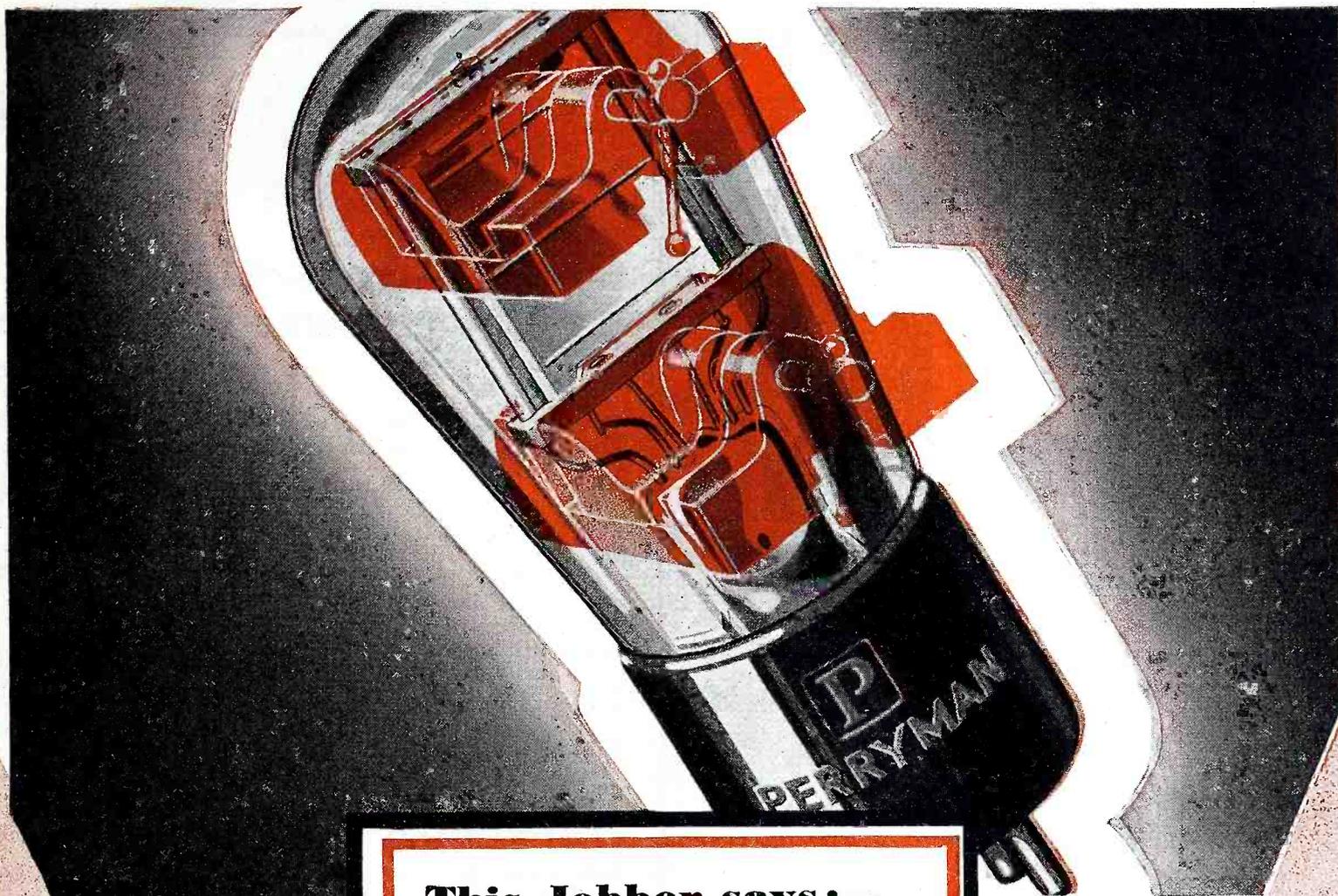
Here is \$_____ in FULL PAYMENT for a one-year subscription to "RADIO," the monthly loose leaf price and data sheet service and a loose leaf binder.

(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 _____

ALL PRESENT SUBSCRIBERS CAN EXTEND THEIR SUBSCRIPTION FOR ANOTHER YEAR BY SENDING \$2.00 NOW. OR SEND \$4.00 AND EXTEND YOUR SUBSCRIPTION FOR TWO YEARS.

LIKE TWO VISES



This Jobber says:—

“ . . . and Perryman is the only brand of tube we have ever carried on which we did not have a loss. We have found that Perryman gives much better satisfaction, fewer service calls, resulting in more satisfied dealers, and naturally more satisfaction to us.”

The double Perryman Bridge grips the elements in Perryman Tubes, top and bottom. It holds the grid, plate and filament in permanent parallel alignment. This absolutely assures uniform operation of every Perryman Tube.

With this sturdy bridge construction Perryman Tubes defy all necessary

handling in shipment, in your store and in your customers' sets.

The Tension-Spring, another exclusive Perryman feature, allows for the uniform expansion and

contraction of the filament due to temperature changes.

Both these features mean fewer replacements—greater net profits to you.

Point out the double Perryman Bridge and Tension-Spring to your customers

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

PERRYMAN RADIO TUBES

Majestic Replacement Condenser Blocks

by the foremost manufacturer of radio condensers

Built to give TEN YEARS of service. Without exception, the best ever made.

For Majestic B-Eliminators



Super-B
& Master-B
Models
PL-1223
List Price
\$8.00

Special
Master-B
Model
PL-1737
List Price
\$10.00



For Majestic A-Eliminators

PL-1778 LIST PRICE \$9.00



For Power-Packs in Majestic Sets

Yr.	Tube Used	Cat. No.	L. Pr.
1928-29	171	PL-1309	\$10.00
"	250	PL-1765	10.00
1929	245	PL-1766	12.00

For Majestic Power-Packs in Stewart-Warner and Mohawk Sets

PL-1761 List Price \$11.00

The New Dubilier Light Socket Aerial

New solid internal design. Better than ever. Going bigger. Increased sensitivity of sets contributes to radio-buyers a saving against outdoor antennas. Manufacturers, jobbers, and dealers are using the light socket aerial as a sales-expedient to make sets sell at less than competition.

Advantages of the Light Socket Aerial:

1. Cost: Far below that of an antenna of any other character.
2. Convenience: Simply plugged into the house-current outlet.
3. Time-saving: Installed in a few minutes as against several hours.
4. Neatness: Saves unsightly roof-mountings and lead-in wiring or cumbersome indoor loops.
5. Safety: Avoids dangerous roof-erecting work.
6. Protection: Avoids lightning hazards and anxiety during storms.
7. Flexibility: Affords long antenna or short antenna results without putting up antennae to determine best size.
8. Durability: Requires no maintenance attention—no damages by weather and storms to be repaired.
9. Serviceability: Efficiency does not impair with age, as in outdoor antennas, where insulation encrusted with soot functions poorly.
10. Efficiency: Maximum signal strength in all directions.
11. Correctness: Avoids all the pitfalls of the average antenna erector, as described in leaflet No. 163.
12. Clarity: Insures first-class antenna conditions, with good signal pick-up, low interference pick-up, avoidance of aerial defect, noises, etc.



The Light Socket Aerial is appropriate to any and all receiving sets, A-C or D-C. Uses the house wiring system as an antenna. Couples to the system only, consumes no current. Needs no attention.

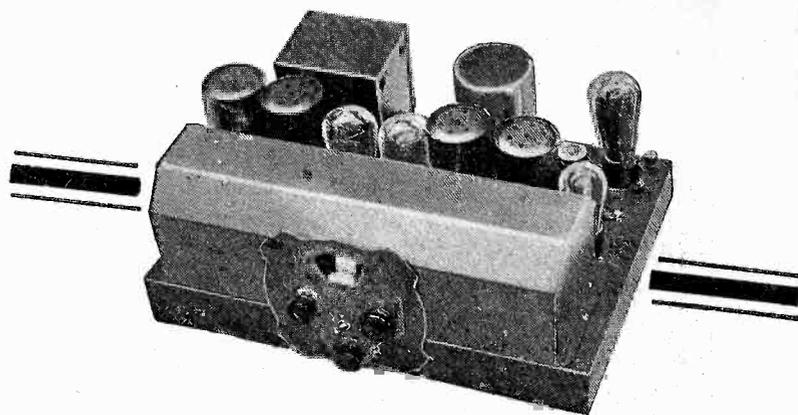
Full exclusive rights are now Dubilier's under Patents 1,526,624, Feb., 1925; 1,716,001, June, 1929, and 1,717,701, June, 1929.

Dubilier

CONDENSER CORPORATION

342 Madison Avenue

New York City



LOOK! Screen-Grid plus Power Detection—Under Your Own Brand

Cash in big this season by offering radio's newest and most modern development—using your own brand name. You set your own resale price to meet every market condition—you banish the bugaboo of one-sided contracts and restricted territories, and by purchasing direct from factory, you get every possible price concession. Most important, you preserve your greatest asset—your trade identity and good will.

This Premier Has Every Needed Feature

The new Premier screen-grid chassis, Model 724, 7 tubes (8 with rectifier), is illustrated. A great performer. Full tone, volume, pleasing eye value. Many features—power detection, 100% shielded, all metal, D.C. dynamic speaker terminals, phonograph pickup, safety fuse and latest tube combination using four 224's, one 227, two 245's in push-pull and one 280 rectifier. Chassis is 18 inches wide, 12 deep, and 7½ high.

WRITE FOR FULL DETAILS

PREMIER ELECTRIC COMPANY

1821 Grace Street, CHICAGO

Established 1905

WESTERN EDITION of RADIO

COMMENCING next month two editions of "RADIO" are planned . . . a National Edition and a Western Edition . . . Both to contain the same helpful editorial content and the same advertising copy from national advertisers.

But the Western Edition will contain *additional* information of particular interest to the Radio industry west of the Rockies.

National advertising will be carried in the Western Edition without additional cost to the advertisers who use the National Edition.

THE PUBLISHERS of "RADIO"

Dealers *Listen!*

THE SET YOUR CUSTOMER WANTS - THE SET THAT MEANS QUICK SALES

Tom Thumb

SCREEN GRID PORTABLE RADIO

Speaks in the tone
of PROFITS



It Will Pay

You to
SEND

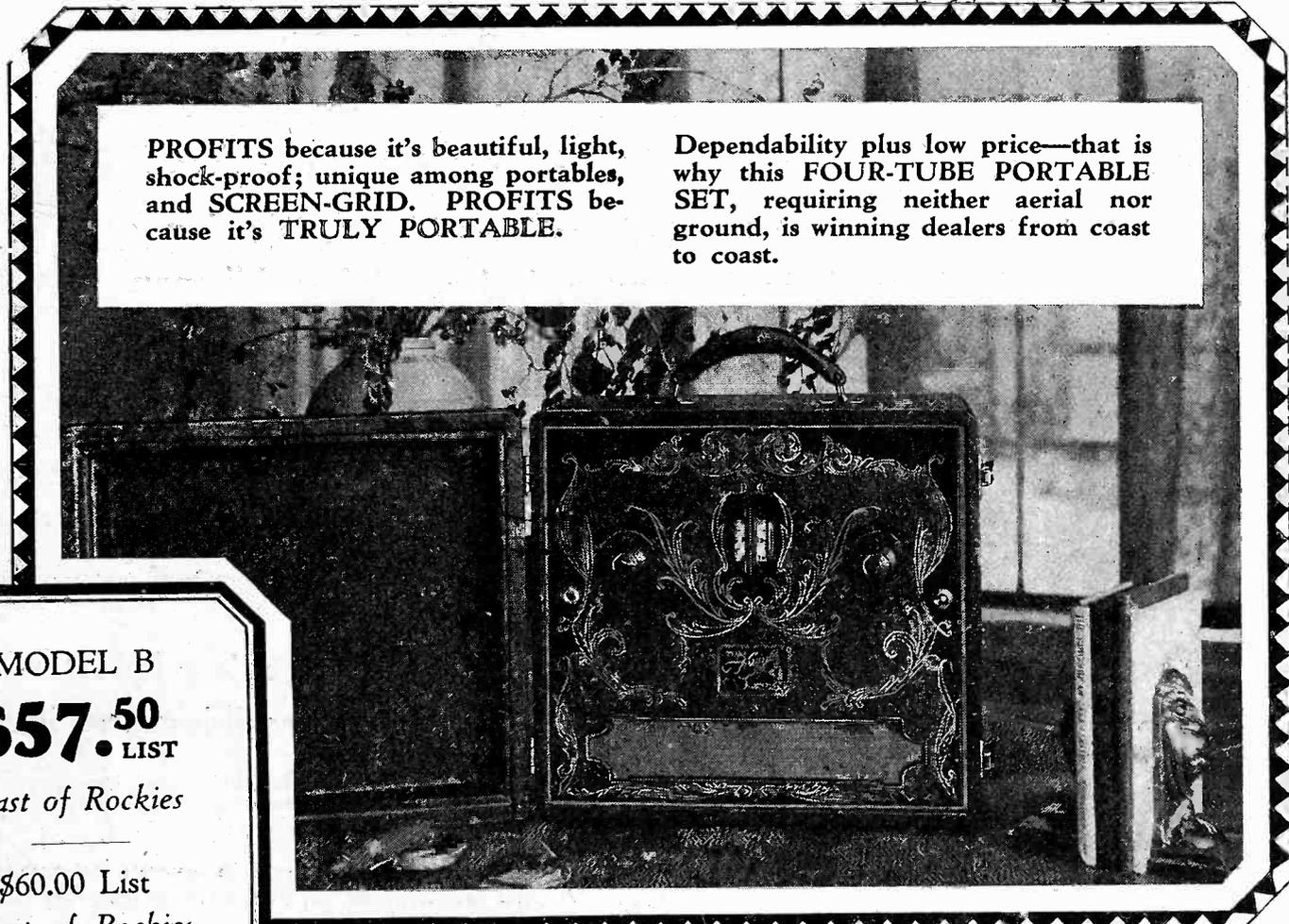
for
Dealer's
Proposition

Now!

Wire or Write

PROFITS because it's beautiful, light, shock-proof; unique among portables, and SCREEN-GRID. PROFITS because it's TRULY PORTABLE.

Dependability plus low price—that is why this FOUR-TUBE PORTABLE SET, requiring neither aerial nor ground, is winning dealers from coast to coast.



MODEL B

\$57.50 LIST

East of Rockies

\$60.00 List

West of Rockies

Less Tubes and
Batteries

ALL-ELECTRIC PORTABLES

Just Plug Into the Light Socket—and Tune In!

A-C PORTABLE ALL ELECTRIC, SCREEN GRID, 110 Volts, 60 Cycles, complete with special cone speaker in front cover—large output—QUALITY REPRODUCTION.

DE LUXE BATTERY MODEL, complete with special cone speaker in front cover and uses power tube. The prince of portables.

\$95.00 LIST

Less Tubes

\$65.00 LIST

Less Equipment

\$99.00

West of Rockies

\$67.50

West of Rockies

AUTOMATIC RADIO MANUFACTURING COMPANY, INC.

332 "A" STREET, BOSTON, MASS.

Northern California Distributors

OFFENBACH ELECTRIC CO., 1452 Market Street SAN FRANCISCO, CALIF.

Tell them you saw it in RADIO

Check these money-making Values *against* any radio cabinets in America!

The reasons why the WOOD CABINET CORPORATION has become one of the greatest factors in the Radio Cabinet Business are illustrated and described in "GENERAL" Radio Cabinets shown in this advertisement.

Check each one of these models. Check its construction and prices. Analyze its VALUE and let your own experience and knowledge of radio cabinets be your guide.

The phenomenal values presented in this great line are entirely due to the fact that this nation-wide organization sells only direct from factory to dealer. All middleman profits, shipping, handling and selling expenses are eliminated. Prices are NET to you.

Cabinets to fit all standard make sets, including Atwater Kent and the new Crosley Screen-grid receiver. Speaker brackets supplied with all models for Atwater Kent chassis.

Order direct from factory-to-dealer headquarters — or write for descriptive literature describing and illustrating the complete "GENERAL" line.

10% discount when purchased in quantities consisting of any assortment of models shown in our general catalog.

*Cabinet designs by Hammarstrom
Salesmen—Valuable Territory Still Available*

**All prices
are net...
You decide
your own
profit!**



WOOD CABINET

T. J. Molloy, Pres.
194 Lexington Avenue, New York.

**Factory-to-dealer
saves shipping
costs and middle
man profits..**

**YOU GET
ALL THE**

Profit!

Model No. 103

Dimensions, 43-in. H. x 25 1/2-in. W. x 15 1/2-in. D. Set Compartment, 10 3/4-in. x 24-in. x 12 1/4-in. Space for dials 12 1/2-in.

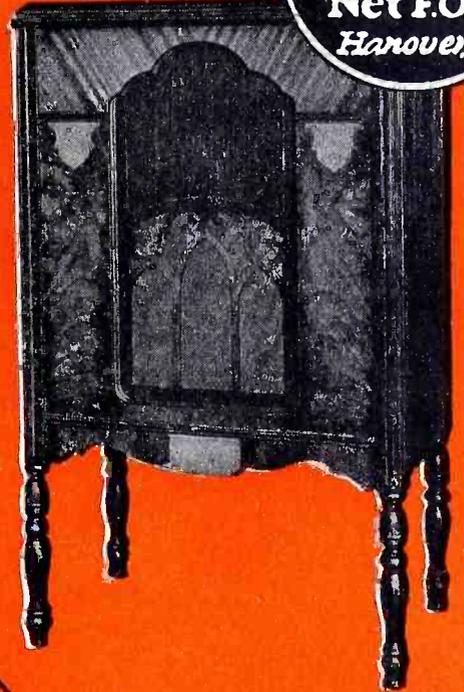
\$20.50
Net F.O.B.
York, Pa.



Model No. 101 (Right)

Dimensions, 42-in. H. x 25 1/2-in. W. x 15 1/2-in. D. Set Compartment, 10 3/4-in. x 24-in. x 14-in. Space for dials 11 1/2-in.

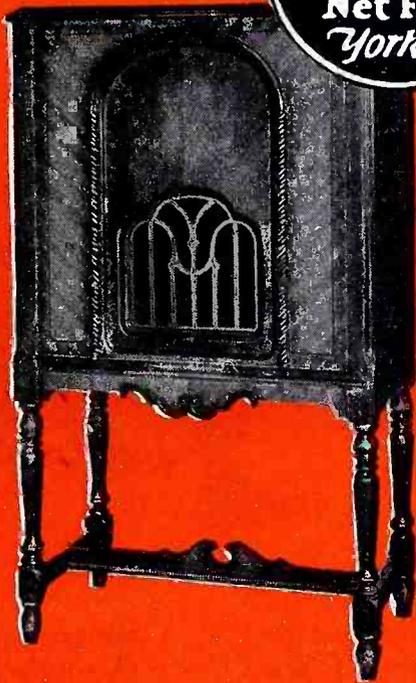
\$16.50
Net F.O.B.
Hanover, Pa.



Model No. 301 (Below)

Dimensions, 46 1/4-in. H. x 27 1/2-in. W. x 15 1/2-in. D. Set compartment, 11-in. x 24 1/2-in. x 14-in. Space for dials 12 1/2-in.

\$16.50
Net F.O.B.
York, Pa.



\$13.50
Net F.O.B.
Phila. Pa.



Model No. 801 (Left)

Dimensions, 40-in. H. x 25 1/2-in. W. x 14 3/4-in. D. Set Compartment, 9 3/4-in. x 22-in. x 13-in. Space for dials 10 3/8-in.

Model No. 401 (Right)

Dimensions, 44-in. H. x 25 1/2-in. W. x 15-in. D. Set Compartment, 11 1/2-in. x 24-in. x 13 1/2-in. Space for dials 9-in.

\$16.75
Net F.O.B.
Jamestown, N.Y.



CORPORATION

T.J. Molloy, Pres.

194 Lexington Avenue, New York

Tell them you saw it in RADIO

All Around the World!

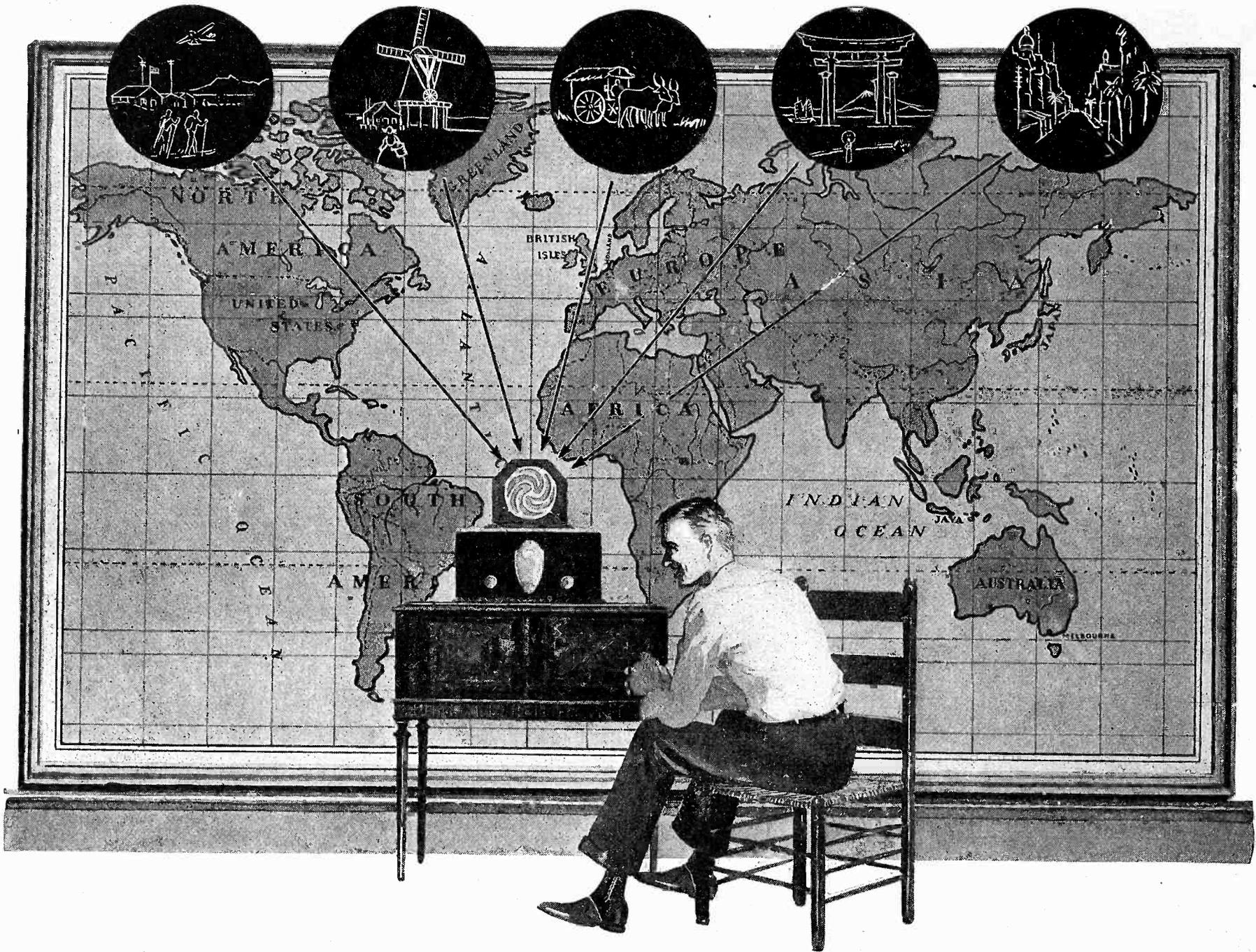
ANTARCTICA

HOLLAND

JAVA

JAPAN

MELBOURNE



YOU can hear words and music from Java, Australia, England, France—from all around the world,—with the NATIONAL Screen-Grid SW-4 THRILL BOX.

Already many famous broadcasting stations abroad and in this country are putting their regular programs on the short waves, too. More and more stations are doing this. These broadcasts may be received anywhere else in the world, in cities, in the country, at the frozen poles, in the jungles and the deserts, with the NATIONAL THRILL BOX.

This simple Four-Tube Screen-Grid THRILL BOX is a trim, neat receiver with single dial tuning and smooth sensitivity-control. It is free from annoying radiation and the design eliminates "tuning holes," formerly a troublesome short-wave difficulty. The special audio system with 171-A Power Tube gives excellent loudspeaker operation, and the plate

supply may be taken from the lighting circuit, through the NATIONAL Velvet-B,—a feature not usually found in short-wave receivers. The interchangeable tuning transformers are kept in special storage sockets *inside* the cabinet, protected from dust and damage, and always ready for use.

The cabinet itself is more than just a box. It is of simple and very attractive design and finish, which harmonizes with the most tasteful surroundings.

Write us for full information and prices today.

NATIONAL COMPANY, INC.
ENGINEERS & MANUFACTURERS
61 SHERMAN ST., MALDEN, MASS.

Est. 1914 . . . W. A. Ready, Pres.



NATIONAL THRILL BOX

SCREEN-GRID SW-4

Tell them you saw it in RADIO

THE WARE ELECTRIC COMBINES

THE SELLING POINTS

• • • OF MANY

FINE SETS • • •



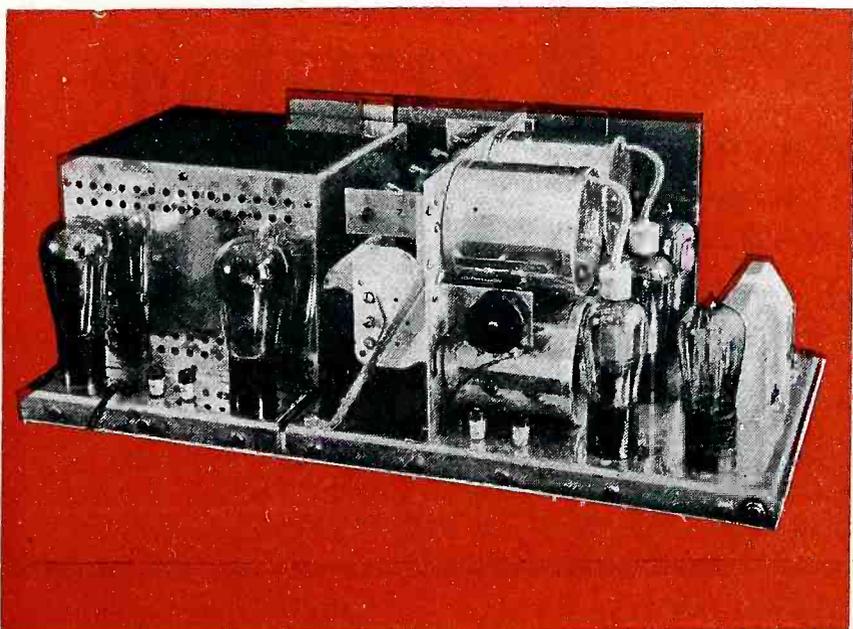
The Ware is a fine radio to own . . . *and to sell.* It is built by Paul Ware for faithful reproduction. Vreeland Band Selector tuning—receiving the whole broad channel of frequencies broadcast—gives marked tonal excellence. With this go well-controlled power, clean selectivity, ample sensitivity.

The Ware may now be had in a complete selection of cabinets developed along modern decorative lines. Prices range from \$135* to whatever your customer wants to spend. At any price, he gets handsome furniture.

And, Throughout the Line, the Allowance Which Has Been Made for the Dealer's Profit Sets a New Record. Ask About It. Ware Manufacturing Corporation, 480 Lexington Avenue, New York, N. Y.

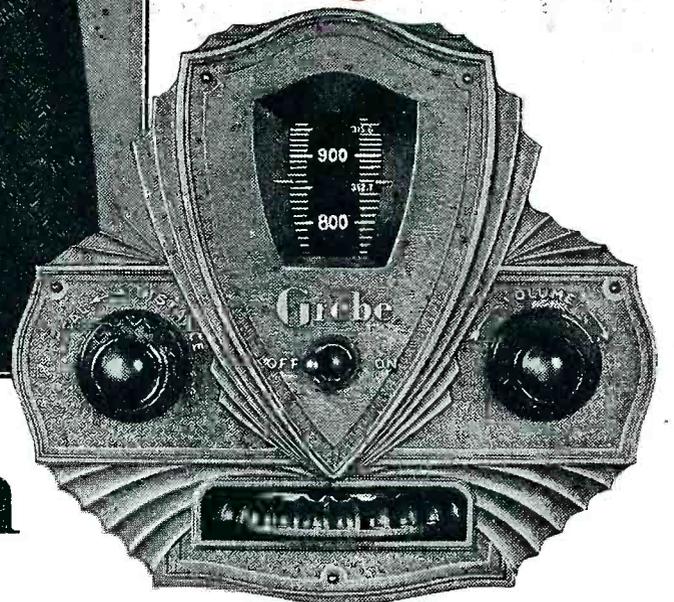
*Prices slightly higher west of the Rockies.

By PAUL WARE: With Vreeland Band Selector Tuning, Screen-Grid and 245 Output Tubes, Built-in Dynamic Speaker, Custom Cabinets if desired.



WARE
Electric

RADIO



You *can* sell this man

Alfred H. Grebe—"Tri-toned radio is more than an advertising promise. This achievement is evident to the consumer as soon as he hears the Super-synchrophase. He may not realize that its tonal vividness is the perfect blending of pitch, volume and character: the three distinct components of every musical sound. But he senses this lifelike quality—recognizes the merit of this new set—wants it in his home. Tri-toned radio brings new delights to the consumer and continuous profits to the Grebe franchise-holder."



BRING on your hardened cynic—the man who walks in with that try-to-sell-me attitude—the bane of your sales force from the star down. Grebe franchise holders welcome him. Let him walk in like a lion; he will go out a Grebe owner.

This man is a second set buyer whose discrimination has been sharpened thru long hours of radio listening. His critical attitude is armor plate against sales talk—his *musical ear* will tell him which set to choose. And it will have to be far ahead of the field: that is why he will buy the Grebe.

For this new set is at least *a year ahead*. It is newer than screen grid. Its lifelike tone is free from outside interference and the dis-

tortion of station overlapping. Without being subdued, its screen grid power is *controlled* by the exclusive equalized band pass filter.

The trade has known since the R. M. A. Trade Show in June that Grebe is pioneering this important principle of the future. Now our advertising proclaims it to the public. Result: the Grebe franchise for your district is becoming more and more valuable.

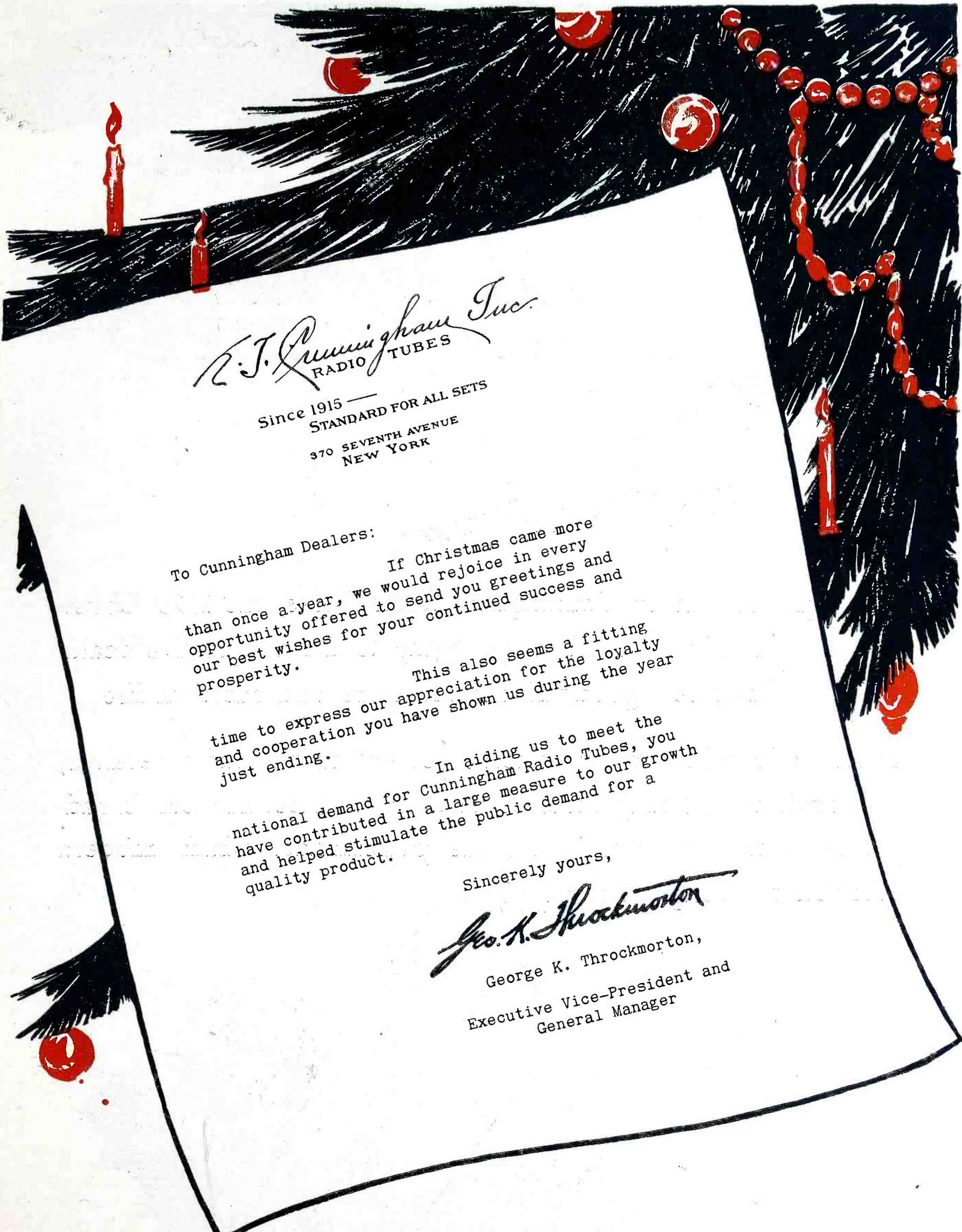
Grebe radio

SUPER-SYNCHROPHASE 

A. H. GREBE & COMPANY, INC., Richmond Hill, N. Y.

Western Branch

443 So. San Pedro Street, Los Angeles, California



E. T. Cunningham Inc.
RADIO TUBES

Since 1915 —
STANDARD FOR ALL SETS
370 SEVENTH AVENUE
NEW YORK

To Cunningham Dealers:

If Christmas came more than once a year, we would rejoice in every opportunity offered to send you greetings and our best wishes for your continued success and prosperity.

This also seems a fitting time to express our appreciation for the loyalty and cooperation you have shown us during the year just ending.

In aiding us to meet the national demand for Cunningham Radio Tubes, you have contributed in a large measure to our growth and helped stimulate the public demand for a quality product.

Sincerely yours,

Geo. K. Throckmorton

George K. Throckmorton,
Executive Vice-President and
General Manager

E. T. CUNNINGHAM INC.

NEW YORK CHICAGO SAN FRANCISCO ATLANTA DALLAS

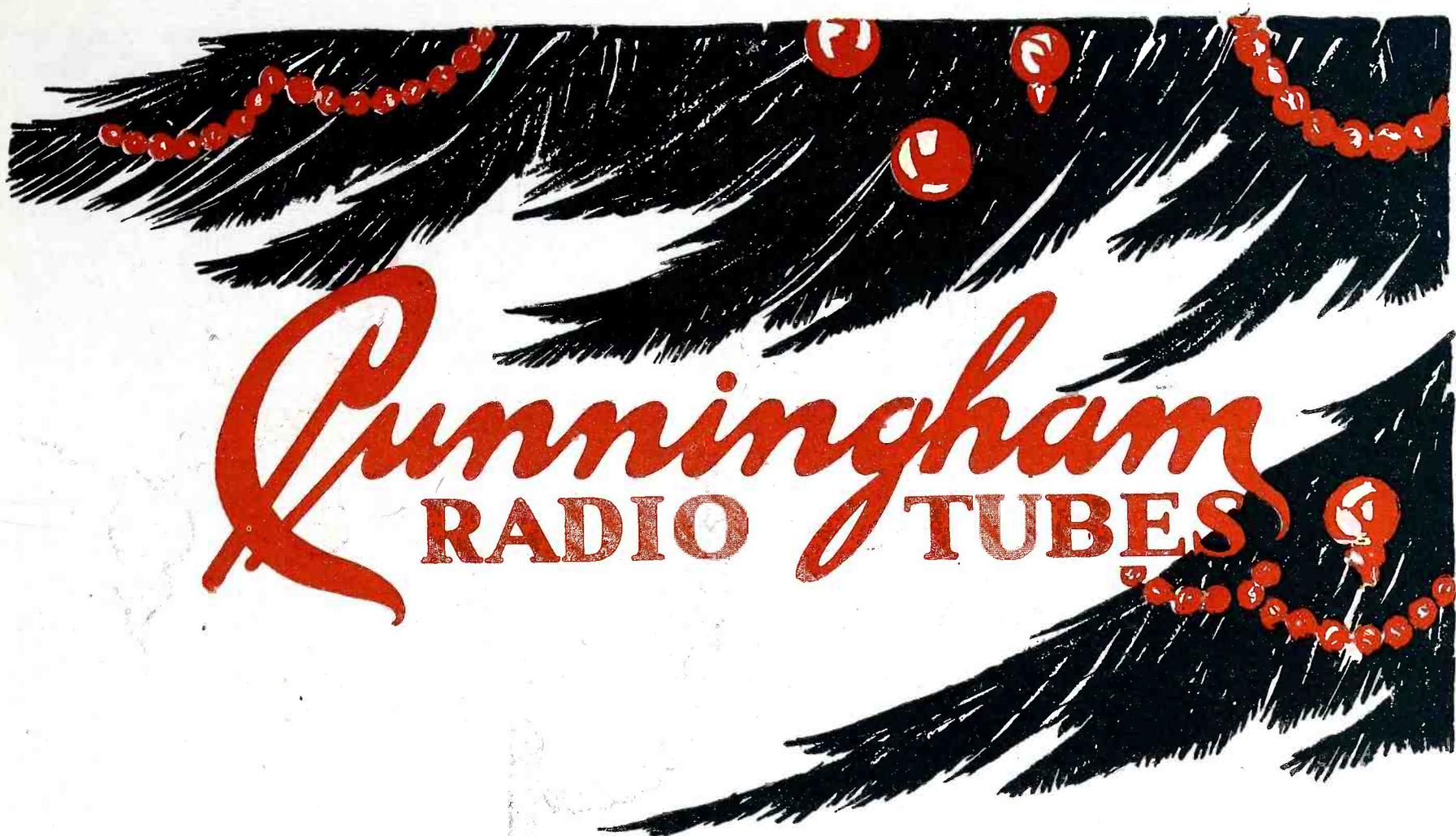


Through the sale of Cunningham Radio Tubes, the 1929 Christmas Season offers a fresh opportunity to the progressive dealer to build increased good-will for his store and merchandise.

Since radio tubes are the "nerve center" of the radio receiver, it is obvious that only tubes constructed to meet modern broadcasting conditions can insure the performance which modern receivers are designed to supply.



E. T. CUNNINGHAM INC.
NEW YORK CHICAGO SAN FRANCISCO ATLANTA DALLAS



We are creating a greater consumer demand through our newspaper and magazine advertising that will naturally result in increased sales for you.

You can recommend and sell Cunningham Radio Tubes with the full assurance that they will enhance the quality of radio reception wherever used.



E. T. CUNNINGHAM INC.

NEW YORK CHICAGO SAN FRANCISCO ATLANTA DALLAS



Sustained public confidence in the name Cunningham for the past fourteen years has been built and maintained upon the meritorious operation of the tubes themselves and national Cunningham dealer good-will.

This great endorsement is a priceless heritage. Our aim is to uphold this tradition with tube quality and a contact with dealers which will merit their continued support.

Cunningham
RADIO TUBES

Forget the Alibis

ALIBI IKE" blames the slowing-up in sales of "radio and other luxuries" on the puncturing of the stock market balloon. Maybe sales have not been as large as was expected. Maybe the crap-shooters can't make another pass and have a bad headache after their prolonged whoopee. But, emphatically, radio is not a luxury to be enjoyed by the few, but the cheapest and most widely satisfying recreation ever devised.

If a family feels too poor to buy books and music and to go out to movies and theaters, concerts and lectures, or football games and dances, the same kind of entertainment is given by the radio at home. It is the poor man's first want after food, shelter and clothing have been provided.

But America is not poor. A few people have lost paper profits which they would have squandered on stocks again. But the great majority are prosperous, as proved by unprecedented savings, high wages, low interest rates and general employment. They want to hear the fine programs on the air. They want radio sets, which were never better nor cheaper.

No, whatever the right alibi may be, whether over-production, too many competing makes, or disquieting price reductions, radio is not a luxury, and it can be sold by the man who is not hunting for alibis, but sales. Let's get busy and forget the alibis.

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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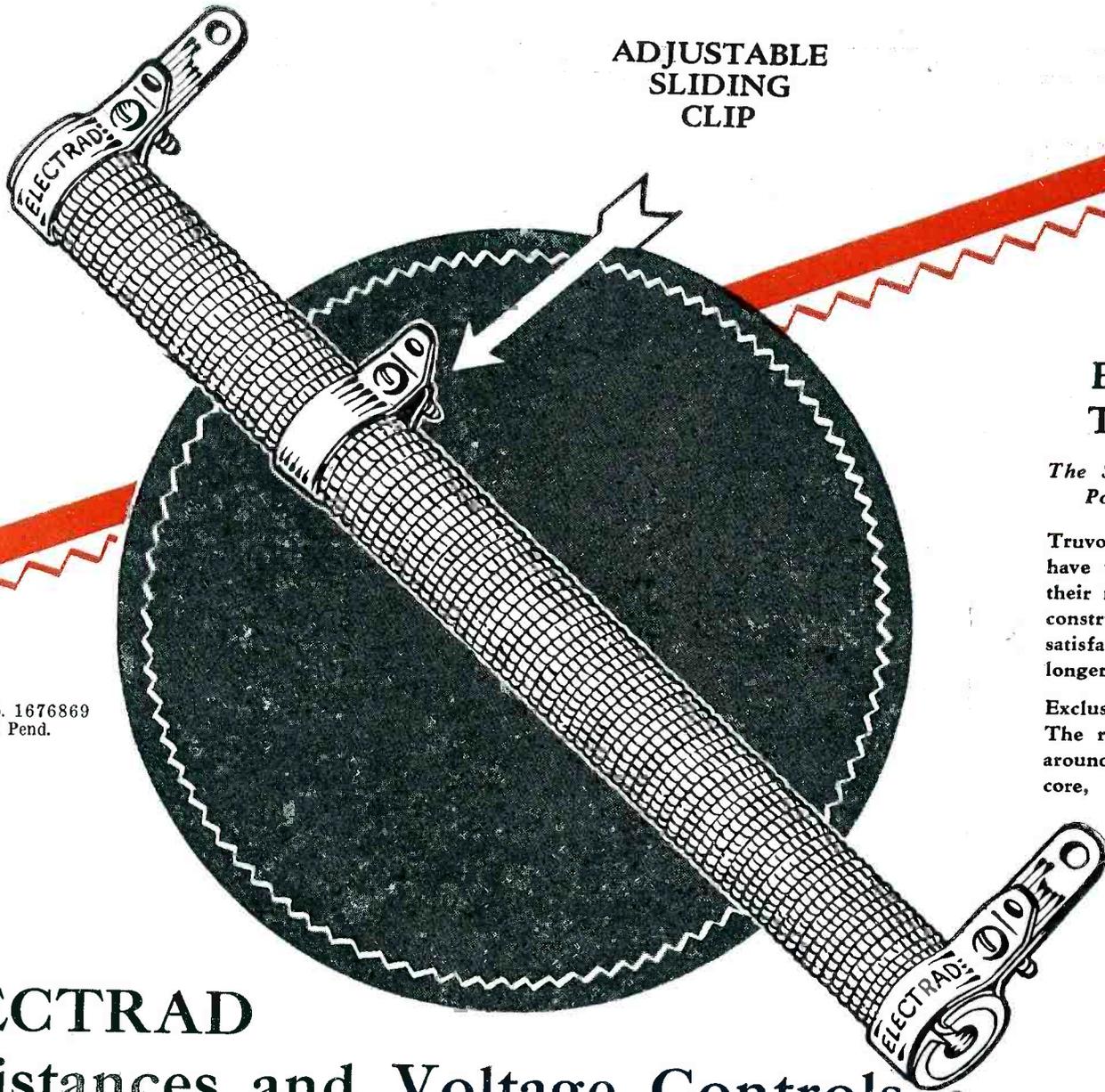
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A Suggestion to the Reader:

After reading this December 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.



ADJUSTABLE
SLIDING
CLIP

ELECTRAD TRUVOLTS

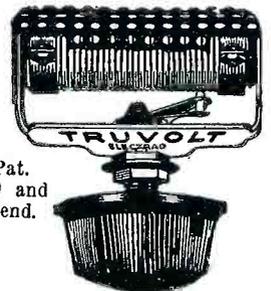
*The Superior Eliminator and
Power Pack Resistance*

Truvolt All-Wire Resistances have won renown because of their many patent features of construction making for more satisfactory performance and longer life.

Exclusively air-cooled winding. The resistance wire is wound around an enameled copper core, which is then wound around the fire clay base, insuring cooler operation and more stable values. A convenient sliding clip gives quick adjustment to exact value desired. Ideal for regulating the B & C Voltages required by the new power tubes.

*Made in all usual resistance
values and wattage ratings.*

TRUVOLT Variable



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

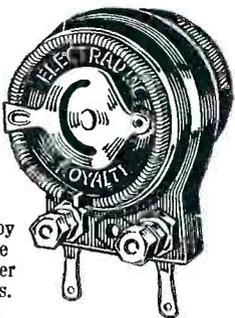
Distinctive Truvolt construction, plus handy knob control. Perforated metal ventilating shield. Greatly simplifies eliminator and power pack construction. Lasts longer owing to endwise travel of contact over wire. Saves time for experimenters.

22 Stock Sizes . . . \$2.50

U. S. Pat. No. 1676869
and Pats. Pend.

ELECTRAD Resistances and Voltage Controls Are Known by the Company They Keep

MORE than ever before, value in radio is being measured in terms of PERFORMANCE. People want to hear before they buy. The lure of the pretty cabinet and silvery chassis, while still strong, has been made a side issue by the hard-boiled radio buyers' demand for PERFORMANCE. The same "show me" trend is evident when manufacturers buy the component parts of their receivers. And the fact that a steadily increasing number of experts select Electrad Resistances and Voltage Controls is the strongest endorsement of Electrad Quality.



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

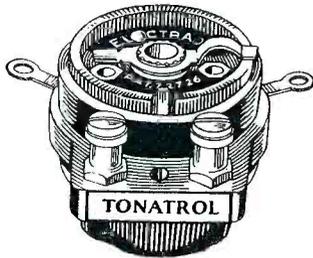
ELECTRAD ROYALTY

Widely used as voltage controls where low self-inductance is desirable. Made with a long-wearing resistance element and finest insulating materials available. Entire resistance range is covered with one turn of the knob—the same resistance always being found at the same setting. 11 types for every radio purpose. Potentiometer types—\$2.00, other types—\$1.50.

Western Representatives
UNIVERSAL AGENCIES
905 Mission Street
San Francisco, California

ELECTRAD TONATROL

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



The TONATROL line of volume controls is characterized by superior workmanship and longer life. Made in a variety of sizes and values with or without filament switch attached. List \$1.50 to \$3.00.

Also Super-TONATROL for high power receivers. New type resistance element fused to an enameled metal plate. Metal construction insures rapid heat dissipation up to five watts. \$2.40 to \$3.50.



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

PHASATROL

A simple effective means of balancing and controlling radio frequency amplification. Can be quickly installed without experience. Complete instructions for adapting to various popular circuits are packed with each PHASATROL. Handsome Bakelite cover. Corrosion-proof soldering lugs. One-hole mounting. \$2.00 each.

ELECTRAD INC.

ELECTRAD, INC., Dept. PR-12, 175 Varick Street, New York, N. Y.

Please send complete literature on

TONATROL

Address

TRUVOLTS

ROYALTY

PHASATROL

TONATROL Line

All Products

Super-

RADIO

for the profession

Profit from *Public Address* Installations

Money-making hints for the live dealer and service man in applying standard amplifiers and reproducers to local situations.

By H. L. WILLIAMS

SOME months ago a farsighted New York radio merchant conceived the idea of linking up the city parks for public address. Today twenty-five of these parks get their music from a band playing in Central Park. Before next spring it is expected that similar installations will be working in the remaining 200 parks in the metropolitan area.

Last Christmas the shoppers in St. Paul, Minnesota, were assisted in their activities, and at the same time entertained, by announcements and musical programs brought to them through loud speakers attached to occasional lamp standards on the main thoroughfares.

At the recent opening of a new railroad line in Oregon a baggage car was equipped with public-address equipment through which the officials of the line, governors and mayors, addressed the citizens of the various towns through which the line passed, and music was provided for their entertainment.

Remarkable as these things are in themselves, they are even more important as an indication of the ever-widening



Baggage Car Installation of Public Address Equipment Used in Connection With Opening New Southern Pacific Line in Oregon

TWO BIG SOUND EQUIPMENT MARKETS

School buildings in U. S. A...280,000
Average classrooms per school 4

One speaker per classroom is possible market, totaling 1,120,000 speakers.

Motion picture theaters in U. S. A..... 21,000

Of these, 18,000 not equipped for talking pictures, therefore markets for phonograph sound equipment.

scope of radio and its associated apparatus. While radio admittedly is in its infancy, it is a thriving and rapidly growing child, and those who fail to keep track of its developments may some day awaken to find they are pushing an empty buggy up the wrong street.

Public address systems and amplifier installations are the more recent mani-

festations of the possibilities of radio apparatus. The three examples cited above are but a faint indication of the multitudinous services to which such equipment can be adapted. From the viewpoint of the radio equipment dealer, the service man, the installation engineer and the contractor, each development means a new market, another source of revenue. In the fast-changing radio industry, perhaps less than in any other, we cannot afford to ignore what our contemporaries are doing. Marketing conditions are constantly changing, and, like Alexander of old, we must ever be on the lookout for fresh worlds to conquer.

The extraordinary developments that have taken place during recent months in the application of radio equipment are due in a very large degree to two things. One of these is the availability of dependable standard amplifiers; the other the production of reproducers capable of handling heavy outputs from these amplifiers.

It is no longer necessary to build special amplifiers for special jobs. The

building of such amplifiers calls for a much greater degree of technical knowledge and practical experience than usually falls to the lot of the average radio expert or dealer. Even where such knowledge is available, each amplifier is ordinarily a separate problem, and no definite degree of performance can be guaranteed without considerable experimentation and trial. Now, however, standard equipment, products of some of the finest radio engineering laboratories in the country, are available at moderate cost. Installation is comparatively simple—definite estimates of cost can be made and results predicted with certainty.

Today, then, the problem that faces the dealer or the technician, whose business it is to install such equipment, is no longer one of design but merely that of finding markets and increasing the scope of the apparatus now available. The purpose of this article, therefore, is to point out what has already been done throughout the United States, and indicate the possibilities of future expansion.

PERHAPS the outstanding feature of the New York park installations is the employment of the city's fire alarm cables for the transmission of the radio signals. This is done without causing the slightest interference with the operation of the fire alarm system.

In the Central Park bandstand is a group of carbon microphones, feeding into a microphone mixer panel. This panel in turn passes on the signals to a double-channel three stage amplifier, similar to those used in theater work. This double amplifier serves two purposes in that the second amplifier can be used as a standby for emergencies or may be coupled to the other when a greater output is desired.

With an output stage of two '50's, the maximum output of this single amplifier is 15 watts with an input signal voltage of .2 volt. Its average power consumption is 135 watts. This amplifier incorporates controls for switching from one amplifier to the other, switching the inputs to both amplifiers in parallel, switching the output of both amplifiers in parallel, and a monitor control. It is a standard job throughout. At each park on the system is a similar amplifier which picks up the signals from the fire alarm cables and feeds into two heavy duty speakers equipped with 5-foot horns.

Another installation that was made possible through the cooperation of the local authorities was that of St. Paul. Like that of New York, however, the idea originated with a wide-awake business representative of the equipment manufacturer, although it might just as well have been a local jobber or dealer who pocketed the substantial profit that undoubtedly accrued. With these things brought to their attention, the possibil-

ities of securing the interest of municipal and educational authorities, at least to the extent of investigating the proposals, are very attractive.

Last August, 1600 superintendents of public schools, meeting in Washington, D. C., were urged by the Department of Education to impress upon their local boards of education the advantages of equipping their schools with receiving and amplifying equipment for the reception of educational programs.

Another public service to which public address equipment might be adapted in a new way is the fire departments. Several attempts have been made at various times to make use of telephones as a means of communication between the fire chiefs and their men while fighting fires. Unfortunately the connecting wires were not only dangerous to the men in hampering their movements, but they were generally burnt up and rendered useless before they could be of real service. Loudspeaker equipment, however, is not heir to such handicaps, although, of course, it might never be 100 per cent efficient. It does seem, though, that suitable speakers and horns might be mounted on trucks and ladders, and an amplifier connected so that the officers could give their orders through microphones and be heard at a considerable distance.

FLYING field installations present problems of their own, but there is no serious difficulty when the demands of this service are fully understood. As this is written, \$22,000 is being spent by the Lambert-St. Louis airport on sound equipment. This installation has one speaker battery mounted on a platform 15 ft. high and 16 ft. across. This giant horn is 16 ft. long, and uses 16 heavy-duty speakers. The whole assembly is mounted on an electrically operated turntable and swivel, so that it can be pointed in any direction.

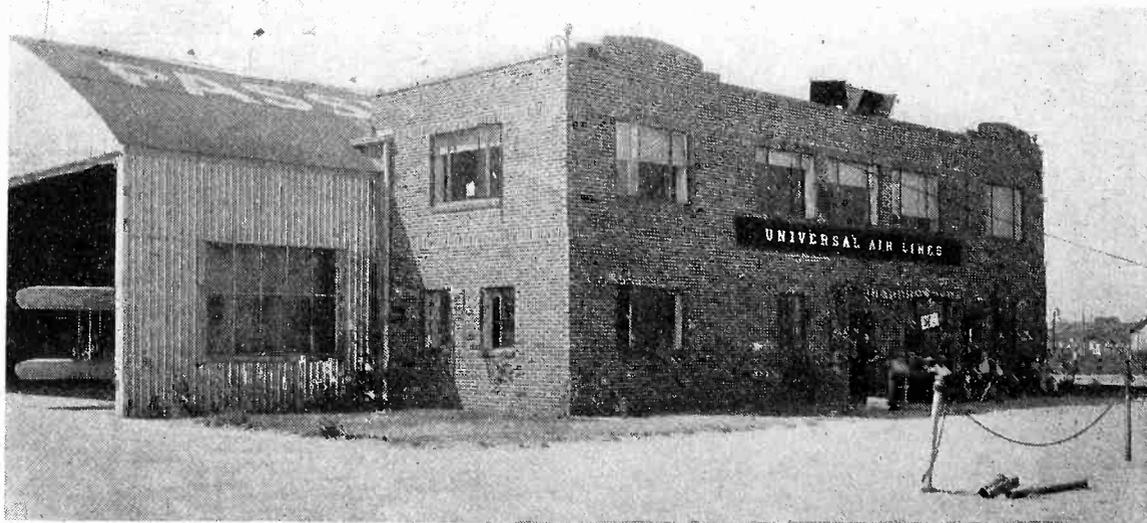
This reproducer will be used to talk to airships and airplanes, the operator making his announcements from a power house where the microphones and amplifiers are located. Another tower on this field will support eight speakers, which can be heard by the crowds and

people in the hangars. Formerly single horns were used for this work, but it was found that ships, when idling their engines in the air, were unable to hear them at distances of over 1000 feet. Public address equipment has been found invaluable at some airports from a purely sales standpoint. They are used to call the spectators' attention to the different types of machines and point out their advantages, safety features and attractions from a passenger's point of view.

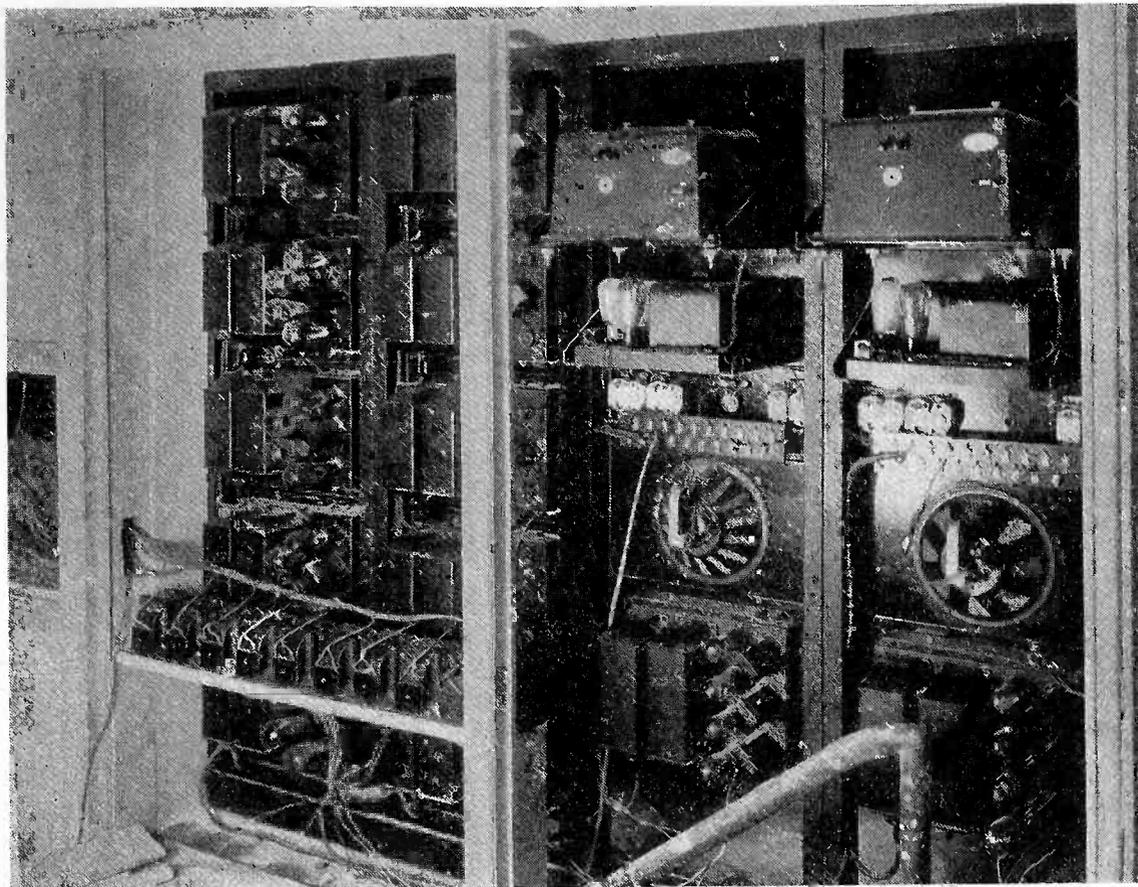
This, by the way, is good sales ammunition for the sound equipment salesman. Apart from this purpose, the loudspeakers save the airport attendants a lot of time and exasperation warning people away from moving or idling ships.

Speaking of ships brings to mind the possibility of ship-to-shore communication by means of equipment similar to that used in the airports. From a technical standpoint there is no difficulty about this, as a single unit horn of the exponential type has been heard as far as 25 miles under favorable conditions.

AT THE present stage of developments it appears that there is still considerable missionary work to be done among the prospective users of sound equipment. A good job has been done by the pioneers with the hotels, and apparently few modern hotels will be erected in the future without provision for radio. On the other hand, it will probably be a very long time before every potential user is educated to the advantages and possibilities of such equipment. Further than that it is only by familiarity with various businesses that the sound equipment engineer can do a real selling job and make the most of the opportunities in his particular locality. For example, a jobber on the West Coast suggested to a restaurant owner that a good deal of time would be saved by waiters if they could give their order to the kitchen through a speaker. A microphone was installed at the most convenient point in the restaurant for all the men. The result was the speeding up of service, and although the proprietor felt he could handle the



An Airport Installation



Power Amplifier Installation at El Cortez Hotel

work with one or two less men, he decided to anticipate a growth of business rather than let them go.

All this work involves considerable pioneering at the present time and constant investigation as well as concentrated effort. For these reasons, the marketing of sound equipment installations cannot be efficiently handled by the dealer as a side line. A special organization is required, which can make an intensive study of the work and keep an accurate record of its experiences for future guidance. One difficulty that has been faced by the pioneers in the business is the popular misconception as to the cost of public address equipment. The average business man appears to think that he should be able to buy a complete installation for \$75 to \$100. The fact that they are inter-

ested enough to make inquiry, however, indicates a consciousness of sound equipment possibilities that sooner or later the wideawake merchandiser should be able to capitalize to good advantage.

ANOTHER opportunity for the radio contractor is found in the installation of power amplifiers and loudspeakers for radio programs in each room of an apartment house or hotel. A typical installation, that of El Cortez Hotel in San Francisco, is illustrated herewith. Here the equipment is mounted behind four racks which are located alongside the telephone switchboard, the tuning and volume control knobs and the dials of the two receivers, and the power switches, pilot lights and monitor speakers being the only visible signs of what the racks contain.

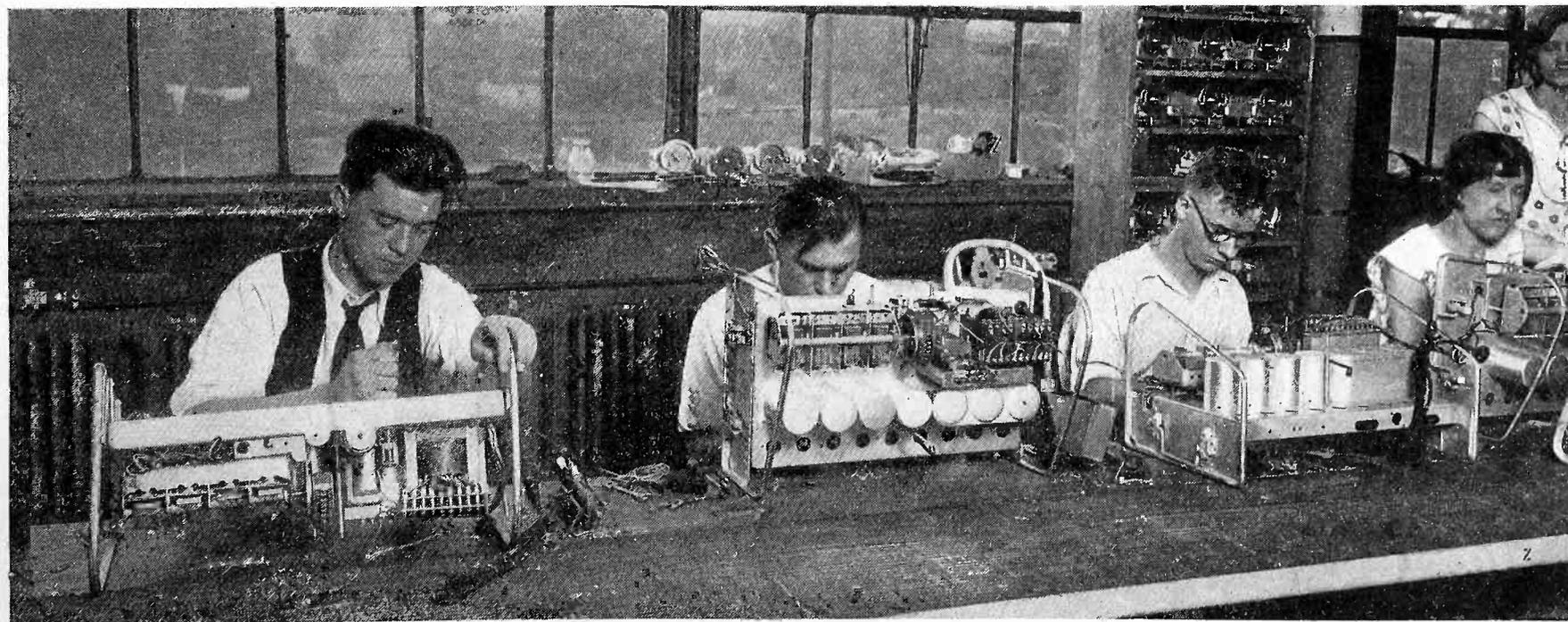
The control is in the hands of the telephone operator who tunes in a popular station on each receiver, adjusts it for proper volume according to her monitor speaker, throws the amplifier switch and lets it run. She listens in occasionally to see that all is running properly and that neither station has signed off without warning, these being the extent of her radio worries.

Each room is equipped with a magnetic speaker, mounted in a neat floor stand, and a two-way switch. When the occupant wishes to listen to a radio program he throws the switch one way and then the other, taking his choice of the two programs offered.

The hotel is equipped with two complete units and each unit is composed of a double panel rack housing a Continental receiver, a monitor panel, a PAM 5 amplifier and five PAM 25 power amplifiers. The PAM 5 is a two-stage unit with an output of .28 watts and is equipped, as are the PAM 25s, with its own power supply. The PAM 25 consists of a single push-pull stage of type '50 tubes and has a maximum undistorted output of 15 watts, being capable of supplying 35 magnetic speakers.

The output of the receiver is first amplified by the PAM 5 and the output of that unit is distributed between the five PAM 25s. A Kellogg telephone switch is mounted in the wall plate of each room, and is so connected that it throws a 6000-ohm resistor across the line that is not being used; across both lines when the switch is at the "off" position. The object of this precaution is to compensate for the resistance of the loudspeaker windings so that both lines will maintain an equalized load in spite of the number of speakers in use. The practical result of this system is a complete avoidance of any variation in volume when a loudspeaker is thrown in or out of the line. A Centralab variable re-

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The "chassis cage," employed at the Gulbransen factory to protect projecting parts of the chassis from strain, suggests itself as a handy addition to the radio service shop. It would have to be somewhat adjustable in order to accommodate all types of chassis but this is a matter that could be solved by the mechanically inclined service man.

Transmission of Television Images

Intimations of How It May Be Ultimately Accomplished in Practice

By PHILO T. FARNSWORTH and HARRY R. LUBCKE
Crocker Research Laboratory



Unretouched Picture of Farnsworth Television Image With 20,000 Elements

THE transmission of television images requires the conveyance of information regarding the light intensity of a great number of elemental areas, reproduced in the same relative position they occupied before transmission. Furthermore the process must be repeated with sufficient frequency to give the illusion of motion. In effect, the field of view transmitted must be dissected, an electrical intensity transmitted corresponding to the light intensity on each elemental area, and the electrical intensities converted back to light intensities and placed in their proper relative positions at the receiving terminal, this being accomplished by a system capable of presenting fifteen or more complete pictures to the eye each second.

Thus far man has evolved only one means of electrical communication. His system is a single dimensional time continuum. The commercial wireless, the telegraph, the telephone, and the radio, transmit intelligence that is initially single dimensional, since a dot or dash or the modulations of voice or music are intensity variations occurring in time and time only. In television, however, information must be transmitted regarding space as well; that is, the placement of the various intensities in the area that

make up the picture must be conveyed, all of which must be transmitted at a rapid rate if fifteen or more complete pictures are to be presented to the eye each second.

Since the nature of the transmission medium is the same for all cases, it is obvious that as the amount of intelligence transmitted increases, the portion of the medium used must also increase. In terms of radio broadcasting, the sideband width must increase as the amount of information transmitted increases. Thus, a commercial code station requires only 200 cycles as a sideband, and the conventional broadcast station approximately 5000 cycles. Telephoto transmission, the sending of pictures or printed matter, requires 3000 cycles, in which system one picture is transmitted in approximately seven minutes. But for television a sideband of at least 50,000 cycles, and better, 500,000 cycles or more is required, depending upon the detail desired.

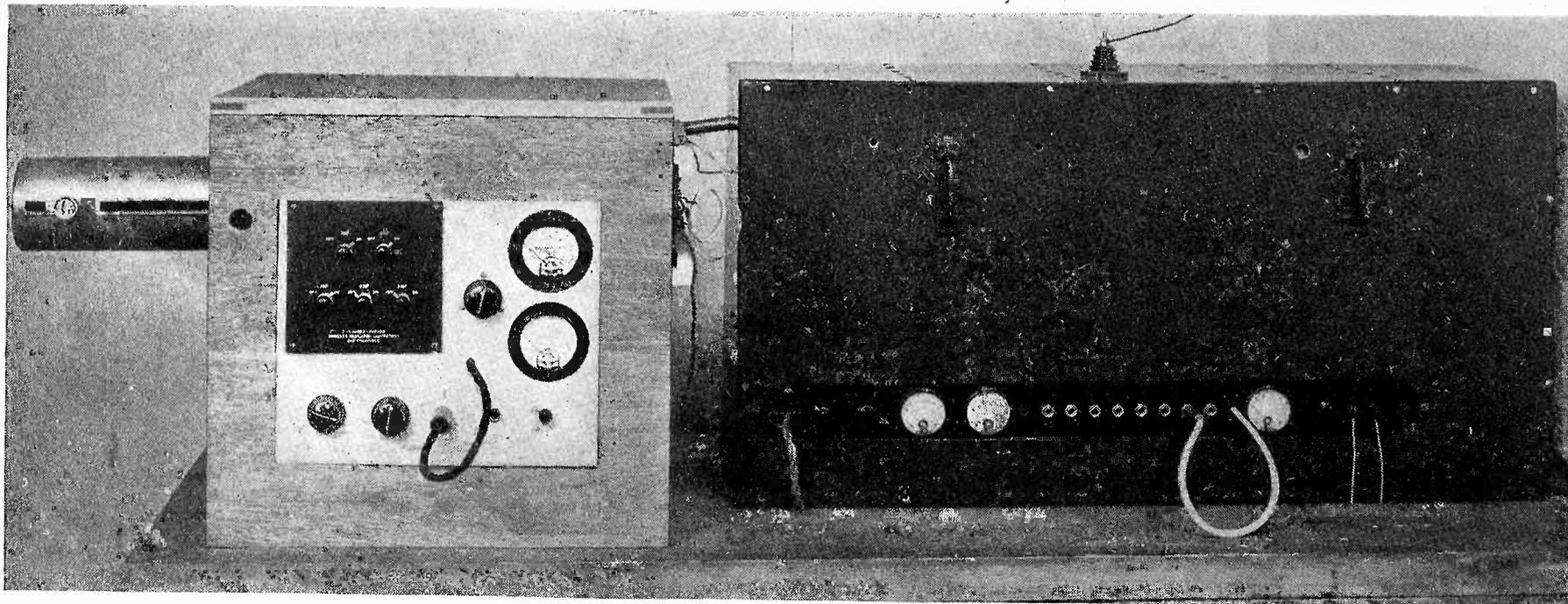
A certain minimum amount of detail must be transmitted by a television system in order that the received image may be said to possess "entertainment value." The system must transmit a person's face, for example, with sufficient detail to make the features readily discernible

and sufficiently clear to "entertain" the viewer if the person should talk and attempt to convey meanings by facial expressions. This minimum has been specified by some workers in the field as an image consisting of 2500 elementary areas, or elements. The picture shown herewith is made from a photograph of a television image consisting of 20,000 elements.

This image of a lady with her eyes closed was transmitted by the Farnsworth system of electrical scanning and is perhaps the first published American photograph of an actual television image. The original image was approximately 3½ in. square. It can well be considered as having entertainment value. The reticence of those working with a 2500 element picture to publish pictures of an image would seem to indicate that the 2500 element limit was fixed more because of the limitations of the apparatus than because of true entertainment value.

It is felt that real entertainment in television will require an image 8 in. square of some 60,000 elements. An image of this size containing 250 lines per side contains 62,500 elements and can be defined as one of real entertain-

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Transmitting Equipment Used in Farnsworth System of Electrical Scanning

Selling RADIO

The first of a series of lessons for the retail salesman, with specific application to merchandising radio equipment.

By HECKERT L. PARKER

THE retail radio salesman is the mouth in the "neck of the distribution bottle." He occupies the front-line trench in the sales battle. No matter how well the campaign may be mapped by the manufacturer's representative in his conferences with the jobber, no matter how well this information may be passed along the line by the wholesaler's salesman, the sales battle cannot be won unless the retail salesman is properly trained and equipped. Furthermore the wholesaler's salesman can operate at maximum efficiency only when he understands the dealer's selling problems.

Salesmanship raises the standard of living by teaching that certain conveniences, like the automobile, telephone, refrigerator and radio, make for a happier existence after the necessities of life are provided. Luxuries, such as art, travel, music and literature, are the next step in raising the standard of living. Radio is both a convenience and a luxury that can be enjoyed for a low cost.

But the mere placing of these luxuries and conveniences before people is not sufficient to cause any but a few inquiring minds to take them away. They must be sold. There is little incentive to produce something that cannot be sold at a profit for the producer and the seller.

The makers of things can be guided toward profitable production by definitely known laws. Every large expenditure of money can be preceded by tests and experiment that prove beforehand whether or not the things can be produced successfully and how to do it. Unfortunately, for successful business, there are no mathematical formulas or chemical tests to predetermine how to sell at a profit after production. Selling and buying are the result of mental effort only. Salesmanship is persuading a prospect to accept and believe your presentation—which may include a physical demonstration—of the thing to be sold.

BECAUSE selling involves mental reaction, much effort has been made to learn how to use knowledge of the human mind in salesmanship. Psychology is a much overworked word among



quacks who claim to teach one human being how to influence another human being. To date, the net results along this line, as applied to selling, is but a lot of bunk, leaving the reader in a daze which has spoiled many a good prospective salesman. Psychology is systematic study and investigation of the powers and function of mind. Psychiatry is the study and treatment of mental diseases. Both require a thorough knowledge of biology, anatomy, medical practice, and what not.

Psychology is the only art dealing with the human mind which has the endorsement of intelligent and educated people, and the only one of such subjects which could be included in a university course on salesmanship. However, before psychology could be of use to a salesman, years of study would be required to understand and apply psychology to his daily work. And by that time he would lose all ability to sell, as is proven by the fact that psychologists and doctors in general are notoriously poor salesmen.

Mental telepathy, astrology, fortune telling, palmistry, and reading facial characteristics, have all been rung in only to waste the time and money of embryo salesmen. Phrenology is a so-called science (?) of the effect of mental characteristics on the shape of the head. Even if there were anything to phrenology, can you imagine a salesman asking his prospect to permit an examination of his bumps so the salesman could know beforehand with what kind of a mind he had to deal?



If it were possible to gaze into a crystal and accurately forecast events, or for any one person to read the thoughts of another person, then the few humans endowed with such power would soon own the earth and everyone else would become their slaves. Most fortune tellers, palm readers, etc., are but one jump away from the poorhouse, and generally have a reputation which causes normal human beings to shun them. Many cities have laws prohibiting any form of fortune telling. Unfortunately, there are no national laws prohibiting similar fakes and the books which are advertised as a sure guide to success in selling.

No, there isn't available for the student of salesmanship any course of "scientific" study that will open the door to success. However, there is much reliable information, based on common sense, observation, and the combined experience of thousands of successful salesmen, that can be used to train anyone to become a better salesman.

So often one hears that "salesmen are born and not made." It is true that certain individuals possess a type of temperament which makes them good salesmen; but when such persons are analyzed, or rather their work is analyzed, it is found they worked hard, and simply used to better advantage whatever judgment and common sense they possessed. Insofar as selling is concerned, they were not "born that way"—they had to be trained. We are not born with the knowledge of how to eat properly; someone trained us not to eat with our knife. We had to learn how to swim, even how to walk. Training is necessary to do things the right way and without training, the wrong way is often pursued. Woodrow Wilson once said: "I am amazed at the ability of the human mind to resist instruction." Perhaps that is the reason for many of us being poor salesmen.

ENTHUSIASM is the parent of enterprise and the most valuable attribute of a successful salesman. An enthusiast was the instigator of every great business organization. No one can reach the maximum success of which he is ca-

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A Leaf from the Diary of Keyhole George

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JUST got in from a jobbers' meeting. The boys all steamed up on dealer service. Seems Cal Stevens, the long-shot wholesaler in these parts, met one of his heavy-weight dealers on the street last week, all hot under the collar. "Say, Cal, what's the idea shooting these buck-and-a-half charges into me for inspecting sets when there's nothing wrong with them?"

Cal has been jobbing the Putrid set quite a while. Art, the dealer, has been juggling with three makes even longer, and there's two sides to every story.

Appears Art's alleged service department has been dragging the lemons over from the customers to Cal's technicians, and Cal has been soaking Art \$1.50 per look. Art obviously didn't like it.

Boiled down, it amounted to this: Eighty per cent of the defectives brought into the jobbing establishment tested k. o. except for, perhaps a bum tube or short on neutralization. Cal figured that Art's service men either were not up to snuff or hadn't the proper test equipment.

The idea, according to Cal, is to catch that stuff before the set is dragged away from the customer's house. Taking the set away starts a whole flock of unpleasant consequences. The customer is apt to get huffy both at the inconvenience and the expense. (All the best programs are on the air when the set's out of order.) The dealer passes the buck to the jobber, who considers the dealer a pest, and so strained relations all around. Art had a big month for trouble and so the present impasse.

Didn't take Cal long to iron it out, though. Great fixer, is Cal. Over a milk shake he showed Art where those little buck-and-a-half's were the price of education. "Art," he asks, "did you ever figure out how much you spend with me every month on service?" Art hadn't. Cal told him, and when Art was himself again Cal gave him a little lesson in simple arithmetic and economics.

Art went back and checked up on his service shop; weeded out the weak sisters, spent a few iron men on real tube and set testers, and now it looks like Cal's service manager will get in a little golf now and then.

Cal told the boys this. Some of them cheered wildly; some wept that the poor dealer should have to fritter away part of his discounts on tube-testers. Some admitted that they stuck their dealers as much as they dared for service; others somewhat sheepishly confessed that they were only too delighted to help the retailer out. No two had the same policy, and finally everybody allowed it was time some definite standard was arrived at, so that everybody would know what to do and when; how much to charge for what; what jobs to handle and which to let Mr. Dealer do; what standards of equipment to set for the dealer, etc.

Next meeting they may agree on all this, and 50 per cent will walk out rubbing their hands, figuring they have the jump on the other guy. That's human nature in the radio game—pardon, business.

Jestful Words of Wisdom for the Radio Salesman

By GRID BIAS

BUYING a radio set is a good deal like having a wart removed. Folks put it off and put it off and never seem to get around to it. And then something happens and the thing is done. We knew a man who buttoned his collar over a wart for fifteen years. He always intended to get himself a collar button, but the wart was already there, and he used it. And then his wife died. He dashed right into a doctor's office, and had the wart removed and bought himself a collar button. He said it didn't seem just right to him to go to his wife's funeral without a collar button.

A radio purchaser is much the same sort of an individual. He'll mull over the idea of getting a set. He'll talk about it. He'll say he ought to have one. But he never gets right down to buying one, and then his wife will invite in some people to dinner, or along will come a football game, and he'll go the limit. Right there is where salesmanship gets in its licks. A good salesman can make this man a friend of radio for life. A poor one can make him as sour as a bucket of brewer's yeast.

Radio sets are not sold like coffins, pants, false teeth, or other human necessities, which people have to have. Folks can get along without radio. We can name off-hand a lot of prominent people who never heard a radio set—and got along just as well. But a good salesman can take a man or a woman who has been getting along without one, and convince him or her that the time has come to change all that. That it is just as old fashioned and behind-times not to have a radio as to crank your own car, or wear red flannel underwear. That is known as "sales psychology." It is making a prospect "dial conscious."

A LOT of salesmen go too far and make a customer "pocket-book conscious." They show him a fancy cabinet, with cathedral doors, windows that light up, two kinds of noise—loud and soft, and running static. They call to his attention that the set looks just like Westminster Abbey in the evening, or the telephone building by moonlight. The customer begins to back away. The most expensive thing he's got at home is his wife's sewing machine. If he took a set like that home, he'd have to build a new house to put it in. The set makes him "sheckle nervous," and he doesn't take it.

Lots of times a salesman gets fooled by his customer. Some old duffer with no shine on his shoes, and a Nat Wills beard, will drift in and begin moseying around a store. The star salesman figures that about all he wants is a couple of tubes or maybe a free grid leak. So he'll turn the old duffer over to the cub salesman and warn him to keep an eye on the safe. And after the old man has meandered about for a time, he'll halt in front of a de luxe, 12-varnish, self-winding high-boy, give it a couple of squints and pull out a check-book. You never can tell!

If a salesman knows his stuff he'll figure that anybody that carries his right hand in his pocket, is a good customer if he can get that hand out. He ought to concentrate on that hand. The customer won't take out his hand for the biggest show cabinet in the place. But he might reach for a volume control button. The minute he does, he'll buy. The trick is to get the hand out. A hobo knows that, but a salesman overlooks it. When a man pulls his hand out of his pocket, it means he's so interested in what he's seeing, he has forgotten to hang onto his purse.

WOMEN are the hardest customers in the world to please. A woman wants the obvious told to her. She likes to hear it. She'll go into a butcher shop and halts in front of a platter of lamb chops.

"Are those fresh?" she'll ask, nine times out of ten.

Now the ordinary butcher will say: "Yes ma'am," and let it go at that. We know one butcher who leans over the counter, looks at the woman in admiration and says: "Well, you certainly know your meat, don't you?" After that he can sell her anything in the shop. She's in a sort of daze. That, from a butcher, is just about equal to a Croix de Guerre from a licensed general.

In the radio field, women react the same way. A radio set is a mystery to most women. They know that one does something to a button and music comes, and twists something else and another station comes in. They also like this cabinet because it matches the hall carpet and that one because the light is in the corner. One enterprising manufac-



turer furnishes a dozen tapestry samples to hide the loudspeaker hole. The one that matches the home furnishing is sold with the set. The technical phases are just so much worry and bother. We saw a salesman sell a woman a set with a dustrag. He showed her that the set collected less dust than another make and she took it. That woman did her own housework and dust was a bigger item than a screen grid tube. That salesman knew his business.

One big mistake that manufacturers have made is not giving their sets romantic names. Women would buy them more fluently. If a set was called "Bijou d'Amour" or "Pepsin d'Esprit," or "Love's Blush" with a soft crimson pilot light, or a waft of incense every time it was turned on, it would sell like a hotcake in a rush restaurant. A good-looking salesman can sell a "D'jer Musique" any time, where a Morgan-Jones super-tick-tack, with power detection would be a glut on the market. Women have been educated to this fancy view of buying, and a salesman who realizes this holds them in the palm of his hand.

Dealers, too, ought to face the need for personal attention in the radio game. A piano house has this down perfect. Every time Mrs. Smith comes in to make a kick about something, a salesman slides forward and says: "Why, how-do-you-do, Mrs. Smith?" That takes the sting out of her right there. Just to think—she hadn't been in there for a month and they remembered her! Piano houses seem to have specialized on that. Piano salesmen know all about the children, and the dog and the new garden, and ask about them. But a radio store is different.

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A GOOD subject for the "embarrassing moments" cartoons would be the radio salesman who is exposed for not knowing what he is talking about. "Imagine my embarrassment when that old gazabo wanted to know how much the side-bands are cut by our knife-edge selectivity radio."

Even though his best friend will not tell him that he knoweth not his onions, the very breath from his mouth revealeth that he has partaken unwisely of the succulent bulb of the edible lily. Indeed he ranketh with the rankest garlic which causeth the tears to flow down the cheeks of the mirthful lad whose laughing-stock he becometh. Whene'er he doth ope his mouth he putteth his foot into it.

Nor is such embarrassment of an ignoramus an unlikely occurrence. The odds are ten to one that it will happen at least as often as he washes the back of his neck. Now-a-days there still are a few people who can be expected to ask an intelligent question about radio. Any innocent-looking gink who wanders into a radio store may be in search of amusement if "in-no-cent" or in search of a radio set if in funds. He needs but ask a few leading questions in order to either floor the salesman or place him upon the pinnacle of confidence:

"How sensitive is this set?"

"How selective is it?"

"What about its tone fidelity?"

Or if these questions seem too technical:

"Can I hear a 500-watt station when 100 miles from it at noon without interference from a local station?"

"Can I hear the highest notes of a piccolo and the lowest notes of a drum, naturally?"

"Why does it hum so?"

By their answers shall ye know your salesman.

WHEN a salesman becomes embarrassed by such questions he is a gone goose. Of course he can try to bluff it out by adroitly changing the conversation to the desirability of owning such a beautiful set. Or he can disparagingly refer to the technically minded salesman of his acquaintance who is now in the booby-hatch.

But in so doing, he loses his own self-confidence, his most valuable personal asset as a salesman. He loses the prospect's confidence in his other glittering generalities. And he loses the sale. No amount of hooey can restore these three essentials.

This does not mean that the salesman is expected to know as much about the set as does the service man who installs and fixes it. But he should at least be

Should Salesman Know

A HUMOROUS DEBATE

By AFFIRMATIVE

familiar with every important detail about its construction and operation. The service man can teach him a lot of things that he ought to know.

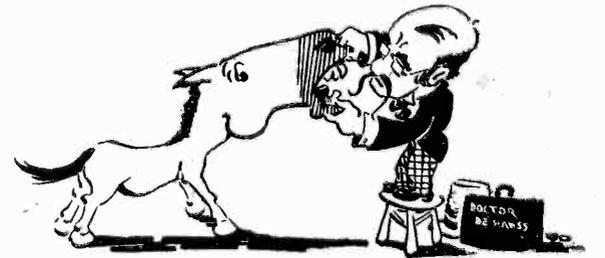
A radio is more "technical" than an automobile or a cash register. Yet the sales managers of companies which sell cars or cash tills insist that their men have an absolute knowledge of what they sell before they are allowed to approach a prospect. They learned long ago that it is not a salesman's attractive personality but his knowledge of the product that finally sells it. If radio men cannot yet create better sales methods, they can at least imitate good ones.

UNFAMILIARITY with the set that he is trying to sell not only weakens a salesman's efforts to interest those who already know something about it, but also robs him of his own confidence and enthusiasm for his product when he is assailed by complaints or temporary faults. A salesman without confidence in himself and his goods is like an incandescent lamp without electricity.

But when a prospect frankly confesses his or her ignorance, the salesman should not then parade his knowledge like a circus does its rhinoceros. He mystifies rather than awes the buyer. His superiority complex, frequently unjustified, arouses the antagonism of their inferiority complex, as Freud might say.

A commuter stopped at a fruit stand to buy a pineapple. As he knew nothing about picking out a good one he asked the fruitman to do it for him. He got a rotten one. He told his friends about it. For a month thereafter each friend went to the fruit stand to buy a pineapple which the salesman was asked to select. After it was all wrapped up, each friend would say, "Oh, you're the man who sold Mr. Jones a rotten pineapple. So I don't want this one. Good-bye."

KNIVES have sold pineapples in bags and pigs in pokes ever since the first sower broadcast his seeds and tares. Likewise fools have bought them without first looking inside. But a wise man opens a horse's mouth to see its teeth or lifts the hood to see the engine, even though he may have driven it from here to kingdom come. Also he peeps under



the cover of a radio even though he has heard its tone.

Since the public is thus becoming radio wise, it behooves the salesman to be more so. Folks have learned that a radio, like a girl, can be beautiful but dumb—in the low and high notes, that crooners are not the only monotone hummers, that distance does lend enchantment, and that selectivity is a good basis for selecting a set.

Consequently it is up to the salesman to really know why these things are so, and to be prepared to give a sensible explanation when asked. For he never can tell when the emergency may arise. Like the old mother skunk, when a dog attacked her and her five little skunks, who said, "Let's pray," his battle is half won when he is well prepared.

Nor is a radio store a bucket-shop or a grab-bag. Buying a radio is not a speculation but an investment. Like the purchase of stocks and bonds, it should be preceded rather than followed by an investigation. And the salesman who can give the best tip, and the reasons why, is the man who will get the business.

Yet his knowledge should not be volunteered, but held till drafted. A fine sense of discrimination is needed as to when and how much to talk.

Last year a super-salesman, one of the kind that can sell a Frigidaire to an Eskimo or an electric pad to a South Sea Islander, might have sold a set on its looks to a woman. But this year the national purchasing agent is wise because she reads the ads before she buys. She knows enough of the lingo to spot a four-flusher. Then, too, friend husband sometimes tags along and chimes in. Neither one of them knows what a screen-grid set is, but they expect to get one just as they expect to get an eight-cylinder car. So the 1930 model salesman must know his onions and keep off his customer's bunions if he hopes to make the grade.

Radio Technicalities?

ON A SERIOUS QUESTION

By NEGATIVE

THE man who tries to locate a shirt in a Chinese laundry by talking French is out of luck. The radio dealer who tries to sell a radio outfit by sandbagging his prospect with technical terms is—out of pocket. Judgment is the watchword or the old profit column doesn't perk.

There is, for instance, the dealer who sold the earnest customer a modern set on the strength of its having "balanced units." Twenty-four hours after the sale was made, the customer was back with a mean gleam in his eye.

"Lissen," he said. "Those units are not balanced. One end is much heavier than the other."

He was not trying to be funny. He had hefted the set and he was right. The man had a literal mind and technical terms were just so much mystery to him.

Another customer bought a set because it had a "power detector" in it. He told a friend of his new set.

"It's got a power tube and everything," he said. The friend laughed.

"Shucks," he said, "my set has had a power tube in it for three years."

Right there, the first man thought he had been bunkoed by the dealer who had worked off an old set on him.

Sales made on technical explanations put too much of a strain on the human brain. It worries set owners. Only the other day we heard one harassed radio listener, who wanted to appear as bright as the rest of the world, ask a friend:

"What kind of frequency have you got in your set?"

That man will snap one of these days and become a raving maniac for no other reason than he is trying to get enough technical patois down so he can talk to another radio owner intelligently. And the other set owner is probably in the same fix.

Dealers sell a man a screen-grid set. They talk long and fluently about the virtues of screen-grid. It is all Greek to the buyer. He wants a screened-pocket and a shielded upkeep. If he finally purchases the set, he has much the same sensations that he had the night he

was first married. He's close to a nervous wreck. He feels that he ought to live up to his set's technical standing, and he goes daft trying to do it.

To add to his troubles, radio manufacturers are continually sending out data on the number of sets that are being made. One firm is making 7000 complete sets a day. Another is turning out 12,000,000 sets a week. At the rate the factories are working, according to their own statements, the highways will be clogged with radio sets. Trains will be stalled. The streets will be littered with the excelsior from packing cases. Within a year we will have to carry alpenstocks to climb mountains of new sets we have to pass on the way to work.

The set owner reads this and looks about him. Here is a world, shortly to be congested to the limit with radio sets and he doesn't know the difference between push-pull hum, and a shielded chassis. He feels as out of place as a corkscrew at a Methodist picnic, and a lot more conspicuous. He wishes, somehow, that he hadn't bought a set because sooner or later somebody is going to ask him a question about the darned thing and he won't be able to answer it. The truth is—the customer has been psychologized by a technical sales talk.

Now let's look at the other dealer—the man who doesn't know any more about the gizzard of his set than a worm knows of Hayward Broun. He walks his man up to a fine looking instrument and turns it on.

"Listen to that tone!" he says. "Look at that control! See that wood! Ain't that a daisy?"

The customer listens and looks. It seems pretty good to him. He hesitates and then takes the plunge.

"Has it—has it got shield, I mean screen-grid tubes?"

The dealer beams at him.

"Well, now—I believe it has. Hasn't it, Joe?"

Joe, out back, who gets \$20 a week to answer "yes," answers "yes."

"That's right," says the dealer. "It has. I never looked inside of it, myself.

You know—I don't give a hang what they put in them, as long as they work. That's one thing about this set. It works—it gives the best music in the country and we never have to look inside it. Just listen to it, will you? Ain't that a daisy?"

And he sells the set. The customer takes it home. And thereafter if any human being, black, white or orange-colored, asks him a technical question about the set, he simply shrugs in superior fashion and says:

"Hanged if I know. I never look inside of the thing. It works—it gives the best music in the country. That's what I bought it for."

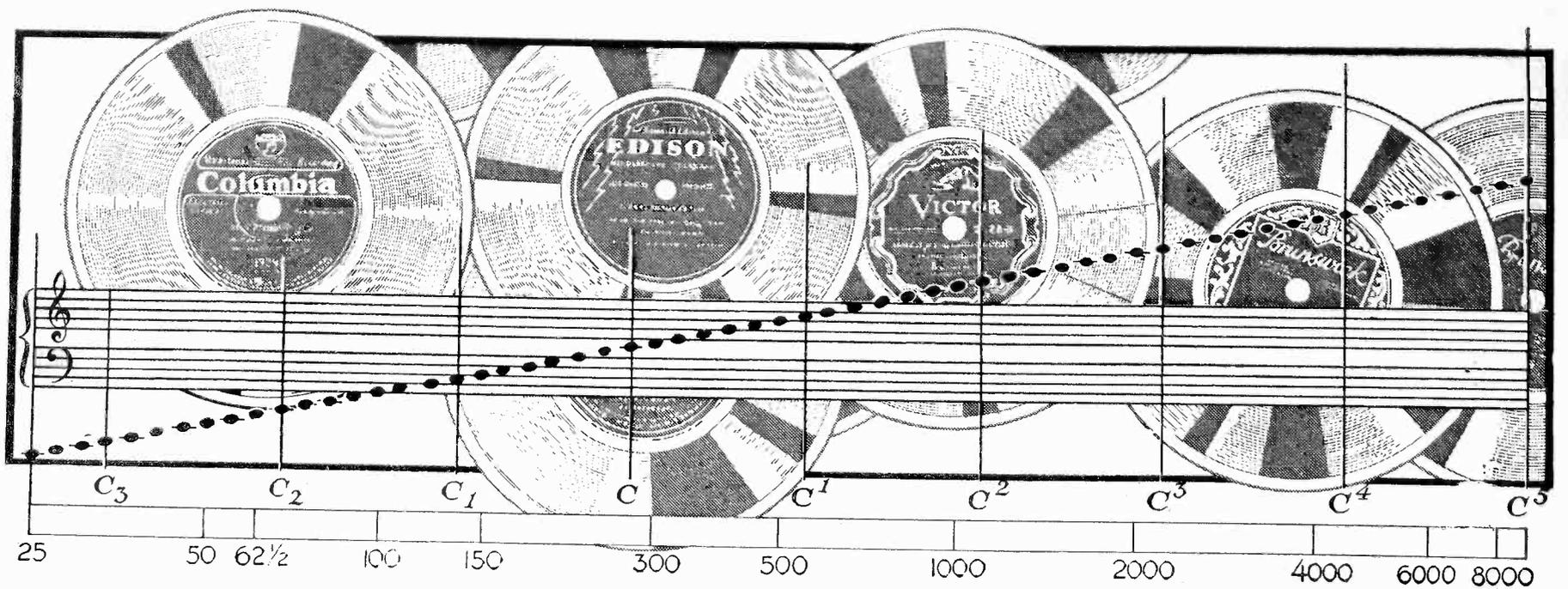
He's not ashamed. He's not cast down. He's not afraid somebody will trap him. He's got the right angle on his set. He doesn't care any more about the gizzard of it than he does about the gizzard of his furnace or his car, and the dealer that instilled that attitude into him has made a real radio set owner out of him. He has taught him to judge a set by what it does and not by what its engineering technicalities ought to do.

MEN pick radio sets a good deal the way they pick a necktie or a wife. They wait until the last minute, make a quick choice—and are glad or sorry all the rest of their lives. If a man sees a woman the first time and likes her—there is a reason. A neatly turned ankle, a trick of the head, a manner of speech, a radiation of personality—and something clicks.

"I want her," he says to himself, and proceeds to lay out his wedding suit.

Would he pick that woman, if a salesman opened her mouth to show him her tonsils were single-controlled, her liver was self-illuminated, her lungs were synchronized, or her pancreas was shielded? He would not. He'd go hunt him up a woman who wasn't so exploited, as it were. And that, in a manner of speaking, is the way he buys a radio set. Looks, quality, style, tone—those are his indexes. Out of it—he builds contentment for his off hours.

The dealer who is smart enough not to make his customer skittish can sell him again next year. And the hardest thing he will have to do is to ask Joe, out in the back room, who will be getting \$22.50 a week by that time, if it isn't a fact that the set has some other new improvement. I know, because I bought three sets that way myself, and they were darned good sets. About Christmas I'm going in and get another, and I'll bet she's a daisy!



Selling *Radio* by Recorded *Music*

Demonstrating Radio Receivers With Phonograph Records

RADIO dealers frequently have occasion to test radio sets or need to demonstrate their quality of reproduction at a time when good radio programs are not available, due either to poor receiving conditions or other causes. With the increasing popularity of the combination radio and phonograph, the selection of the best records for such demonstrations is of prime importance if a good impression is to be made on the prospective customer. The same holds true for any testing work in which the records are a source of music or speech.

Phonograph records, as a rule, do not have as good a frequency characteristic as may be expected from the average radio station of today, due mostly to the limitations of the present method of recording on wax records. Therefore if a radio set gives an excellent performance, insofar as the audio frequency amplifier is concerned, when used to reproduce phonograph records, the set can be depended on to give fine reproduction of radio programs, with the proviso that the r-f end of the set is working properly.

To qualify the above statements, the average wax recorder used to convert electrical currents into lateral vibrations of the recording stylus has a flat frequency characteristic from about 300 to 5000 cycles, and drops rapidly in efficiency, for a given input, at frequencies above or below these limits. At frequencies below 100 cycles the recorder requires many times the energy it needs at 1000 cycles, to produce the same cut in the wax record. This characteristic was purposely introduced into the design of the recorder by its makers, so that the record can be filled to its maximum permissible level without fear of overcutting the grooves due to heavy bass notes from drums, horns or the like. The "over-

By CLINTON OSBORNE

cut" is the principal source of worry in making records, for if the stylus on the recorder swings so far that it cuts into the adjacent grooves, the needle of the reproducer will not track, and the record is ruined.

It is possible to select a reproducer which accentuates the lower frequency range somewhat, thus overcoming to a certain extent the drop in efficiency of the recorder, but it has been the writer's experience that such reproducers introduce a resonant "hump" into the circuit which does more harm than good. There are now a number of excellent electrical pick-ups which will admirably serve the purpose of testing radio receivers, and in combination with suitable input transformers, a first-class circuit from the pick-up to the audio amplifier, with proper impedance match, can be obtained.

IN SELECTING music records for testing, those records which have a wide frequency range will prove most useful. Contrary to general opinion, pipe organ records frequently do not have the low notes which they are supposed to contain. This is because in recording the music, the very low frequency pipes are disconnected, as they require the general recording input level to be lowered to such an extent that the higher frequencies are not recorded properly. They might also overcut the record, so that in their place, a combination of the higher pedal pipes are used, which produce an effect practically the same as that produced by the lower frequency pipes, without danger of overcutting.

A typical example of this is contained in Victor record No. 35760-A, "The Lost Chord," played on the Mormon

Tabernacle organ at Salt Lake City. It is doubtful if frequencies of appreciable amplitude are present below 100 cycles, and yet when listening to the record through the medium of a first-class electrical phonograph, the impression of deep bass notes is conveyed. Anyone who has read Dr. Harvey Fletcher's "Speech and Hearing" will appreciate the fact that we can cut off the fundamental frequency of a musical instrument which is producing a tone that is rich in harmonics, and yet we can still retain the sensation of hearing the fundamental tone. This is because the harmonics which are still heard combine to create the impression in the brain which would have been produced by hearing the fundamental tone; hence we often imagine that we hear low notes in phonograph and radio reproduction, when they are actually not present.

There are several pipe organ records, however, which have frequencies in the range of 50 to 100 cycles to the full capacity of the record, notably such records as Victor Nos. 21121 and 35843, both being organ selections by Edwin H. Lemare. The lowest pedal note which it records with full amplitude is about 50 cycles, and by holding the record at the proper angle in a good light, these low frequencies can be plainly seen as a series of wavy patterns, about $\frac{5}{8}$ in. apart.

If in doubt about the actual frequency of any particular set of alterations on a record, measure the distance between the peaks with a finely graduated rule, using a low power magnifying glass. Then measure the radius of the record at that particular groove, and obtain the circumference of the groove by squaring the radius and multiplying it by 3.1416. As the record rotates about 1.3 times a second, the speed of the groove past the needle point can be obtained by

multiplying the circumference by 1.3, to obtain the frequency of the wave which has been measured, divide its length into the groove speed. This measurement becomes increasingly difficult as the frequency rises, and for the higher frequencies a microscopic measuring device would be needed to obtain even a rough calculation.

As most pipe organ records do not contain many frequencies above 3500 cycles, even though the pipe organ has a range much higher than this, the organ records are best used to test the low frequency range of the radio set. A symphony orchestra record usually contains both the low and high frequency limits, and there are many excellent records of this type to be had. A particularly fine record with a wide range is Victor No. 9146-B, a part of the Victor Herbert suite No. C-1. This record has bass viol notes which range from 50 to 100 cycles, and some of the low frequencies are such heavy cuts that unless the pick-up is well designed, the record soon wears out at that point.

Some of the cheaper electric pick-ups will actually jump several grooves when the needle passes along the cuts produced by the plucking of the bass viol strings, so that this record can be used to determine the suitability of any pick-up device which is to be tested. Very light weight pick-ups which have a stiff armature are very liable to jump on heavy low frequency cuts, and one has been noted which will jump several grooves on any frequency below 100 cycles. A pick-up which is well designed will be heavy enough to force the needle to track on cuts of full amplitude, and yet the armature will be flexible enough to follow the cuts without tearing the walls of the groove due to tendency of the full mass of the pick-up to follow the swings of the needle. Pick-ups used in the talking picture system using disc records are counterbalanced so as to give exactly the right pressure on the needle, so as to hold the needle in the groove, with the least wear and tear on the record.

There are other records in the Victor Herbert suite above mentioned which have the same wide frequency range as No. 9146-B, particularly the "March of the Toys," from *Babes in Toyland*. For demonstrating the ability of a loudspeaker on voice, Tibbett's "Toreador Song," Victor No. 8124, or the Sextette from Lucia, Victor No. 10012, are excellent selections. Tibbett's voice is rich in harmonics which include many high frequencies, and the same applies to the sextette number. Almost any of the late recordings of popular orchestra numbers have a wide frequency range, although the low notes are as a rule somewhat subdued.

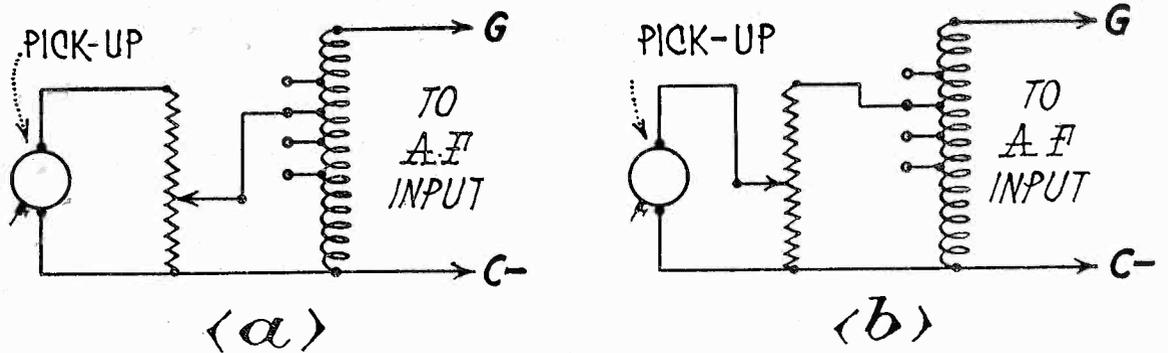


Fig. 1. Circuit for Connecting Phonograph Pick-up to Radio Set

THE circuit best suited for connecting the pick-up to the average radio set is shown in Fig. 1a, although the pick-up can also be connected as shown in Fig. 1b. It is best to use a low impedance pick-up unit, as the volume control is smoother and is spread over a wider range of the scale than is the case with a high impedance unit. The preferred method is to connect the output of the pick-up to the two terminals of the slide wire resistor, so that no matter what the setting of the slider is, the pick-up is terminated with an impedance which is something near a constant value. The slider is then connected to the ungrounded side of the impedance matching transformer, and the ground side of the resistor is connected to the ground side of the transformer.

A coupling impedance now in general use has several primary taps to accommodate the various pick-ups on the market, and has a secondary impedance high enough to match the primary of the first audio transformer in the a-f amplifier of the radio receiver. If the pick-up is connected directly to the a-f transformer input, a very poor impedance match is obtained, with resultant distortion and reduction of the output of the pick-up to such a low value that it may be useless.

If the pick-up is of the high impedance type, better results can be obtained by connecting the pick-up directly to the grid and negative C bias connections of the first audio stage, provided that the a-f amplifier gives enough gain. If the pick-up is connected as in Fig. 1b, the pick-up is practically short circuited at low volume settings of the potentiometer, with the result that the output at low frequencies will be much lower than that of the high frequencies.

The best method of connecting the pick-up assembly to the radio receiver will vary with the make of set. If the primary terminals of the first audio transformer are exposed so as to be accessible, a pair of clips on the end of a piece of twisted wire will be satisfactory, or if the circuit is such as to permit the removal of the detector tube, and the use of an old vacuum tube base as a terminal plug for the two leads from the impedance matching transformer, the connection will be even simpler. Some sets have a jack or pair of terminals for connection of external phonograph pick-

ups, and of course the combination radio and phonograph outfits are ideal.

A word about demonstrating loudspeakers of the electro-dynamic type with phonograph records. Frequently such a speaker is deficient at the higher frequencies, and even with the best of pick-up devices, the resultant music is somewhat "bassy" and lacks the brilliance which the mechanically coupled long air column phonograph always has. By placing a $1 \mu\text{f}$ condenser in series with the slider of the volume control shown in Fig. 1a, sufficient loss will be inserted at the lower frequencies to enable the use of higher amplification in the amplifier, which will tend to accentuate the higher frequencies, and thus produce a more pleasing balance.

This is particularly true at high volumes, and especially when using some of the large diameter dynamics which are deficient at the higher end of the frequency scale. Some of you may have had experience with some of the cheaper talking picture reproducing outfits designed for disc records, in which a pair of dynamics on a large baffle are placed behind the screen. The results have frequently been disappointing because the high frequencies were distinctly missing in the theater, and the speech was almost unintelligible as a result. The proper sized fixed condenser in series with the pick-up would correct this trouble entirely, and while probably reducing the low frequencies somewhat, the increase in intelligibility would more than make up for the loss of the low notes.

Several simple methods are available for accentuating the bass note from a receiver. In case it uses a '27 detector with a single audio stage consisting of two '45 tubes in push-pull, connect a condenser across the two grid terminals of the push-pull input transformer. Such a condenser should have a capacity of from $.00025$ to $.0005 \mu\text{f}$, depending upon the deepness of tone desired, the greater the capacity the more the high frequencies are reduced. Similar results may be obtained by shunting a $\frac{1}{2}$ megohm resistor across each half of the push-pull input transformer secondary and connecting a $1 \mu\text{f}$ condenser from -B to F on the transformer. Less accentuation of bass notes may be obtained by shunting a $\frac{1}{2}$ megohm resistor across the secondary of the first audio transformer.

Radiotorial Comment

By the Editor

DIRE predictions of a decrease in radio sales because of the slump in the stock market are based upon an exaggerated estimate of the public interest in what Wall Street does. As Will Rogers says: "The cows are still coming up to be milked and the chickens are still laying eggs."

A Note of Optimism

The money that has been playing on stocks will now go to work in more legitimate lines of trade which give employment to prospective buyers of radio sets. There is no hundred-and-fifty dollar investment which adds more to the enjoyment of home life than does a radio set. Every radio dealer ought to have a Merry Christmas.

VAGUE murmurings of dissatisfaction with present-day broadcast programs are becoming definitely crystallized as the result of comprehensive surveys which are being made throughout the country.

What's Wrong With Radio?

One of the most significant of these surveys is that recently made by the Commonwealth Club of California, since it represents an independent and unbiased attempt to learn the preferences of a typical cross section of a community of listeners. The conclusions are based upon four thousand sets of answers to a group of twenty questions.

Two-thirds of the replies showed that listeners think that there is something wrong with the programs. More than half of them stated that they are constantly annoyed by radio advertising, although 86 per cent admit that they are grateful to the advertisers and nearly half are led to buy through this medium.

Music is greatly preferred to the spoken voice, only one-third of the audience wanting more talks, although more than two-thirds of the listeners want more educational talks and half of them want more radio drama. Saxophone music is wanted by only 106 out of 4000, of which 85 per cent prefer semi-classical orchestral music. Men's voices received a four to one vote as compared to women's. One of the most surprising features in the poll is that only 19 per cent do not enjoy phonograph music.

Fishing for distance still amuses 37 per cent and 69 per cent think that distance reception has improved during the past two years. Local reception has also improved in the opinion of 94 per cent. Many critics agree that there are too many stations and that they are too close together. The preference is 71 to 29 for chain programs as compared to local. The great ma-

majority think that there should be no censorship of programs.

Proposed remedies run all the way from "killing announcers" to broadcasting legislative sessions. There seems to be especial interest in re-broadcast foreign programs and in university extension courses in cultural subjects. The favorite remedy for financing programs without advertising is by endowment of stations or by all sorts of special taxes.

Yet while this audience criticizes what is being done, it is able to offer no practical suggestions for worthwhile features that have not already been tried. It seems easier to criticize than to improve. And the fact that only five per cent say that they are "tired of radio" indicates that the present programs are fulfilling a real need for home entertainment.

MANY a radio salesman and service man has been puzzled by the fact that a screen grid set may not be as selective in actual operation as might be indicated by its selectivity curve. The curve may show,

Apparent Selectivity

for instance, that the same loudspeaker output will be given by a desired signal and a signal of ten times the field intensity in an adjacent channel. This corresponds to a difference of twenty decibels (sound units) in the loudspeaker volume from two signals of the same field intensity. This is perhaps passably selective, although engineers figure that a tolerably selective set is defined by a difference of thirty decibels. Yet when the same set is operated at full volume, the interfering signal almost drowns out the desired signal. The apparent selectivity is poor.

Such poor apparent selectivity is not due to any fault in the design of the set. The selectivity curve is figured for a standard output of fifty milliwatts. As the output becomes greater, due either to a strong input from a powerful interfering broadcast station or to the great amplification given by screen grid tubes, the apparent selectivity becomes poorer. Selectivity depends entirely upon minimizing the off-resonance voltage. This can be done by reducing the signal input or by reducing the r-f amplification. A short aerial reduces the signal input and thus improves the selectivity. As the volume control of most screen grid sets is accomplished by changing the r-f amplification, low volume likewise improves selectivity. An understanding of these simple facts will often prevent the loss of a sale.

POOR voltage regulation is the cause of many service calls and much dissatisfaction with the performance of a-c radio receivers. The sets are designed

Standardize on 115-Volt A-C Supply

to be operated with 110 volts because this is the nominal voltage at which electricity has been supplied to the majority of domestic consumers ever since Edison invented the incandescent lamp. It has been said that 10 x 11 volts was originally selected, not by a devotee of the ancient game of craps, but as an incidental 10 per cent factor of safety over 100 volts. But be this as it may, the fact remains that there is not an electric power company in the United States that does not continually or occasionally give service which varies from this standard.

This was learned years ago by manufacturers of incandescent lamps who make lamps of different rated voltages for different localities. The National Electric Light Association finds that nearly two-thirds of the population of the country is served with a nominal 115 volts, one-seventh with 110 volts and one-tenth with 120 volts. They publish a booklet which gives the nominal central station voltage for each town in each state. This guides the lamp manufacturer in the distribution of his product.

But even this is not enough to prevent many lamps from being inefficiently operated above or below their rated voltages. Hourly changes in load cause wide variations from the nominal supply voltage, notwithstanding that valiant efforts are made to avoid them.

A radio set is even more sensitive to voltage changes than an incandescent lamp. Vacuum tube manufacturers specify that a-c tubes should be operated within five per cent of their rated voltages. This means that for a 110 volt set the supply voltage should not go below 104.5 volts nor above 115.5 volts. Yet there are records of voltage fluctuations from 90 to 130 volts during a day. Low values cause insufficient emission and high values burn out the filaments. Furthermore any variation in line voltage changes the plate voltage from the rectifier-filter system in the set. Thus the volume changes when an electric iron or other device is turned on or off.

The set manufacturer usually provides a power transformer which can be tapped so as to deliver what would correspond to a 110 volt supply. This adapts the set for use with the nominal supply voltage in the community but does not take care of line voltage fluctuations unless manual adjustments are frequently made with the aid of a voltmeter.

Consequently many manufacturers introduce an automatic voltage regulator in the set. This regulator may take the form of a special tube or a nickel wire resistor which is designed for the load of a specified set or it may consist of a combination of two transformers and a condenser in a circuit so as to be operated by the variation in line voltage. Details of the latter scheme are given by Claude F. Cairns in the May 1929 Proceedings of the Radio Club of America in describing

a commercial regulator of this type. With these simple facts in mind a service man should have little difficulty in clearing up any trouble that may be caused by voltage peculiarities in his community.

Meanwhile the power companies are sincerely trying to improve the regulation on all their lines and the National Electric Light Association is carrying on a campaign to have 115 volts adopted as a standard throughout the country. Because of the latter campaign manufacturers would be wise in designing their sets primarily for 115 instead of 110 volt operation.

A CONTEMPORARY has impugned the statement in these columns that measurements of receiver performance are necessarily relative and that several similar receivers cannot be expected to give the identical performance indicated by the

Pot Calls Kettle Black

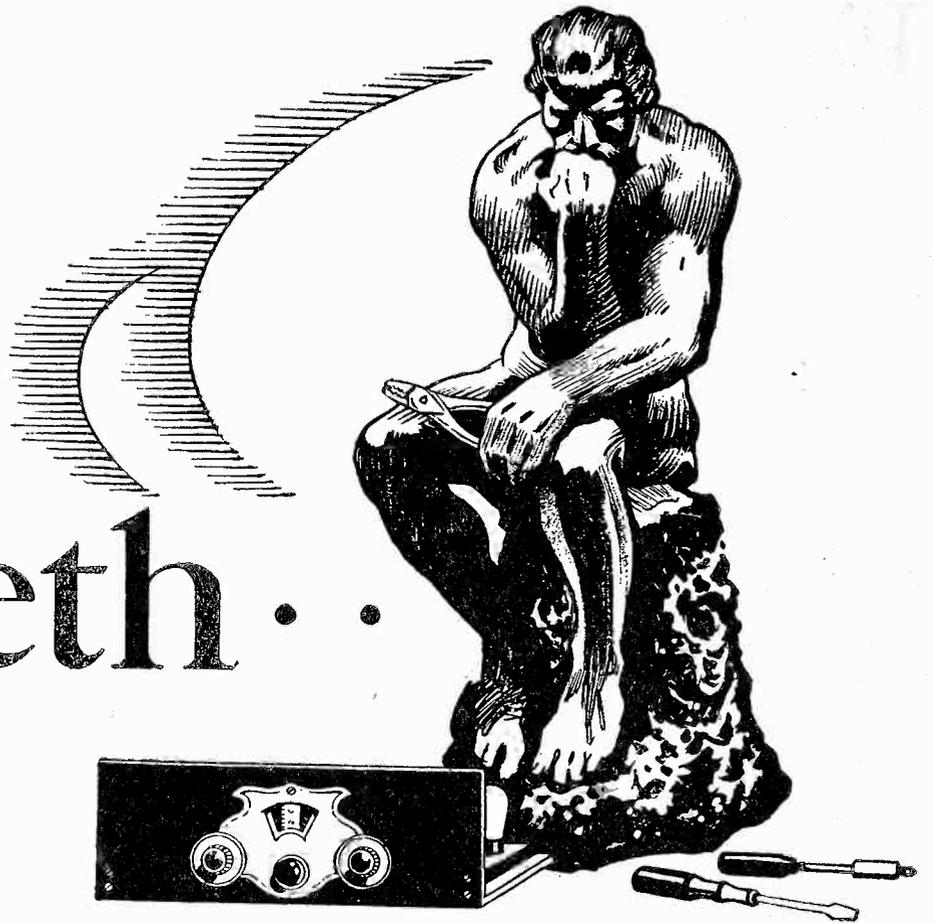
curves taken for any one of them. Such an impugnement might be ignored as due to ignorance were it not that the apparatus used for the measurements is derided and that the purpose for which the curves are intended is distorted. This "home-made apparatus" was designed by an experienced factory engineer, built under his direction in a factory, and operated by him under conditions as rigorous as employed in a factory. The purpose of the curves is not so much to enable the installer "with his handy screw-driver (to) wiggle the condenser plates or otherwise make up for a dip in the curve," as to serve as a guide in determining how well a receiver may be expected to perform.

Modesty and good sense forbid any claim for infallibility in the curves. They are painstakingly and honestly taken for standard stock sets. Nor should a manufacturer object when a competent service man improves a receiver's performance by adjusting the trimmer condensers. What else are they for?

On the same page, this critic disdains the "screw-driver expert" by citing his own prowess in eliminating a hum which a service man had previously diagnosed as due to a burned-out resistor strip. To quote from him: "We took out the power tube. It still hummed. We took out the rectifier and the hum stopped. Clearly the trouble was in the rectifier or loudspeaker circuit—not the radio circuit. Without throwing any bouquets at ourself, we found the trouble in a few minutes." Might it be assumed, therefore, that if "we" had pulled the power plug clearly the trouble would have been there?

Without the additional information which is given by the critic, he might appear to be as great a "dumb-bell" as the service man he excoriates. Yet his criticism of "a dangerous practice recommended" in these columns is based upon a like half-reading of the text. Which all goes to show that people who live in glass houses ought to employ a "blind-man" so that their neighbors may not be tempted to point out the error of their ways.

As The Trade Thinketh..



H. B. RICHMOND:

President, Radio Manufacturers' Association.

"There are no radical changes in construction of receiving sets in sight this year and probably for some time to come, although there are great advancements in manufacturing refinements, especially in beauty of design."

A. J. CARTER:

President, Carter Radio Co.

"Parts manufacturers have been the leaders in the technical development of the radio art. With the enormous growth in the factory production of receiving sets and the passing of radio from the toy to the utility stage, there has been consequent decline in the parts business so far as the amateur and experimenter are concerned, but this is now being more than counterbalanced by the greatly increased sales of parts to receiving set factories. There are fewer manufacturers of parts, but their output is increasing."

A. E. BRYSON:

Vice-President, Halsey, Stuart & Co.

"Look at radio advertising (broadcasting) not as a new toy, but as one of the amazing developments of this age, given us to cope with new conditions. It is a mass rather than a class medium, and one of great penetrating power. It is most effective when used as an indirect sales medium."

POWEL CROSLEY, Jr.:

President, Crosley Radio Corporation.

"The sales possibilities of screen grid battery sets are tremendous. Only eight per cent of American farms are electrified and there are at least five million farms without electric service. Unwired city homes, summer camps, mining towns, and motor boats all offer big markets."

ERNEST KAUER:

President, CeCo Manufacturing Co.

"Radio manufacturers can well afford to purchase most of the time available on the larger networks and retailers on the local stations, thus making the radio industry economically responsible for the cost of broadcasting and providing programs which will insure the desired appreciation of the public."

J. E. SMITH:

President, National Radio Institute.

"The centralized radio sets and wiring of today, which are being installed in hotels, hospitals and schools, are but the forerunner of similar equipment in the average home. A wonderful field will soon be developed for those capable of planning, installing and maintaining these built-in radio systems, in which a far greater proportion will be spent for the purely radio end than for the furniture as under the present system."

J. H. DELLINGER:

Principal Physicist, Bureau of Standards and Formerly Chief Engineer, Federal Radio Commission.

"The test of 'public interest, convenience, or necessity,' is being applied in broadcasting to mean that the rights of listeners are superior to those of the broadcasting stations. This means that, as far as possible, interference must be avoided. It means that rural listeners, remote from any station, as well as city listeners, must be given service. It means that excessive duplication of programs by many stations cannot be permitted, and the high power stations cannot be located in the midst of large populous areas. Perhaps the most important implication is that the total number of broadcasting stations must be limited to the number necessary to prevent undue interference."

MARY F. PHILPUT:

Director of Radio Studio, University of Pittsburgh.

"Radio's contribution to education is to carry into the home a constant incentive to know more. Mark Hopkins' ideal as a teacher at one end of a log and the pupil at the other, has been transformed to a teacher at the microphone and millions of pupils at receivers tuned to his wavelength."

For Engineers Only Salesmen Keep Out

Experimenting With Screen Grid Tubes

By FREDERICK EMMONS TERMAN
Stanford University

How to use four-element tubes for grid-leak detection with either screen-grid or space-charge grid connection.

SINCE four-element tubes came on the market several years ago many circuits for their use have been described. These have dealt primarily with radio frequency amplification and plate circuit detection. It does not seem to be generally appreciated that it is possible to use grid-leak grid-condenser detection with four-element vacuum tubes, and it is the purpose of this article to show how such detection may be applied to screen-grid and space-charge grid tubes.

The presence of an extra grid does not appear to have much effect upon the grid circuit characteristics of a vacuum tube. A large number of grid-leak detection experiments on four-element tubes which have been made at Stanford University show that, as far as the detector action in the grid circuit is concerned, the four-element tube operates in exactly the same manner as the well-known three-element tube. In fact, the performance of the two is not only qualitatively the same, it is actually quantitatively the same.

In grid-leak detection the radio signal voltage applied to the detector is rectified in the grid circuit, and causes the grid-condenser to charge up negatively, making the grid more negative. This change of grid voltage is then amplified in the plate circuit of the tube. The change of grid voltage produced by a given signal is exactly the same amount in four-element tubes as in a three-element tube with similar type of filament.

The relative merits of these two types of tubes when acting as grid-leak detectors therefore depend upon the relative amount the change of grid potential is amplified in the plate circuit. This resolves itself into a question as to the relative merits of four-element tubes vs. three-element tubes in audio frequency amplification, and is too big a question to debate here. It may be said, however,

that at the present time screen-grid audio frequency amplification can be obtained that is at least as satisfactory as triode amplification.

The four-element tube can be used as a grid-leak detector in a number of ways. Thus it is possible to use weak signal detection or power detection. Again, the tube either may be arranged for the screen-grid connection or the space-charge connection. The screen-grid grid-leak detector is very satisfactory for the reception of high quality broadcasting as well as for code signals. Grid-leak detection, when used with the space-charge grid connection, is only suitable for code signals, as it gives poor reproduction of the high notes in speech and music.

The circuit for grid-leak detection with screen-grid connection is shown in

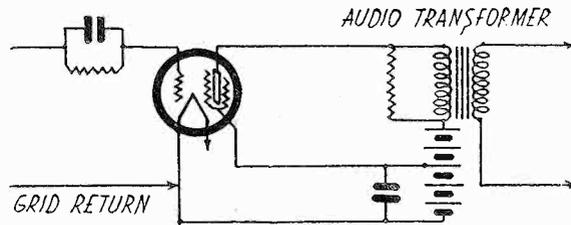


Fig. 1. Circuit for Grid-Leak Detection with Screen-Grid Tubes

Fig. 1. When a detector is to operate with small signal voltages applied to the grid, the leak and condenser should be of the usual size. Values of 1 megohm and $0.00025 \mu\text{f}$ are recommended for a-c tubes, while a leak of 1.5 to 2 megohms and the same size condenser as before can be expected to give best results with the type '22 d-c tube.

When used in this manner with small input voltages, it will be necessary to have one stage of audio-frequency amplification between the detector and the input to the power tube. This is because the detector output with weak signals is not sufficient to properly load up the power tube. Grid-leak detection of small

signals by means of screen-grid tubes can be expected to introduce exactly the same amount of distortion as is obtained when the same signal is applied to a three-element grid-leak detector. The quality is no better and no worse with shield-grid tubes.

By changing the proportion of grid-leak and grid-condenser it is possible to operate the power tube directly from the output of the detector. The proper proportion of grid-leak and condenser for the a-c and d-c screen-grid tubes are shown in Table 1. It will be noted that the proportions are entirely different from the proportions usually employed with weak signals. These sizes of leak and condenser are absolutely necessary if the grid-leak detector is to give distortionless rectification of large signal voltages. In the case of the grid-leak power detector, the grid return lead should go to the negative side of the filament of d-c tubes and to a grid bias of about -1 volt with a-c tubes.

With the low resistance leak and small grid-condenser specified for grid detection in Table 1 the grid-leak detector will give sufficient undistorted output to operate any ordinary power tube directly from the detector output. Power grid-leak detection has the advantage over power plate detection with screen-grid tubes in that the grid-leak detector is approximately three times as sensitive. Thus the plate detector requires about three times as much r-f amplification to obtain the same loudspeaker volume. As far as distortion is concerned, the grid-leak power detector is at least as good as the plate rectifier, and in fact our measurements have indicated that it is slightly superior.

The circuit for grid-leak detection with the space-charge grid tube is shown in Fig. 2, and the proper sizes of leak

(Continued on Page 72)

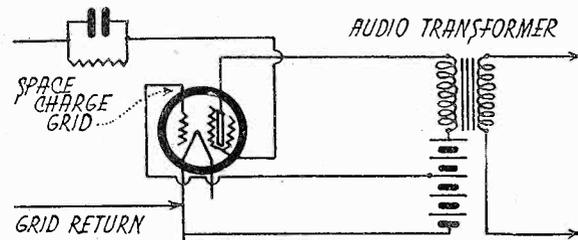


Fig. 2. Circuit for Grid-Leak Detection with Space-Charge Grid Tube

TABLE 1

Circuit Constants for Screen-Grid and Space-Charge Grid. Grid-Leak Detection		Type 22 D-C Tube	Type '24 A-C Tube
Weak Signal	Grid condenser	$0.00025 \mu\text{f}$	$0.00025 \mu\text{f}$
	Grid leak	1.5-2 megohms	1 megohm
	Grid return lead	F+	Cathode
Power Detection	Grid condenser	$0.0001 \mu\text{f}$	$0.0001 \mu\text{f}$
	Grid leak	$\frac{1}{4}$ megohm	$\frac{1}{4}$ megohm
	Grid return lead	F-	-1 volt

Some Fallacies in Band-Pass Tuning

By FRANK C. JONES

A mathematical analysis which shows some of the weaknesses in the usual sales argument.

BAND-PASS tuning as applied to radio receivers usually consists of two or more tuned circuits coupled inductively or capacitively. These systems work on the principle that when two tuned circuits are coupled together, a double resonant peak may result if the coefficient of coupling is great enough. Most schemes either give too variable a band width or too much variation in coupling over the broadcast band of frequencies.

peaks. If the coupling was chosen to give an effective 10 kilocycle band at 550 kilocycles, it would be nearly $2\frac{3}{4}$ as wide as 1500 kilocycles. In actual practice, due to coil resistances, the ratio would be even greater so this band-pass scheme is not much good. There will also be some capacity coupling between the two circuits which may change the total effective coupling. This will be considered after discussing the next form of pure capacitive coupling.

$5\frac{3}{4} \mu\mu f$, then $k = \frac{5\frac{3}{4}}{54 + 5\frac{3}{4}} = .096$. This would give $\frac{.096}{.0142} \times \frac{1500}{550} = 18.4$ times as

wide a band at 1500 kilocycles as at 550 kilocycles, which is entirely unsatisfactory from the standpoint of band-pass tuning.

In case both inductive and capacitive coupling of the two types discussed were used, the capacitive coupling may either aid or oppose the magnetic coupling. Two coils magnetically coupled will have a certain capacity coupling due to the electrostatic fields and this capacity may be lumped into an equivalent C_m between the high r-f potential points of the two circuits.

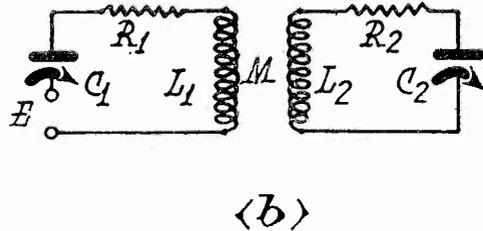
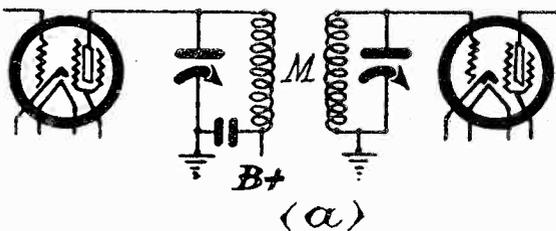


Fig. 1. An Inductively Coupled Band-Pass Tuner Circuit and Its Equivalent

In Figs. 1a and 1b are shown a scheme that has been used in a popular receiver kit for the past year. Magnetic coupling is used to provide so-called band-pass tuning. Fig. 1b is the equivalent of Fig. 1a. Here both primary and secondary are tuned to resonance so $\omega_r = \omega_1 = \omega_2$ where $\omega_r = 2\pi f_r$ and f_r is the resonant frequency. The coefficient of coupling, k , is defined as the ratio of the common reactance to the square root of the product of the reactance of the two circuits similar to the coupling reactance. For the circuit shown in Fig. 1b this gives $k = M \div \sqrt{L_1 L_2}$.

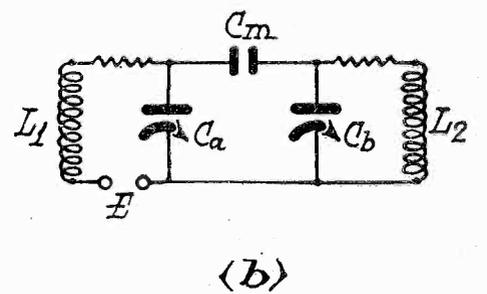
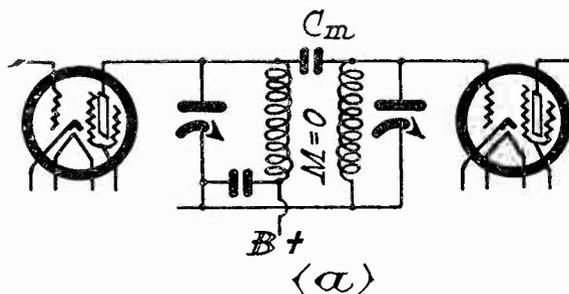


Fig. 2. A Capacitively Coupled Band-Pass Tuner Circuit and Its Equivalent

Fig. 2a shows a form used by the writer in one or two experimental receivers described in RADIO a year or so ago. Here $k = C_m \div \sqrt{(C_a + C_m)(C_b + C_m)}$ in the equivalent circuit of Fig. 2b. Again neglecting resistances, $d = kf$ but k is not constant. For example, at 550 kilocycles suppose $C_a = C_b = .0004 \mu\mu f$ and $C_m = 5\frac{3}{4} \mu\mu f$, $k = \frac{5\frac{3}{4}}{\sqrt{(400 + 5\frac{3}{4})(400 + 5\frac{3}{4})}} = \frac{5\frac{3}{4}}{400 + 5\frac{3}{4}} = .0142$, the desired value at

For example, if C_m were such as to give a coupling of .0015 at 550 kilocycles, then using the above figures it would be .010 at 1500 kilocycles. If the inductive coupling were set to give $k = .015$, then the effective $k = k_1 + k_c = .0145$ at 550 kilocycles and $k = .005$ at 1500 kilocycles. In this case the coils would have to be wound in such a direction as to have the inductive coupling oppose the capacitive coupling or $k = k_1 - k_c$. Then $d = kf$ would be nearly constant width since k would vary inversely as the frequency.

With this circuit, as shown in Figs. 3a and 3b, it is possible to keep the effective
(Continued on Page 72)

Neglecting resistances in the circuits, the two resonant peaks can be determined from the expressions $f' = f_r \div \sqrt{1 - k}$ and $f'' = f_r \div \sqrt{1 + k}$. Since we are interested in the difference between the two peaks $f' - f'' = d = \frac{f}{\sqrt{1 - k}} - \frac{f}{\sqrt{1 + k}} \approx kf$ for k less than 2 per cent. To obtain a band width of 10 kilocycles the two peaks would have to be about 7 or 8 kilocycles apart. If $d = 8000$ cycles, then $k = \frac{d}{f} = \frac{8000}{550 \times 10^3} = .0142$ at 550 kilocycles and $k = \frac{8000}{1500 \times 10^3} = .00533$ at 1500 kilocycles.

However, M is constant and so k would be constant instead of varying to keep an 8 kilocycle difference between

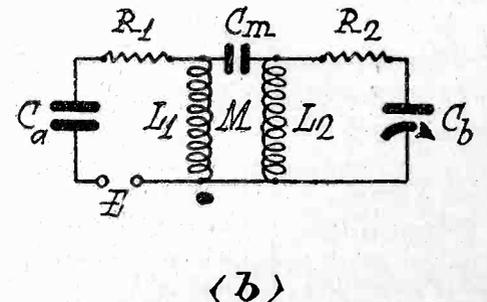
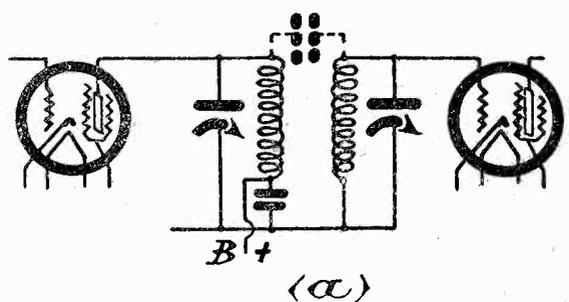
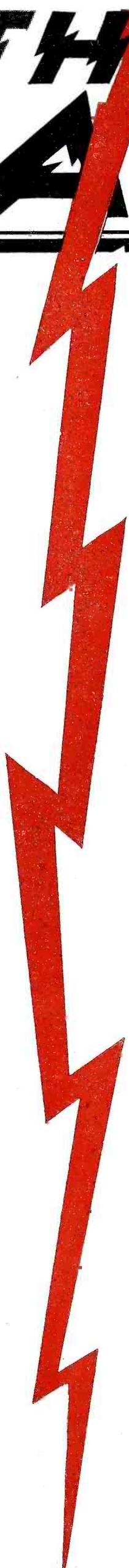


Fig. 3. Circuit in Which Both Inductive and Capacitive Coupling Is Used
RADIO FOR DECEMBER, 1929

THE FLASH



"No hard times are in sight in our opinion. But if they should come radio would do better than most businesses, because it provides world's greatest entertainment at world's lowest cost."—Paul B. Klugh, Zenith.

"Believe 1930 will find radio industry more stabilized, with fewer manufacturers, more standard lines and less public confusion. It will prove a profitable year to those who conduct their business on stable principles."—W. P. Roche, Lyon & Healy, Inc.

"I hope that with more expert dealers may come an improvement in the sincerity of all radio advertising, further deflations of such few fictitious values as still encumber the market, and a more general appreciation of the reasons upon which the selection of a receiver ought to be based."—McMurdo Silver, Silver-Marshall.

"The radio set is a proven necessity and nothing is in sight to replace it. The attraction of too much capital spent without the direction of radio-minded business men has been a handicap. The industry needs less attention from financial interests attracted for the purpose of floating stock issues."—Peter L. Jensen.

Cable Radio Tube Corporation have not curtailed production of Speed tubes at its five tube factories in Brooklyn and Newark. All factories are working a full day every day in the week and are running overtime five nights a week.

The American Bosch Magneto Corporation does not contemplate reducing its current list prices on radio merchandise.

Stromberg-Carlson has advised all retailers that it is not their policy to reduce list prices of receivers. On November 24 the price of their No. 642 was advanced to \$259, less tubes.

General Motors Radio Corporation will continue the manufacture of Day-Fan radio receivers and will handle all advertising on a controlled basis for both distributors and dealers. Models are available for either standard or screen-grid tubes with prices for four cabinets ranging from \$169.50 to \$250, less tubes. Sets are sold on the deferred payment plan provided by the General Motors Acceptance Corporation.

New models of Dodge Bros. motor cars are equipped with six-tube Transitone radio sets. Tuning controls are placed on the dash-board; *A* current is supplied from the car battery and *B* voltage from dry batteries. A copper screen in the roof of the car serves as an aerial. The loudspeaker is of the magnetic type with a small horn, mounted above the windshield.

United Reproducers Corporation inform the trade that there will be no price reduction in Kylelectrons. Lester Noble has succeeded Arthur T. Hill, resigned, as president of the company.

A. H. Grebe & Company will make no price changes in their line.

Zenith Radio Corporation wires that it has no distress merchandise and will maintain its prices on all models.

Price reductions have been announced by Atwater Kent, Brandes, Bremer-Tully, Brunswick, Colonial, Crosley, Day Fan, Earl, Freed, Graybar, Kellogg, Lyric, Majestic and RCA.

Arthur Walsh, Vice-President, Thomas A. Edison, Inc., has wired Edison distributors that Edison foresees no economic reason why price reductions will be necessary or advisable after January 1, 1930. He further states that Edison prices will not be increased and there are no Edison radios in cold storage.

Sparks-Withington Company announce that there will be no reduction in prices on Sparton radios. Model 931 may be slightly increased in price.

Stewart-Warner Corporation says that no price changes will be made in mid-season and no purchaser will find that his neighbor has bought at a lower price in the same season.

McMurdo Silver, who has completely recovered from his recent accident, advises that Silver-Marshall do not intend to reduce prices on Silver radios, which has always been under-priced. The inventory position is favorable and regular production is being continued without curtailment.

F. A. D. Andrea wires that FADA prices are not to be reduced at present. Should reductions be made in the future the price protection offered in the FADA franchise covering any stocks in the dealers' hands will be fulfilled to the letter.

A \$300,000 fire completely destroyed the manufacturing plant of Gray and Danielson in San Francisco where Remler parts and sets were being made. E. G. Danielson states that a new plant will be built immediately and that within six months production will again be under way.

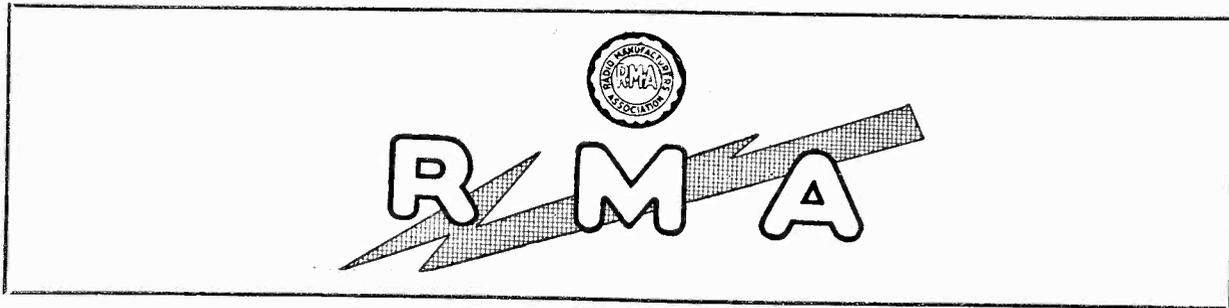
The DeForest Radio Company are selling a comprehensive line of transmitting tubes directly to the consumer. This includes 15, 50, 500 and 5000-watt oscillators, a 50-watt modulator, and a 50-watt amplifier.

The Philadelphia Storage Battery Company has advised all dealers that there will be no reductions in the prices of its receiving sets or loudspeakers.

Thomas A. Edison, Inc., has discontinued the manufacture of commercial phonograph records (including both diamond disc and needle types) in order to make available additional factories for the manufacture of radio and radio-phonograph combinations. Mechanical phonographs of the portable type will continue to be manufactured and sold.

The first announcement that Grigsby-Grunow Company would stop production of this season's Majestic models a month earlier than usual has been modified by a statement that production will be continued at the rate of 2000 sets daily. Latest reports from dealers indicate that sales are normal for this time of year.

ASSOCIATION NEWS



PRESIDENT H. B. RICHMOND ADVISES COURAGE AND CAUTION

"Events of the past month demand both courage and caution for the future. The future will be brighter because of them, but today we must be alert. The radio industry has hesitated to talk publicly about some of its major problems, one of the most prominent of which is overproduction. Only after wide publicity had been given to overproduction did the oil industry tackle its problem in earnest.

"The crash in the stock market will affect the radio industry. There will be some temporary curtailment in purchasing power, but this is not the major effect. The greatest effect will eventually prove a great aid to the industry as a whole. Because of the weak stock market, it is now difficult to float new stock issues.

"Radio has a magic public appeal. Radio stocks have sold readily, which has made it possible to obtain capital for radio expansion programs with little difficulty. This easy capital has made possible enormous production schedules. There can be no denying that many more sets were scheduled this season than could have been absorbed.

"Because of these enlarged schedules and new entries into the field, most manufacturers' sales departments had not met their quotas this fall. Moderate curtailments were already being considered in production schedules; then came the market crash. While not the major basic factor in the problem, it immediately became the straw which broke the camel's back. Stop production and liquidate! These were the words of many a radio executive. New reduced prices have featured advertising.

"Is it a panic? Are we all to be caught in a crash? No! The present commotion is but a ripple to what would have occurred had initial production schedules continued as originally planned. For many, the season's earnings will be disappointing, but the industry in general will end the season in a liquid and sound condition.

"Where plans had been made to finance production by public security sales, and where the margin of selling price over cost is not sufficient to withstand the temporary price reduction, strained credit conditions will result. Numerically, the majority of the membership of the R. M. A. are manufacturers of component parts. Many of these companies, while financially strong, are small. They have in many cases extended credit on individual accounts representing a substantial part of their own capital. Should that account become involved, their own structure might not be able to withstand the shock.

"Now is the time for every radio executive to face the facts, to throw aside hysteria of optimism or pessimism. Let credit managers use caution, but have the courage to help where help is worthy. It is a time when the R. M. A. and the associations you have

made through membership in it should prove of inestimable value to you. It is a time of trouble that we shall soon look back on as the pain of the birth of a brighter future."

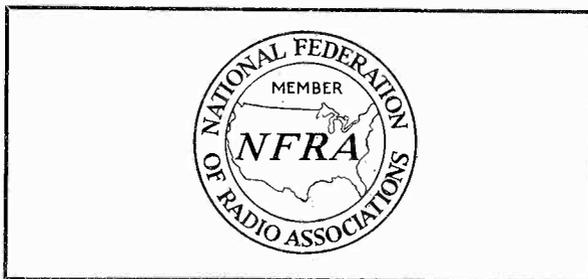
The RMA Traffic Department has secured a 10 per cent reduction in freight rates on carload shipments on console receiving sets and of 24 per cent on table models, effective about January 1, 1930. Furthermore rates to the Pacific Coast from Buffalo and points west were reduced on September 15, 1929, so as to effect an estimated saving of \$200 per car. These new rates will aid jobbers and dealers and may be reflected to the public in reduced prices for sets.

Express service has been restored via Texas border between all Railway Express Agency offices in the United States and all offices of the Mexican Railways (Express Department) in the Republic of Mexico. This obviates consignment to customs brokers. Shipments must be accompanied by documents for customs clearance at the border point.

The R. M. A. Traffic Department is working for better freight ratings on loudspeakers, cabinets, amplifiers and horns.

The Broadcasting Committee finds that twenty-seven R. M. A. members are sponsors for programs over the Columbia and NBC Systems. During the first six months of 1929 radio manufacturers spent nearly \$2,000,000 on programs, which is nearly twice that of the next largest radio broadcast sponsor, the automobile industry. This is exclusive of local programs and of those who operate their own stations.

The R. M. A. is undertaking a campaign to bring about uniform current and voltage supply throughout the country in order to facilitate the introduction of the standard 110-volt 60-cycle a-c set.



The directors of the Federated Radio Trade Association have changed the name to the National Federation of Radio Associations so that the name will be more truly representative of that portion of the industry represented by the association.

The Fourth Annual Convention of the National Federation of Radio Associations and the Radio Wholesalers' Association will be held at Cleveland, Ohio, February 10-11, 1930. An invitation to attend is extended to all individual radio dealers, wholesalers, manufacturers and broadcasters, as well as to all state and territorial radio trade associations. This is to be a "down-to-facts" convention to get at the vital problems of the industry. It is also an opportunity to meet the leaders of the industry "man to man."

THE Radio Wholesalers' Association, which is affiliated with the National Federation of Radio Associations and employs the same Chicago offices, includes in its membership most of the large radio jobbers throughout the country. This association has been active in securing a reduction in freight rates on radio equipment and in making recommendations with regard to the handling of sets, tubes and accessories by wholesalers.

Its activities are well illustrated by its list of committees: Vigilance, Dealer Relations, Traffic, Sets, Tubes, Accessories, Furniture, Insurance, Dealer Deferred Payment Plan, and Credit and Collection. The Sets, Tubes and Accessories Committees are each subdivided into three sections concerned with Trade Relations, Market Study and Better Selling.

A survey of wholesaling conditions has been started as a basis for outlining future policies. Opinions have been invited as to what are the greatest evils that now menace the merchandising structure of the radio industry.

A specific example of its work in the city of Chicago is a recent investigation wherein it was found that of 300 newspapers who had requested advertising appropriations from the industry, 75 were not worth considering and 15 had gone out of business. Advertising rates and circulation figures were investigated and as a result the dealers were notified that they could, of course, advertise in any papers that they chose, but that wholesalers would share the expense only in those papers on the approved list.

Among the important accomplishments of the Association has been the drafting of a serial number ordinance which has been adopted by many state legislatures and city councils. This bill, which makes it a felony to remove or deface serial numbers from radio apparatus, is intended to protect the legitimate radio merchandiser. It also publishes a booklet on "How to Organize a Local Radio Trade Association" and a "Suggested Code of Business Practices," for radio dealers. A copy of the model serial number bill or of either of the booklets may be had upon application to association office at 32 West Randolph Street, Chicago.

The Association is cooperating with the National Association of Broadcasters and the R.M.A. in work to retain the broadcasts of national sporting events. It is also assisting the Educational Department at Washington in sponsoring and increasing the use of radio in the public schools.

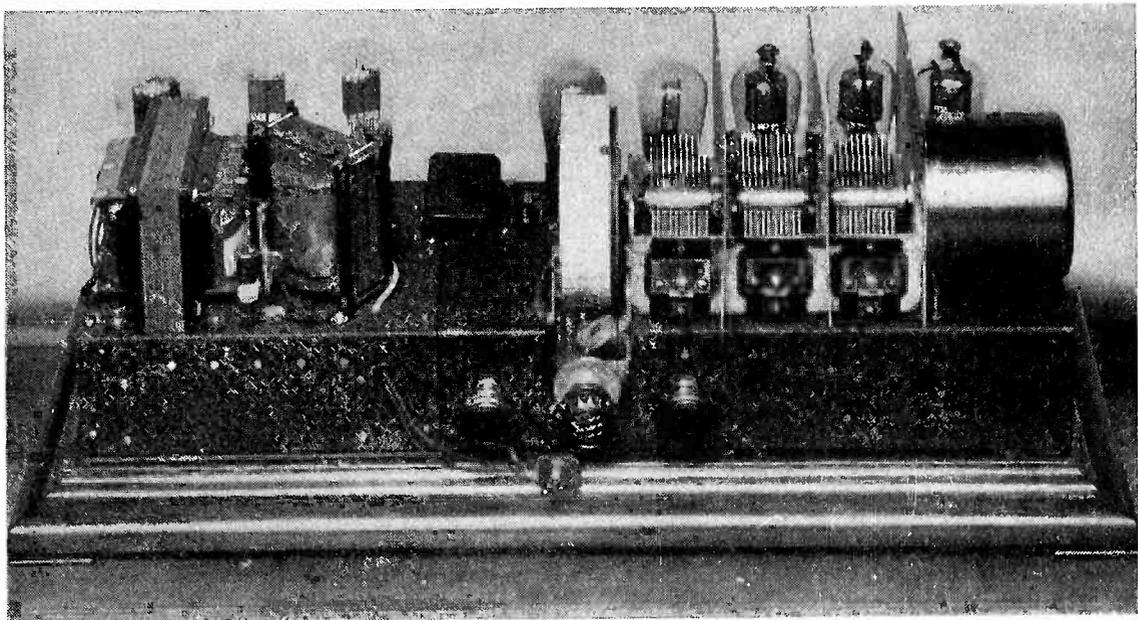
The association's fourth annual convention will be held in conjunction with that of the Radio Wholesalers' Association at Cleveland, Ohio, February 10-11, 1930, with the Ohio Radio Trade Association as official host. Every radio tradesman is most heartily and cordially invited to attend.

Analysis of Eveready Series 50 Circuit

THE chassis used in the three models of this series incorporates three stages of r-f amplification with screen grid tubes, a power detector in which a '27 tube is used, a resistance coupled first audio stage which also employs a '27 tube and a push-pull power stage using two '45 tubes. A type '80 rectifier tube is employed in the power pack.

Both the inductance and capacity of the input circuit are variable. The inductance is in the form of a variometer and is mounted on the end of the gang condenser shaft. Across this circuit is connected a 500,000-ohm potentiometer, the variable contact being connected to the grid of the first tube. This comprises one section of the dual volume control. Fixed inductive coupling is employed in the three subsequent circuits, the secondary of each r-f transformer being tuned by one of the variable condensers in the four-unit gang.

Grid bias is supplied to the three screen grid tubes from the drop through a fixed resistor and a variable resistor

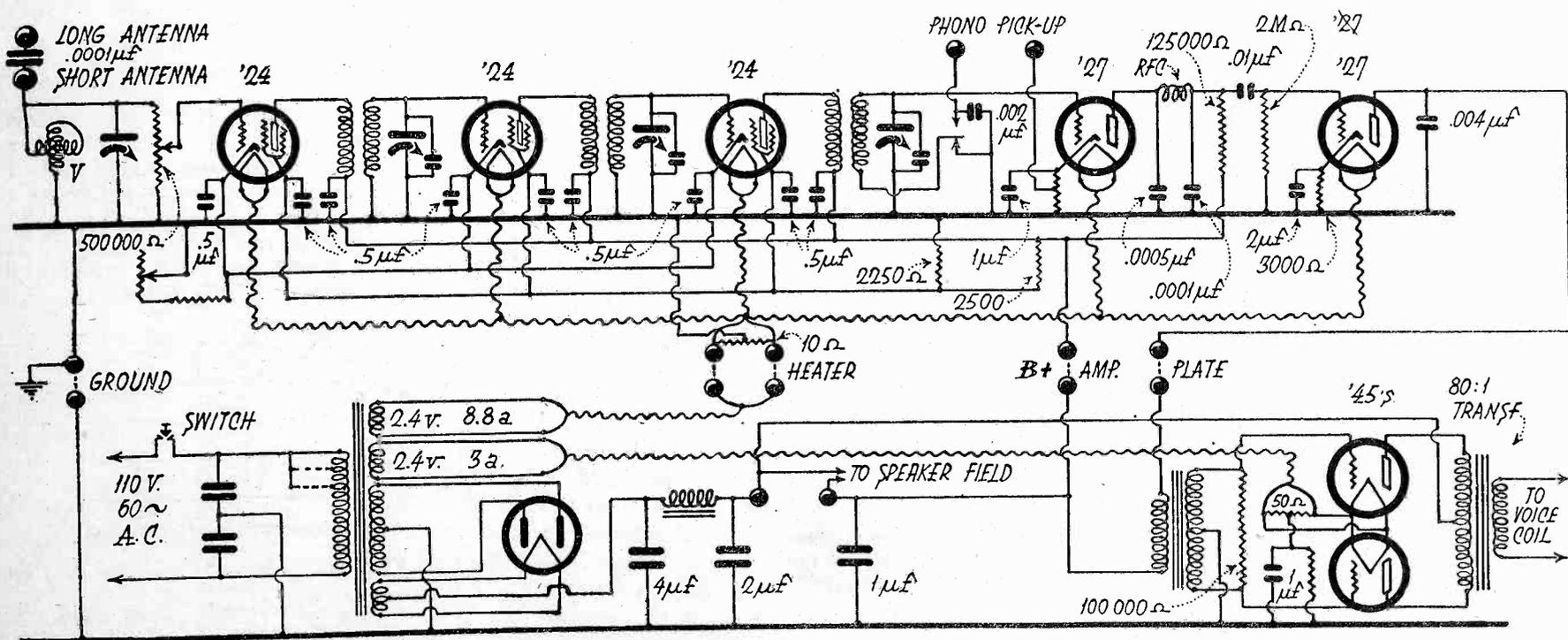


Eveready Screen-Grid Chassis, Models 52, 53, 54

connecting the three cathodes to ground. The variable resistor changes the grid bias simultaneously with the input signal voltage, forming the second section of the volume control. The plates of these tubes are supplied with their posi-

tive potential direct from the power unit while the screen grids are supplied from the same line, but through a 2500-ohm resistor. Another resistor of 2250 ohms is connected from this point in the high
(Continued on Next Page)

Circuit Diagram of Eveready Series 50 Receiver



Analysis of Eveready Series 50 Circuit

(Continued from Preceding Page)

voltage line to ground in order to secure the stabilization effect of a voltage divider. Each cathode, screen grid and plate in the r-f amplifier is bypassed to ground through an individual .5 μ f condenser.

The phono-radio switch is connected in the detector input circuit. The grid return in this circuit goes to ground through the s.p.d.t. switch when the latter is thrown to the radio side, and goes through the phonograph pickup back to the cathode via one-half of the bias resistance when the phonograph is used. By using only half of the bias resistance the grid voltage is reduced to conform more nearly to the output voltage of the pickup. A .002 μ f condenser is connected across the pickup windings, passing, in its return, through the remaining half of the bias resistor. This series resistance capacitance arrangement acts as a scratch filter for the phonograph pickup, attenuating all frequencies above 5000 cycles.

An r-f filter is connected in the detector output circuit and consists of a .0005 μ f condenser from plate to ground, an r-f choke and a .0001 μ f condenser from the high potential side of the choke to ground. Resistance coupling is used between the detector and the first audio stage, employing a 125,000-ohm resistor in the plate circuit, a .01 μ f coupling condenser and a 2-megohm grid resistor. The detector plate is fed from the high voltage line, the 125,000-ohm resistor dropping the effective voltage slightly.

Grid bias for the first a-f tube is supplied by a 3000-ohm resistor between the cathode of this tube and ground. This resistor is bypassed through a 2 μ f condenser. A .004 μ f condenser is connected across the first a-f tube's plate circuit and ground for the purpose of eliminating further the stray r-f currents that may have passed the detector.

The second stage is in push-pull and is coupled through transformers to the

output of the first a-f stage and to the voice coil of the speaker. Grid bias to the two tubes is supplied from the drop through a resistor between the center-tap of the filament shunting resistor and ground. The grid return is grounded.

The power transformer has four secondaries; filament windings for the rectifier, the '24 and '27 tubes and the two '45 tubes, and the high voltage winding. The filter system consists, in order, of a 4 μ f condenser, an audio frequency choke, a 2 μ f condenser, the field winding of the loudspeaker and a 1 μ f condenser. The center-tap of the '45 tube filament windings is by-passed through another 1 μ f condenser.

Voltage readings taken at the various sockets should be as follows: r-f and first a-f plates, 165 to 175; grids, minus 4 to 10, r-f readings depending upon the volume control setting in each case; screen grids, 90; detector plate 75 to 80; power tube plates, 265 to 275; grids, 50 to 55.

Performance Curves of Eveready Series 50 Receiver

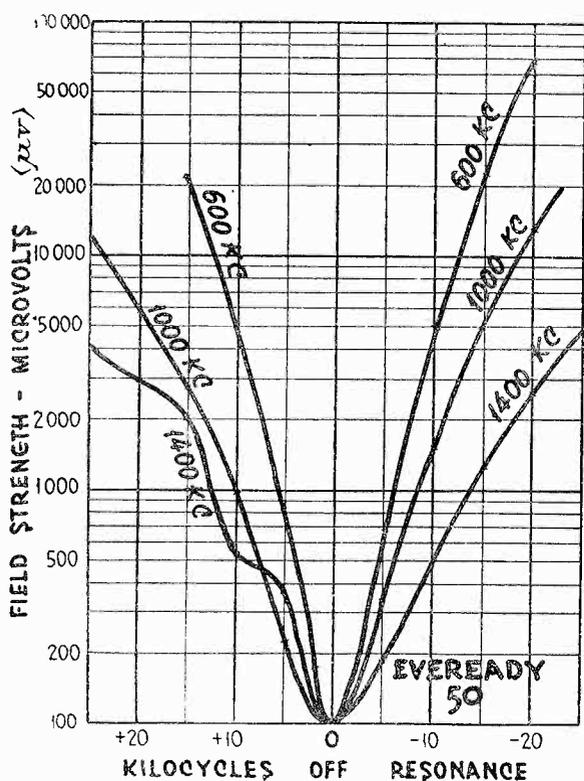


Fig. 1. Selectivity Curves of the Eveready Receivers

This set of Eveready selectivity curves is almost perfectly symmetrical with the exception of the 1400 kc curve's left leg. As two circuits were slightly out of line on the stock receiver tested, two humps or false peaks appear in this section of the curve. This does not indicate poorer performance,

however, but performance that is improved in spots. By following the curve from the resonance point leftward it will be noticed that the first peak makes the receiver more selective at 1405 kc than at 1005 kc. Then the curve flattens out until it has almost reached normal again, whereupon it heads up into another peak, increasing the selectivity of the section between 1410 and 1420 kc to a degree above that which it should have attained if the curve had been normal and above that of the negative side of the curve. Flattening out at 1420 kc it probably should have resumed its course if it had been carried out a little farther.

By comparison it will be noticed that the 600 kc selectivity curve is not as sharp as that of most receivers. This is an advantage or disadvantage depending upon whether the user desires fidelity in preference to the ability to cut out a high-powered low frequency local in order to get a distant local on a nearby channel or vice versa. It is not intended to infer that this cannot be accomplished, for at 10 kc off resonance the field strength ratio is 50 to 1; the signal from the local station will be only one-fiftieth as effective. As has been explained, fidelity's dependence upon selectivity is due to the cutting of side bands; the attenuation or reduction of strength of the frequencies up to 5 kc, or 5000 cycles. These are the audio frequency currents which make up the musical tones.

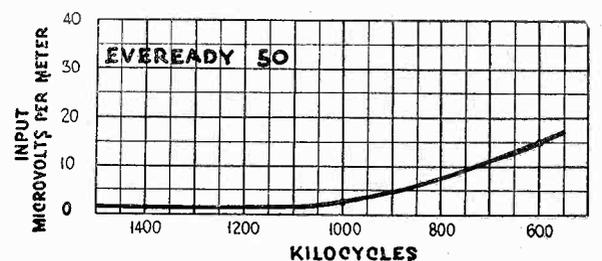


Fig. 2. Eveready Sensitivity Curve

The Eveready sensitivity curve outstrips all that have been tested in RADIO's laboratory. Sensitivity such as this should make the receiver an excellent distance getter as the curve indicates that the receiver has enough overall gain to pick up a field strength of from 1½ to 15 microvolts per meter and amplify it to 50 milliwatts, or fair room volume.

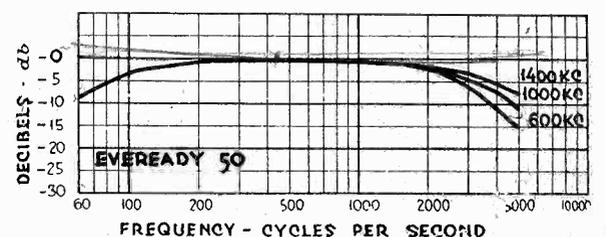


Fig. 3. Eveready Curves: Fidelity of Tone

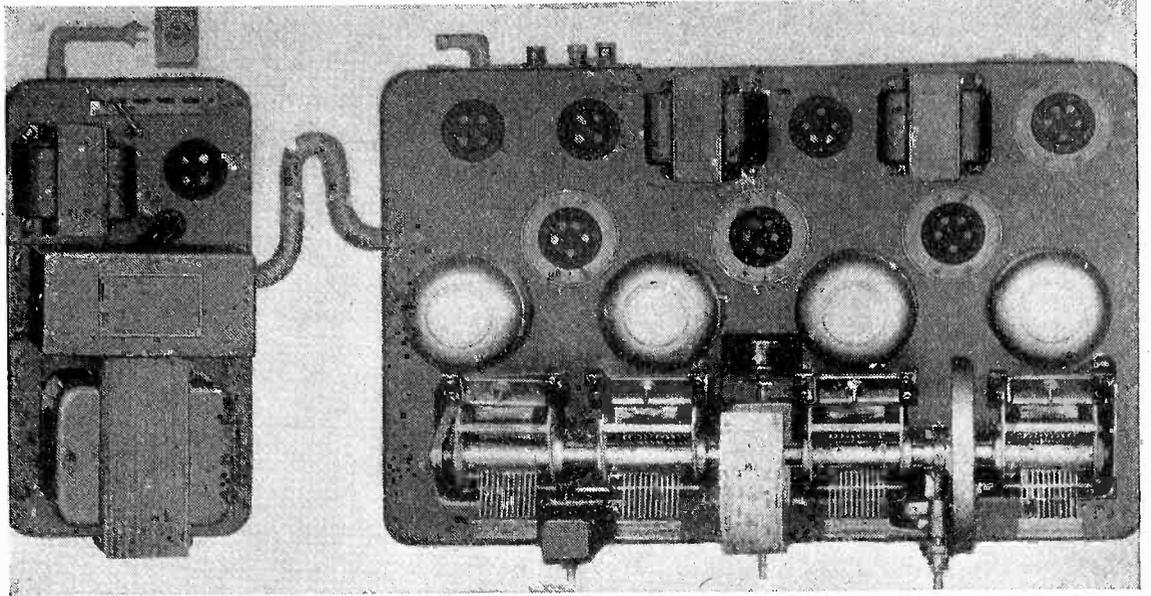
Eveready fidelity is also very good. The fact that the 600 kc curve drops a maximum of only 15 decibels is due to the comparatively broad shoulder on the 600 kc selectivity curve; hence a not serious cutting of side bands.

Analysis of Fada 35-B Circuit

THIS is a seven tube receiver in which the three stages of r-f amplification employ '24 screen grid tubes, the detector and first a-f stage use '27s and the power stage consists of two '45 tubes in push-pull. A single '81 half wave rectifier tube is used in the power unit.

A switch is provided which connects the antenna coil to one side of the a-c line through a .001 μf fixed condenser in case no other aerial is desired. The primary of the antenna coupling transformer is shunted with a 12,000 ohm potentiometer, the variable arm of which goes to ground. This is the section of the dual volume control with which the input signal strength is reduced as the part between the movable arm and the antenna is decreased.

The first tuned circuit differs from the subsequent stages in that inductive coupling is used between the antenna and grid circuits. Coupling is accomplished in the other three tuned circuits by a fixed .001 μf condenser between the plate and a tap in the grid inductance, the plate being fed through a separately shielded r-f choke.



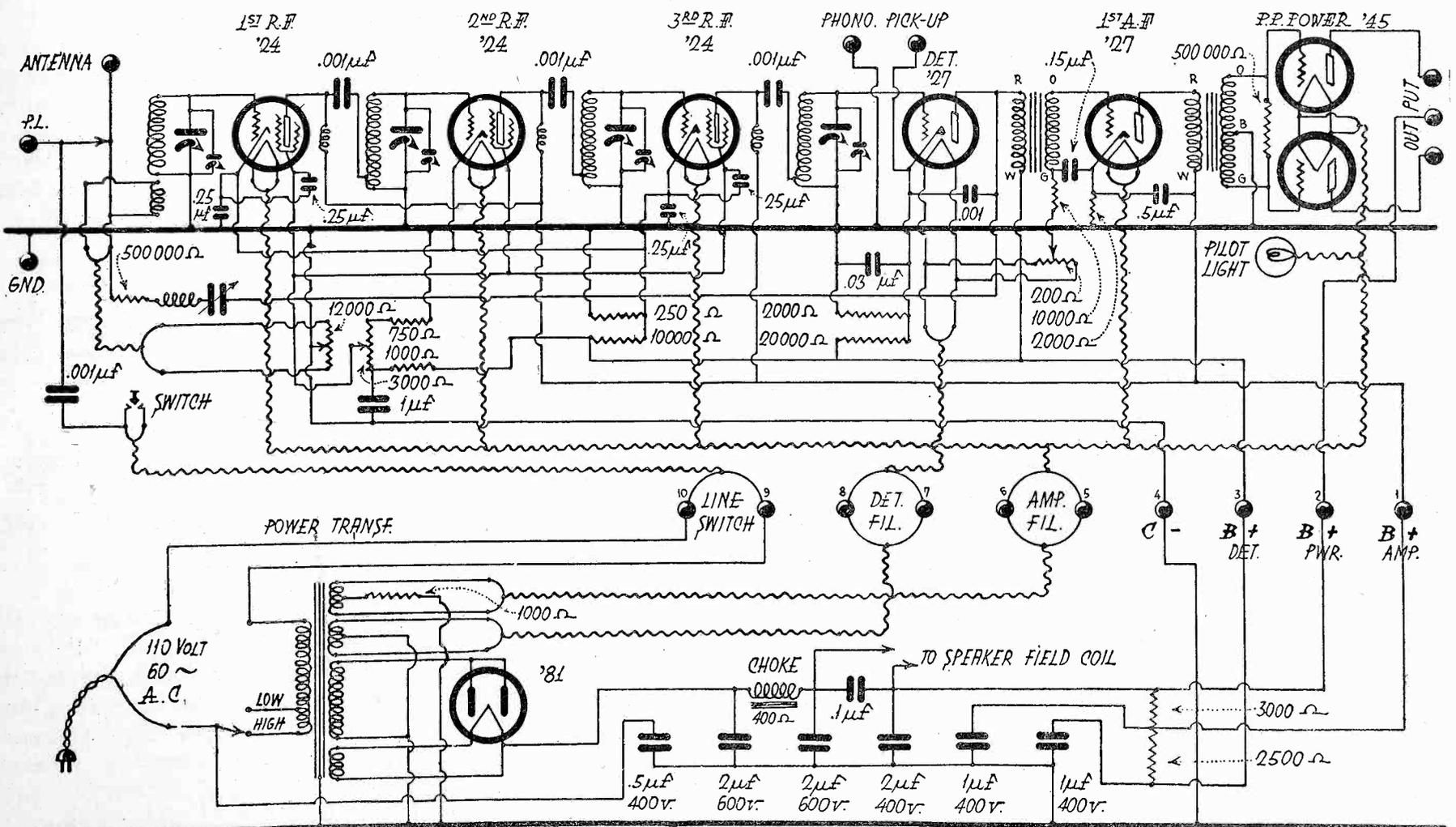
The cathodes of the three r-f tubes are connected together and to the junction between a 250 ohm resistor and a 10,000 ohm resistor. The other end of the 250 ohm resistor goes to ground, as do the grid returns, and the voltage drop across this resistor, which connects the cathodes to the grids, puts a negative bias on the latter. However, unless there is a current flowing through this resistor there can be no voltage drop,

therefore the cathode side of it has been connected to the detector plate lead via a 10,000 ohm resistor in order to maintain this constant current in the 250 ohm grid bias resistor. Two pair of .25 μf condensers bypass each end of the cathode lead to ground and to the common screen grid lead.

The screen grid voltage is variable, being taken from a 3000 ohm poten-

(Continued on Next Page)

Circuit Diagram of Fada 35-B



ANALYSIS OF FADA 35B CIRCUIT

(Continued from Preceding Page)

tiometer which is connected between the positive lead and ground. A 1000 ohm fixed resistor separates the potentiometer from the positive lead and reduces the voltage to the required maximum while a 750 ohm fixed resistor between the potentiometer and ground determines the minimum of screen grid voltage. The common screen grid lead is bypassed to ground via a .25 μ f condenser. The potentiometer, of course, forms the second section of the dual volume control.

Plate voltage for the three screen grid tubes is obtained from the positive line after it has passed through a choke, the speaker field winding and a 3000 ohm resistor. It might be said that the 3000 ohm and 2500 ohm resistors in the power pack, plus the 1000 ohm resistor, 3000 ohm potentiometer and 750 ohm resistor in the set proper, constitute a voltage divider, although they are scattered hither and yon over the set. The 10,000 and 250 ohm resistors constitute another voltage divider from which the r-f tube grid bias is obtained and the 20,000 and 2000 ohm resistors, not yet studied, from a divider for the purpose of supplying the detector grid bias.

The phonograph pickup jacks are connected to the detector input so that this tube may act as an amplifier. A small neutralizing condenser, r-f choke and $\frac{1}{2}$ megohm resistor, connected between detector plate and the antenna post, are designed for the purpose of obtaining a slight feedback in addition to that caused by the .001 μ f condenser between plate and cathode. The positive potential for the detector plate is supplied through the primary of the first a-f transformer direct from the 2500 ohm resistor in the power unit.

The detector cathode is connected to a junction between a 2000 ohm resistor and a 20,000 ohm resistor, the other side of the latter going to the plate lead and that of the former going to ground. Here again we find that it is necessary to maintain a constant current in the grid bias resistor in order to cause a voltage drop for the purpose of biasing the grid. The potential from the positive line to ground (negative) through the 20,000 and 2000 ohm resistors provides this constant current and the drop through the 2000 ohm resistor supplies the grid bias. This is the third arm of an elaborate and widely scattered voltage divider.

The detector heater is supplied from an individual secondary winding while

the heaters and filaments of all other tubes, with the exception of the rectifier, are heated by a common secondary. A 200 ohm potentiometer across the detector heater supply, with the lead from its movable arm going through a 10,000 ohm resistor to the first a-f grid return, acts as a hum control. The 2000 ohm resistor between the first a-f cathode and ground supplies the grid to this tube with its bias, for the grid really does return to ground, merely passing through the 10,000 ohm filter resistor, the 200 ohm potentiometer and the detector heater secondary on its way. The latter resistors do not add to the bias because there is no current passing through them. A .15 μ f and a .5 μ f condenser bypass the detector cathode to grid return and plate lead respectively.

Transformer coupling is used again in the second stage, and a $\frac{1}{2}$ megohm resistor is shunted across the secondary for the purpose of modulation. Grid bias is supplied the power tube grids from the 1000 ohm resistor which connects the center tap of the filament winding to ground.

Half wave rectification is used, and the output of the '81 tube is filtered through a 2 μ f condenser, a choke, another 2 μ f condenser, the speaker field winding, and a third 2 μ f condenser.

Reducing the Noise Level

By L. W. VAN SLYCK

A FEW simple precautions in the installation of a broadcast receiver will greatly reduce the amount of extraneous noise which is picked up and consequently give greater satisfaction to the user. The set should first be placed at the greatest possible distance from any wires that may be suspected as a possible source of interference. It should be connected either to a temporary water-pipe ground or to a standard ground consisting of one or two ground rods driven deep in the soil outside as near to the receiver as possible. One end of a 100-ft. length of enameled copper wire should be connected to the antenna post, and the set put into operation.

Then, using a pair of gloves, carry the far end of the wire around the house in a semicircle, having an assistant listen at the set until the quietest spot is found. Run the antenna in this indicated direction, erecting a pole if necessary. The antenna should be as high as the pocketbook or local conditions will permit. Get the whole hundred feet up in the air if possible, and up as high above power wires and surrounding objects as practical. This is important.

Next, procure some shielded wire. Both Packard and Belden make it, and doubtless there are other sources just as satisfactory. Use this wire for a lead-in from the antenna proper way up to the "ANT." binding post on the set. Use the same kind of wire from the "GND" binding post to the ground clamp. Do *not* ground the shield covering on either the antenna or ground wires, and use insulating tape whenever needed to prevent an accidental grounding of same. This is important for best results.

If the antenna, as erected, is so long as to cause the receiver to tune broadly or is too long for the design of the set, use a series fixed condenser of from .0001 to .00025 μ f in the antenna lead to cut down the effective length, with a miniature S. P. S. T. switch in shunt.

Try both the water-pipe and the ground-rod grounds and select the quieter of the two. There should be no change in volume of a received signal when switching from one to the other, but often there is some difference in noise level. A water-pipe ground should be connected on the street side of the meter, or as near this point as possible

for best results. Of course, do not use gas pipes.

The Tobe Filterette, Jr., or some such similar device plugged in between an a-c set and the a-c socket helps to cut down noise arising from electrical devices used in the same house as the set. If any such device is known as a source of interference, eliminate it, or filter it

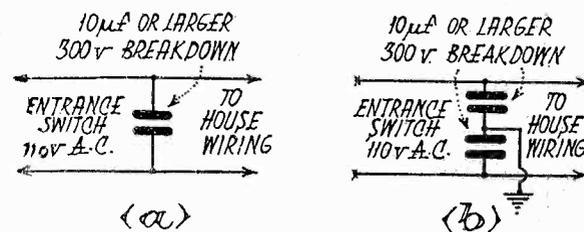


Fig. 1. Method of Connecting Condensers to Minimize Interference

in the manner described above. One or two large condensers, connected as shown in Fig. 1, will effectively filter outside noises arriving via the a-c line.

In a real noisy location, conditions may oftentimes be improved greatly by following the complete procedure outlined here. The whole thing is more effective, of course, with a modern, shielded, selective receiver, but improved results can be obtained under almost any conditions.

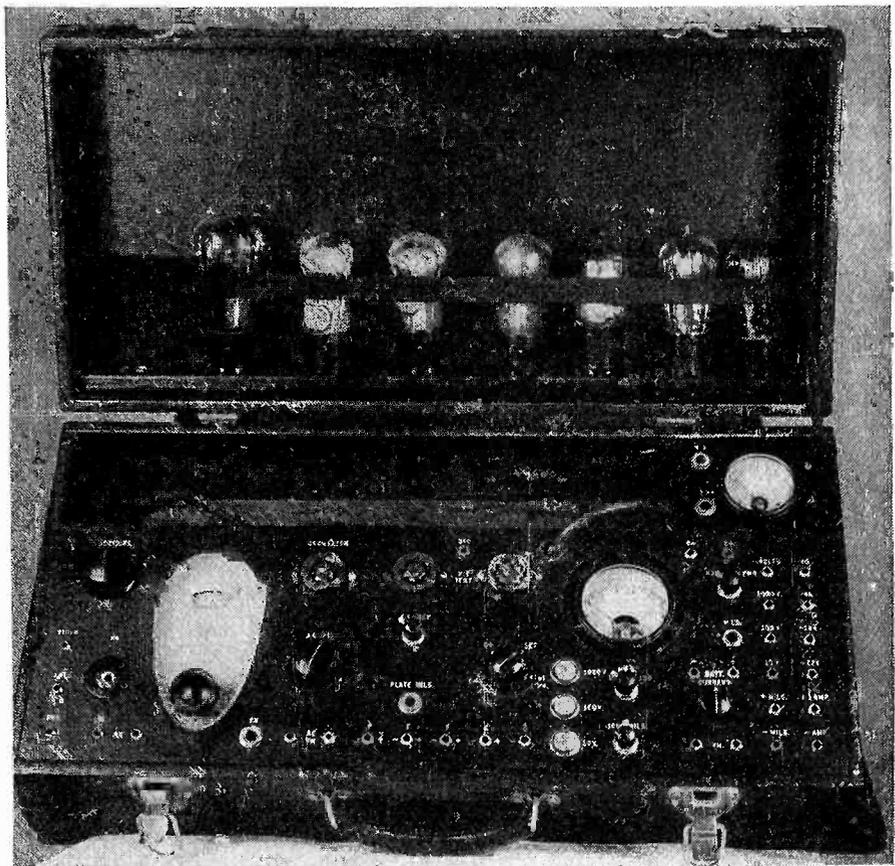
A Complete Test Kit for Bench or Portable Use

By B. E. ESTES

TO MEET the demand for a radio testing set that can handle any type of service work which he may meet either at the bench or in the field, and yet be simple in construction and operation, the service man may readily build the outfit here described. It includes an oscillator, a continuity tester, a tube tester, and a power unit tester, as well as facilities for making other tests and adjustments which are herein described. It is mounted in a specially made case so as to be portable.

A good idea as to its general construction is given by the pictures and the panel layout and drilling dimensions shown in Fig. 1. The layout is designed to use the parts specified in the list of parts, but can be changed so that equivalent parts will fit. The complete wiring diagram in Fig. 2 should present no difficulty to the average service man.

The oscillator is coupled to the external circuit by means of a $.000035 \mu\text{f}$ midget condenser. The ground side of the oscillator circuit is connected to its output post by a $.5 \mu\text{f}$ condenser so that the 110-volt plate supply will not be shorted to the ground of a receiver under test.



Panel View of Test Kit

The oscillator coil consists of 100 turns of No. 30 D.S.C. wire tapped at 50 turns and wound on a tube base plug-in

form. A 10-ohm rheostat, connected in series with a 6-ohm fixed resistor, is used
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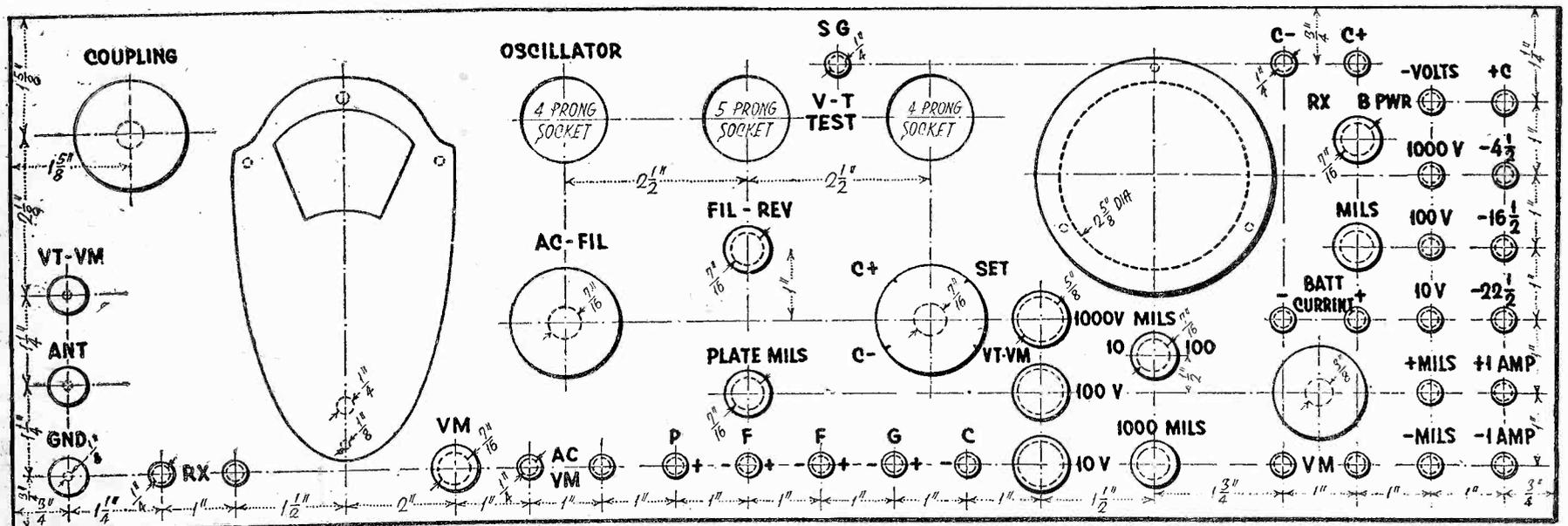


Fig. 1. Panel Layout and Drilling Dimensions of Test Kit for Bench or Portable Use

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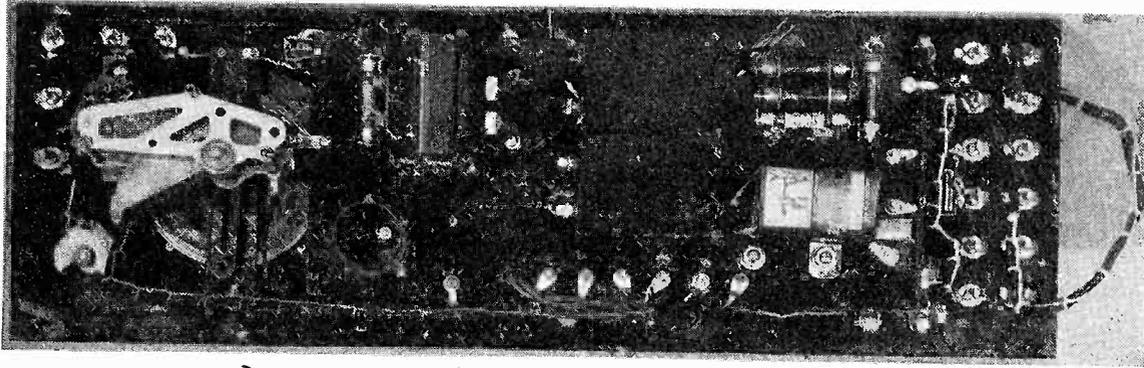
to control the filament voltage to the oscillator tube, the filament lighting transformer being an 8-volt device. The two leads from the filament terminals of the oscillator tube to the tip jack "AC VM" enable the filament voltage of the oscillator tube to be checked with the a-c voltmeter. A rough check on the line

adjusted to 5 volts and the line voltage at that instant measured, the point on the rheostat will serve as a reference point to show whether the line voltage at any other location or time is above or below the voltage measured for this point. If greater accuracy is desired, a celluloid scale can be put under the rheostat knob and calibrated in terms of line

bridge arrangement of bakelite so as to space the phone tips an inch apart. The plate, filament, grid and cathode leads from the test plug are connected to tip jacks which are also spaced an inch apart. By moving this bridge from pair to pair of the tip jack arrangements the voltmeter is connected across the different parts of the circuit. The bridge has a pointer which should always point to the top of the test set in order to give normal voltage readings. If it is necessary to reverse the plug in order to make the meter read in the right direction, the voltage to the receiver is reversed. This, however, does not apply in case of the filament reading and for this reason, a four-pole double-throw Yaxley switch is provided for reversing the terminals of the tip jacks to the test cord from the receiver.

A Weston Model 301 0-1 milliammeter is connected in series with multipliers so as to function as a high resistance voltmeter with ranges of 10, 100, and 1000 volts or connected in parallel with the proper shunt as a milliammeter with ranges of 10, 100 and 1000 milliamperes. It will be noticed that all of the ranges are in multiples of ten of the original scale. The selection of the proper multiplier is made by means of

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Rear View of Test Kit

voltage can also be obtained by means of this connection.

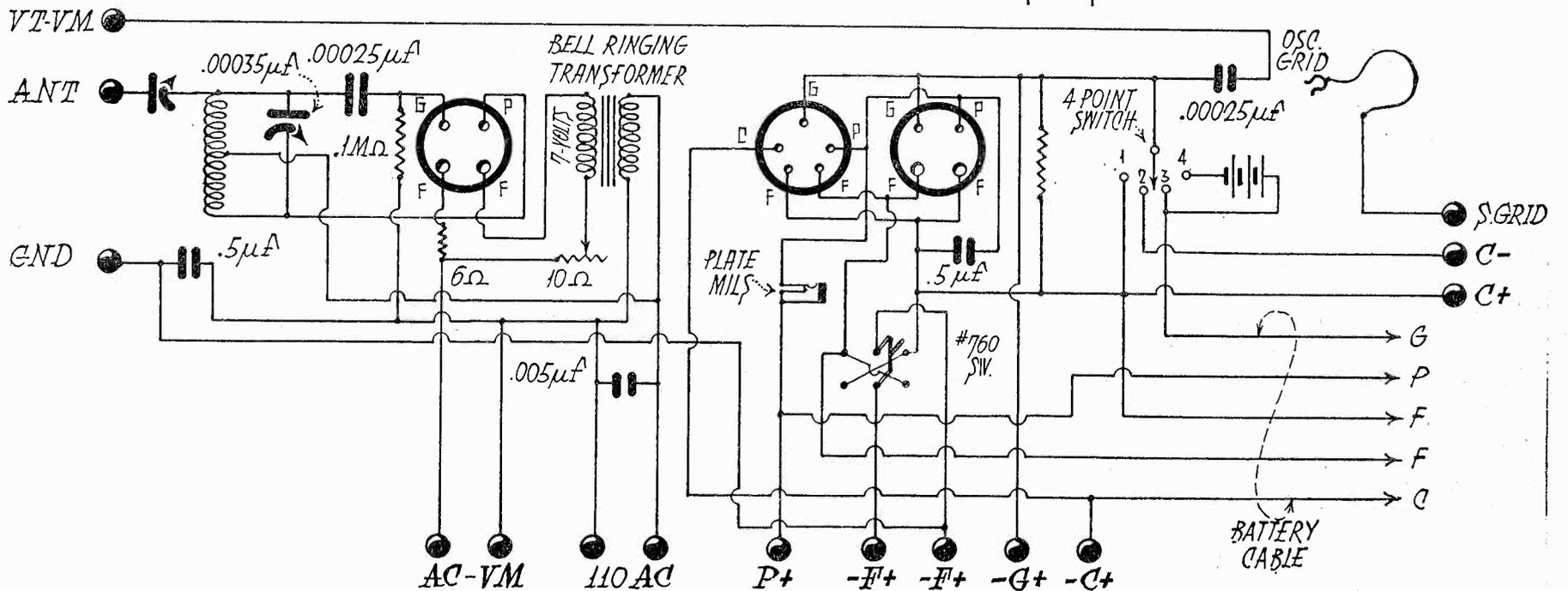
With 110 volt supply a certain amount of resistance is needed in the filament rheostat to reduce the voltage of the secondary to 5 volts for the '01A tube used in the oscillator. If the line voltage rises it will take more resistance and if it drops it will take less. If the filament voltage of the oscillator tube is

voltage for rheostat setting necessary to supply 5 volts to the filament to the oscillator tube.

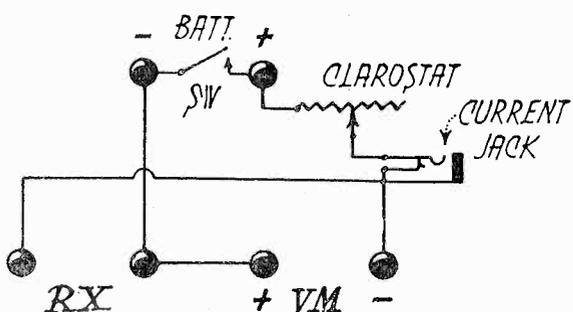
Voltages for continuity testing are brought to the panel by means of a cable which terminates in a tube-base plug. The voltages across the different circuits are read by a high resistance voltmeter which is connected through a test cord to two phone tips which are held in a

MODULATED OSCILLATOR

CIRCUIT TEST SET



• CONNECTIONS FOR TESTING •
• B POWER UNITS •
• AND MEASURING RESISTANCE •



0-1 MILLIAMMETER

• METER SWITCHING •
• CONNECTIONS •

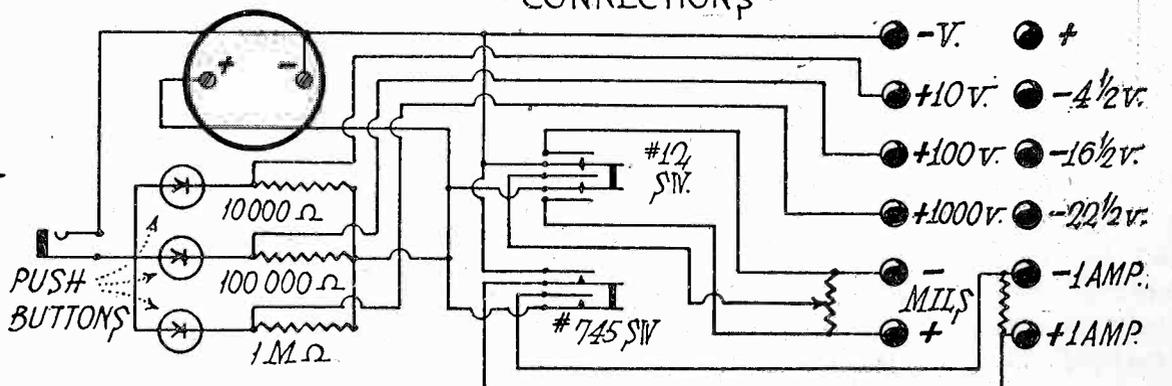


Fig. 2. Wiring Diagram of Test Kit

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push-buttons which throw into the circuit a 10,000, 100,000 or 1 megohm Super Davohm. Tip jacks are provided for use without the push-buttons.

The switch used to select the milliammeter range is a Yaxley No. 12 with two non-locking and one neutral position. In the neutral position the milliammeter is entirely disconnected from the shunts and the circuit. In one position the milliammeter is connected across the 10 milliampere shunt and in the other it is connected across the 100 milliampere shunt. If the milliammeter starts to overload the meter can be disconnected from the circuit by releasing the knob of the switch. The 1000 milliampere shunt is connected across the meter by means of a No. 745 Yaxley switch.

The circuit tester is provided with both UX and UY sockets. The cable which plugs in the tube socket of the receiver has six wires, five for the prongs of the UY tube base in which it terminates and an extra wire which terminates at the tip jack S-G on the test panel and on the handle of the UY tube base in the form of a clip which can be clipped to the control grid clip of the receiver being tested. A UY to UX

adaptor is used to adapt the five prong plug to the four prong tube sockets.

The grid of the tube sockets on the test panel connects to the arm of a Yaxley No. 44 four-point switch so that the grid of the tube can be connected to either the positive or the negative terminals of an external C battery when testing the mutual conductance of the tubes in the set; or to the set with a 4½ volt C battery in series with the grid. The 4½ volt C battery is connected with the negative terminal to the grid when the switch is on the point marked VTVM.

The external C battery inside the case provides C bias for tubes and the voltage for continuity tests. The battery is of the 22½ volt type and is tapped at 4½, 16½ and 22½ volts and these taps brought out to tip jacks on the extreme right hand edge of the test panel.

The Clarostat, the telephone jack MILS, the tip jacks VOLTS and the tip jacks -BATT+ are for measuring the output of a B power unit while under load or as an ohmmeter for measuring resistance. The Yaxley No. 10 battery switch is used to switch from one function to the other.

The filament voltage of the tubes in an a-c receiver is checked by means of a Model 517 Weston a-c voltmeter with

a range of 0-3 volts. An extra range of 0-9 volts is provided by means of a 36-ohm multiplier in series with the meter. The meter is adjusted by taking a reading on the 3 volt scale and then switching to the 9 volt range and changing the resistance of the multiplier until the meter reading is exactly one-third of the former reading.

The shunts for the d-c milliammeter are wound on a strip of 3/16 in. bakelite 3/8 in. wide and 2½ in. long. The 10 milliampere scale requires 40 turns of No. 36, the 100 milliampere scale 15 turns of No. 30, and the 1000 milliampere scale an experimentally determined number of turns of No. 20, D. S. C. copper being used in each case. The milliammeter is calibrated with a standard milliammeter in series and a C battery with variable resistance to regulate the current. It is best to adjust the shunt so that the calibration point will be at the middle of the scale, say 5 milliamperes on the 10 milliampere scale and 50 milliamperes on the 100 milliampere scale. When calibrating, it is best to use a longer length of wire than will be required as it is easier to remove than to add wire. If the meter reading is higher than the standard milliammeter, the resistance of the shunt should

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be lowered by removing turns and if the meter reading is lower than the standard milliammeter, more wire should be added to increase the resistance.

Test Routine

The test plug is inserted in the receiver's first r-f socket and the plate voltage checked by plugging the telephone plug on the end of the test cord into the telephone jack VOLTS and touching the bridge of the test cord across the tip jacks P and F. The voltmeter circuit is then completed by pushing the 1000 V button. If the voltage is not greater than 100 volts, it may be read more accurately by pressing the 100 V button. The voltage shown will be the B potential of the tube read through the primary of the r-f transformer, thus checking both the voltage and continuity of that circuit.

The filament circuit is checked by moving the bridge across the two tip jacks marked F. Although the filament voltage will be within the range of the 10 volt scale, it is wise to press the 1000 and 100 volt buttons first on all tests, as this habit may save the pointer of the meter from being bent. If the filament voltage shows a reversed reading on the 100 volt scale, the switch FIL-REV can be thrown so as to cause the meter to

indicate in the right direction on the 10 volt scale. In checking battery receivers, care should be taken to see that the filament voltage is correct without reversing the bridge. If this reading is reversed, it will affect the C bias on the tube when testing tubes or taking a grid circuit continuity reading. The filament voltage should be checked when all the tubes are in the sockets. If the receiver uses a-c tubes, the external a-c voltmeter is used to check the filament voltage. This can be connected in the circuit by plugging the telephone plug of the test cord in either the telephone jack marked 3 or 9 volts, according to the tube, and putting the bridge of the test cord across the two tip jacks F.

The grid circuit is checked by placing the bridge of the test cord across the tip jacks F and G. The usual type of battery receiver has the filament return of the grid r-f coil brought back to the negative filament, which would make the grid bias of that tube zero. To check the continuity of that circuit change the Yaxley at the four point switch from the normal position marked SET to the next point marked VTVM. This connects a 4½-volt C battery in series with the grid circuit, negative terminal to the grid, so that a reading across the filament and grid tip jacks will show 4½

volts on the voltmeter. In the a-f amplifier where a C bias is used or in an a-c receiver where the C bias is furnished by the power pack, this change from the normal position of the switch will be unnecessary. Due to the grid condenser in most detector circuits, the voltage of the grid circuit will be zero or practically so, depending upon the resistance of the grid leak.

If '27 type tubes are used in the r-f stage the grid circuit test is made from the tip jack G and C as the center tap of the filament circuit is usually connected at the same potential as the grid; that is B-. The reading will be the negative C voltage of the tube, but it will be necessary to reverse the bridge of the test cord to take this reading. The tube should always be in the socket in the test set during the test.

If the r-f tube is a '24 type the reading from the filament to the grid circuit will be the screen grid voltage when the Yaxley four point switch is on the position marked SET. As this grid has a positive potential of around 70 volts, it will be necessary to reverse the bridge to take the voltage reading. Two wires are connected to the tip jack S-G at the top of the test set. One wire terminates in a clip and fastens to the control grid

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cap of the screen grid tube and the other connects to the tip jack also at the top of the set which is marked *C-*. The control grid voltage is read by changing the Yaxley four point switch to the position marked *C-* and taking the reading from the tip jack *G* to the tip jack *C*. This also will be a reversed position of the bridge of the test cord.

After this test, all tubes using the same filament voltage as the r-f tube should be tested in this socket. This is done by the grid swing method of measuring the mutual conductance of the tube in question. To do this, the Yaxley four point switch is changed from the normal position marked *SET* to the position marked *VT-VM*. This connects a 4½-volt *C* battery in series with the grid and increases the negative *C* bias of the tube by that amount. The plate current of the tube is read in both positions and the difference between the plate current readings of the tube for the two positions is indicative of the worth of the tube as an amplifier or detector. The actual value of the tube in micro-mhos of conductance may be found by dividing the change or difference in amperes by the change in grid volts and multiplying the quotient by 1,000,000.

The milliammeter is connected in the

plate circuit of the tube by plugging the telephone plug of the test cord in the telephone jack marked *PLATE MILS* and the bridge of the test cord in the tip jacks *+MILS* and *-MILS*. The mils switch is first held in the 100 milliamperere position and if the current indicated is not over 10 milliamperes, the switch is changed to the 10 milliamperere position for a more accurate reading. The following table gives the normal change in plate current of different types of tubes for the more commonly used plate voltages. It should be remembered, however, that the change will be less with a lower or greater with a higher plate voltage.

Normal changes in plate current with 4½ volts grid change.

Type of tube	Plate voltage	Milliamperere change
11-12	90	1.8
'99	90	1.6
'01A	90	3.0
'00A	45	2.8
'40	135	.8
'20	135	2.2
112A	135	7.0
'71A	180	6.2
'22	135	1.2
'24	180	2.0
'26	135	3.7
'27	135	3.6
'45	250	7.0
'50	425	10.5
'10	425	6.6

A slight deviation from normal change may be expected, but any tube which shows a change considerably less than that given in the table should be replaced. On account of the high plate voltage needed, it will be necessary to test the power tube in its own socket, but the other tubes should be checked in the first r-f socket as the resistance of the transformers in the audio stages will affect the value of plate voltage at the tube socket and consequently the tube test reading.

If the test set is being used as a bench tube tester, the test plug of the set should be plugged in a four prong tube socket connected as shown in Fig. 3. This gives 90 volts to the plate of the tube sockets and 6 volts of storage battery which can be regulated by means of the switch and a 15 ohm rheostat to any desired voltage. The *C* bias for the tubes is supplied from the 22½ volt *C* battery with the test set. The *C* battery is connected to the tubes by means of leads from the tip jacks *C-* and *C+*. The lead from *C-* can be plugged in the tip jack which will give the correct voltage for the tube being tested.

The change in grid voltage is effected by changing the Yaxley four point switch from the position marked *C-* to

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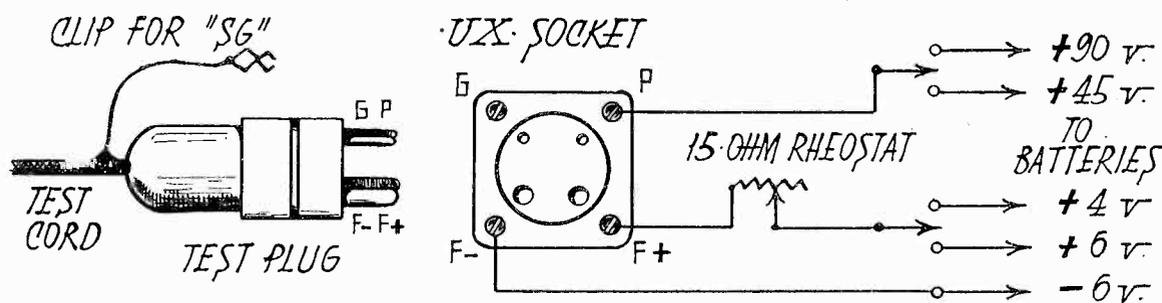


Fig. 3. Connection for Bench Tube Tester

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the position marked *C+*. The change in grid voltage is the entire value of the *C* battery used. The table following gives the corresponding change in plate current for a given change in grid voltage.

Readings for Vacuum Tube Tester

Type	Plate Volts	Fil Volts	Grid Volts	Minimum Difference in Milli-amps	Minimum Plate Current at Zero Grid ma
'01A	90	5.0	0 & -4½	3.0	5
'99	90	3.3	0 & -4½	1.6	4
11 & 12	90	1.5	0 & -4½	1.5	4
'20	90	3.3	0 & -16½	6.0	9
'12-A	90	5.0	0 & -4½	3.5	7
'71-A	90	5.0	0 & -16½	17.0	27
'10	90	7.5	0 & -4½	3.5	7

It also gives the minimum value of plate current at zero grid, which is a check on the condition of the filament in the tube. If it is desired to take a standard emission test as outlined by the tube

manufacturers, the plate voltage of the tube socket should be changed to 50 volts and the tip jack marked *P* and *G* connected together by means of a test lead. The plate current is then read on the 100 milliamperere scale and the reading should correspond to the table marked "Emission Values."

When a '24 tube is tested, a plate current reading is taken first of the tube at normal grid potential, that is, the grid potential supplied by the receiver. This is applied to the tube when a clip lead from the tip jack *S-G* is clipped to the control grid of the tube, and the screen grid lead from the test plug is connected to control grid clip in the receiver. After the plate current reading has been taken, the clip to the control grid of the tube is connected to the tip jack marked 4½. Another clip is connected to the control grid cap of the tube and the other end connected to the tip jack marked *+C*.

This connection puts a positive potential of 4½ volts in series with the control grid of the tube and bucks the grid voltage past zero grid, in fact, over a volt positive. This will cause the plate current of the tube to increase and the difference between the two readings will be a check on the condition of the tube. A good tube will show a difference of between 1½ and 2 milliamperes.

After the tubes have been tested a continuity and voltage test should be made of the plate, filament, grid and cathode circuits of the rest of the sockets in the receiver in the manner outlined above. A record of the readings should be kept, as any open circuit or abnormal voltage condition will show in the readings. For instance, if the r-f plate voltage were zero and the power tube voltage were low, a shorted bypass across the r-f tap in either the power pack or the receiver would be indicated. No grid voltage would indicate either an open grid circuit or a shorted grid bias resistor in an a-c receiver. In a battery receiver it would indicate either an open winding or a dead *C* battery. No plate voltage or a low one would indicate a defective or deactivated rectifier tube or a shorted bypass condenser. Other troubles can be similarly analyzed.

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If a defective *B* power unit is suspected, it can be tested under load by connecting the output of the unit to the tip jacks *RX*. The telephone plug of the test cord is plugged into the telephone jack *MILS* and the bridge of the test set is plugged into the tip jacks $+MILS$ and $-MILS$. The Yaxley battery switch is put into the closed or *B PWR* position and the *MILS* switch held in the 100 milliamper position. The Clarostat is adjusted until the milliammeter shows about 40 milliamperes in the circuit. The test cord is now removed and the telephone plug put into the telephone jack *VM* and the bridge plugged into the pair of tip jacks marked *VM* which are directly under the Clarostat. If the voltage reading, when the 1000 button is pressed, is zero or nearly so, a defective unit is indicated. If the voltage is low, for instance, under 150 volts, a shorted bypass condenser or deactivated rectifier tube is indicated. The voltage at the other voltage taps can be measured by connecting a lead to the tip jack *1000 V* and testing with it to the positive voltage taps.

The same circuit can be used as an ohmmeter for checking the resistance of *B* power pack resistors, grid resistor, and grid bias resistors. The connections are

the same as above for the milliammeter circuit with the exception that the Yaxley switch is in the open or the *RX* position. The voltage for the milliammeter is supplied by 6 volts of *C* battery, which is taken from the battery in the test set by connecting leads from the tip jacks above the Clarostat which are marked $-BATT\ CURRENT+$, to the $-16\frac{1}{2}$ and the $-22\frac{1}{2}$ tip jacks.

The test leads connected to *RX* are shorted and the *MILS* switch is held in the 10 milliamper position and the Clarostat adjusted until the meter indicates full scale value. The *MILS* switch is then held in position permanently by means of a rubber band looped between it and the *1000 MILS* switch. The ohmmeter is now ready for use and any resistance connected between the clips on the test leads from *RX* may be determined from the curve of Fig. 4. However, this curve holds true only when the meter is adjusted to 10 milliamperes and the battery gives 6 volts. This connection makes an excellent continuity tester, as the approximate resistance of the circuit being tested can be easily taken from the curve.

Quite often the receiver lacks the proper selectivity and the sensitivity is poor. The usual cause is that the tuned

circuits are out of resonance. They can be re-aligned by the following procedure:

The *ANT* and *GND* tip jacks of the test set are connected to the antenna and

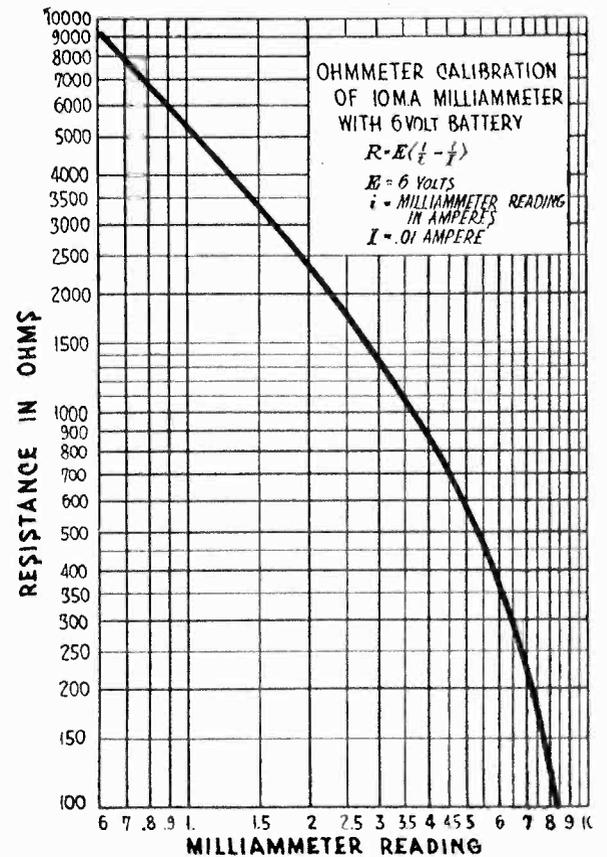


Fig. 4. Ohmmeter Calibration Scale

ground terminals of the receiver. An '01A tube is put in the *OSCILLATOR*

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socket and the *AC-FIL* rheostat turned on. The first a-f tube of the receiver is removed and the test plug of the test set inserted in its place, with the tube which was removed in the test set socket. The Yaxley four-point switch is set in the *VT-VM* position, which places an additional $4\frac{1}{2}$ volts of negative *C* bias on the grid of the tube in the test set so that it will be working on the lower portion of the curve and will act as a plate rectification type of vacuum tube voltmeter. With this connection, any increase in voltage across the input of the tube will cause the current reading of the milliammeter, which should be connected in the plate circuit, to rise. The milliammeter is connected in the same manner as for tube testing and the *MILS* switch is held in the 10 milliamper position by means of a rubber band. The tuning dial of the receiver is set at about 1400 kc and the oscillator dial is turned until it is in resonance with the receiver. This can be determined by the maximum reading of the plate milliammeter.

To determine whether the receiver is out of alignment, the receiver tuning dial should be turned back and forth across the resonant point with the oscil-

lator. If the alignment is correct, the meter will rise rapidly as the resonant point is approached and drop rapidly as it is passed. If the resonant point is not well defined, or if there is more than one point at which the meter reading increases, the receiver needs adjustment.

This is done by adjusting the trimming condensers or bending the rotor plates of the gang condensers until the meter reading is at maximum and the resonant points have converged into one or become well defined. Each trimming condenser should show a resonant point of its own, that is, the milliammeter reading should rise and then fall as the condenser is turned through its range. If this point cannot be found, it is probably because one of the tuned circuits is too far out of resonance with the rest of the circuits to be compensated for by the trimming condenser or by bending the rotor plates.

In this case the circuits should be measured by the method described in the next paragraph, and if one of the circuits is too high or too low in comparison with the other circuits, the gang condenser or the turns of the coil should be adjusted until they can be brought within range of the other circuits by means of the trimming condensers. The

receiver should be checked for alignment at three points, or approximately 1400, 1000 and 600 kc.

If it is desired to check the resonant point of the individual tuned circuit of the receiver, the test plug is inserted in the first audio tube socket of the receiver, the Yaxley four-point switch set on some off position, such as *C-*, and the milliammeter connected in the plate circuit of the tube in the same manner as for tube testing. The r-f tubes are removed from the receiver and a lead from the tip jack marked *VT-VM* is connected to the tip jack marked *ANT* and then to the antenna terminal of the receiver. The oscillator is then tuned until a drop in the milliammeter reading denotes resonance with the tuned circuit of the receiver. The reading of the oscillator dial is noted and the lead is moved to the plate terminal of the first tube and the oscillator again tuned until resonance is shown. If the circuits are properly aligned, this should be at the same reading as the first circuit. Of course if the first circuit is of the untuned type, no reading will be obtained.

All of the circuits are checked in this manner and the reading of the oscillator dial at resonance noted. If the oscillator

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reading of one circuit is higher than another, this would show that either the inductance or the capacity of that circuit needs to be reduced, and if lower, that it needs to be increased. It is not necessary to make connection to the GND tip jack of the oscillator, as that is connected through the filament wiring and bypass condensers of the receiver to the B+ terminal of the primary of the r-f transformer. The reason the meter reading decreases at resonance is that the tube is being used as a grid rectification type of vacuum tube voltmeter.

The same connections as used in testing for re-alignment may be utilized for neutralizing a receiver. A dummy tube is used, that is, with one of the filament prongs cut off, but normal otherwise. The oscillator is tuned to resonance with the receiver so that the milliammeter in the plate circuit of the first audio tube indicates the voltage from the oscillator. The dummy tube is now placed in the last r-f socket and the neutralizing condenser of that stage adjusted until the reading of the milliammeter indicates zero voltage from the oscillator, or if impossible to adjust to zero voltage it should be adjusted until the voltage is a minimum. The dummy tube is moved

to the next stage and the process repeated until all the stages of the receiver are neutralized. This neutralizing should be done around 1000 kc. This neutralizing changes the tuning of the circuit so the receiver should be re-aligned after it has been neutralized.

The oscillator and vacuum tube voltmeter can also be used for checking within certain limits the inductance of r-f transformers and the capacity of variable and fixed condensers. To do this, it is first necessary to calibrate the oscillator in either wavelength or frequency. This can be done by tuning in some station whose frequency is known on the receiver and then tuning the oscillator until a heterodyne note is heard with the carrier wave of the broadcast station. This note is adjusted to as near zero beat note as possible and the dial setting of the oscillator noted. By obtaining points from several stations, a curve may be plotted with degrees of the oscillator dial against the station frequency.

Several condensers whose capacities of .0001, .00025 and .00035 μf are guaranteed within 2 per cent, should be on hand. An r-f transformer whose secondary inductance is known should also be available, the inductance being about 180 microhenrys.

To check the capacity of a fixed condenser, the r-f transformer and inductance should be connected to the test set as shown in Fig. 5a.

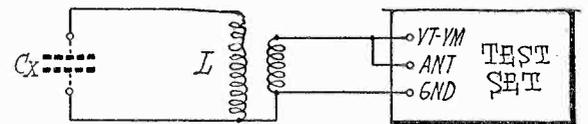


Fig. 5. Connections for Measuring Capacity

The test plug of the test set is plugged into the socket, which is used to supply voltage for tube testing, and the oscillator dial is turned until the milliammeter in the plate circuit of the tube in the test set indicates resonance by dipping. The 10 milliampere scale of the meter is used for this purpose with the telephone plug of the test set in PLATE MILS jack and the bridge in the tip jacks for the milliamper connection.

The frequency of the oscillator at the resonant point is determined from the curve and the LC value of that frequency is divided by the inductance of the secondary of the r-f transformer in microhenrys and the quotient will be the capacity of the condenser in microfarads. This value will also include the distributed capacity of the coil, but allowance can be made for that.

(Continued on First Column Below)

(Continued from Third Column Above)

The inductance of a coil or r-f transformer may be checked in the same manner, except that in this case one of the condensers is used for the capacity and the unknown inductance is substituted for the secondary of the r-f transformer. If the unknown inductance has no primary coil, a coupling coil of about 15 turns of wire on 2-inch tubing can be used to couple this inductance to the oscillator and vacuum tube voltmeter. After the frequency of the resonant point is found, the LC value of that frequency can be divided by the value of the capacity in microfarads to give the value of the inductance. These LC values may be found in a number of different publications.

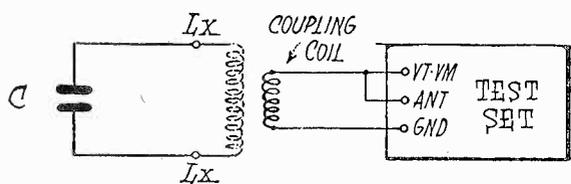


Fig. 6. Connections for Measuring Inductance

This connection may also be used to match the sections of the gang condenser in a single control receiver. The connection for measuring capacity is used with one terminal of the r-f transformer connected to the frame or common ter-

minal of the gang condenser. The other terminal is connected to a clip which can be moved from one stator terminal to the other. The clip is fastened to one of the stator terminals and the condenser shaft turned until the condenser is near the zero setting. The resonant point with the oscillator is found and the dial setting noted. The clip is fastened to each of the stators of the other sections and the trimming or compensating condensers adjusted until each section is resonant at the same point on the oscillator dial as was the first section. The reason for matching near the zero capacity of the condenser is that an error here results in the greatest loss of selectivity and sensitivity in the receiver.

The same procedure may be used in matching inductances, using a .00025 μf condenser as the capacity, and adjusting each coil until it is resonant with the oscillator at the same point on the oscillator dial.

List of Parts Used in Test Kit

- 1 .000035 μf midget condenser.
- 1 .00035 μf SLF variable condenser.
- 1 National Type F Vernier dial.
- 1 Plug-in coil (tube base type).
- 2 Pilot or Kelford 4-prong sockets.
- 1 Pilot or Kelford 5-prong socket.

- 1 Yaxley 10-ohm Junior rheostat.
- 1 Yaxley No. 760 switch.
- 1 Yaxley No. 745 switch.
- 1 Yaxley No. 12 voltmeter switch.
- 1 Yaxley No. 10 battery switch.
- 1 Yaxley No. 44 switch.
- 3 Pilot short jacks.
- 33 Carter tip jacks.
- 1 Standard Clarostat
- 1 7 x 21 x 3/16-inch bakelite panel.
- 1 Model 301 0-1 Weston milliammeter.
- 1 Model 517 0-3 Weston voltmeter.
- 3 5/8-inch pearl push buttons.
- 2 .5 μf bypass condensers.
- 1 10,000-ohm Super Davohm resistor.
- 1 100,000-ohm Super Davohm resistor.
- 1 1-megohm Super Davohm resistor.
- 1 100,000-ohm grid leak.
- 1 2-megohm grid leak.
- 1 8-volt bell-ringing transformer.
- 1 .006 μf fixed condenser.
- 2 .00025 μf fixed condensers.
- 6 feet of 6-wire battery cable.
- 1 4-outlet attachment plug and 6 feet of cord.
- 1 UY to UX adaptor.
- 1 UV 199 to UX adaptor.
- 1 UX to UV 199 adaptor.

Miscellaneous material such as phone tips, test leads, grid leak mountings and scrap bakelite.

An Examination for Service Men

By J. GARRICK EISENBERG

ELEMENTARY

1. State the procedure you follow in diagnosing causes of receiver failures in an orderly sequence, and outline a simple method of isolating these troubles quickly.

Check all tubes for low emission or possible internal defects; check socket terminals for correct voltages. Check voltage supply devices for correct output. If all ok, determine audio circuit continuity by touching grid leak or detector grid terminal at socket with finger; this should produce a click in speaker if circuits are ok. R-F circuits can be quickly tested by connecting antenna lead to detector tuning circuit and rotating variable condenser until local signals come in, then working backwards towards antenna stage until signals disappear or tuning condenser has no effect, which would indicate shorted or open r-f tuning circuit.

2. In checking condition of an "A" battery, would you use voltmeter or hydrometer method?

The hydrometer method is more positive, but a shorted cell might give a fairly high reading; both checks must

SINCE employers have adopted the written examination as a measure of an applicant's fitness for a position as service man, the typical one here presented may serve as a guide to those who take them. The questions are designed to test the scope of the applicant's background and to afford an insight into his experience and ingenuity. The answers are intended to indicate an acceptable method of treatment.

be made for an exact knowledge of battery's condition, if this is in doubt.

3. What should the output of a charging device be in order to take care of a 6-volt battery? How are the connections made?

Its terminal voltage should be in excess of 6 volts (from 8 to 12 volts) since a fully charged battery sometimes rises to 7 volts while on charge, and would tend to discharge through the device if its terminal voltage were lower than that of the battery. Connections are al-

ways battery + to + terminal of charger, otherwise the battery will actually be discharged rapidly, and probably ruined.

4. If a receiver having five '01A tubes and a '71A power tube were run on an average of 6 hours per day, what should the trickle charging rate be in order to keep the battery fully charged?

Since the current drain is 9 amperes per day, the charging rate should be a little more than half an ampere, in order to bring the battery up during the 18 hours of idleness.

5. If you encountered a line voltage of 125 volts, which it was desired to cut down to 105 volts, how would you go about this? Draw simple sketch and explain. The current load drawn by the set is 2 amperes.

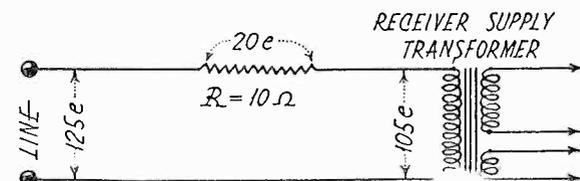


Fig. 1. Sketch of Voltage Reducer

A resistor would be inserted in the line as shown in Fig. 1 to drop the (Continued on First Column Below)

(Continued from Third Column Above) voltage the desired amount (20 volts). As the load is 2 amperes this is divided into the voltage drop: $20 \div 2 = 10$ ohms, which gives the amount of resistance necessary.

6. What should be the safe rating in watts of the resistor?

Watts dissipation (heat) is determined by current squared times resistance (I^2R) = $2^2 \times 10 = 40$ watts. Safe practice demands that a 100 per cent overload factor be provided so a 75-watt resistor should be used in this case.

7. You have a number of .5 mfd. condensers on hand. How would you connect these across a circuit to give a total capacity of 2.5 mfd.? .25 mfd.? Draw simple sketch.

Condensers in parallel increase the capacity in direct additive proportion. In series capacity decreases by law of reciprocals: See Fig. 2 for connections.

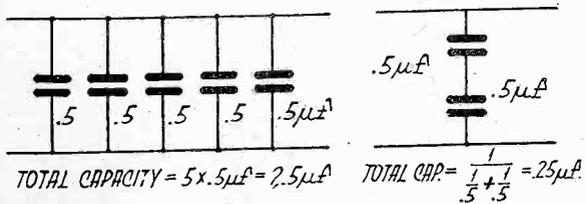


Fig. 2. Condenser Connections for Different Capacities

RECEIVER FAILURES

1. State in categorical order, possible causes of following troubles encountered in a modern a-c receiver.

- No filament voltage.
- No grid voltage.
- No plate voltage.
- Voltage, but little or no plate current.
- Excessive plate current.
- Loose terminal or broken connection in filament wiring circuit. Primary fuse out. Defective filament control switch. Open or shorted filament winding in power transformer.
- Open or shorted out grid suppressor resistance. Open section, voltage dividing resistance. Open a-f or r-f transformer winding.
- Open voltage dividing resistance. Shorted filter condenser. High resistance connection, broken connection or loose terminal in plate circuit. Open transformer winding.
- Low emission rectifier tube. Partial short in plate supply. Dirty tube contacts at socket. Excessive bias.
- Plate circuit grounded. Defective tube. Open a-f or r-f grid circuit. High line voltage causing high plate voltage.

2. Assuming no response obtained when making audio check for continuity, what

possible causes of trouble may be expected; tubes and socket terminal voltages being normal?

Shorted primary or secondary winding in audio transformer. Loose connection or high resistance contact in tube sockets. Open speaker winding or open or shorted speaker coupling transformer.

3. With audio circuits apparently ok, antenna lead is connected to detector tuning circuit with no signal response. State possible causes of trouble.

Open or high resistance connection in coil circuit. Shorted variable condenser. Open grid condenser. Defective tube; possible internal grid-filament short. Defective antenna; substitute short length of wire to check.

4. Using the method outlined above, signals drop out in one of the r-f stages; socket voltages and tube test ok. Coil circuit and tuning condenser check clear. Where would you look next for possible trouble?

In shorted out primary winding of preceding r-f stage. This puts an effective short circuit across the secondary also (the tuning circuit of the succeeding stage) which will bypass the signals entirely, or cause them to be materially weakened.

5. When the trouble encountered in a receiver is that of poor quality, what causes (Continued on Next Page)

(Continued from Preceding Page)

may this be attributed to? Assume that "B" and "C" voltages check normal.

Low *A* voltage—particularly with a-c tubes—would cause poor quality by fixing the operating point on the I_p characteristic below the desired position; low emission will of course bring about a like result. Partial grid-filament short in r-f or a-f stages. Internal tube short, or possible unsoldered grid wire inside of one of the audio tubes. Open field winding of dynamic speaker, or jammed armature in magnetic speaker.

6. What may be the possible causes of trouble in a receiver in which signals fade in and out periodically?

Bad tube; periodic internal short or open. Swinging antenna. Periodic breakdown of filter or bypass condenser.

7. What may cause an a-c receiver to develop hum?

Low emission tubes. Shorted or open filament balancing resistor. If a-c type of dynamic speaker, partial breakdown of rectifier unit.

8. When noisy reception is encountered, how would you determine whether this is due to inherent receiver trouble or outside interference?

Remove antenna and ground connection and short circuit these binding posts. If noise is due to outside source, this will usually cause it to disappear or be materially weakened.

9. If noise is due to outside pickup, how would you go about clearing this up?

Check antenna for bare rubbing contacts, loose joints, dirty insulators, etc. Run temporary antenna to ascertain nature of pickup (possible sources). If antenna checks clear, run set with indoor counterpoise in place of ground to determine whether noise is coming in over ground circuit. If so, check all ground pipes, bonding those which are close enough to touch; bypass water meters with jumper wire, etc. Check electrical fixtures when possible, for bad connections, arcing contacts, etc.

10. If noise still persists after removing antenna and ground from receiver, what may be the possible causes? Give as many as possible.

Rundown or defective battery supply. Low emission or defective rectifier tube in *B* pack. Dirty contacts at tube prongs or poorly soldered or corroded joint in receiver. Corroded terminals at *A* battery. Noisy grid leak. Intermittent breakdown of filter or bypass condenser. Internal breakdown in audio transformer. Defective tube.

11. What is the quickest way of isolating such noises to one particular part of circuit.

Remove all tubes except last audio; if noise prevails, trouble may be either in this circuit or in voltage supply, or pos-

sibly in speaker circuit. A defective condenser in filter circuit may not break down until nearly all the tubes have been replaced, causing normal current drain through set. If receiver is quiet under this test, replace tubes one by one until noise recurs. Trouble will then ordinarily be found in this or next preceding stage or in apparatus associated with these (filament or volume control).

12. If trouble is traced to audio stage outline method of determining whether the transformer is noisy.

Connect a 22½-volt battery in series with pair of headphones and shunt across the transformer winding as in Fig. 3.

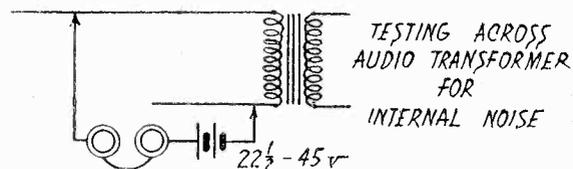


Fig. 3. Testing Audio Transformer for Internal Noise

Transient internal currents will be heard as grating or scratching noises in phones.

13. Give some remedies for noisy filament rheostats and volume controls.

Clean contact arm and stiffen spring tension where necessary. Rub winding lightly with soft lead pencil so as to leave lubricating deposit, insuring smooth

(Continued on First Column Below)

(Continued from Third Column Above) contact over winding surface. Clean terminal connections and resolder whenever doubtful. Disassemble unit and clean oil or dirt from sleeve or shaft with dry rag (or use very fine sandpaper) when all other remedies fail.

VOLTAGE SUPPLY DEVICES

1. The plate of the rectifier in a "B" pack glows red, and output voltages are practically zero. What is the probable cause?

Shorted filter condenser in *B* pack; shorted bypass condenser in receiver, or short in the receiver wiring.

2. How would you go about isolating the trouble?

Disconnect *B* pack from receiver and observe again; measure its output voltage. If ok trouble is undoubtedly in receiver itself. Apply continuity test with 45-volt battery and meter in series, bridged between plate leads and ground. Unsolder bypass condensers one at a time, and separate adjacent plate and ground circuit wires, until trouble is cleared.

3. If you encountered an open circuit say at the 90-volt terminal of a "B" pack how would you make repairs, if the pack were sealed in and its circuits inaccessible?

Connect an external resistor between 90-volt terminal and next highest one, as in Fig. 4.

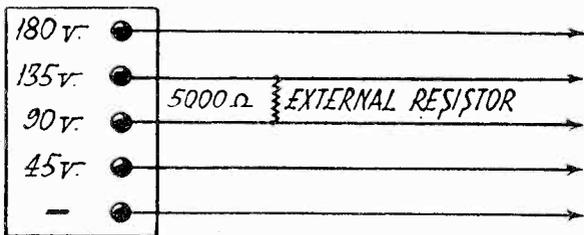


Fig. 4. Replacement of Burned-out Voltage Divider

4. How would you make sure of obtaining the correct voltage thereby?

Determine the normal current (in fractions of ampere) flowing through the 90-volt terminal; divide this into the voltage drop desired—90 subtracted from the next highest terminal voltage

—which will give the amount of resistance required in ohms.

5. Assuming the load in the 90-volt circuit to be 9 milliamperes, what should be the rating of the voltage dividing the resistance used?

If the next highest terminal voltage is 135, then the drop required is 45 volts (135—90). Then: $45 E \div .009 I = 5000 R$ in ohms.

Since watts dissipation (I^2R) = $.009^2 \times 5000 = .405$ watts. To give a 100 per cent safety factor a resistor rated at 1 watt should be used.

6. A "B" eliminator has a maximum voltage of 180; the receiver uses a '71 (Continued on Next Page)

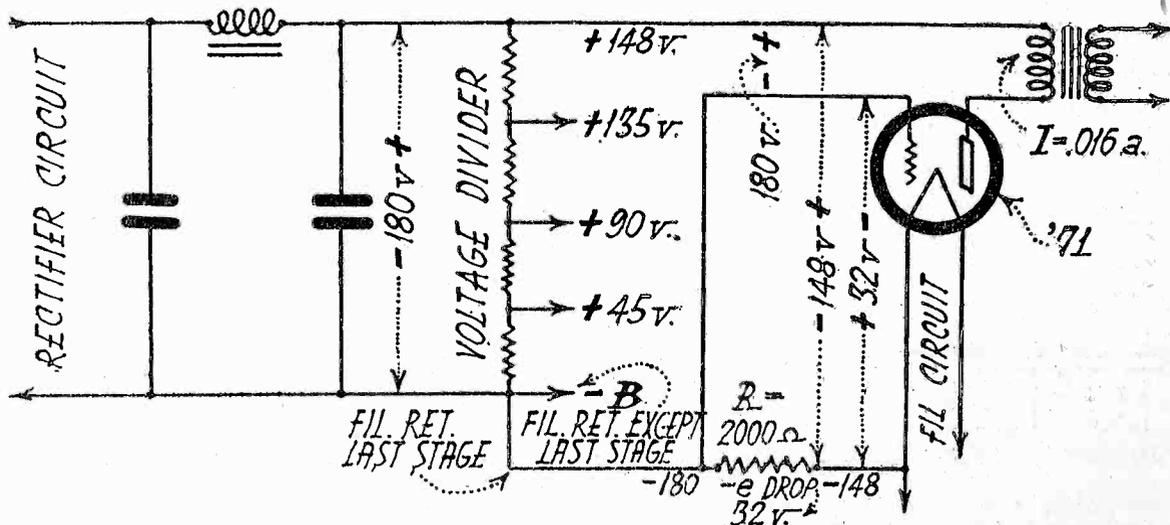


Fig. 5. Connection for Obtaining Grid Bias

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in the power stage and it is desired to have the eliminator furnish "C" voltage for this stage. Draw a diagram showing how this could be done, and explain.

The '71 must be worked at some potential less than 180 of course; the difference is then applied as grid biasing potential by dropping the voltage through a resistor in the B— lead, in the manner shown in Fig. 5.

On the basis that a '71 requires about 27 volts grid bias at 135 volts plate potential, there is still available an additional 18 volts. Since the tube has a μ

Tube	Use	E_p	E_g	I_p
'01A	Det.	20; 45	-----	1.0; 1.5 ma.
'01A	Amp.	45; 90	1.5; 4.5	1.0; 3.0 ma.
WD12	Det.	20; 45	-----	.8; 1.5 ma.
WD12	Amp.	45; 90	1.5; 4.5	1.0; 2.5 ma.
'99	Det.	20; 45	-----	1.0; 1.5
'99	Amp.	45; 90	1.5; 4.5	1.0; 2.5
'20	Amp.	90; 135	16.5; 22.5	3.0; 6.5
'12A	Amp.	90; 135; 180	4.5; 9.0; 13.5	5.5; 7.0; 10.0
'71A	Amp.	90; 135; 180	16.4; 27.0; 40.5	10.0; 16.0; 20.0
'27	Det.	45	-----	2.0
'27	Amp.	90; 135; 180	6.0; 9.0; 13.5	3.0; 5.0; 6.0
'26	Amp.	90; 135; 180	6.0; 9.0; 13.5	3.5; 6.0; 7.5
'22	Amp.	90; 135; 180	1.5; 1.5; 3.0	1.5; 1.5; 1.0
'24	Amp.	90; 135; 180	-----	-----
'45	Amp.	180; 250	33.0; 50.0	26.0; 33.0
'50	Amp.	250; 350; 450	45.0; 65.0; 85.0	28.0; 45.0; 55.0
'80	Rect.	350 per plate	-----	125 ma. max.
81	Rect.	700 max. (RMS)	-----	75 ma. max.

Note: For '22 and '24 screen grid tubes, the + screen grid voltage is 45, when used as amplifiers.

of 3, it can roughly be calculated that the grid potential should be increased 1 volt for each additional 3 volts of plate. The final determination for plate voltage therefore would be 148, and a grid bias of 32 (making up the full 180 volts available). Plate current at these values is mightily in excess of 16 mls. A resistor of 2000 ohms would therefore be correct for the grid biasing drop desired.

7. Give the approximate values of plate current and grid voltages, at the various plate voltages ordinarily used for the tubes listed herewith.

HOW GOOD ARE YOUR AERIALS —MECHANICALLY?

By Boris S. Naimark

AN antenna, although it may be fine electrically, is useless if its masts or other means of support fail. While no service man is expected to erect a receiving aerial which is as elaborate as that used by a broadcast station, it should be mechanically strong enough to withstand any probable cause of breakdown. A good workman may be known by the strength of the masts which he erects.

Any mast can withstand a much greater stress along its length than at an angle thereto. Thus in an umbrella type

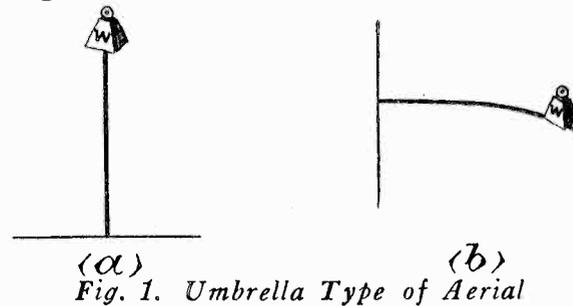


Fig. 1. Umbrella Type of Aerial

of antenna where the result of the acting forces is straight down the mast, as in Fig. 1, the strength of the mast is being utilized to better advantage than in a horizontal wire aerial where the stress (Continued on First Column Below)

(Continued from Third Column Above) is at right angles to the length of the aerial, as in Fig. 2. This inherent mechanical weakness of a horizontal antenna may be overcome by attaching a

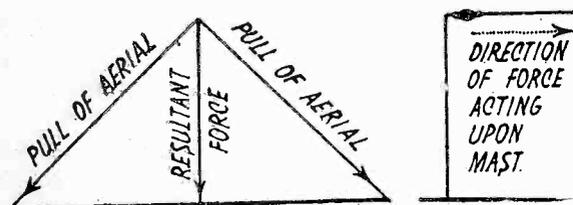


Fig. 2. Horizontal Aerial

stay or guy wire between the top of the mast and a point some distance away from the foot. By proper placement of the guy point, the resultant of the two forces can be made to act straight down the length of the mast, as in Fig. 3.

It is good practice to make the distance from the foot of a mast to the ground end of its stay-wire equal to half the length of the mast. While a greater length will lessen the value of the resultant force along the mast, the size of

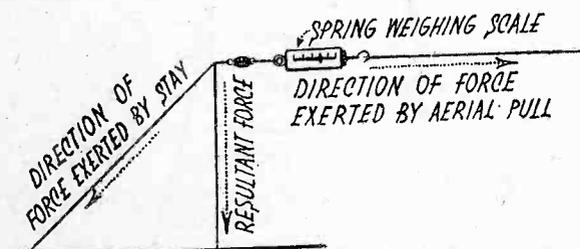


Fig. 3. Horizontal Aerial With Stay-Wire

the open space and the length of the guy soon becomes prohibitive.

There is also a limit to the force which can be applied to a mast without causing it to buckle. Thus it can be shown that the weight which a mast will carry without buckling is inversely proportional to the square of its length. Halving the length, permits four times the force. Doubling the length reduces the force that may be safely acting straight down its length to one-fourth.

The inherent weakness of a long mast can be overcome by fastening a stay to the middle of the mast so that it cannot move sideways at the point of attachment. By thus staying a mast in the middle it will withstand four times the downward force that an unstayed mast will stand without buckling. By staying it at two points which divide it into three equal lengths it will carry nine times the pressure.

The numerical value of the forces acting upon a mast can be calculated if the pull of the aerial and the angle between the mast and stay are known. The aerial pull can be measured with a spring scale as shown in Fig. 3. The angle can be measured with a protractor or calculated by simple trigonometry. The vertical downward force is found by construct-

ing the parallelogram $ABEF$ in Fig. 4.

Assume that the spring scale shows that the aerial expects a 400 lb. pull. Lay off the horizontal line AB so that it

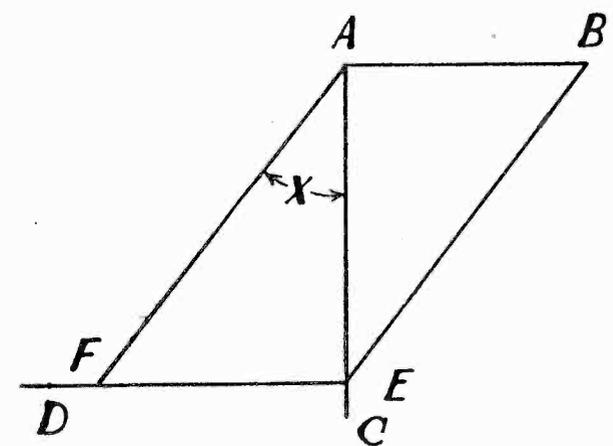


Fig. 4. Force Parallelogram

is 2 in. long, 1 in. representing 200 lb. Draw AC of indefinite length perpendicular to AB . Draw AD so that it makes the same angle with AC as the guy wire makes with the mast. Draw BE parallel to AD until it intersects AC at E . The length of AE represents the vertical force in the mast, each inch being equivalent to 200 lbs. Likewise the length of AF represents the force in the stay wire, the point F being found by drawing EF parallel to AB until it intersects AD at F . The angle X is 27 degrees if EF is half AE .

A New Resistance-Coupled Amplifier

A FOUR-STAGE resistance-coupled audio amplifier which is designed to give a gain of 55 decibels and an undistorted power output of $4\frac{1}{2}$ watts over a 30-10,000-cycle band has been designed by the engineering department of the International Resistance Co. Together with its associated 800-volt power supply it may be used as a phonograph pick-up, a power amplifier for an r-f and detector unit, or for laboratory measurements of loudspeaker fidelity.

The amplifier uses straight resistance coupling without condensers. The design factor that contributes to constant amplification of all frequencies is the resistor and balancing battery in the output circuit. A '40, '01A, 112A, and '50 tube are used in the successive stages. The details and constants of the circuit are shown in Fig. 1.

A power supply of about 75 milliamperes at 800 volts is needed for B and C voltages. The power transformer (built to order) has three center tap secondaries—one 1500-volt winding and two $7\frac{1}{2}$ -volt windings for the '50 and '81 tubes. Low resistance chokes are connected in a condenser-input-filter circuit to provide a high terminal voltage. Variable supply voltages are obtained through a resistance bank of 60,000 ohms. A 5000-ohm, 100-watt, wire-wound unit with four vari-

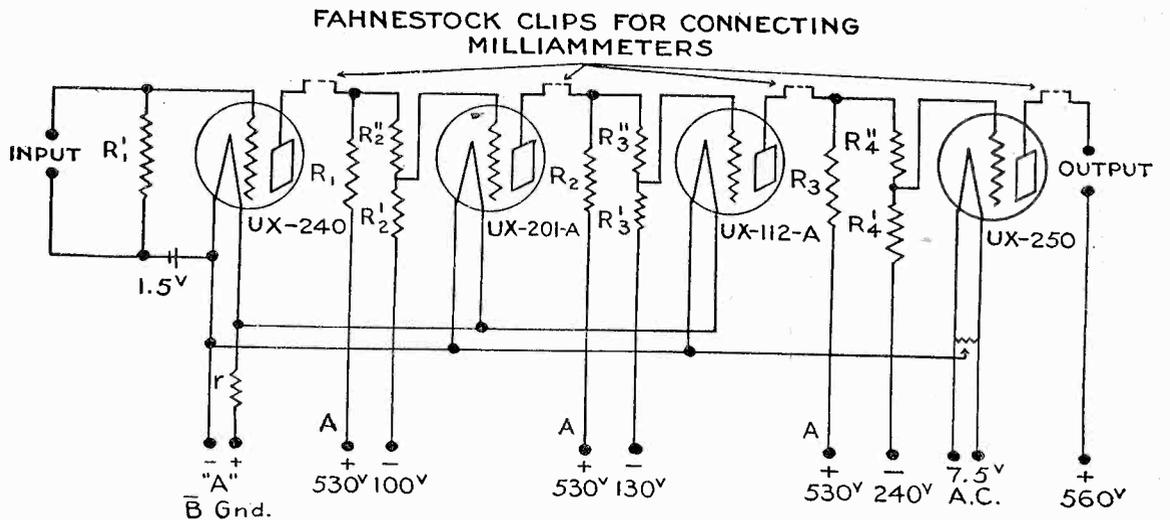


Fig. 1. Resistance-Coupled Amplifier Circuit

R_1' —0.25 Meg.	R_2 —0.075 Meg. 2 Watt	R_3' —0.25 Meg. 1 Watt	R_3'' —0.25 Meg. 1 Watt
r — $\frac{3}{4}$ Amp. Amperite	R_3 —0.045 Meg. 4 Watt	R_4' —0.25 Meg. 1 Watt	R_4'' —0.25 Meg. 1 Watt
R_1 —1 Meg. 1 Watt	R_2' —0.5 Meg. 1 Watt	R_2'' —0.75 Meg. 1 Watt	

able taps is connected to each terminal. Stability is maintained by a 50,000-ohm bridging resistor across the ends of the adjusting units. Fig. 2 shows the wiring diagram.

The parts are mounted in "breadboard" fashion as shown in Fig. 3. Vibration is

minimized by sponge rubber strips attached to the end cleats. Input and output binding posts are arranged on hard rubber strips at the ends of the board. The eight Fahnestock clips along the front of the amplifier

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board are connected to four milliammeters for reading plate current values during preliminary adjustments of the supply voltages. After the initial adjustment a busbar jumper is inserted in each of the four pairs of clips. The insulated filament supply wires are placed underneath the mounting board.

All of the resistor units are of 1-watt rating except the 2-watt resistor in the plate lead of the '01A and the two 2-watt units in parallel in the plate circuit of the 112A. Durham metallized power ohms are used throughout. The specified values provide the same potential to the supply side of the plate resistors, A in Fig. 1. But separate leads are brought to the binding post strip so as to provide maximum flexibility.

This amplifier and associated power supply have been used in making oscillograph studies of the output of a beat frequency oscillator. Many other uses will come to the mind of the experimenter. The total cost of the parts, exclusive of the power transformer and filter chokes, is about \$100.

- 1—Power Transformer—Primary—110 V., 60 ~ 3 Secondaries—1-1500v, 250 Mils.; 2-7.5v. 2.5 Amps.
- 2—UX-281 Rectifiers
- 3—4 Mfd. 1300v. Condensers
- 4—2 Mfd. 1300v. Condensers
- 5—Type 557 Amerchokes
- 6—50,000 Ohms—Capacity 50 Watts
- 7—5,000 Ohms—Capacity 100 Watts

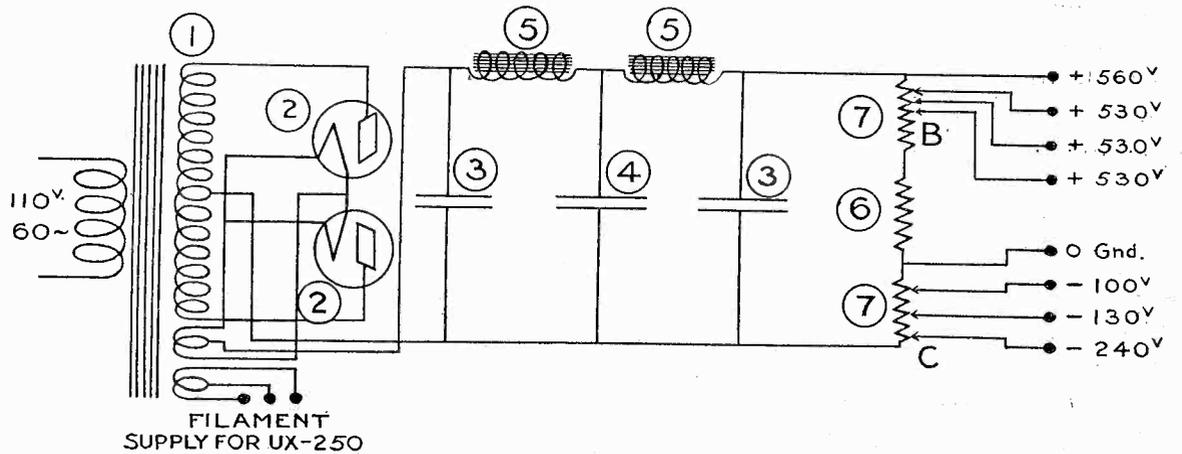


Fig. 2. Circuit Diagram of Power Supply Unit

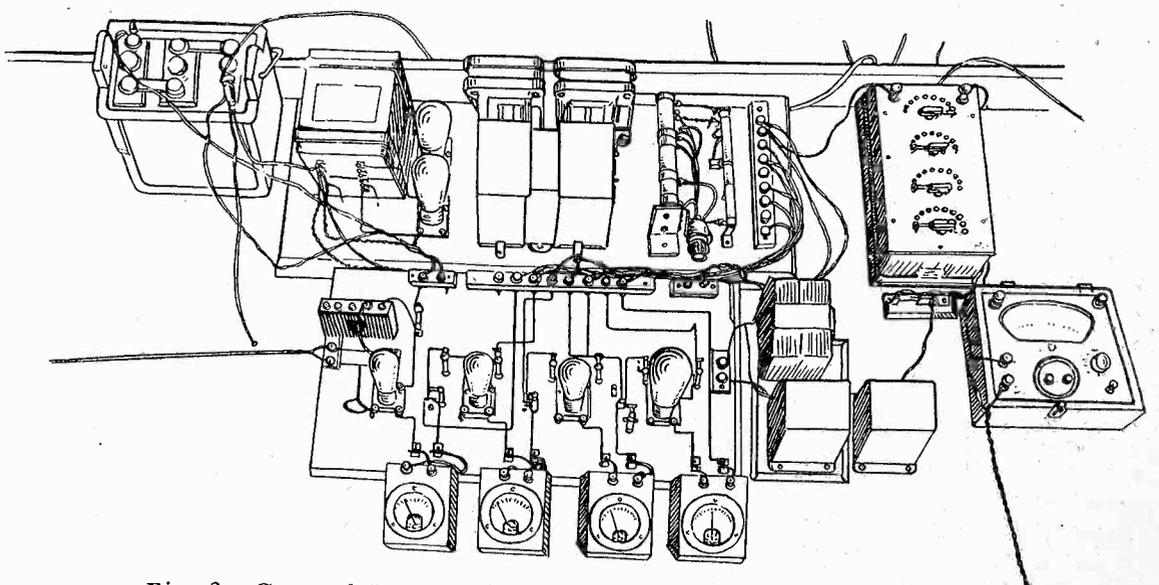


Fig. 3. General Layout of Parts in Amplifier and Power Units

Radio Pickups

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

Trade gossip says that Studebaker has bought the Jensen electro-dynamic speaker and the Marvin tube companies, and that Farrand is owned by Brunswick. The Earl-Kolster deal, as reported in November RADIO has fallen through.

Electrad, Inc., will introduce a new type of volume control and a full line of amplifiers about January 1. Additional manufacturing space has been provided.

Van Horne Tube Co. has prepared a table of "normal" readings from vacuum tubes in oscillation tests and filament emission tests with a Supreme diagnetometer. Thus it shows that a normal '26 tube should pass an oscillation current of 15 ma and have a filament emission of 6 ma when 110 volts is applied to the diagnetometer.

The Potter Company of North Chicago, Ill., are making a condenser type speaker based upon the designs of Philip E. Edelman. It is claimed to give true reproduction of all sound frequencies in the voice and music range and to have a non-directional effect. It requires 450 to 500 volts d-c for polarization and has a capacity which varies from .03 to .05 μ f. It will accept and reproduce great volume from '45 tubes. It is made in various sizes from 15 by 18 in. to 24 by 30 in., the larger speaker weighing 1½ lbs.

Triad tubes are sold with an insurance certificate that guarantees free replacement if they fail from any cause except breakage of glass or burn-out of filament within a six months period.

Dubilier Condenser Corp. advocates that a light socket aerial be included with every radio set when it is sold, thereby avoiding the cost of installing and servicing an outside aerial.

Paper condensers are of two types: inductive and non-inductive. The former may be used in low-frequency circuits and power filters, the latter for r-f and high audio frequency work. The foil in the inductive type is narrower than the paper and is contracted by tinned copper strips inserted in the winding. The foil in the non-inductive type is of the same width as the paper and is staggered so that the condenser plates project over the ends of the paper; the terminals are soldered to the extending foil so as to make contacts with every turn.

From Chicago comes the story of a sale of a set which was selected by a canary bird. The bird refused to sing when several sets (names not supplied by request) were being played, but burst into song when a Blank set (name supplied on request) was played. Some bird fancier is missing a good bet if he doesn't train birds to sing only with each of the different sets which the Chicago bird disdains.

As a switchboard instrument generally has an allowable error of from 1 to 3 per cent, which is not accurate enough for vacuum tube measurements, and as the more accurate portable instruments require a horizontal position, Westinghouse E. & M. Co. has designed a series of panel standard instruments in which a high-accuracy portable mechanism is placed in a switchboard type case. This combination is applicable in all kinds of testing work where the otherwise preferable horizontal position of portable instruments cannot be employed.

Dealers who are selling or contemplate selling movie cameras and projectors in connection with radio sets will be interested in the announcement that the Kodak Electric & Mfg. Co. will market a new outfit next year. This outfit takes four pictures in the space ordinarily occupied by one picture on the usual 16 m.m. film, thus giving a running time of 16 instead of 4 min. for a 100 ft. roll of film. The pictures are taken horizontally and laterally in turn.

Electrical Research Products, Inc., is marketing a portable talking-picture outfit using a variable density sound-track for reproduction from film records. It sells for about three thousand dollars and is intended primarily for institutional use.

A coin-operated radio is marketed by the Mills Novelty Co. of Chicago. It is a screen-grid set with seven tubes and electro-dynamic speaker, all housed in a 44 by 29 by 17½ in. walnut cabinet weighing 80 pounds. The instrument brings in the music from the station to which it is tuned after a dime is dropped in the slot.

The Rauland Corporation has been formed at Chicago with E. N. Rauland as president. It has purchased the equipment of the All-American-Mohawk Corp., for the manufacture of audio transformers. It will also make power amplifiers.

The great advantage of the screen-grid tube, in the opinion of R. H. Langley of the Crosley Radio Corporation, is that it eliminates the feed-back capacity between the plate and the grid which was the outstanding defect of the three-element tubes. Thereby there is no need for neutralizing with its complicated transformers, condensers and wiring, and no need for balancing. While no claim is made for actual utilization of all its tremendous amplifying possibilities, it does give greater r-f gain and thus permits less audio amplification and bias detectors. It enables the use of low-ratio r-f transformers which give nearly uniform gain and selectivity over the entire range of broadcast frequencies. Its life is the same as that of the three-element tube and any temporary variation in tube constants causes less trouble than the former variations in feed-back capacity.

There's an honest difference in opinion about the value of broadcast "canned music." Radio Commissioner Harold Lafount believes that the scarcity of radio channels requires that they be used to provide original entertainment or instruction not otherwise obtainable. Furthermore he states that small stations cannot maintain high-grade original programs in competition with the low prices quoted by other stations which broadcast records. On the other hand, the Association of National Advertisers has decided that canned music is just as good for most practical purposes as is an original performance unless the auditors are warned beforehand. Their tonal quality is better than the wire-transmitted programs of the chain broadcasts.

The Hytron Corp. of Salem, Mass., has moved into a new plant which gives them a capacity of 10,000 vacuum tubes a day.

NEW RADIO CATALOGS

Cornell Elec. Mfg. Co., Long Island City, N. Y., have issued a new catalog of their line of paper condensers. These include "Cub," filter and by-pass condensers as well as the "Quietone" filter for preventing line noises and a unit for correcting power factor.

Karas Elec. Co. of Chicago are distributing a bulletin which lists and describes the various kits and parts they make for dealers and set builders.

Albert Grasfield, Inc., of New York City, have issued a beautifully illustrated catalog of radio cabinets which are of authentic period design.

A new bulletin from Arthur H. Lynch, Inc., of New York City, in addition to listing the various Dynohmic and Veritas resistors, illustrates and describes several new products. Among these is the Lynch Tubadapter for connecting two similar tubes in parallel without change in receiver wiring. There are also filament equalizers or cartridge units to be mounted in leak-proof mountings, the Filgrid control for giving the proper grid bias drop for a screen-grid tube, and resistance-coupled amplifier kits.

PUBLICATIONS RECEIVED

In Research Paper No. 90 from the U. S. Bureau of Standards, Frederick W. Grover compares the accuracy of various formulas for calculating the inductance of coils and spirals wound with large wire. The treatment is mathematical and of interest primarily to physicists.

Cable Radio Tube Corporation, manufacturers of Speed tubes, are distributing a station locating chart whereby any station of 100 watts or more can be located on a semi-circular dial which is divided into 96 channels, corresponding to frequencies from 960 to 1500 kilocycles.



Letters to the Editor

Eliminating the Joy-Rider

Sir: We are inclosing, herewith, an idea which we have put over in Topeka in order to eliminate joy-riders on free radio demonstrations. We have secured the signature of every large radio store in the city, and every small store with the exception of one new radio dealer who was not ready to sign owing to the fact that he had not been in business long enough to know the evil of free demonstrations.

We feel that the radio dealers throughout the country have had to carry in stock from two to three times a normal radio stock because it required an average of three demonstrations to sell one radio.

We believe with our new policy of requiring a \$5 deposit on a free demonstration that no person will object to paying the \$5 when they consider the fact that their money will be refunded to them should they not decide to buy within three days.

Many a time we have heard a customer say, "I am going to try out from eight to ten radios before I buy," simply because they knew that the dealers were very anxious to send radios out on free demonstrations and that the cost of these demonstrations would be nothing to them, so why should the customer worry if they did have four or five demonstrations at one time? But if a customer knows that they have to pay a \$5 deposit for every radio they are not going to be so anxious to try every radio on the market.

Of course, some dealers will get cold feet when they find out that they are not getting 100 calls each week for free demonstrations. But what is the sense of receiving 100 calls when only 25 or 35 of these people are really interested in buying a radio? Furthermore, the greatest cost of free service is on the radio that is on demonstration, for every set that is out on demonstration requires the constant service and attention of your salesman as well as your service man, for the simple reason that in many cases your customer being a joy rider, is trying to find something wrong with the radio so as to make the perfect alibi as to why they do not purchase. Therefore we feel and know from past experience that one-half of our service cost is caused by free demonstration.

But when customers desire to buy a radio they will not hesitate to pay a \$5 deposit, and they are aware of the fact that if they are going to buy no company will sell them

a radio for less than \$5 down and in many cases one-fourth down. As long as your agreement reads that the money will be refunded if the radio is not bought within three days, the customer is not taking any chance, and if your refund reads three days as the limit of the demonstration the customer is naturally going to decide one way or the other within three days. We know of many cases where customers keep putting us off on demonstrations for weeks at a time, and being good customers, we naturally hate to tell them that we could not leave the radio that length of time. But when the customer realizes that he or she must decide within three days it changes the situation.

You will notice that we call ourselves the National Radio Dealers' Association because we believe that this idea will become national and we are passing this information on to you so that you can give it to your readers and explain to them that they can join this National Radio Association by simply adopting our policy of a \$5 deposit on free demonstrations and send us a copy of their ad showing that they had become a member of the National Radio Dealers' Association. The writer being at the head of one of Kansas' largest radio stores, feels that it is his duty to pass this information on to other dealers of the country without any charges.

R. E. MARLING, Instigator.

Harris-Goar Co.,
Topeka, Kansas.

Yes, the Jobber Is Needed

Sir: Your "Radiatorial Comment" in November RADIO revives the long mooted question as to whether the jobber is an economic superfluity. We have been hearing for years that the jobber of any line of merchandise is doomed. It somehow looks that way, but the jobber is still in the picture and in for a long while. Magazine articles have always given to the public the troubles of the small dealers and the manufacturers in selling their goods. I wonder if one has ever stopped to consider the difficulties that the jobber has to meet.

In the radio industry there is the man who makes the sets, then the man who buys them to sell to the store who ultimately sells them to the final purchaser. Today the manufacturer turns first to the jobber to sell his radio. Likewise the dealer turns to the jobber in order to buy a set. This state of affairs has made the jobber one of the keenest of merchandisers.

Unfortunately most of the radio dealers

regard the jobbing house as a necessary evil, a place where they can buy sets and not pay for them, where they can have all the service work done free of charge, and in a great many cases even have a man go out and sell his sets for him.

The greatest trouble the jobber has today is trying to teach, as it were, the dealer how to sell his sets. But for some reason the dealers resent this. They forget that the jobber is in a position to help them and show them their mistakes.

Most radio dealers today are men who are primarily first-class electricians, and have no real fundamental business ability and who lack the real get-up and go that is so necessary to a successful business. A great many lack capital to carry on their business.

Another of the jobber's problems is the financing of the small dealers. During the summer months when the radio business is slow very few dealers can discount their bills. Incidentally here is when the jobber is a life-saver to those that are in that condition.

Today, more than ever, one is confronted with the problem of what to handle in the line of sets and how many lines to carry. The dealer who will strive to carry as few lines as possible, will find he has unlimited capital as far as the jobber is concerned and will have his resources as to sales ability and helps and in time of trouble will have someone to fall back on.

A difficult situation the jobber is up against is when in certain types of stores the radio department is run either by a man who knows nothing about radio or by a man who should really be servicing radios instead of trying to sell them. This occurs frequently in small towns where there is no alternative for a dealer to choose. Then there is usually a row between the two houses as to the number of sets that will be sold and the number that should be sold, so that the dealer can make a profit and the jobber will have a worthwhile representative in that territory.

Often a jobber will be so unfortunate as to have his lines fall into the hands of a dealer who wants to sit in his store and wait for customers, *a la grocery store*. When this happens a jobber has to hunt for someone else, who will give the proper representation to the line. When this is done the jobber is blamed for having too many dealers in one town. Then there must follow explanations as to why the other dealer was granted a franchise.

The amount of stock in sets that a dealer will carry always gives the jobber some trouble. The tendency of the dealer is to buy as few sets as he can. He will buy two or three sets at a time, put them on the floor, and then wait for someone to come in and buy them. This may sound rather far-fetched, but if one were to follow a jobber's salesman on his daily rounds he would soon see how true this is. There are very few real merchandisers in retail radio today.

If the dealers would put out more sets on demonstration they would find their sales would increase in proportion to the number of sets they put out. If a jobber suggest that he do that, the dealer feels that he is being loaded with sets that he cannot sell and

(Continued on Page 90)

FREE RADIO DEMONSTRATION

Date.....

Received

From **\$5 DEPOSIT**
on a Free Radio Demonstration in my home. My Five Dollar Deposit is to be cheerfully refunded if for any reason I decide not to buy within THREE DAYS.

By.....
Member National Radio Dealers' Association

New Sets & Accessories Announced in November. Changes in Models, Prices, Etc.

HIGH LIGHTS OF THE MONTH

Drastic reductions in price of many leading makes of receivers. Likewise news from other large manufacturers strenuously denying that prices of their sets will be lowered.

One new line of receiving sets announced during November. One new radio tube manufacturer enters field.

ATWATER KENT PRICE REDUCTION

Announced and Advertised November 5—\$27.00 Reduction

MAJESTIC

Price Reduction

Model 91, less tubes, now...\$116.00
Former price, less tubes...\$137.50
Model 92, less tubes, now...\$146.00
Former price, less tubes...\$167.50
Majestic prices are same both East and West.

EARL PRICE REDUCTION

Model 31 now...\$116.00
Former price \$161.50.
Model 32 now...\$142.00
Former price \$191.50.
Model 41 now...\$162.50
Former price \$250.00.
New Western prices same as Eastern prices.

DAY-FAN PRICE REDUCTION

Eastern Prices

Model 66 now...\$85.00
Former price \$115.00.
Model 68 now...\$129.50
Former price \$169.50.
Model 69 now...\$195.00
Former price \$225.00.
Model 72 now...\$135.00
Former price \$175.00.
New Western prices \$95.00, \$139.50, \$205.00, \$145.00 respectively.

BRANDES

Price Reduction—Announced and Advertised November 6

EASTERN PRICES

Brandes Console B-15, less tubes, now...\$97.50
Former price...\$125.50
Brandes Model B-16, now...\$136.00
Former price...\$165.00
Brandes Table Model B-10, now...\$56.00
Former price...\$85.00

WESTERN PRICES

Brandes Console B-15, now...\$97.50
Former Western price...\$133.25
Brandes Model B-16, now...\$136.00
Former Western price...\$175.50
Brandes Table Model B-10, now...\$56.00
Former Western price...\$88.50

VICTOREEN

Superheterodyne

The Victoreen "Circumnavigator." Fourteen tubes, eight heater tubes. Two '81 rectifier tubes, two voltage regulator tubes, one '01-A tube and '50 power tube in audio stage. One spot tuning. Two separate chasses. Tuner as one chassis and power plant with amplifier and voltage regulator tubes as another chassis. Three models: "The Artist Grand," 15th Century Gothic Cabinet, with Speaker...\$325.00
"DeLuxe Model," same chassis, console, price, with speaker...\$395.00
Combination Phonograph and Radio in console cabinet, with speaker, priced at...\$595.00
Prices listed are Eastern prices.

RADIOLA

Price Reduction—Announced November 4. Generally advertised November 6

Radiola 44, less tubes, now...\$75.00
Former price...\$110.00
Radiola 46, less tubes, now...\$130.00
Former price...\$179.00
RCA Loudspeaker 103, now...\$18.00
Former price...\$22.50
RCA Loudspeaker 106 (Electro-Dynamic), now...\$35.00
Former price...\$49.00
All Radiola prices are same both East and West.

KELLOGG

Price Reduction

Model 523, now...\$175.00
Former price...\$250.00
Model 524, now...\$225.00
Former price...\$295.00
25-cycle Models
Model 526, now...\$185.00
Former price...\$260.00
Model 528, now...\$235.00
Former price...\$305.00

WESTERN PRICES

Model 523, now...\$219.50
Former price...\$265.00
Model 524, now...\$296.00
Former price...\$310.00

FREED PRICE REDUCTION

NR78 now...\$119.50
Former price \$145.00.
NR79 now...\$145.00
Former price \$172.50.
NR95 now...\$162.50
Former price \$225.00.
New Western prices same as Eastern prices.

GRAYBAR PRICE REDUCTION

New Prices

Model 330 Table now...\$98.50
Model 330-F-45 now...\$175.25
Model 500 Table now...\$75.00
Model 550 now...\$130.00
Model 600 now...\$225.00
Prices are same both East and West.

New Sets & Accessories Announced in November. Changes in Models, Prices, Etc.

MILLS COIN OPERATED RECEIVER

Made by Mills Novelty Co., Chicago. Screen-grid console radio phonograph combinations, with and without coin-in-slot operating device. Same chassis in all receivers. Four screen-grid tubes. Two heater tubes and push-pull '45 audio system, using two '45 tubes.

Prices, (East) Model 300...\$175.00
Model 310...\$175.00
Model 400...\$350.00
Model 410...\$350.00
Model 500, combination...\$750.00

Troubador model remotely controlled combination with or without radio as desired. In model for operation with ten-cent coin operating device. Made by Mills Novelty Company, 4100 Fullerton Avenue, Chicago, Ill.

BREMER-TULLY

Announces New Screen-Grid Receivers

The following new screen-grid models are added to the line of Bremer-Tully Heater Tube Receivers:

Model S-81, seven tubes, not including rectifier...\$134.00
Model S-82, seven tubes, not including rectifier...\$159.00
Prices are same both East and West

BRUNSWICK

Announces Screen-Grid Receivers

Announced November 13

In addition to the line of heater tube receivers there are now three new Brunswick screen-grid models, each using seven tubes (not including rectifier). Prices of these new receivers are:

Model S-14, Lowboy Console, now at...\$129.00
Model S-21, Highboy Console, now at...\$154.00
Model SO31, Combination Panatrop and Radio...\$249.00
Prices are same both East and West.

These new Brunswick receivers have linear power detection. Resistance Coupling and a new sensitive detector circuit, which it is claimed, makes unnecessary high amplification in individual R-F stages.

BRUNSWICK

Price Reduction

Battery operated model, now...\$60.00
Model 14, now...\$119.00
Former price...\$148.00
Model 21, now...\$144.00
Former price...\$174.00
Model 31, Combination...\$239.00
Former price...\$272.00
Brunswick prices are same both East and West.

CROSLEY

Price Reduction

Crosley 31-S, Screen-Grid Table Model, now...\$56.50
Former price...\$67.00
Crosley 33-S, Screen-Grid Receiver, now...\$112.00
Former price...\$115.00
Crosley 34-S, Screen-Grid Receiver, now...\$116.00
Former price...\$125.00
Crosley 41-S, Screen-Grid Receiver, now...\$65.85
Former price...\$85.00
Crosley 42-S, now...\$126.00
Former price...\$140.00
Crosley Dynacoil Speaker...\$21.10
Former price...\$28.00

MAJESTIC MODEL 101 ANNOUNCED

A new Majestic Phono-Radio Combination Model 101. List price, with tubes...\$245.00
Priced same East and West.

This new combination is housed in the same console cabinet as the Majestic Model 181. The new Model 101 uses five heater tubes, two '45 tubes and one rectifier tube. Power detection and one stage push-pull audio when receiver is used for radio reception. The new model uses a larger speaker than other Majestic models. Several important changes in construction of the speaker cone have been made.

CROSLEY

New Western Prices

31-S, with Speaker, now...\$95.00
Former price (less Speaker)...\$70.00
33-S, now...\$114.50
Former price...\$119.00
41-S, with Speaker, now...\$106.50
Former price (less Speaker)...\$88.00
42-S, now...\$135.50
Former price...\$145.00

DAY-FAN ANNOUNCES SCREEN-GRID MODELS

Model 93. 6 tubes, not including rectifier, Eastern price...\$159.50
Western price...\$169.50
Model 94. 6 tubes, not including rectifier, Eastern price...\$210.00
Western price...\$220.00

BREMER-TULLY

Price Reduction

Battery Model 80, now...\$60.00
Former price...\$89.50
Model 81, now...\$124.00
Former price...\$164.00
Model 82, now...\$149.00
Former price...\$195.00
Prices are same both East and West

Eastern List Prices of Heater and Filament Tube Sets

NOTE: RECTIFIER TUBES ARE NOT COUNTED IN LISTINGS BELOW.

MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE
A-C DAYTON			BUSH & LANE			EARL Induct Dyn			FREED Electro. Dyn.			RCA continued		
Batt. 98.....	7	79.00	20.....	7	125.00	21 Tbl.....	7	75.00	NR-79.....	7	169.00	60.....	8	98.00
AC-98.....	8	108.00	21.....	7	169.50	21-DC.....	7	75.00	NR-95.....	7	225.00	64.....	8	550.00
AC-9960.....	8	148.50	30.....	7	169.50	21-25 cy.....	7	80.00	NR-79.....	7	174.00	66.....	7	225.00
AC-9970.....	8	165.00	32.....	7	179.50	22.....	7	99.50						
AC-9980.....	8	185.00	40.....	7	179.50	22-DC.....	7	99.50	*GRAYBAR			*SONORA		
AC-9990.....	8	188.00	50.....	7	197.50	22-25 cy.....	7	104.00	300.....	8	98.00	A-30.....	7	190.00
AC-99100.....	8	234.00	60.....	7	199.50	31.....	7	139.00				A-32.....	7	250.00
			70.....	7	207.50	31-DC.....	7	139.00	*HOWARD			A-40.....	7	375.00
*ACME			90.....	7	217.50	31-25 cy.....	7	144.00	Consol.....	8	175.00	A-36.....	7	470.00
77.....	6	115.00	10-C.....	7	250.00	Electro-Dyn.			Shern.....	8	235.00	A-44.....	7	695.00
88.....	7	139.50	11-C.....	7	290.00	32.....	7	169.00	Hplwt.....	8	235.00			
			12-C.....	7	297.50	32-25 cy.....	7	174.00	LXV1.....	8	255.00	*STEWART WARNER		
*ALL AMER "LYRIC"			COLUMBIA			41.....	8	225.00	Goth.....	8	275.00	35-900.....	7	142.50
94-T10.....	9	145.00	C-11.....	7	155.00	41-25 cy.....	8	235.00	Flor.....	8	275.00	58-900.....	7	165.50
95-T10.....	9	175.00	940 Comb.....	7	297.50				HiBoy.....	8	199.50	Ensemble.....	7	123.25
96-T70.....	9	147.00				EDISON						Table.....	7	95.00
			CONTINENTAL			R-1.....	6	260.00	MAJESTIC			47-900.....	7	154.50
*APEX (with tubes)			"Star Raider"			R-20.....	6	225.00	91.....	7	116.00			
100-NU.....	7	95.00				R-2.....	6	225.00	92.....	7	145.00	SPARTON		
140-NU.....	7	140.00				R-4.....	7	205.00	101 Comb.....	7	245.00	49 Batt.....	9	76.00
160-NU.....	8	160.00				R-5.....	7	174.00	181 Comb.....	7	265.00	931.....	8	179.50
60 Table.....	7	60.00				Comb. C-2.....	6	395.00				301.....	8	284.50
45 Battery.....	6	45.00				Comb. C-4.....	7	305.00	*MANDEL			110.....	10	395.00
			*CROSLEY						Chassis.....	8	100.00	111.....	10	395.00
*AUDIOLA			31.....	6	52.00	*EVEREADY						Comb. 101.....	11	795.00
8430.....	7	95.00	31, with Legs.....	6	57.50	31 Tbl.....	7	115.00	*PHILCO			Tubes included in all Sparton models.		
			41.....	7	70.00	32.....	7	157.50	LoBoy.....	7	129.50	*STEINITE		
BALKEIT			41, with Legs.....	7	75.00	42.....	7	157.50	HiBoy.....	7	149.50	Comb. 102.....	8	250.00
"C".....	8	175.00	32.....	7	99.50	43.....	7	195.00	DeLuxe HiBoy.....	7	205.00			
BRANDES			42.....	7	125.00	34.....	7	225.00						
B-10.....	6	56.00	82-H.....	7	150.00	44.....	7	225.00	*PREMIER-Chas. only					
B-15.....	7	97.50							601.....	6	45.00	*TEMPLE		
B-16.....	7	136.50	*DAYFAN			*FADA			771-M.....	7	66.00	8-60.....	8	149.00
			66.....	8	85.00	Tbl.....	7	99.50	745-D.....	7	70.00	8-80.....	8	169.00
*BREMER TULLY			68.....	8	129.50				845-D.....	8	74.00	8-90.....	8	269.00
80.....	6	60.00	69.....	8	195.00	FREED Induct. Dyn.			PT-771-M.....	7	74.00			
81.....	8	124.00	72.....	8	135.00	55 Batt.....	7	55.00	*RCA			VICTOR		
82.....	8	149.00	*EARL			56 Tbl.....	7	75.00	33-AC, with Legs.....	6	54.00	R-32.....	8	155.00
			21.....	7	92.75	NR-55.....	7	99.50	33-DC-110-V, with Legs.....	6	64.00	R-52.....	8	215.00
*BROWNING DRAKE			22.....	7	117.25	NR-56 Tbl.....	7	75.00	18.....	6	80.25	Comb.....	8	275.00
63 Table.....	9	98.00	31.....	7	116.00	NR-78.....	7	119.50	60.....	8	550.00	RE-75 Comb.....	8	350.00
666 Console.....	9	149.50	32.....	7	142.00	NR-79.....	7	145.00	66.....	7	225.00			
			41.....	8	162.50	NR-95.....	8	162.50						
*BRUNSWICK									*SENTINEL					
14.....	7	119.00							See Screen Grid Data Sheets. Other sets discontinued.					
21.....	7	144.00												
31 Phono Comb.....	7	239.00												

*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	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE
A-C DAYTON			*BROWNING DRAKE			EARL Induct. Dyn.			*GRAYBAR			*SONORA		
Batt. 98.....	7	Notcar'd	63 Table.....	9	105.00	21 Tbl.....	7	75.00	330.....	8	98.00	A-30.....	7	190.00
AC-98.....	8	Notcar'd	666 Console.....	9	149.50	21-DC.....	7	75.00				A-32.....	7	250.00
AC-9960.....	8	154.40				21-25 cy.....	7	80.00	MAJESTIC			A-40.....	7	375.00
AC-9970.....	8	175.00	*BRUNSWICK			22.....	7	99.50	91.....	7	116.00	A-36.....	7	470.00
AC-9980.....	8	192.50	14.....	7	119.00	22-DC.....	7	99.50	92.....	7	146.00	A-44.....	7	695.00
AC-9990.....	8	197.50	21.....	7	144.00	22-25 cy.....	7	104.00	101 Comb.....	7	245.00			
AC-99100.....	8	260.00	31 Phono. Comb.....	7	239.00	31.....	7	139.00	181 Comb.....	7	265.00	SPARTON		
						31-DC.....	7	139.00				49 Batt.....	9	Notst'kd
*ACME			COLUMBIA			31-25 cy.....	7	144.00	*MANDEL			931.....	8	189.50
77.....	6	115.00	C-11.....	7	155.00	Electro-Dyn.			Chassis.....	8	100.00	301.....	8	294.50
88.....	7	139.50	940 Comb.....	7	297.50	32.....	7	169.00				110.....	10	415.00
						32-25 cy.....	7	174.00	*PHILCO			111.....	10	415.00
ALL AMERICAN "LYRIC"			CONTINENTAL			41.....	8	225.00	LoBoy.....	7	139.50	Comb. 101.....	11	845.00
94-T10.....	9	158.00	"Star Raider"			41-25 cy.....	8	235.00	HiBoy.....	7	159.50	Tubes included in all Sparton models.		
95-T10.....	9	190.50							DeLuxe HiBoy.....	7	215.00	*STEWART WARNER		
96-T10.....	9	160.00				EDISON						35-900.....	7	147.00
						R-1.....	6	260.00	*PREMIER			47-900.....	7	159.25
*APEX (with tubes)						R-20.....	6	225.00	Chassis only.....			58-900.....	7	170.50
100-NU.....	7	104.50				R-2.....	6	225.00	601.....	6	45.00	Ensemble.....	7	128.50
115-NU.....	7	124.50				R-4.....	7	205.00	771-M.....	7	66.00	Table.....	7	97.50
140-NU.....	7	149.50				R-5.....	7	174.00	745-D.....	7	70.00			
160-NU.....	8	169.50				Comb. C-2.....	6	395.00	845-D.....	8	74.00	*STEINITE		
60 Table.....	7	64.50				Comb. C-4.....	7	305.00	PT-771-M.....	7	74.00	102 Comb.....	8	268.00
45 Batt.....	6	49.50												
*AUDIOLA			*CROSLEY			*EVEREADY			*RCA					
8430.....	7	95.00	31.....	6	57.00	31 Tbl.....	7	115.00	33, with Legs.....	6	54.00	*TEMPLE		
			31, with Legs.....	6	62.50	32.....	7	167.50	33-DC-110-V, with Legs.....	6	64.00	8-60.....	8	159.00
BALKEIT			41.....	7	73.00	42.....	7	167.50	18.....	6	80.25	8-80.....	8	179.00
"C".....	8	185.00	41, with Legs.....	7	78.50	43.....	7	205.00	60.....	8	98.00	Comb.....	8	289.00
BRANDES			32.....	7	105.00	34.....	7	235.00	64.....	8	550.00			
B-10.....	6	56.00	42.....	7	130.00	44.....	7	235.00	66.....	7	225.00	VICTOR		
B-15.....	7	97.50	82-H.....	7	155.00							R-32.....	8	155.00
B-16.....	7	136.00	*DAYFAN			*FADA						R-52.....	8	215.00
			66.....	8	95.00	Table.....	7	104.50	FREED Induct. Dyn.			Comb.....	8	275.00
*BREMER TULLY			68.....	8	139.50				NR-55.....	7	99.50	RE 75 Comb.....	8	350.00
80.....	6	60.00	69.....	8	205.00	*EARL			NR-78.....	7	119.50			
81.....	8	124.00	72.....	8	145.00	21.....	7	92.75	*NR-79.....	7	145.00			
82.....	8	149.00				22.....	7	117.25	*NR-95.....	8	162.50			
						31.....	7	116.00	*Latter two have electro. dyn. spkrs.					
						32.....	7	142.00						

EASTERN LIST PRICES OF SCREEN-GRID SETS

NOTE: RECTIFIER TUBES ARE NOT COUNTED IN LISTINGS BELOW.

MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE
*ACME			66 Chassis.....	7	110.00	40-S.....	7	80.00	*KENNEDY			*STEINITE		
78.....	6	130.50	Chass. DC, 61-C.....	7	76.00	41-S.....	7	65.85	220.....	7	159.00	70.....	6	118.00
88-SG.....	7	77.00	Table DC, 61.....	7	80.00	42-S.....	7	126.00	320.....	7	189.00	80.....	6	149.50
*ALL AMERICAN LYRIC			Batt. Chassis 67.....	7	58.00	82-S.....	7	160.00	KOLSTER			*STERLING		
94-SG.....	7	153.00	Batt. Table 67.....	7	62.00	*DAY-FAN			K-43.....	7	175.00	Troubador.....	7	129.50
95-SG.....	7	183.00			93.....	6	159.50	K-44.....	7	260.00	Serenader.....	7	149.50	
96-SG.....	7	155.00			94.....	6	210.00	K-45.....	9	500.00	Imperial.....	7	187.50	
AMERICAN BOSCH			AUTOMATIC TOM THUMB PORTABLES			*EARL			PEERLESS			STROMBERG CARLSON		
17.....	6	230.00	B.....	4	57.50	33.....	7	179.00	21.....	9	195.00	641.....	5	155.00
18.....	6	240.00	DeLuxe.....	4	65.00	31-S.....	7	124.00	22.....	9	245.00	25 cy. 641.....	5	155.00
19.....	6	280.00	DC.....	4	87.50	32.....	7	149.50	23.....	9	245.00	642.....	5	247.50
"L".....	6	230.00	AC.....	4	95.00	ERLA "TROPHY"			24.....	9	375.00	25 cy. 642.....	5	247.50
"R".....	6	280.00	BALDWIN			31.....	7	150.00	25 Comb.....	9	600.00	846.....	8	347.50
Table 48.....	6	119.50	Chassis.....	6	On req'st	30.....	7	169.50	*PHILCO			*SENTINEL		
Table 48-A.....	6	168.50	Low Boy.....	6	198.00	32.....	7	145.00	65.....	5	67.00	444.....	6	89.50
"J".....	6	240.00	High Boy.....	6	219.00	AR-3.....	7	134.50	LoBoy.....	5	119.50	666.....	8	99.50
AMRAD			*BREMER-TULLY			EVEREADY			HiBoy.....	5	139.50	Comb. 666-C.....	8	149.50
Aria.....	7	198.00	S-81.....	7	134.00	52.....	7	167.50	HiBoy DeLuxe.....	5	195.00	*SONORA		
Serenata.....	7	245.00	S-82.....	7	159.00	53.....	7	205.00	SCREEN GRID PLUS LINE			A-31.....	6	149.50
Symphony.....	7	295.00	*BROWNING DRAKE			54.....	7	235.00	Table 95.....	8	92.00	A-33.....	6	179.50
Duet (Comb.).....	7	495.00	56.....	9	154.50	FIRST NATIONAL			LoBoy.....	8	149.50	A-35.....	6	240.00
*ANDREA FADA			53 Table.....	9	102.50	Table.....	7	75.00	HiBoy.....	8	169.50	*TEMPLE		
15-M Chass.....	7	115.00	*BRUNSWICK			*GRAYBAR			DeLuxe.....	8	225.00	8-61.....	8	149.00
15-MZ Chass. (25-40 cycle).....	7	115.00	S-14.....	7	129.00	330 Table.....	8	98.50	RCA			8-81.....	8	169.00
25.....	6	165.00	S-21.....	7	154.00	330-F-45.....	8	175.25	Radio Victor			8-91.....	8	269.00
35-C.....	7	220.00	S-31.....	7	249.00	500 Table.....	4	75.00	44.....	4	75.00	TRAV-LER (Portable)		
35-B.....	7	255.00	COLONIAL			550.....	4	130.00	46.....	4	130.00	Standard.....	5	65.00
75.....	7	360.00	Cavalier.....	7	175.00	600.....	7	225.00	21 Batt.....	5	69.50	DeLuxe.....	5	75.00
77 Comb.....	7	675.00	Picadilly.....	7	175.00	GREBE			22 Batt.....	5	135.00	Aristocrat.....	5	100.00
*APEX (with tubes)			Modern.....	7	235.00	21950-A.....	6	219.50	Comb. 47.....	4	275.00	WARE		
11.....	6	124.50	COURIER			270-C.....	6	270.00	Comb. 67.....	8	690.00	Trianon Chass.....	5	125.00
14.....	6	149.50	650 Table.....	7	85.00	285-A.....	6	285.00	SILVER			Table.....	5	135.00
ATWATER KENT			651.....	7	140.00	Comb. 450.....	6	450.00	60.....	7	160.00	*ZENITH		
55-C, Chassis.....	6	64.00	652.....	7	165.00	GULBRANSEN			Concert Grand.....	7	173.00	52.....	8	175.00
55 Table.....	6	68.00	653.....	7	165.00	291.....	8	139.50	95.....	7	195.00	53.....	8	250.00
25 Cycle Chassis.....	6	64.00	*CROSLEY			292.....	8	149.50	*STEWART WARNER			54.....	8	370.00
25 Cycle Table.....	6	68.00	30-S Chassis.....	6	62.00	200 (Comb.).....	8	235.00	Cabin't 35, M'd 950	7	142.50	55 Comb.....	8	700.00
60 Chassis.....	7	76.00	31-S.....	6	56.50	KELLOGG			Sher't'n 58, M'd 950	7	165.50	57.....	8	495.00
60 Table.....	7	80.00	33-S.....	6	211.00	523.....	8	175.00	Consolette ens'ble.	7	123.25			
						524.....	8	225.00	Table Model.....	7	95.00			
						525 Comb.....	8	395.00	Model 47-950.....	7	154.50			

*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	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE
*ACME			60 Table.....	7	84.00	*CROSLEY			KELLOGG			SILVER		
78.....	6	130.50	66 Chassis.....	7	115.00	31-S.....	6	95.00	523.....	8	219.50	60.....	7	170.00
88-SG.....	7	77.00	Chass. DC, 61C.....	7	61.00	33-S.....	6	114.50	524.....	8	296.00	Concert Grand.....	7	183.00
*ALL AMER "LYRIC"			Tbl D C. 61.....	7	65.00	41-S.....	7	106.50	Comb. 525.....	8	471.00	95.....	7	210.00
94-SG.....	7	166.00	ARCO			42-S.....	7	135.50	*KENNEDY			Special Cabinets for Coast only.		
95-SG.....	7	198.50	Chassis.....	8	75.00	43-S.....	7	124.50	220.....	7	159.00	"Princess".....	7	170.50
96-SG.....	7	168.00	*AUDIOLA			82-S.....	7	155.50	320.....	7	189.00	"Aristocrat".....	7	195.00
American BOSCH			Chassis.....	6	85.00	Table models, 31-S and 41-S, quoted with speaker.			KOLSTER			"De Luxe".....	7	216.00
16.....	6	205.50	AUTOMATIC TOM THUMB PORTABLES			*DAY-FAN			K-43.....	7	188.00	*SONORA		
17.....	6	237.00	B.....	4	60.00	93.....	6	169.50	K-44.....	7	275.00	A-31.....	6	154.50
18.....	6	248.00	DeLuxe.....	4	67.50	94.....	6	220.00	K-45.....	9	522.50	A-33.....	6	186.50
19.....	6	290.00	DC.....	4	90.00	EARL			PEERLESS			A-35.....	6	245.00
"L".....	6	238.00	AC.....	4	99.00	33.....	7	179.00	21.....	9	207.00	*STERLING		
"R".....	6	290.00	BALDWIN			ERLA "TROPHY"			22.....	9	260.00	Troubador.....	7	139.50
Table 48.....	6	122.50	Chassis.....	6	On req's	31.....	7	158.50	23.....	9	260.00	Serenader.....	7	165.00
Table 48-A.....	6	172.50	Low Boy.....	6	198.00	30.....	7	179.50	24.....	9	400.00	Imperial.....	7	201.00
"J".....	6	248.00	Highboy.....	6	219.00	32.....	7	152.50	25 Comb.....	9	635.00	*STEWART WARNER		
WESTERN CONSOLES			*BREMER-TULLY			EVEREADY			*PHILCO			Cabin't 35, M'd 950	7	147.00
140.....	6	174.50	S-81.....	7	134.00	52.....	7	167.50	65.....	5	72.00	Sher't'n 58, M'd 950	7	170.50
141.....	6	154.50	S-82.....	7	159.00	53.....	7	205.00	LoBoy.....	5	129.50	Consolette ens'ble.	7	128.50
149.....	6	194.50	*BROWNING DRAKE			54.....	7	235.00	HiBoy.....	5	149.50	Table Model.....	7	97.50
AMRAD			56.....	9	154.50	GILFILLAN			HiBoy DeLuxe.....	5	205.00	Mod. 47-950.....	7	159.25
Aria.....	7	213.00	53 Table.....	9	109.50	Console.....	8	156.50	"Screen Grid Plus" Line			*STEINITE		
Serenata.....	7	260.00	*BRUNSWICK			Console.....	8	175.50	Table 95.....	8	102.00	70.....	6	125.00
Symphony.....	7	310.00	S-14.....	7	129.00	Console.....	8	187.00	LoBoy.....	8	159.50	80.....	6	157.50
Duet (Comb.).....	7	520.00	S-21.....	7	154.00	*GRAYBAR			HiBoy.....	8	179.50	STROMBERG CARLSON		
*ANDREA-FADA			S-31.....	7	249.00	330 Table.....	8	98.50	DeLuxe.....	8	235.00	641.....	5	165.00
15-M Chassis.....	7	120.00	COLONIAL (Add Fr eight)			330-F-45.....	8	175.25	*PREMIER			25 cy. 641.....	5	165.00
15-MZ (25-40 cy.).....	7	120.00	Cavalier.....	7	175.00	500 Table.....	4	75.00	724.....	7	On Request	642.....	5	272.50
25.....	6	172.00	Picadilly.....	7	175.00	550.....	4	130.00	*RCA Radio Victor			25 cy. 642.....	5	272.50
35-C.....	7	227.00	Modern.....	7	235.00	600.....	7	225.00	44.....	4	75.00	846.....	8	377.50
35-B.....	7	265.00	COURIER			GREBE			46.....	4	130.00	*TEMPLE		
75.....	7	370.00	65 Table.....	7	88.00	21950-A.....	6	223.50	Batt 21.....	5	69.50	8-61.....	8	159.00
77 Comb.....	7	695.00	651.....	7	148.00	270-C.....	6	274.00	Batt 22.....	5	135.00	8-81.....	8	179.00
*APEX (with tubes)			652.....	7	175.00	285-A.....	6	292.00	Comb. 47.....	4	275.00	8-91.....	8	289.00
11.....	6	124.50	653.....	7	175.00	Comb. 450.....	6	465.00	Comb. 67.....	8	690.00	*ZENITH (with tubes)		
14.....	6	149.50				GULBRANSEN			*SENTINEL			52.....	8	225.00
ATWATER KENT						291.....	8	149.50	444.....	6	89.50	53.....	8	300.00
55-C, Chassis.....	6	67.00				292.....	8	159.50	666.....	8	99.50	54.....	8	425.00
55 Table.....	6	71.00				200 Comb.....	8	235.00	Comb. 666-C.....	8	149.50	55 Comb.....	8	750.00
60 Chassis.....	7	81.00												

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

BAND-PASS TUNING

(Continued from Page 48)

coupling such as to give constant selectivity even including the effect of coil resistances. The latter tends to make the resonance curves much wider at 1500 kilocycles since the optimum value of coupling would be lost, though antenna coupling circuit and regenerative effects would usually compensate for this in gain.

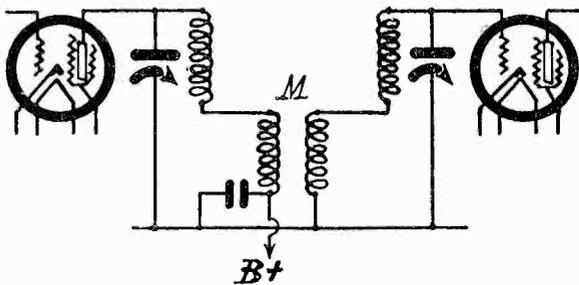


Fig. 4. Another Combination of Inductive and Capacitive Coupling

The circuit shown in Fig. 4 is equivalent to Fig. 3b since there exists a slight capacitive coupling between the two small coupling inductances. This is also equivalent to the scheme of using a single common inductance. But the former has the advantage of isolating the grid circuit of the following tube from the plate battery without using stopping condensers and grid-leaks. Usually the capacitive coupling will not be sufficient in practice to give the desired band-pass effects when this form of inductive coupling is used. The only quick way of determining what the equivalent C_m is, in respect to the high potential parts of the circuit, is to measure the selectivity of one or more stages of amplification using this circuit.

Another point which sometimes determines r-f coil design is the "salesmen's selective viewpoint." People, especially salesmen, are used to "mellow" toned radio reproduction in which the high frequencies are cut down from 10 to 30 db. So if the r-f coil design does not cut side-bands and attenuate the high audio frequencies, a shunt condenser is placed in the audio amplifier system to do that very thing.

Most receivers tune very sharply at 550 kilocycles and a band-pass scheme of the same number of tuned circuits will apparently lower the selectivity greatly. For this reason present-day band-pass tuning systems are invariably designed with the value of k so low as to give but a single resonant peak at 550 kilocycles with resultant side band cutting. However, as stated before, "band-pass tuning" has a nice sales appeal from a standpoint of what it should do rather than what it actually does do in practice.

In production no radio receiver can have its tuned circuits exactly in alignment throughout the broadcast band.

This means in a band-pass tuning stage that one resonant peak will be higher than the other and if ordinary tuned-secondary r-f transformer circuits are used elsewhere in the set, one of these peaks will probably be lined up and the other one not. This would give an overall selectivity curve with a small bump or hump part way down the curve with apparently broad tuning effects.

This is simply another reason why all so-called band-pass tuners are adjusted in quantity production radio receivers to give but a single resonant peak for maximum selectivity.

There is another form of capacity coupling which is being used at present and which has good possibilities from a standpoint of band pass effect. This circuit is shown in Fig. 5. Here k is given by the expression $k = C \div (C + C_m)$, where $C = C_1 = C_2$. This is nearly the

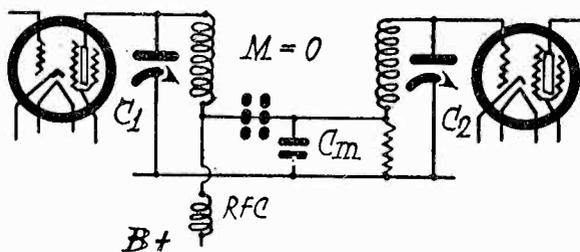


Fig. 5. Capacitive Coupling to Give Constant Selectivity

inverse of the expression given for the other form of capacity coupling where $k = C_m \div (C + C_m)$. From this it can be seen that C_m must here be quite large. C_m is usually of the value of .01 to .03 μf in the former. In the latter case the reactance of C is a series effect common to both tuned circuits. Substituting the values of .0004 μf at 550 kilocycles

$$\text{we have } k = \frac{.0004}{.0004 + .02} = .0196 \text{ and}$$

$$\text{at 1500 kilocycles, } k = \frac{.000054}{.000054 + .02} = .0027.$$

$$\text{The band width comparison would be } \frac{.0027}{.0196} \times \frac{1500}{500} = .375 \text{ or about}$$

one-third width at 1500 kilocycles.

In actual practice, due to the higher resistance of the tuned circuits at 1500 kilocycles (this is not taken care of in the above formulae), the band width would be ample at that end of the band. In most commercial r-f coils the selectivity curve at 1500 kilocycles is wide enough at the top without a double peak. It is only towards the other end of the broadcast band that a double peak is necessary to give a 10 kilocycle flat-top band-pass tuning effect. One disadvantage of this circuit is that while the selectivity curve may remain constant, the amplification does not unless the gain is raised some place else in the receiver at the high frequency end.

As far as quality of reproduction of audio frequencies is concerned, the use of such a device in one stage only means very little. The use of such a circuit purely as a selective tuner ahead of the first tube in a receiver has its value in reducing modulation effects between some powerful local signal and the desired signal to which the receiver is tuned.

Some of the selectivity curves published in RADIO during the past few months were proofs of the "band-pass tuning" effects discussed. These may be studied by anyone sufficiently interested in this matter.

There are two, or rather three, other forms of obtaining band-pass tuning which may be discussed in a future article. These have their good points and bad points, but I believe have greater possibilities than those discussed in this article. These systems are: staggered tuned circuits, rejector and acceptor tuned circuits, and fixed resonant primary, tuned secondary r-f transformer coupled circuits.

SCREEN-GRID TUBES

(Continued from Page 47)

and condenser are the same as in the case of the screen-grid connection. This type of detector will give very excellent results with code signals, but is not entirely satisfactory for broadcast reception because of the high μ of the space-charge grid amplifier. Grid-leak detection always gives poor reproduction of the high notes with the high μ tubes because of feed-back effects through the plate-grid capacity. The space-charge grid tube is no exception to this rule, and so is recommended only for code signals, where it will function splendidly.

PUBLIC ADDRESS INSTALLATIONS

(Continued from Page 35)

sistor is connected across the speaker terminals and mounted on the wall plate for volume control.

In hooking up the works Mr. A. J. Nachbaur, who handled the radio phase of the job for the Alta Electric Company, found that there are just two places where weaknesses may develop, those being the switches and volume control resistors in the rooms. It was therefore necessary, in order to insure reliable service, to avoid the use of the light contact switches ordinarily found in radio work and supplement them with more expensive telephone switches and carbon resistors.

TOBE

Filterette

DECEMBER, 1929

SOURCES OF INTERFERENCE

Analysis Shows Appreciable Percentage Preventable

IN VIEW of the storm which has been raging over the question of radio interference, an analysis of a typical list of sources may prove enlightening. While the statement has been made that the amount of prevention which can be accomplished is negligible in proportion to the whole, the individual who knows that his own trouble *can* be remedied has little interest in knowing that others are less fortunate than himself: what he wants is action—and clear radio reception.

It may be interesting to learn, then, that the percentage of reported causes which are preventable is by no means small even when we take into account such present stumbling-blocks as street cars, telephone dialing and heterodyning stations.

Not infrequently we are asked the question, "Well, what can you do if the interference is on somebody else's premises and they refuse to do anything about it?" We freely grant that there are still many instances in which it is not possible to aid the beleaguered listener: what we do resent is the implication that because we cannot help in one hundred per cent of the cases we should at once drop the seventy-five which can be stopped.

In communities like Los Angeles, where radio interference prevention laws have been adopted, the percentage of preventable causes is necessarily higher because the investigator is empowered to invoke the law, when, in his estimation, the circumstances warrant.

The owner of a cheap battery charger, for example, who ruins reception in an entire apartment house and deliberately refuses to go to the slight trouble entailed in correcting this nuisance, certainly de-

(Continued on Page 76)



EARL R. HAYES, SERVICE

The Watchword of Tobe has always been "Service" and we take pleasure, in this connection, in reproducing here the pleasing countenance of Mr. Earl R. Hayes, whose tireless efforts have been largely instrumental in making this pledge to Tobe users a fact.

TOBE WHIPS DELCO LIGHT INTERFERENCE

At the moment of going to press, we have just been informed by the engineering department that they have succeeded in developing a successful Filterette for the elimination of radio interference from Delco Lighting Equipment Systems. The next issue of the *Filterette* will contain full details of the designing of this Filterette and its application.

Advertisement

INTERFERENCE THREATENS TO BANKRUPT DEALERS

Showrooms Leased, Decorated, Now Cannot Demonstrate

AT THE recent radio show in New York a man walked up to the Tobe booth and pointed to the sign, "Man-made Static Can be Stopped."

"I'd give five hundred dollars," he said, "if I could believe that."

The engineer in charge of the booth saw that the man really meant it.

"What's your trouble, sir?" he asked, "we may be able to help you."

"Well, here's the story. I've just leased a showroom on Blank Avenue (I'm carrying a high-priced line, you know; the people in that neighborhood want the best) and I spent a lot of money fixing it up, you know—tapestries, orientals on the floor, separate booths, floor lamps, had a decorator in and he did the whole place over—and now the interference there is so bad you can't demonstrate a set."

"What have you done about it?" asked the engineer.

"Well, we had our service man look the situation over and he tried some condensers but he didn't have much luck, and somebody told me about your outfit, so I thought I'd ask you people if you could suggest anything. As I say, I've only just leased this place, the term is five years, and here I am with a big bill on my hands for decorating a showroom that I can't even demonstrate a set in. I'm not a rich man, by any means, but unless I can get rid of that interference, I might as well close up shop. And I wouldn't be the first. Another fellow up the street folded up last week for just the same reason. I'd gladly give anything up to five hundred dollars to get rid of that racket!"

"Well," said the engineer, "I'm not here to do field work, but you seem to

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Filterettes— An Engineering Problem

Three Distinct Factors Embodied in Correct Filterette Design

By R. L. HASKINS

Engineer-Director of Laboratory

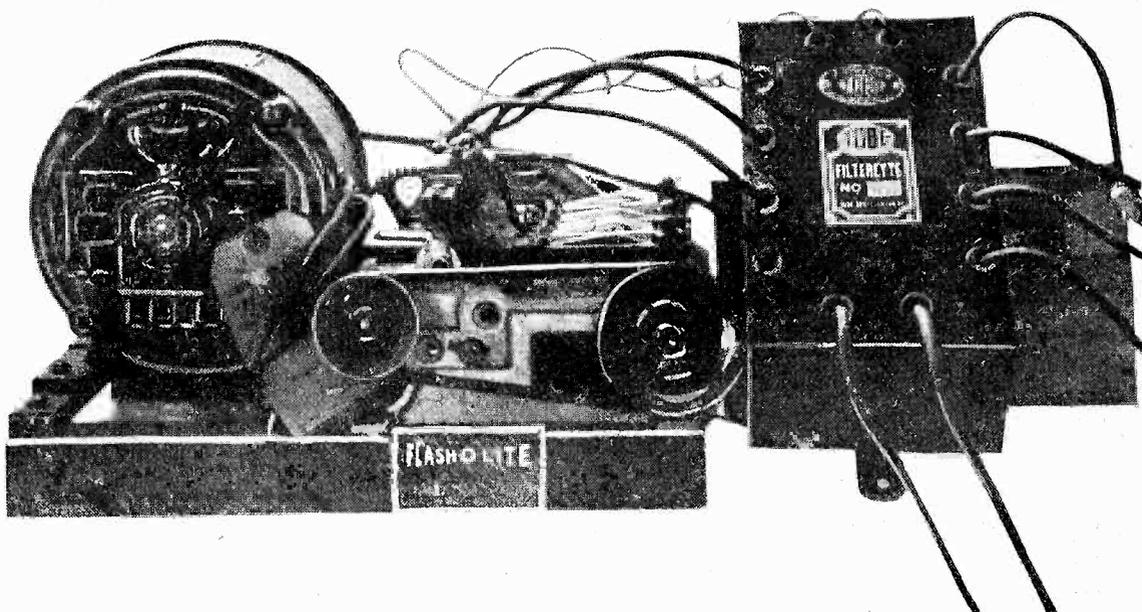
A FILTERETTE is a device embodying radio, electrical and mechanical design, the value of each of these components being an important factor in its successful operation.

The need for such a device was the logical outcome of increased radio interference caused by the operation of unfiltered electrical apparatus in the vicinity of radio sets. This interference usually originates in a sparking circuit, the constants of which determine the intensity of the interference set up thereby. The function of the Filterette is to suppress these undesirable transients and to confine them to a limited area, usually the distance between the apparatus and the Filterette.

It will readily be seen from the above explanation that it is advisable for best results, that the Filterette should be installed as close as possible to the spark circuit of the apparatus to be filtered, in order that the area of interference may be as limited as possible.

Each of these characteristics of a Filterette—radio, electrical, and mechanical—varies, as a rule, with the individual apparatus to which it is to be applied. For example, an engineer who has already succeeded in devising a filter circuit which completely stops interference from a specified apparatus, may have to work three times as long in accommodating the filter circuit to the space allotted. Let us say that he has found that to eliminate the interference caused by the sparking of the brushes at the commutator of a vacuum cleaner motor a small capacitor type Filterette is adequate. The filter, from a radio standpoint, is completed. But there remain the other two factors, mechanical and electrical.

Among the mechanical factors to be considered are space, shape, heat, weather, accessibility, and so forth. Let us suppose that the manufacturer of the vacuum cleaner wants the Filterette to be built on the frame of the motor and into a given space, and that the Filterette which has already been demonstrated to be efficient will not fit the space allotted. A new Filterette must be built to meet these requirements which, by the way, are usually extremely awkward, owing to the fact that most apparatus was not



Multi-Contact Flasher with Filterette

After the r-f characteristics and electrical constants have been successfully determined, a temporary installation, as here shown, is made on a standard motor-driven, four-circuit flasher. This illustrates the second stage in the design of N. Y. L. No. 4 Filterette.

designed with the idea of incorporating a filter into its construction, and little space is therefore available for its insertion.

But this is not all. There still remains the electrical factor—the voltages which the filter must withstand, the wattage consumed, the effect of the filter on the operation of the apparatus to which it is to be attached, and similar requirements, all of which must be met satisfactorily before the filter can be passed.

Not infrequently, moreover, these requirements demand modification of the other two. It may be found, for example, that a capacitor of greater dielectric strength must be employed to meet the electrical requirements. This means that additional space, not always available, will be required. Cases have even been encountered where the use of wire capable of handling the required currents and wattages fails to suppress the interference when the use of a smaller size wire, which was used in the filtering experiments, has already been shown to work satisfactorily. This means that the work of devising the filter circuit must be begun all over again, in order to develop a filter which shall employ the requisite size of wire.

We have used for the sake of example, one of the easiest types of devices to fil-

ter, a vacuum cleaner. The capacity was found by a short experiment, the voltage of the condenser was obtained by test, giving the electrical constant, and the mechanical design was determined by the space allowed and the size of the condenser.

But suppose we consider now a piece of electrical apparatus that requires a more complicated Filterette, and see the work involved in the completion of its design—a four-contact, multi-circuit flasher. Analysis of this apparatus shows four circuits, each breaking a load circuit, and one lead which is common to the four flasher circuits. Thus we see, by a study of the wiring diagram of the flasher, there are five outlets for the interference—the five leads leaving the flasher. These five leads must first of all be filtered, as described in November RADIO, in order to establish the r-f constants of the filter circuit.

From the rating on the flasher mechanism we learn that each breaking contact arm is rated at 1000 watts, that is to say, if the mechanism is being used at its maximum capacity, each contact arm will break approximately 10 amperes and the common lead will carry approximately 40 amperes, this last ratio depending upon the time ratio of the break-

ing arms of the flasher. This time ratio is usually given in blueprint form with the flasher, and from this the correct value of current in the common lead may be obtained. We now have an electrical problem dealing with 60 cycle current.

Our experiment in developing a filter circuit has established the fact that we must use an inductive-capacitive type filter. Such a filter will embody an inductance designed to handle the above load, and a capacitor which will stand the above voltage. These requirements are absolutely essential, as this filter has now become a piece of electrical equipment, and must pass certain tests speci-

ination. The diathermy machine, whose filtering was discussed in a recent issue of the *Filterette*, required not only a special filter but a totally screened compartment for machine, operator and patient. The devising of the filter was the least part of the laboratory research on this problem which occupied in all an entire month.

Similarly, the cost of filtering certain types of apparatus is all out of proportion to the cost of the apparatus itself. A \$25 hand violet ray machine, for example, requires a filter costing \$15 and a screen costing \$75, a total cost of \$95 for suppressing the radio interference from a piece of electrical apparatus

NEW UNIVERSAL FILTERETTE FOR SIGN FLASHERS

The Filterette Laboratories of the Tobe Deutschmann Corporation have just announced a new and improved Filterette which will totally eliminate radio interference from any motor-driven sign flasher having from one to four contact arms, where the load per contact is not over 1000 watts.

Reports of the engineering department show that exhaustive research was necessary on this flasher, the engineers worked hard on it, and say that it is one of the best jobs they ever turned out. This Filterette, N. Y. L. No. 4, illustrated on page 74, is the result of laboratory research work undertaken at the request of the New York Power and Light Company, mention of which has previously been made in this publication. It will list for \$30.

INTERFERENCE THREATENS TO BANKRUPT DEALERS

(Continued from Page 73)

be in a pretty bad fix, and perhaps I can take a run up there before the week is up."

And he kept his word. What he found was this: a motor-generator set, used for converting d-c to a-c to demonstrate alternating current sets, and various minor causes, from telephone dialing to the plopping sound which told of a switch being turned on.

"Can you shut off this converter for about fifteen minutes?" the engineer asked.

"Sure thing, anything you want if it will help to straighten things out."

Some time after the engineer called out, "All ready, try your set now and see whether you get it."

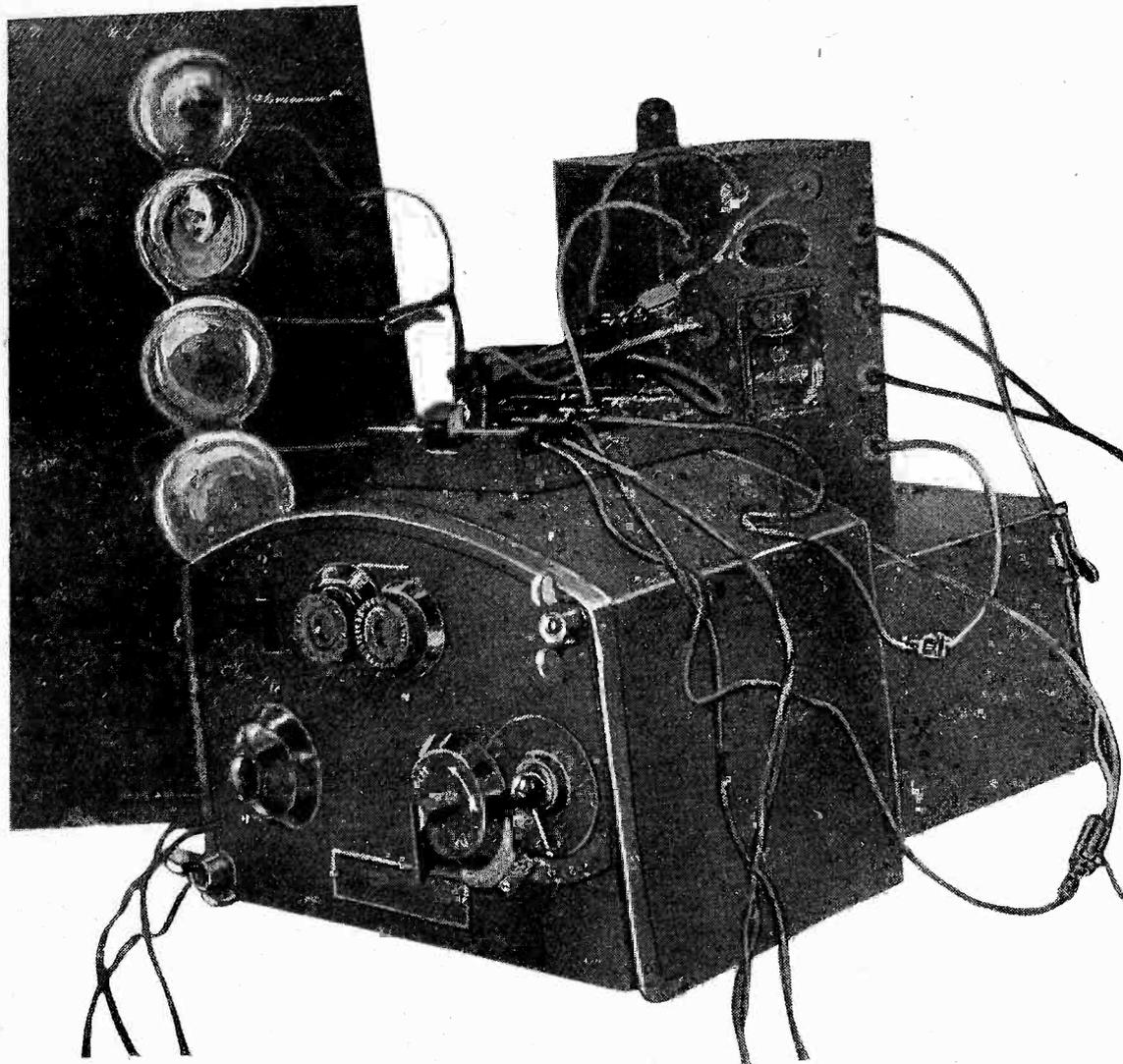
After a minute the dealer called back, "It seems to have gone."

To satisfy himself the engineer went out to the front of the store where the dealer was listening on a set. He turned the dial first rapidly then slowly, but at no point did he pick up the roar which had blasted through so deafeningly a short time before. Even on the lower wavelengths the set was quiet, except for an occasional snap.

"Some difference, eh?" said the dealer, chuckling.

"It's a lot better, all right," said the engineer, "you've got to expect a certain amount of noises in the midst of a city, of course, but I guess you won't have any difficulty in convincing them that it is a fine sounding set."

The dealer laughed, "And the best of it is I won't have to tell them any more, 'Oh, it won't sound like that when you get it home!'"



Time Switch for Street Signals, with Filterette

Just a mass of wires, but who would think that 26 days were spent in designing this Filterette?

fied by the underwriters. Assuming that these constants have been worked out, what mechanical layout is required to complete our assignment?

In this phase of Filterette design, the last, but by no means the least, we have a number of factors to consider.

It has been established, by long experiment, that a large percentage of electrical appliances which come to the laboratory for elimination of radio interference, require, in addition to the application of a filter, some sort of additional shielding to supplement the work of the filter itself.

Oil burner ignition systems, for example, require, as a rule, the addition of some sort of shielding to the high tension leads in order to secure complete elim-

costing \$25—obviously impractical.

It is hoped that this article will convey some impression of the difficulties encountered in devising filters of the so-called universal type, which shall be suitable for application to not one, but many types of widely diverse pieces of electrical apparatus.

AN EXCELLENT RECORD!

Among the most successful of the Authorized Filterette Service Stations in New England is that maintained by Hobart W. Troop of Dorchester, Mass. Mr. Troop is constantly on the alert for new potential interference sources, and writes us not only of his problems, but also of his successes.

SOURCES OF INTERFERENCE

(Continued from Page 73)

serves small consideration. It is significant that investigators rarely run across cases of this kind: the average man is only too glad to cooperate when he finds that the cost and trouble occasioned amount to very little.

Let us take, at random, a list of causes from the report of a prominent radio interference committee:

Oil burner in bakery.	Packing house interference.
Construction work on building.	Heating pad.
Set trouble.	Caution signal.
Code interference from amateur.	Defective 227 tube.
High frequency apparatus.	Defective rectifying tube in eliminator.
Dentist's drill.	*Short wave click.
Thermostatic control on still.	*30,000-volt line in front of house.
Theatre sign.	Transformer pole which brings trouble if shaken.
Doctor's equipment.	Loose bonds on street railway.
*Heterodyne whistle.	Defective sign flasher.
Batteries down and tubes flat.	Defective power pack.
*Broadcasting station in neighborhood.	Hair dryer.
Tightening bonds.	Quarrel about aerial.
Wig-wag—new condenser.	*Cause not determined, radio returned to store before investigation.
Traffic signal.	Battery charger.
Fuses, cutouts, loose plugs in floor lamps.	Trees rubbing wires.
Ice machine.	*Arc welder.
Low voltage.	
Incubator.	
Violet ray.	

* Causes marked with asterisk probably impossible to remedy.

The list examined contained, of course, many duplications which have been omitted here. It is evident, however, that a large majority of the causes reported can be remedied.

The report, "Cause not determined, radio returned to store before investigation" is also significant. Whether or not the customer's despair was premature, the fact remains that there must still be many such instances where a little investigation might disclose some easily remedied cause of interference, and in this way the sale would go through.

At a recent radio show the writer was questioned by a listener who complained that his set located in the vicinity of Boston "always made an awful noise when you listened to stations on the Pacific Coast." We who are in the midst of radio are likely to forget how little the public sometimes knows about it. That man might have returned his set to the dealer if no one had explained the workings of static to him. Now he understands that he has an exceptional set, and instead of thinking that the dealer cheated him, he takes pride in the distance his set will pull in.

And so, when a customer says a set is "noisy," don't give up too soon. Try a personal investigation, and perhaps a filterette will remedy the trouble.

INTERFERENCE ENGINEERS CLEAN UP

So desperate is the need for competent radio interference engineers that many contracts, running into thousands of dollars, are going begging for want of sufficient competent men to take them over.

Contracts often cover a whole municipality, and the smallest take in at least the interference from all the machinery of a modern plant or a factory. It will readily be seen that a trained interference engineer, of which there are startlingly few, need never want for employment, and, if industrious, can boast of an enviable salary.

Such excellent firms as the Cross Engineering Company, of Carbondale, Pennsylvania, refuse to incur the displeasure of their neighbors by allowing the slightest taint of radio interference from their plant. At their request a Tobe engineer is now making an interference survey of their premises.

Such public-spirited action commends itself to the approbation of all. It is hoped that more of our rising young engineers will see the possibilities of cooperation in work of this sort, for the public betterment.

TOBE INTERFERENCE MANUAL JUST OFF THE PRESS

A NEW study of interference problems entitled "Filterette Service Manual" is just off the press. It contains in simple question and answer form the inquiries received most frequently by our Service Department.

Since January 1 over 67,000 inquiries and requests for information have been received and answered by our Service Department. In no instance has this correspondence been handled with form or mimeograph letters. While this service will be continued as usual, we believe that every service man interested in the problems of this nature will see the advantage of having a complete file of information ready at hand.

This manual contains circuit diagrams, descriptive matter and other features essential to the practical service man. It will be sent postpaid on receipt of 25c, price of the book.

"CO-OPERATION DOES IT," SAYS TOBE

While it is generally conceded that the end of radio interference must come through co-operation and not legislation it is not so generally known that the secret of Tobe's own success is the helpful co-operation between officials and executives at the company's plant at Canton, Mass.

No sooner is word received of the

designing of a net unit than all departments are busy, each preparing his own contribution to the perfect whole. The planning department is listing material required, the artists designing blueprints, the engineers striving for simplicity and ease of assembly by the elimination of unnecessary parts, the purchasing department ordering supplies from all parts of the country, the publicity department acquainting the public with the new unit, and so, all are awaiting the word for production to start.

OUR SERVICE MEN'S COLUMN

The first time you strike a Filterette installation that is new to you, an oil burner, when you have been doing a lot of vacuum cleaners and ice-machines, don't get stage fright. Remember—we're back of you.

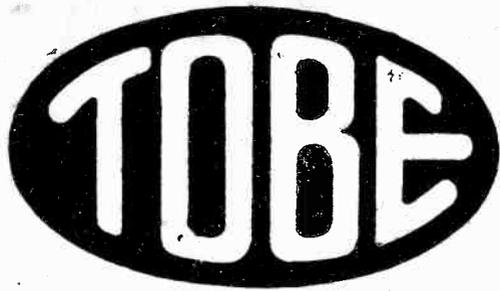
Filterettes are new. *We* don't know *everything* about them. We are still learning. So how can *you* expect to be able to handle every problem offhand?

In tackling a cranky installation, try going at it this way. Imagine that the apparatus causing the interference is a transmitter (which it is) and say to yourself, "Now where can I find the transmitting antenna of this apparatus so that I can effectually muzzle that?"

Only too often we ourselves have discovered that we couldn't just attach a couple of wires and sit back and wait for the Filterette to work. We have had to design thirty-two different models to take care of every type of interference and we are still developing new models, so you will readily see that there may be other types that we ourselves haven't yet run up against. We can fix them but we'll have to work over them, and if you're the first man to run into them—the discoverer, so to speak—to you goes the work—and the credit—of devising a Filterette hook-up best adapted to take out the interference.

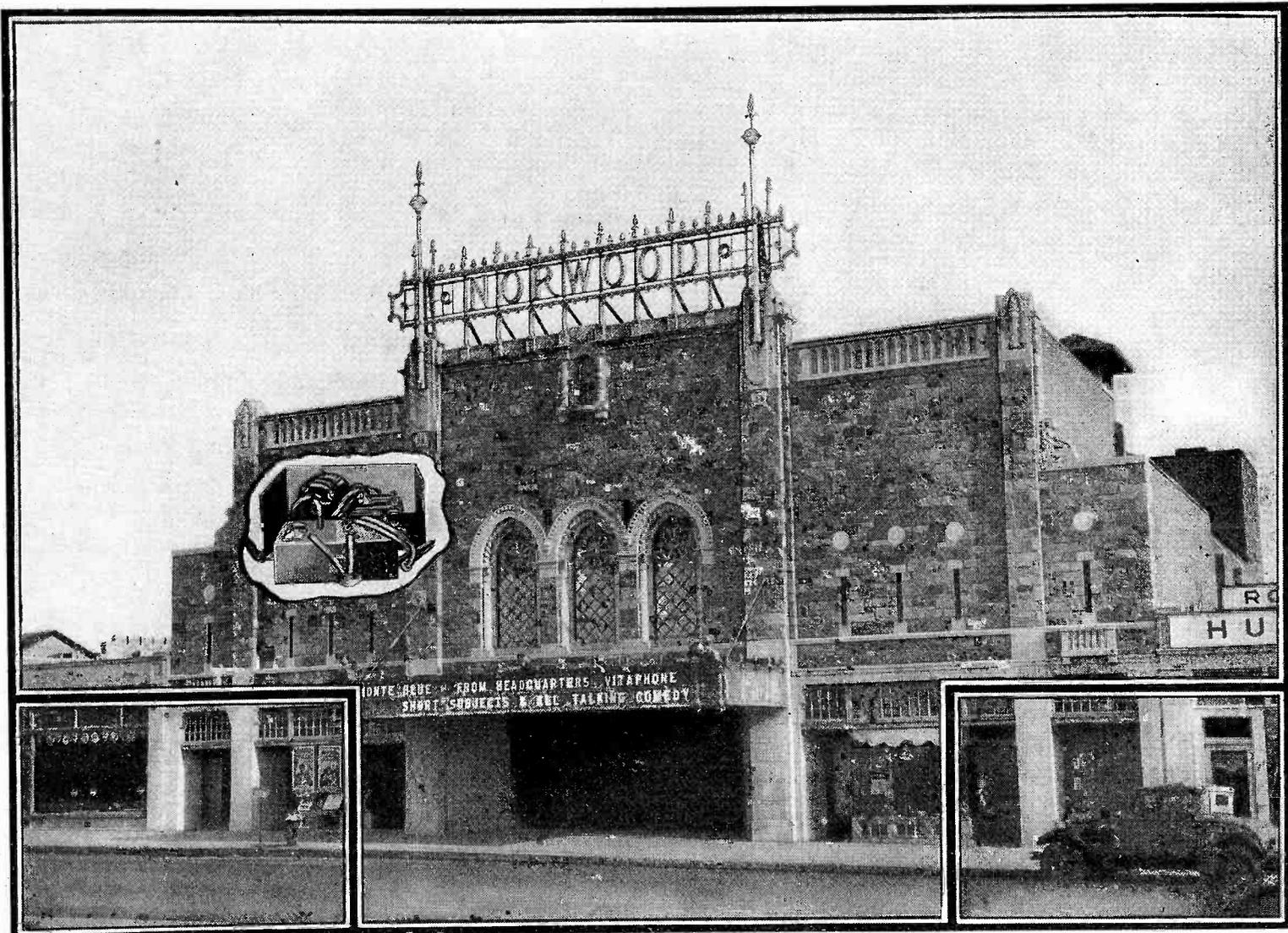
So, if you run up against any new problems, or any cranky ones, don't give up right off; put in a little time on it, try different hook-ups, find the antenna, and then, if you are stumped, write us. And please, oh please, until television is perfected, write FULL DETAILS!

And if any of the more enterprising among you happen to discover a new wrinkle, a trick installation, a time-saver, a handy knack of some sort, send it in. We'll publish it, give you credit, and, if you're good-looking, we'll publish your picture, too. Let's go!



TOBE RESEARCH SCORES AGAIN»»»»

Interference from Flashing Signs Positively Eliminated



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
CANTON, MASS.

*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.....

.....

Who Makes It

Classified Index of Radio Equipment and Its Manufacturers Corrected Monthly

Key to Letters and Numbers

- A-1 The Abox Co., 215 N. Michigan Avenue, Chicago, Ill.
A-2 The A-C Dayton Co., 300 E. First St., Dayton, Ohio.
A-3 Accusti-Cone Laboratories, 1 N. Seventh, Philadelphia, Pa.
A-4 Acme Apparatus Corp., 37 Osborn St., Cambridge, Mass.
A-5 The Acme Elec. & Mfg. Co., 1444 Hamilton Ave., Cleveland, Ohio.
A-6 Acme Products Co., 22 Elkins St., South Boston, Mass.
A-7 The Acme Wire Co., New Haven, Conn.
A-8 The Actron Corp., 123 N. Sangamon St., Chicago, Ill.
A-9 Adler Mfg. Co., 29th and Chestnut Sts., Louisville, Ky.
A-10 Adrola Corp., Fort Jefferson, N. Y.
A-11 Advance Electric Co., 1260 W. 2nd St., Los Angeles, Calif.
A-12 Aerial Insulator Co., Inc., 429 N. Washington St., Green Bay, Wis.
A-13 Aero Products, Inc., 4611 E. Ravenswood Ave., Chicago, Ill.
A-14 Aerovox Wireless Corp., 70 Washington St., Brooklyn, N. Y.
A-15 Ajax Electric Specialty Co., 1926 Chestnut, St. Louis, Mo.
A-16 Akron Porcelain Co., Akron, Ohio.
A-17 Alden Mfg. Co., Brockton, Mass.
A-18 Aladdin Mfg. Co., 602 E. 18th St., Muncie, Ind.
A-19 All-American Mohawk Corp., 4201 Belmont Ave., Chicago, Ill.
A-20 Allan Mfg. Co., 102 N. Fifth St., Harrison, N. J.
A-21 Allen-Bradley Co., 494 Reed St., Milwaukee, Wis.
A-22 Allen-Hough-Carryola Co., 279 Walker St., Milwaukee, Wis.
A-23 Aluminum Co. of America, 2400 Oliver Bldg., Pittsburgh, Pa.
A-24 American Bosch Magneto Corp., Springfield, Mass.
A-25 American Electric Co., 64th and State St., Chicago, Ill.
A-26 American Hard Rubber Co., 11 Mercer St., New York City.
A-27 American Lava Corp., 29 William St., Chattanooga, Tenn.
A-29 American Porcelain Co., Akron, Ohio.
A-30 American Radio Hardware Co., 135 Grand, New York City.
A-31 American Reproducer Corp., 1200 Summit St., Jersey City, N. J.
A-32 American Transformer Co., 178 Emmet St., Newark, N. J.
A-33 Amoroso Mfg. Co., 60 India St., Boston, Mass.
A-34 Amplex Instrument Labs., 132 W. 21st St., New York City.
A-35 Amplion Corp. of America, 133 W 21st St., New York City.
A-36 The Amrad Corp., 205 College Ave., Medford, Mass.
A-37 Anaconda Wire & Cable Co., 111 W. Washington St., Chicago, Ill.
A-38 F. A. D. Andrea, Inc., Jackson, Orchard and Queen Sts., Long Island City, New York.
A-39 Anylite Electric Co., Fort Wayne, Ind.
A-40 Arc-Aerial Inc., Green Bay, Wis.
A-41 Arco Electrical Corp., 207 E. Columbia St., Fort Wayne, Ind.
A-42 Arcturus Radio Tube Co., 260 Sherman Ave., Newark, N. J.
A-43 Argon Tube Corp., 102 Livingston, Newark, New Jersey.
A-44 Argus Radio Corp., 257 W. 17th St., N. Y. C.
A-45 Armstrong Electric Co., 187 Sylvan Ave., Newark, N. J.
A-46 Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa.
A-47 Arnold Electric Co., Racine, Wis.
A-48 Aston Cabinet Mfrs., 1223 W. Lake St., Chicago, Ill.
A-49 Atlantic Electric Lamp Co., Salem, Mass.
A-50 Atlas Radio Corp., Peabody, Mass.
A-51 Atwater Kent Mfg. Co., 4700 Wissahickon Ave., Philadelphia, Pa.
A-52 Auburn Button Wks., Inc., Auburn, N. Y.
A-53 Audak Co., 565 Fifth Ave., New York City.
A-54 Audiola Radio Corp., 430 S. Green, Chicago, Ill.
A-55 The D. L. Auld Co., 5th Ave. and 5th St., Columbus, Ohio.
A-56 Automatic Radio Corp., 1014 Chamber of Commerce Bldg., Cincinnati, Ohio.
A-57 Automobile Radio Corp., 1475 E. Grand Blvd., Detroit, Mich.

- A-58 American Battery Corp., 2053 N. Racine Ave., Chicago, Ill.
A-60 American Apparatus Co., Richmond, Ind.
A-61 American Storage Battery Co., 128 Dartmouth, Boston, Mass.
A-62 American Piezo Supply Co., 1101 Huron Bldg., Kansas City, Mo.
A-63 Amperite Corp., 561 Broadway, New York City.
A-64 Alpha Wire Corp., 520 Broadway, N. Y. C.
B-1 Bailey-Cole Electrical Co., 1341 Flatbush Ave., Brooklyn, N. Y.
B-2 Baldor Radio Corp., 80 4th Ave., N. Y. C.
B-3 Nathaniel Baldwin, Inc., 3474 S. 23rd St., E., Salt Lake City, Utah.
B-4 Balkeit Radio Co., North Chicago, Ill.
B-5 Barkelew Electric Mfg. Co., Middletown, Ohio.
B-6 The Wallace Barnes Co., Box 506, Bristol, Conn.
B-7 Bassett Metal Goods Co., Derby, Conn.
B-8 Bastian Bros. Co., 1600 Clinton Ave. N., Rochester, N. Y.
B-9 Batteryless Radio Corp., 116 W. 65th St., New York City.
B-10 Beaver Manufacturing Co., 625 N. 3rd St., Newark, N. J.
B-11 Belden Mfg. Co., 2300 S. Western Ave., Chicago, Ill.
B-12 Benjamin Electric Mfg. Co., Des Plaines, Ill.
B-13 Benwood-Linze Co., 19th and Washington Ave., St. Louis, Mo.
B-14 Best Mfg. Co., 1200 Grove St., Irvington, N. J.
B-15 Birnbach Radio Co., 254 W. 31st St., N. Y. C.
B-16 Bisby Mfg. Co., 59 Warren, New York City.
B-17 Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill.
B-18 Bond Electric Corp., Jersey City, N. J.
B-19 Bosworth Electric Mfg. Co., Main and Lexington Ave., Norwood, Cincinnati, Ohio.
B-20 L. S. Brach Mfg. Corp., 127 Sussex Ave., Newark, N. J.
B-21 The Brandes Corp., 200 Mt. Pleasant Ave., Newark, N. J.
B-22 Braun Co. W. C., 551 Randolph, Chicago, Ill.
B-23 Bremer-Tully Mfg. Co., 656 Washington Blvd., Chicago, Ill.
B-24 Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
B-26 Browne & Caine, Inc., 2317 Calumet Ave., Chicago, Ill.
B-27 Browning-Drake Corp., Calvary St., Waltham, Mass.
B-29 Brunswick-Balke-Collender Co., 623 S. Wabash Ave., Chicago, Ill.
B-30 Buckeye Electric Mfrs., Gladwin, Mich.
B-31 The Buckingham Radio Corp., 440 W. Superior St., Chicago, Ill.
B-32 Bud Radio, Inc., 2744 Cedar, Cleveland, O.
B-34 Burgess Battery Co., Harris Trust Bldg., Chicago, Ill.
B-35 Bush & Lane Piano Co., Holland, Mich.
B-36 Boudette Mfg. Co., 67 Crescent Ave., Chelsea, Mass.
B-37 Bright Star Battery Co., Hoboken, N. J.
B-38 Borden Electric Co., 480 Broad, Newark, N. J.
B-39 Bernard Electrical Mfg. Co., 36 Flatbush Ave., Brooklyn, N. Y.
B-40 Broadcaster's Service Bureau, San Jose, Cal.
B-41 Baritone Mfg. Co., 844 W. Jackson, Chicago.
B-42 Bethesda Crystal Lab., Bethesda, Md.
C-1 Cable Radio Tube Corp., 84 N. Ninth St., Brooklyn, N. Y.
C-2 Candy & Co., Inc., 2515 W. 35th St., Chicago.
C-3 Cannon & Miller Co., Inc., Springwater, N. Y.
C-4 The Capehart Corp., Fort Wayne, Ind.
C-5 Carborundum Co., Niagara Falls, N. Y.
C-6 Cardwell Mfg. Corp., 81 Prospect St., Brooklyn, New York.
C-7 Carter Radio Co., 407 S. Aberdeen St., Chicago, Ill.
C-8 The Caswell-Runyan Co., Huntington, Ind.
C-9 CeCo Mfg. Co., Inc., 702 Eddy St., Providence, Rhode Island.
C-10 Central Radio Corp., Beloit, Wis.
C-11 Central Radio Labs., 16 Keefe Ave., Milwaukee, Wis.
C-12 Champion Radio Works, Inc., 140 Pine St., Danvers, Mass.
C-13 Chicago Transformer Corp., 4541 Ravenswood Ave., Chicago, Ill.
C-14 Chillicothe Furniture Co., 1 Cherry St., Chillicothe, Mo.
C-15 Circle F. Mfg. Co., Trenton, N. J.
C-16 Clarostat Mfg. Co., Inc., 285 N. Sixth St., Brooklyn, N. Y.

Items

- ADAPTERS, Tube**
A-17, C-7, C-33, F-21, G-9, I-4, L-10, M-5, P-1, R-11, R-17, S-22, W-25.
- AERIAL EQUIPMENT, Leads, Lightning Arresters, Loops, Mastarms, Plugs, Poles**
A-15, A-30, A-33, A-40, A-46, B-7, B-11, B-16, B-17, B-20, B-32, C-15, C-16, C-30, D-8, D-14, D-15, E-1, E-20, F-11, F-14, G-1, G-9, G-21, G-25, H-7, H-13, H-24, I-4, L-9, M-14, M-17, N-5, S-11, S-14, S-22, S-42, T-17, T-18, U-6, W-13, W-19, Y-1.
- AERIAL INSULATORS**
A-12, A-15, A-16, A-26, A-27, A-29, A-46, B-5, B-20, C-27, C-29, F-13, F-15, G-9, H-6, H-13, I-3, I-4, J-3, K-13, L-9, M-8, P-8, P-18, P-23, R-31, S-22, S-27, T-15, U-4, U-5, W-19.
- ALUMINUM, Sheet, rod & tube**
A-23.
- AMPLIFIERS, Audio**
A-1, A-17, A-41, B-21, C-19, F-2, F-6, G-7, G-14, G-19, K-2, K-16, L-10, M-4, M-15, N-3, O-3, O-4, P-1, P-13, P-20, R-3, R-12, R-32, S-1, S-15, S-16, S-21, S-31, T-7, W-8.
- BATTERIES, Dry**
B-1, B-18, B-34, B-37, D-7, F-18, G-4, N-2, S-17, S-44.
- BATTERIES, Storage**
A-58, B-30, E-12, G-13, G-18, G-27, P-7, S-17, S-44, U-15, W-15.
- BATTERY CHARGERS**
A-19, A-41, A-58, C-19, D-16, E-11, E-15, E-24, G-6, G-15, K-15, K-19, P-7, S-45, S-47, T-9, T-12, U-16, W-2, W-11, W-24.
- BATTERY CHARGING RELAYS**
A-19, A-41, C-37, C-40, E-25, F-23, H-6, H-13, L-11, R-26, T-5, U-5, W-2, Y-2.
- BATTERY ELIMINATORS (For Plate Current Supply)**
A-19, A-40, A-60, A-61, B-13, B-18, B-21, B-39, C-33, C-39, D-5, E-10, E-15, E-25, F-2, F-16, F-23, G-7, G-22, G-29, K-15, K-16, K-19, K-20, M-19, N-3, P-1, P-7, P-13, P-20, P-22, P-29, S-15, S-17, S-35, S-47, T-9, T-13, W-7, W-15.
- BATTERY POWER UNITS, Combination**
A-41, A-61, C-41, D-13, D-16, E-11, F-23, G-7, G-18, G-23, H-7, K-10, K-19, P-7, R-8, S-17, S-46, S-47, T-10, V-6, W-15, W-24.
- BINDING POSTS**
A-3, A-15, A-23, A-52, B-6, C-16, E-4, E-10, F-1, F-7, G-9, G-14, I-4, K-4, P-13, R-14, S-22, W-5, X-1.
- BRACKETS, Sub Panel**
A-13, B-12, E-8, E-10, F-21, I-4, K-2, P-13, S-15, S-22.
- BROADCASTING EQUIPMENT**
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- CABINETS**
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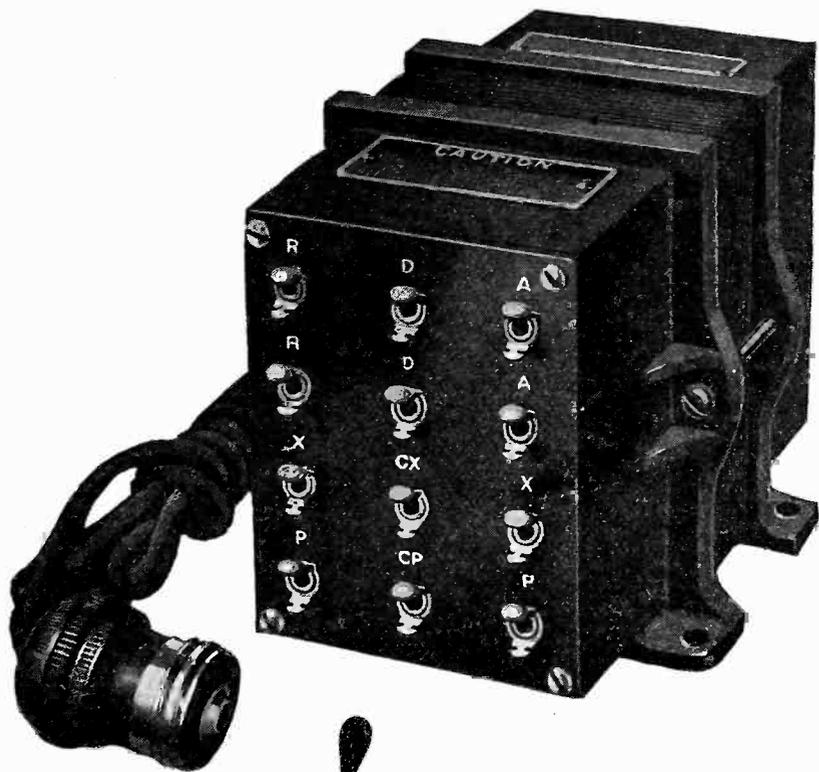
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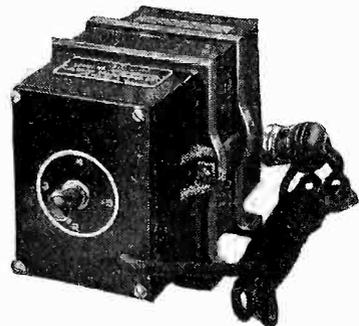
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- D-17 Davis Industries, Inc., 314 W. 43rd St., Chicago, Ill.
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- CLAMPS, Ground**
A-46, A-59, B-6, B-11, B-20, B-38, C-16, C-37, C-38, E-1, E-7, F-1, F-21, F-22, G-28, H-6, H-13, I-4, K-12, M-14, M-17, R-23, T-22, Y-1.
- CLIPS**
A-15, A-17, B-6, F-1, K-15, L-10, M-14, M-17, N-3, P-8, W-5.
- COILS, A-F Choke**
A-4, A-7, A-41, C-7, C-13, D-11, D-15, E-2, E-15, F-6, F-23, G-3, G-5, G-7, G-9, G-10, G-19, H-1, J-2, K-9, M-17, N-3, P-13, P-16, P-22, P-24, R-3, R-19, R-20, S-1, S-4, S-15, T-13.
- COILS, R-F Choke**
A-4, A-13, D-15, E-2, E-10, F-23, G-5, G-9, G-19, H-3, H-5, K-2, M-17, N-3, P-13, P-24, R-3, R-19, R-20, S-1, S-15, T-24.
- COILS, R-F**
A-4, A-5, A-6, A-13, B-12, B-15, B-17, B-23, B-30, C-10, C-19, D-1, E-2, E-10, F-23, G-3, G-9, G-19, H-3, H-5, K-2, K-9, M-4, N-3, P-1, P-13, P-21, P-24, R-14, R-20, R-29, S-5, S-15, T-21, T-24, V-5.
- COIL WINDING MACHINES**
B-11, H-1, M-14.
- CONDENSERS, Fixed Mica**
A-14, A-34, C-33, C-42, D-14, E-8, E-10, F-21, M-10, M-17, P-13, P-16, P-19, S-2, W-17, X-1.
- CONDENSERS, Fixed Paper**
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- CONDENSERS, Electrolytic**
A-14, A-36, C-33, D-14, E-15, I-1, P-19, P-22.
- CONDENSERS, Variable**
A-13, C-6, C-33, D-4, E-10, G-1, G-3, G-7, G-9, G-19, H-3, H-14, K-2, L-3, M-17, N-3, P-1, P-8, P-13, P-21, P-24, R-7, R-14, R-29, S-6, S-15, U-11.
- CONDENSER SHAFTS AND COUPLINGS**
H-3, N-3, P-13, P-21, S-6.
- CRYSTALS, PIEZOELECTRIC**
A-62, B-42, R-28.
- DIALS**
A-17, A-26, A-52, B-24, C-33, C-34, D-4, E-10, G-9, G-19, H-3, I-4, K-2, K-17, M-5, N-3, N-13, P-1, P-8, P-13, P-14, P-21, P-24, R-2, R-14, S-6, S-15, S-22, T-21, W-5.
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B-10, M-5, M-21, N-2, N-3, P-13, P-24, Y-2.
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C-24, I-4, N-6, P-13, S-21.
- FILAMENT BALLASTS**
A-6, D-1, L-10, M-17, P-13, R-2.
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A-14, A-21, C-5, D-14, E-1, E-8, H-4, I-5, L-10, M-10, M-17, N-3, P-1, P-8, P-13, P-16, S-48, W-2.
- GRID LEAKS, Variable**
A-21, A-34, C-11, C-16, C-36, E-1, E-8, G-1, H-4, M-17, R-9, W-2.
- GRID LEAK HOLDERS (See MOUNTINGS, Resistor)**
- HEADSETS**
A-15, A-31, B-3, B-21, C-3, F-21, G-20, K-16, P-1, P-8, T-12.
- INSULATION, Composition**
A-7, A-17, A-26, B-31, C-2, C-24, F-15, G-8, I-1, I-4, K-17, L-9, M-11, N-6, P-14, S-7, S-22, W-5.
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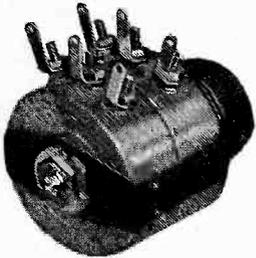
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- O-3 Operadio Mfg. Co., St. Charles, Ill.
- O-4 Oxford Radio Corp., 3200 Carroll Ave., Chicago, Ill.
- O-5 Ohmite Mfg. Co., 613 N. Albany Ave., Chicago, Ill.
- P-1 Pacent Electric Co., Inc., 91 7th Ave., N. Y. C.
- P-2 Packard Electric Co., Warren, Ohio.
- P-4 R. M. Peffer, Harrisburg, Pa.
- P-5 Perryman Electric Co., 33 W. 60th St., N. Y. C.
- P-6 Pfanstiehl Radio Co., 10 E. Kinzie, Chicago, Ill.
- P-7 Philadelphia Storage Battery Co., Ontario and C Sts., Philadelphia, Pa.
- P-8 Philmore Mfg. Co., 106 7th Ave., N. Y. C.
- P-9 Phono-Link Co., 490 Broome, N. Y. C.
- P-10 Phonomotor Co., 121 West Ave., Rochester, N. Y.
- P-11 Pierce-Airo, Inc., 119 Fourth Ave., N. Y. C.
- P-12 The Pierson Co., Cedar and Pleasant Sts., Rockford, Ill.
- P-13 Pilot Electric Mfg. Co., 323 Berry St., Brooklyn, N. Y.
- P-14 Pioneer Radio Corp., Plano, Ill.
- P-15 Platter Cabinet Co., Madison Ave., North Vernon, Ind.
- P-16 Polymet Mfg. Corp., 829 E. 134th St., N. Y. C.
- P-17 The Pooley Co., 1600 Indiana Ave., Philadelphia, Pa.
- P-18 Porcelain Products, Inc., Findlay, Ohio.
- P-19 The Potter Co., 1950 Sheridan Rd., North Chicago, Ill.
- P-20 Powrad, Inc., 121 Ingraham Ave., Brooklyn, N. Y.
- P-21 Precise Products, Inc., 254 Mill St., Rochester, N. Y.
- P-22 Precision Mfg. Co., 1020 Santa Fe Ave., Los Angeles, Calif.
- P-23 Premax Products, Inc., Niagara Falls, N. Y.
- P-24 Premier Electric Co., Grace and Ravenswood Aves., Chicago, Ill.
- P-25 Premier Radio Corp., Defiance, Ohio.
- P-26 Presto Machine Products Co., Inc., 70 Washington St., Brooklyn, N. Y.
- P-27 Prime Mfg. Co., 653 Clinton, Milwaukee, Wis.
- P-28 M. Propp Co., 524 Broadway, New York City
- P-29 Harold J. Power, 5 High St., Medford Hillside, Mass.
- Q-1 QRS-DeVry Corp., 1111 Center St., Chicago, Ill.
- Q-2 Quam Radio Products Co., 9705 Cottage Grove Ave., Chicago, Ill.
- Q-3 Quinn Tube, 1890 E. 40th, Cleveland, Ohio.
- R-1 Racon Electric Co., Inc., 18 Washington Place, New York City.
- R-2 Radiall Co., 50 Franklin St., N. Y. C.
- R-3 Radiart Corp., Inc., 13229 Shaw Ave., East Cleveland, Ohio.
- R-4 Radio Appliance Corp., Springfield, Mass.
- R-5 Radio Cabinet Co., 818 Butterworth St., Grand Rapids, Mich.
- R-6 Radio Cabinet Co., Seminary St., Rockford, Ill.
- R-7 Radio Condenser Co., Copewood and Davis Sts., Camden, N. J.
- R-8 Radio Corp. of America, 233 Broadway, New York City.
- R-9 Radio Foundation, Inc., 1 Park Place, New York City.
- INTERFERENCE ELIMINATORS**
A-14, T-9.
- JACKS**
A-3, A-17, B-6, B-24, B-32, C-7, D-4, E-4, E-8, F-21, G-9, K-3, P-1, P-8, P-13, P-24, S-22, Y-2.
- KEYS, SOUNDERS AND BUZZERS**
K-3, M-22, S-14, S-22, T-23, V-7.
- LOUDSPEAKERS**
A-3, A-15, A-18, A-19, A-24, A-31, A-35, A-38, A-39, A-51, A-55, B-3, B-14, B-21, B-23, B-27, B-29, B-30, B-36, B-41, C-3, C-27, C-33, E-15, F-2, F-8, F-16, G-20, G-23, H-12, J-5, K-5, K-7, M-2, M-17, M-20, N-2, O-2, O-3, O-4, P-1, P-7, P-12, P-15, P-17, P-26, Q-2, R-1, R-8, R-9, R-13, R-22, S-15, S-16, S-19, S-24, S-29, S-31, S-32, S-35, T-4, T-12, T-19, U-3, U-7, U-9, U-10, U-12, U-14, V-2, W-14, W-21, W-23.
- LUGS, Soldering**
A-17, B-5, B-15, K-3, L-5, S-6, W-5, Y-2.
- MARKERS, Metal Cable**
C-34, W-5, Y-2.
- METERS, Ammeters & Voltmeters**
D-11, F-6, G-6, H-15, H-19, J-6, R-11, R-17, S-29, S-40, W-11, W-12.
- MOTORS, Phonograph**
A-22, A-47, B-17, B-29, D-10, G-6, G-16, J-8, K-4, L-4, P-1, P-10, P-27, S-14, S-19, S-31, S-36, U-7, U-14, W-11.
- MOUNTINGS, Resistor**
A-14, C-16, D-4, E-1, E-8, I-5, K-3, L-10, N-3, M-15, M-17, P-13, P-16.
- OUTLETS, Convenience Wall**
B-10, B-32, C-7, E-1, F-21, H-10, R-21, S-42, Y-2.
- PANELS, Composition**
A-26, F-7, F-13, F-15, F-21, I-4, L-9, N-10, P-13, P-22, R-14.
- PANELS, Metal**
A-23, A-55, B-8, B-30, C-10, C-24, C-33, C-34, N-3, P-13, R-12, R-14, S-6, S-29, U-5, V-3.
- PICK-UPS, Phonograph**
A-17, A-22, A-24, A-25, A-35, A-36, A-51, A-53, B-21, B-31, C-3, C-20, C-33, E-9, E-10, G-16, H-4, K-16, M-18, P-1, P-9, P-26, R-3, S-14, S-31, S-35, S-36, T-11, T-19, U-2, U-7, U-14, W-8.
- PLATES, Name**
A-15, A-55, B-6, C-7, C-34, S-6, W-11.
- PLUGS, Phone & Multiple Connector**
B-10, B-20, D-4, E-1, F-21, G-9, H-10, K-12, M-5, M-17, N-3, P-13, P-16, S-22, Y-2.
- REACTIVATORS, Tube**
I-5, J-2, S-29.
- RECEIVING SETS**
A-2, A-5, A-11, A-19, A-24, A-34, A-36, A-38, A-51, A-54, A-56, A-57, B-2, B-4, B-9, B-19, B-21, B-23, B-27, B-29, B-30, B-31, B-35, C-17, C-18, C-19, C-26, C-33, D-2, D-5, D-17, E-5, E-9, E-10, E-16, E-25, F-16, F-17, F-24, G-12, G-19, G-20, G-22, G-23, G-24, G-26, H-9, H-18, K-3, K-5, K-9, K-11, K-16, L-1, L-3, L-5, M-4, M-9, M-12, M-13, M-17, N-1, N-2, N-3, N-4, N-8, N-16, P-6, P-7, P-8, P-11, P-12, P-14, P-24, P-25, Q-1, R-8, R-11, R-13, R-24, S-5, S-9, S-10, S-11, S-12, S-13, S-14, S-15, S-16, S-19, S-20, S-28, S-29, S-32, S-34, S-35, T-4, T-6, T-8, T-14, T-20, U-7, U-9, U-11, U-12, V-1, W-1, W-3, W-4, W-9, W-14, W-20, W-22, W-25, Z-1.
- RECEIVING SET KITS OR CHASSES**
A-13, B-27, E-1, G-19, G-22, H-3, H-5, H-16, K-2, L-3, L-12, N-3, P-13, P-24, R-20, R-29, S-9, S-15, S-49, T-21, V-5.
- RECTIFIER UNITS**
A-1, A-41, A-42, B-4, D-5, E-15, F-2, F-23, G-7, G-23, K-15, K-20, N-3, P-7, R-12, S-16, T-12, W-8.

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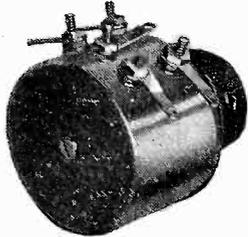


No. 280-280. Combination metal shell wire wound and composition elements. Wire wound up to 15,000 ohms. Composition, 5,000 to 1 megohm. Rheostat or potentiometer type in either unit. Units insulated from each other. Diameter, 1 11/16 in. Depth of shell, 1 3/8 in.

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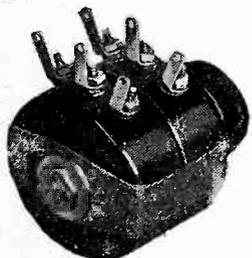
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No. 890. Double depth metal shell unit in rheostat or potentiometer type. Rotors in same electrical connection. Composition elements, 5,000 ohms to 1 megohm in each unit. Diameter, 1 7/8 in. Depth of shell, 1 3/16 in.

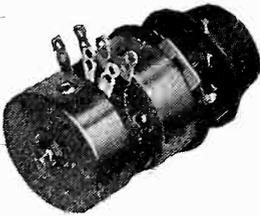
they may be.

Write us in detail regarding your variable resistor problems, and have us submit samples to meet your specifications.

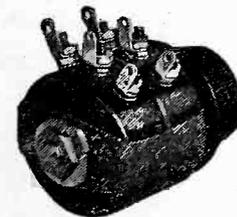


No. 1880-1880. Same as 280-280 except all bakelite.

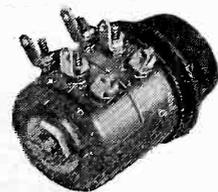
No. 200-200. Metal shell type wire wound resistors with resistances from 5 ohms to 10,000 ohms. Split windings. Rheostat or potentiometer types. Units insulated. Diameter, 1 7/16 in. Depth of shell, 1 1/2 in.



No. 2880-2880. Bakelite shell composition element only. Resistance range from 5,000 ohms to 1 megohm. All curves. Potentiometer or rheostat types. Units insulated from each other. Diameter, 1 1/2 in. Depth of shell, 1 1/8 in.



No. 590-590. Metal shell, composition element only. Resistances from 5,000 ohms to megohm. All curves. Potentiometer or rheostat types. Units insulated from each other. Diameter, 1 5/16 in. Depth of shell, 1 1/8 in.



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R-11 The Radio Products Co., Fifth and Norwood Sts., Dayton, Ohio.
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R-13 Radio-Victor Corp. of America, 233 Broadway, New York City.
R-14 Ranger Coil Co., W. Davenport, N. Y.
R-16 R. B. M. Mfg. Co., Logansport, Ind.
R-17 Readrite Meter Works, 15 College Ave., Bluffton, Ohio.
R-18 Red Lion Cabinet Co., Red Lion, Pa.
R-19 A. E. Rittenhouse Co., Honeoye Falls, N. Y.
R-20 Robertson-Davis Co., 361 W. Superior St., Chicago, Ill.
R-21 Rodale Mfg. Co., 200 Hudson, N. Y. C.
R-22 The Rola Co., 4250 Hollis St., Oakland, Calif.
R-23 Rosenbeck & Sons, Torrington, Conn.
R-24 Roth-Downs Mfg. Co., 2512 University Ave., St. Paul, Minn.
R-25 Runzel-Lenz Electric Mfg. Co., 1751 N. Weston Ave., Chicago, Ill.
R-26 Reliable Parts Mfg. Co., Wellington, Ohio.
R-27 Rival Radio & Battery Co., 180 E. 123rd St., New York City.
R-28 J. T. Rooney, 4 Calumet Bldg., Buffalo, N. Y.
R-29 Radio Engineering Labs., 100 Wilbur Ave., Long Island City, N. Y.
R-30 Radio Utilities Corp., 67 Winthrop, Newark, New Jersey.
R-31 Radio Insulation, Parkersburg, W. Va.
R-32 The Rauland Corp., 3341 Belmont Ave., Chicago, Ill.
R-33 Radio Wire Corp., 6629 Central Park Ave., Chicago, Ill.
S-1 Samson Electric Co., 227 Washington St., Canton, Mass.
S-2 Sangamo Electric Co., Springfield, Ill.
S-3 Saturn Mfg. & Sales Co., 48 Beekman St., New York City.
S-4 Scanlon Electric Mfg. Co., 1113 N. Franklin St., Chicago, Ill.
S-5 Scott Transformer Co., 4450 Ravenswood Ave., Chicago, Ill.
S-6 Scovill Mfg. Co., 99 Mill St., Waterbury, Conn.
S-7 Scranton Button Co., Scranton, Pa.
S-9 Shamrock Mfg. Co., 196 Waverly Ave., Newark, N. J.
S-10 Shelby Co., 10 Prince, Trenton, N. J.
S-11 Shinn Mfg. Co., N. Racine Ave., Chicago, Ill.
S-12 Shortwave & Television Lab., 104 Brooklyn Ave., Boston, Mass.
S-13 Showers Brothers Co., 10th and Morton Sts., Bloomington, Ind.
S-14 Signal Electric Mfg. Co., Menominee, Mich.
S-15 Silver-Marshall, Inc., 6401 W. 65th St., Chicago, Ill.
S-16 Simplex Radio Co., Sandusky, Ohio.
S-17 B. H. Smith, Danbury, Conn.
S-18 Sonatron Tube Co., 1020 S. Central Park Ave., Chicago, Ill.
S-19 Sonora Phonograph Co., Inc., 50 West 57th St., New York City.
S-20 The Sparks-Withington Co., Jackson, Mich.
S-21 Spaulding Fibre Co., Inc., 484 Broome St., New York City.
S-22 Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
S-23 Sprague Specialties Co., 1511 Hancock St., Quincy, Mass.
S-24 Standard Radio Corp., 41 Jackson St., Worcester, Mass.
S-25 Standard Transformer Co., Warren, Ohio.
S-26 The Starr Piano Co., S. 1st and A, B, C and D Sts., Richmond, Ind.
S-27 Starr Porcelain Co., Trenton, N. J.
S-28 Steinite Radio Co., Fort Wayne, Ind.
S-29 The Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
S-30 Stettner Phonograph Corp., 310 E. 75th St., New York City.
S-31 Stevens Mfg. Corp., 46 Spring St., Newark, N. J.
S-32 Stewart-Warner Speedometer Corp., 1826 Diversey Parkway, Chicago, Ill.
S-33 St. Johns Table Co., Cadillac, Mich.
S-34 Story & Clark Piano Co., 173 No. Michigan Ave., Chicago, Ill.
S-35 Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
S-36 Studner Bros., 67 W. 44th St., N. Y. C.
S-37 Sunlight Lamp Co., 76 Coit, Irvington, N. J.
S-38 Superior Cabinet Corp., 206 Broadway, N. Y. C.
S-39 Supertron Mfg. Co., Hoboken, N. J.
S-40 Supreme Instruments Corp., Bright Bldg., Greenwood, Miss.
S-41 Swaboda Co., 612 E. Pike St., Seattle, Wash.
S-42 Swan-Haverstick, Inc., Trenton, N. J.
S-43 Sylvania Products Co., Emporium, Pa.
S-44 Sturges Multiple Battery Corp., Jamaica, N. Y.
S-45 Sarras Electric Co., 67 Park Place, N. Y. C.
S-46 See Jay Battery Co., 915 Brook Ave., N. Y. C.
S-47 A. R. Spartana, 806 N. Gay, Baltimore, Md.
S-48 Shallcross Mfg. Co., 700 Parker Ave., Collingdale, Pa.
S-49 Scott Transformer Co., 4450 Ravenswood Ave., Chicago.
T-1 Taylor Electric Co., Madison, Wis.
T-2 Tectron Radio Corp., 1270 Broadway, N. Y. C.
T-3 Televocal Corp., 588 12th St., West New York, N. J.
T-4 Temple Corp., 5253 W. 65th St., Chicago, Ill.
T-5 Therm-A-Trol Mfg. Co., 52 Willow, Springfield, Mass.
T-6 Thompson Radio Co., 25 Church, N. Y. C.
T-7 Thordarson Electric Mfg. Co., 500 W. Huron St., Chicago, Ill.
T-8 Tilman Radio Corp., Lagro, Ind.
T-9 Tope Deutchmann Co., 136 Liberty St., New York City.
T-10 Todd Electric Co., 42 Vesey, N. Y. C.
T-11 Toman & Co., 2621 W. 21st St., Chicago, Ill.
T-12 Tower Mfg. Corp., 124 Brookline Ave., Boston, Mass.
T-13 Transformer Corp. of America, 2301 S. Keeler Ave., Chicago, Ill.
T-14 Trav-Ler Mfg. Corp., 1818 Washington Ave., St. Louis, Mo.
T-15 Trenle Porcelain Co., East Liverpool, Ohio.
T-16 Triad Mfg. Co., Inc., Fountain and Blackstone Sts., Pawtucket, R. I.
T-17 Tri-Boro Radio Mfg. Corp., 62 W. 21st St., New York City.
T-18 Trico Products Corp., 817 Washington, Buffalo, N. Y.
T-19 Trimm Radio Mfg. Co., 847 W. Harrison, Chicago, Ill.
T-20 Trutone Radio Sales Co., 114 Worth, N. Y. C.
T-21 Tyrman Electric Corp., 314 W. Superior St., Chicago, Ill.
T-22 Thomas & Betts Co., 15 Park Place, N. Y. C.
T-23 Teleplex Co., 76 Cortlandt, N. Y. C.
T-24 Teleradio Engineering Corp., 484 Broome St., New York City.
U-1 The Udell Works, 1202 W. 28th St., Indianapolis, Ind.
U-2 Ultraphonic Products Corp., 270 Lafayette, New York City.
U-3 Ultratone Mfg. Co., 1046 W. Van Buren St., Chicago, Ill.
U-4 Union Electrical Porcelain Works, Muirhead Ave., Trenton, N. J.
U-5 Union Insulating Co., 296 Broadway, N. Y. C.
U-6 Union Metal Products Co., 2938 Pillsbury Ave., Minneapolis, Minn.
U-7 United Air Cleaner Co., 9705 Cottage Grove Ave., Chicago, Ill.
U-8 United Radio & Electric Corp., 500 Chancellor Ave., Irvington, N. J.
U-9 United Reproducers Corp., Springfield, Ohio.
U-10 United Research Labs., Inc., 864 W. North Ave., Chicago, Ill.
U-11 United Scientific Lab., Inc., 113 Fourth Ave., New York City.
U-12 U. S. Radio & Television Corp., Marion, Ind.
U-13 Universal Electric Lamp Co., Newark, N. J.
U-14 The Utah Radio Products Co., 1737 S. Michigan Ave., Chicago, Ill.
U-15 Universal Battery Co., 3410 S. La Salle, Chicago, Ill.
U-16 Universal Electro Chemical Corp., 30 W. 15th St., New York City.
V-1 Vaga Mfg. Co., 720 Atlantic Ave., Brooklyn, N. Y.
V-2 Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.
V-3 Van Doorn Co., 160 N. La Salle St., Chicago, Ill.
V-4 Van Horne Tube Co., 280 Center St., Franklin, Ohio.
V-5 Victoreen Radio Co., 2825 Chester Ave., Cleveland, Ohio.
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W-1 Walbert Radio Corp., 1000 Fullerton Ave., Chicago, Ill.
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W-3 Ware Mfg. Corp., Broad St. Bank Bldg., Trenton, N. J.
W-4 Wasmuth-Goodrich Co., Peru, Ind.
W-5 Waterbury Button Co., Waterbury, Conn.
W-6 Watsontown Table & Furniture Co., Watsontown, Pa.
W-7 The Webster Co., 850 Blackhawk St., Chicago, Ill.
W-8 Webster Electric Co., Racine, Wis.
W-9 Wells Gardner & Co., 816 N. Kenzie Avenue, Chicago, Ill.
W-10 Western Felt Works, 4029 Ogden Ave., Chicago, Ill.
W-11 Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
W-12 Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark, N. J.
W-13 T. C. Wheaton Co., Millville, N. J.
W-14 Wilcox Labs., Charlotte, Mich.
W-15 Willard Storage Battery Co., 346 E. 131st St., Cleveland, Ohio.
W-16 Wireless Corp. of America, 1744 N. Robey, Chicago, Ill.
W-17 Wireless Specialty Appliance Co., 76 Ather-ton St., Jamaica Plain, Mass.
W-18 Wise-McClung Corp., New Philadelphia, Ohio.
W-19 Wirt Co., 5221 Greene (Germantown), Philadelphia, Pa.
W-20 Wiz Mfg. Co., 225 Sixth Ave., N. Y. C.
W-21 J. W. & W. L. Woolf, 133 W. 21st St., N. Y. C.
W-22 World Electric Co., San Dimas, Calif.
W-23 Wright-DeCoster, Inc., 2233 University Ave., St. Paul, Minn.
W-24 Wubco Battery Corp., Swissvale Sta., Pittsburgh, Pa.
W-25 Workrite Radio Corp., 1838 E. 30th St., Cleveland, Ohio.
W-26 Winnebago Mfg. Co., Rockford, Ill.
W-27 Wireless Egert Eng., Inc., 179 Greenwich St., N. Y. C.
X-1 X-L Radio Labs., 1224 Belmont Ave., Chicago, Ill.
Y-1 Yahr-Lang, Inc., 207 E. Water, Milwaukee, Wis.
Y-2 Yaxley Mfg. Co., 1528 West Adams, Chicago, Ill.
Z-1 Zenith Radio Corp., 3620 Iron St., Chicago, Ill.
- RESISTORS, Fixed Carbon**
A-21, C-11, C-16, H-4, I-5, M-10, M-15, P-16.
- RESISTORS, Fixed Processed**
A-14, C-5, C-7, C-16, C-32, E-8, H-4, I-5, L-10, M-10, M-15, N-3, P-13, P-16, R-2, W-19.
- RESISTORS, Fixed Wire Wound**
A-14, A-32, C-7, C-16, C-32, D-1, D-4, F-6, E-8, E-10, F-6, F-21, G-6, G-9, K-18, L-3, M-10, M-15, M-17, N-3, O-5, P-1, P-13, P-16, R-17, R-20, S-48, W-2, W-19, Y-2.
- RESISTORS, Variable Carbon**
A-21, B-24, C-7, C-16, E-8, F-21, K-3, P-13, P-16.
- RESISTORS, Variable Wire Wound**
C-7, C-16, C-36, D-4, E-8, E-10, F-21, G-7, G-9, H-4, K-18, M-15, M-17, N-3, P-1, P-8, P-13, P-16, R-14, U-11, V-5, W-2, W-19, Y-2.
- SHIELDS**
A-23, C-7, C-10, C-33, G-19, L-3, N-3, P-13, S-15.
- SOCKETS, Tube**
A-17, A-26, A-52, B-12, C-10, C-36, D-4, E-4, E-10, F-21, G-9, G-19, I-1, I-4, K-3, K-15, K-18, N-3, N-13, P-1, P-8, P-13, P-14, P-24, R-14, S-3, S-9, S-15, U-5.
- SOLDER, Self-Fluxing**
K-8.
- SWITCHES & SWITCH CONTACTS**
A-15, B-5, B-10, B-24, C-7, C-11, C-36, E-10, F-1, F-21, G-9, G-14, H-10, H-13, H-16, K-3, K-19, M-17, P-1, P-8, P-13, P-21, R-14, R-31, S-3, U-5, W-17, Y-2.
- TESTING EQUIPMENT, Tube and Set**
E-24, F-6, F-10, G-9, H-14, H-15, H-19, J-2, J-6, K-18, L-3, L-8, N-3, P-4, P-28, R-11, R-17, R-29, S-14, S-29, S-40, T-1, T-19, W-2, W-12.
- TRANSFORMERS, Audio**
A-4, A-13, A-32, A-34, C-7, C-13, C-19, D-15, F-3, F-6, F-13, G-2, G-3, G-7, G-9, G-10, G-17, G-19, H-1, H-3, H-5, J-2, K-2, K-3, L-5, M-17, N-3, N-13, P-1, P-13, P-21, P-24, R-14, R-19, R-20, R-32, S-1, S-2, S-3, S-4, S-15, S-25, T-7, T-13, V-3, V-5, W-8.
- TRANSFORMERS, Power**
A-4, A-6, A-13, A-32, A-41, B-19, B-24, C-7, C-13, D-11, D-15, E-15, E-24, F-1, F-6, F-7, F-23, G-3, G-5, G-7, G-9, G-10, G-17, G-19, H-1, H-14, J-2, K-2, K-3, K-9, K-10, K-15, K-18, L-3, M-17, N-3, N-9, P-13, R-2, R-3, R-9, R-19, S-1, S-9, S-15, S-17, S-25, T-7, T-21, U-5, V-5, W-7, W-17.
- TRANSFORMERS, R-F (See COILS, R-F)**
- TRANSMITTING APPARATUS**
A-4, A-13, A-62, C-6, E-23, F-21, G-9, G-30, H-14, H-25, K-3, L-3, N-3, N-14, R-13, R-29, S-2, S-17, T-7, T-9, W-27.
- TUBING, Spaghetti**
A-7, A-15, I-4, P-8.
- UNITS, Loudspeaker & Phonograph**
A-3, A-13, A-22, B-3, B-14, B-41, C-18, E-7, E-10, E-15, F-8, H-16, M-17, P-8, R-22, S-19, S-41, T-12.
- VACUUM TUBES**
A-8, A-20, A-24, A-42, A-43, A-45, A-49, A-50, B-18, B-22, C-1, C-9, C-12, C-22, C-23, C-25, C-35, D-1, D-3, D-7, D-9, D-12, D-18, D-19, E-13, E-19, F-18, G-15, G-23, G-31, H-22, H-23, J-1, K-3, K-6, K-22, L-2, M-1, M-6, M-16, M-21, N-2, N-7, N-11, N-15, P-5, P-13, Q-3, R-13, R-30, S-9, S-18, S-37, S-39, S-43, T-2, T-3, T-16, U-7, U-8, U-13, V-4, W-11, W-16.
- VARIOMETERS & VARIOCOUPERS (See COILS, R-F)**
- VOLTAGE REGULATORS**
A-4, A-63, C-16, E-1, G-1, I-4, M-7, N-3, R-17, W-2, W-19, X-1.
- WIRE (See CABLE)**



TYPE 360 TEST OSCILLATOR

ONE of the new test oscillators for the radio service laboratory is now ready. It will deliver a modulated radio-frequency voltage at any point in the broadcast band (500 to 1500 kilocycles) and at 175 and 180 kilocycles. The tuning control is calibrated with an accuracy of 2 per cent.

The Type 360 Test Oscillator is intended to be used for neutralizing, ganging, and tuning of the radio-frequency stages in a receiver, and it is fitted with an output voltmeter for indicating the best adjustment.

Price \$110.00

GENERAL RADIO CO.

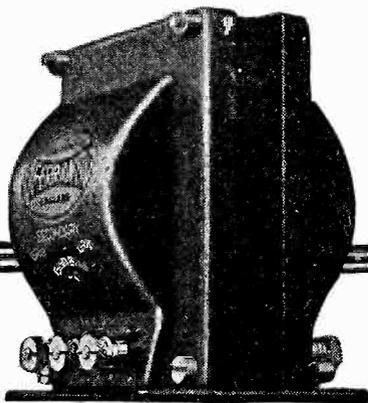
30 State Street Cambridge, Massachusetts

SCORE 1 2½ miles of wire—primary inductance of 175 henries with 1 mill D. C.

SCORE 2 Flat Curve—25 to 8000 cycles; no pronounced resonant peaks at any frequency.

SCORE 3 for FERRANTI

High Amplification—3½ to 1 Ratio (A.F.5) With Curve flat within 1 db. between 25 and 8,000 cycles.



when used with tubes having approximately 8000 to 10,000 ohms impedance.

THE ability of a transformer to maintain high amplification is dependent upon the primary inductance. In FERRANTI Audio Frequency Transformers the primary inductance is made large by using a great number of primary turns, a core of large cross section and a short mean core path, but not so short as to make the D. C. saturation appreciable.

Ferranti Transformer superiority is proved by scientific tests and emphasized by unchallenged performance.

27 different types... one for every audio need. Write for correct type for your requirements.

Do you know that Ferranti Transformers have removable feet... that they may be mounted in any desired position (top, bottom or side) in a radio receiver or power amplifier?

Out NOW!
New 1930 FERRANTI Amplifier Book

Contains much hitherto unpublished information on Power Amplifiers as developed in Ferranti laboratories by Ferranti engineers. Needed by everyone interested in Power Amplifiers. Send 15c, coin, to help pay production and mailing cost.



Inc.
130 W. 42nd St. Desk 112
New York, N. Y.

TRANSMISSION OF TELEVISION IMAGES

(Continued from Page 85)

scanning is used instead of the more unwieldy disks.

The problem of real entertainment value of television is unique and difficult. Fundamentally it requires a wide spectrum of frequencies for its accomplishment. It cannot be realized with present voice broadcasting frequencies, channels, or methods. Attempts at such practices can only hope to yield approximations to what is really wanted. Not by means of broadcasting facilities, broadcasting networks, or semi-short waves will anything lasting be achieved, but by the use of short waves and ultra-short waves will real television finally be accomplished.

SELLING RADIO

(Continued from Page 37)

pable as a salesman without possessing an earnestness of purpose, a confidence in his powers, and a knowledge and faith in the worthwhileness of his endeavors, which he can impart to listeners.

Why do our biggest and most successful business concerns, at great cost, hold sales conventions? Chiefly to arouse enthusiasm, to kindle fresh ambition, to inspire a new effort. For any important position, employers today will not engage men lacking in enthusiasm. The dull, indifferent person never evolved a brilliant product. Half-heartedness never attained whole success. The man who loses his enthusiasm gives up hope, and the race is over for him. He is licked! Enthusiasm can make even unpalatable work interesting. Enthusiasm brightens the eye, stirs the pulse and quickens the step. Enthusiasm in itself inspires the listener's confidence.

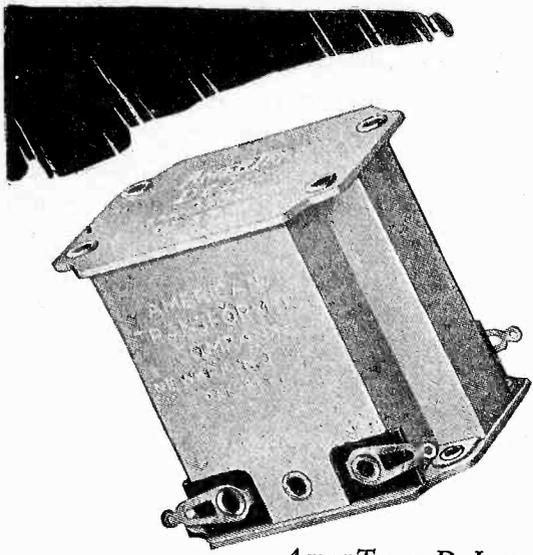
"No profit grows where there is no pleasure ta'en," wrote the all-wise Shakespeare. It was Roosevelt who, when asked while he was in the White House, how he contrived to get through so much work, replied: "I like my job!"

Does not history show that, given enthusiasm, tasks apparently superhuman can be accomplished? To be able to muster up enthusiasm, you must believe in yourself, believe in what you are doing, believe in its legitimacy, believe in its efficacy, believe in its benefit to society.

A CANDIDATE for salesmanship must first convince himself that he is in the right line of work. If not, get out quick into something that can be liked; otherwise failure is absolutely certain to follow.

To determine for yourself whether or not you are in the right place or in the right line of work, there is a simple method of grading: Set down figures as follows: 100, 80, 60, 40, 20, 10, 0.

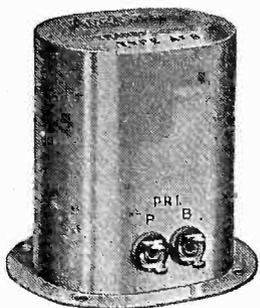
(Continued on Page 88)



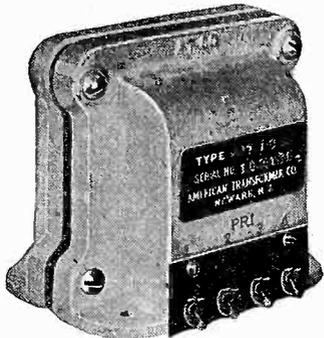
AmerTran De Luxe Audio Transformer—List Price \$10.00. Type 151—Between one input and two output tubes—List Price \$15.00



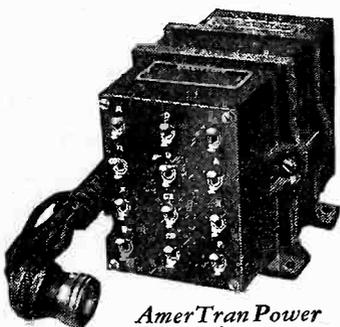
Bring the Studio to your Home



Type AF-8 Audio Transformer—Either 1st or 2nd stage audio—Turn ratio 3½—List Price \$6.00



Type 710 Audio Transformer—Between two input and two output tubes—List Price \$20.00



AmerTran Power Transformer—Type PF-245A—List Price \$22.00



There is no excuse for imperfect radio reception. But even today, receiving sets fail to reproduce music and the speaking voice in true tone identical with the range of pitch and the rich fulness of sound quality as broadcast in the studio.

The weak point in most receiving sets is in the audio system.

AmerTran Audio Transformers and Power Transformers shown here perfect the audio system and bring the programs into your home exactly as they go over the air through the microphone. For further descriptions of these and thirty-odd products in the field of radio reproduction that have attained the perfection necessary to AmerTran Standard of Excellence, write for Bulletin 1065.

The facilities of our engineering department are at the service of everyone interested in better radio reproduction.

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QUALITY RADIO PRODUCTS
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AMERICAN TRANSFORMER CO.
178 Emmet St., Newark, N. J.

Please send me Bulletin 1065 containing complete information on AmerTran Transformers, for better radio reception.

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Address

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Carton of four Eveready Raytheon B-H Tubes

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MOST "B" power units are designed for the B-H tube . . . the original gaseous rectifying tube. Millions of such units have been sold in the past few years. When tube replacements are necessary, a new Eveready Raytheon B-H Tube will give the greatest satisfaction. Tell your customers what a tremendous improvement in reception a new rectifying tube will make.

Eveready Raytheon B-H Tubes come in handy packages of four tubes each. Always keep at least one full carton on display. The market for these tubes is enormous!

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Unit of  and Carbon Corporation



Trade-marks

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FOR
SERVICE AND REPAIR MEN

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4343	Majestic Special Master	11.00
4347	Majestic Super "B"	12.00
4359	Majestic Master "B"	11.50
4360	Brown "B" Super Power (Green Brown)	11.00
22-54	Zenith ABC Power Sup- ply ZE-9	12.00
572-S	Mohawk AC (27-28) 226 Type Power Unit	12.00
572-S	Stewart Warner	12.00

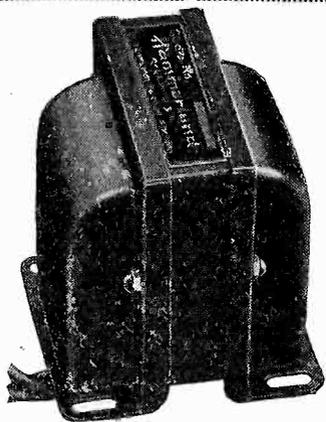
Potter Filter Blocks

RR-245	Condenser Block for single and push-pull 245 type tube amplifiers	\$19.75
T-2900	Condenser Block for the single 250 type tube amplifier	\$20.00
T-2950	Condenser for the push-pull 250 type tube amplifier	\$22.50
T-2098	Condenser Block for single 210 type tube amplifier	\$20.00
T-280-171	Condenser Block for pow- er pack with 280 type tube rectifier	\$18.00

The Potter Co.

North Chicago, Illinois

A National Organization at Your Service



**AUDIO
TRANSFORMERS**
Worthy of the
HAMMARLUND
Name Plate

DESIGNED primarily for the new "HIQ-30" Custom-Built Receiver, Hammarlund Transformers are a revelation in amplifying power and tone fidelity over the entire audible frequency range. The large cross-section core of specially treated laminations permits high primary currents without saturation. Completely shielded. Pigtail terminal leads for sub-panel connection. Four types:—First stage, Push-Pull Input, Push-Pull Output for magnetic speakers, Push-Pull Output for dynamic speakers. Hear them! Try them! They will greatly improve the output of any circuit.

Write Dept. PR-12 for Details

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For Better Radio
Hammarlund
PRECISION
PRODUCTS



ON THE OCEAN FRONT

The
Breakers
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Preferred—

In all seasons by those who
know and wish the best upon
either the American or
European Plan.

Sensible Rates Withal!

HILLMAN MANAGEMENT



The
COMMODORE
250 Rooms

All outside—each with private bath

Rates \$2.50 to \$6.00 a Day

In the heart of everything

A friendly, hospitable home
for the traveler

Class A fireproof building

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LOS ANGELES

West Seventh at Lucas

HILDA FOOTE
Manager

de Forest

23 Years of Leadership

DE FOREST RADIO CO., JERSEY CITY, N. J.

SELLING RADIO

(Continued from Page 86)

Think earnestly what you would do if you were to inherit one million dollars. If you would be happy to continue in your present line of work and could think of nothing different you would rather do, then you grade 100. If the sudden possession of a million dollars, or a sum so large that you no longer had to work for a living, made you think you would possibly like to do some other kind of work, then grade yourself 80. If the possession of financial security seemed a godsend to you, because it would permit you to immediately start doing some kind of work for which you have a longing, then grade yourself 10. If you hate or dislike your present work, grade yourself 0. And so on for the grades between 80 and 10.

If you grade yourself anything less than 50, you are doing yourself, your employer, and society in general, a lot of harm by not quitting now—without that million as security—and getting into some kind of work over which you can become enthusiastic.

NEXT, the candidate must believe in himself—be able to sell to himself before he can ever sell himself to anyone else. He must sit down, relax, and think. Let imagination run wild and build up a picture of what he would like to do, what he would like to become; that is, set a goal to be reached. Then he must realize that, to reach that goal, he must pay the price. The price is much greater than the cost of some magic formula or system that can be read quickly and just as quickly forgotten. The price is a lot of hard work and a lot of bumps.

Next month's lesson will show how to test the effect of one's personality on others. These tests will show up weaknesses that must be overcome. Actions, facial expression (not facial contour), voice inflection, dress, environment, all tell a story about people. Dealing With Different Kinds of People will be considered in the same lesson with that on personality.

WORDS OF WISDOM

(Continued from Page 39)

MOST radio stores, when a sale is made, heave customers out as they would a packing case. If the customer comes back for anything he has to stand around, or go find it himself, and then chase up a salesman and ask him the price. That is why cigar stores, drug stores, automobile concerns, and other outfits are selling radio. The customer would rather go there and get a little personal attention. He likes to be shaken by the hand. He likes to talk

about his brother's poor health. And this comes down to the loudspeaker.

Radio dealers would be surprised how often a sale is killed by a set working day and night, overtime and always. Autos are not sold by racket. A razor is not marketed with roars and hoots.



But when a man tries to buy a radio set, his throat gets tired trying to yell above the din of one or more loudspeakers. A man gets to thinking what a set would sound like in his quiet flat about 10 p. m., and he changes his mind, after going into a radio store. The loudspeakers blast themselves out of a good home by shouting like a preacher at a revival.

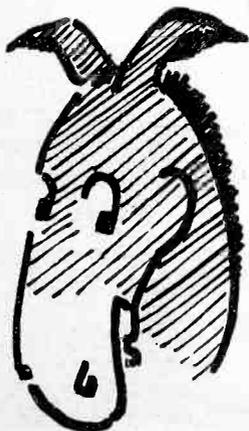
Also an always-going set cheats a customer out of the fun of turning it on. We heard one bright salesman say to a customer:

"Go over there and turn it on yourself. If it's too loud, just turn that right-hand knob back to 2 o'clock. . . ."

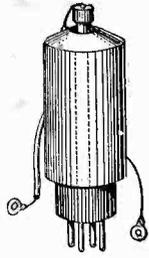
The customer tiptoed over, tried it, found he could do it and was tickled to death. He went out and got his wife and she tried it. She found she could do it—could find any station she wanted just as easy as anything. They bought the set. The salesman kept an eye on them, and kept busy elsewhere until the time was ripe. That was salesmanship.

A good salesman in a radio store has to be a cross between a pawnbroker, a policeman, a diplomat, a nightwatchman, and an attorney. He must leave his sand bag at home, and forget his commission—until he gets it. Radio isn't like anything else that was ever sold before. And it can't be sold like anything else. Like the wart, a radio is "gotten around to," and a buyer can't be shoved into a sale any more than an army mule can be shoved into a box car.

Ask any mule.



**CAPS MADE OF LEAD ONLY
METAL USED FOR X-RAY AND
RADIUM SHIELDS**



Type 224

**Screen-Grid Tube
Shield
With Shielded
Lead**

List Price 60c
Net. Wt. about 4 ozs.



Type 227

**Shield Type
No-Phonic Tube
Cap**

List Price 35c
Net Wt. 5 ozs.



Type 200

**Plain Type
No-Phonic Tube
Cap**

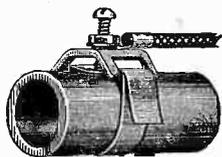
List Price 25c
Net Wt. 5 ozs.



Type 199

**No-Phonic Tube
Cap for 199 Tubes**

List Price 25c
Net Wt. 2 1/2 ozs.



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Approved
Ground Clamp
1", 2" and 3"
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1308 Stockton St. Wilmington, Del.

**Copper, Brass,
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Hot Tinned or Plain

We specialize in the manufacture of rolled metals .001 thick and thicker, 1/16" wide and wider, either hot tinned or plain.

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A RADIO PARTS GUIDE

The New

YAXLEY

Catalog



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

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**SEND FOR SHORT WAVE
BOOK—IT'S FREE!**

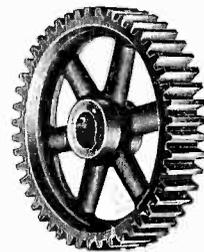
Shows how to make new design short-wave receivers and short-wave adapters. How to use the new screen-grid tube in D-C and A-C circuits. How to make short waves get long distance. Latest information on all new radio developments. It's free. Send for copy today.

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LOOSE LEAF BINDER

FREE 6 x 9-in. loose leaf binder for data sheets given free with one year subscription to "Radio." **SUBSCRIBE NOW!**

DOLLARS TO DOUGHNUTS

(Continued from Page 68)

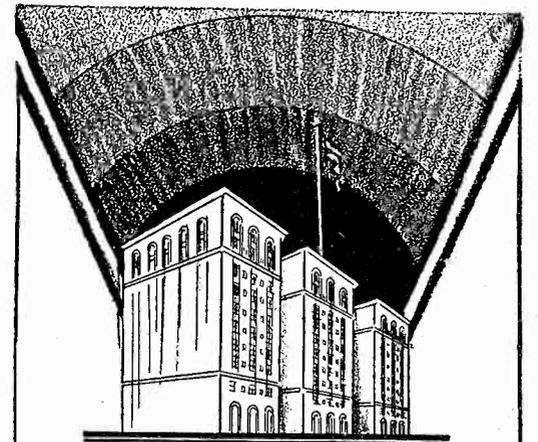
cannot pay for. Today many of the leading jobbers are trying to win the dealers over to the point that they must have on their floor fewer lines of sets. The sooner they see that they can do that and make money it won't be long before there will be more successful dealers and fewer failures.

In the metropolitan districts the jobber is troubled with the unnecessary service work the dealer brings in to have looked over. It seems that a great many dealers cannot even find a poor tube or are not able to accurately test one. The only remedy is for a dealer to employ a good service man. Somehow the dealers think that if they bring in a chassis to be tested the service man should be able to find the trouble immediately and when they don't there is war. If they would only write a little note on what they think the trouble is their work would be out just twice as fast and they would not have to make two or three calls to have it completed.

Another thing the jobber is trying to impress on the dealers today is the fact that they must not lose track of a customer to whom they sold a set eighteen months or a year ago. These people are potential buyers of new model sets. But for some reason the dealers do not want to keep in touch with them. With the trend of radio merchandising as it is today, that is towards a jobber's dealers specializing in one or two lines of sets, it is more important than ever that the dealer keep in touch with his trade. Competition is so keen today that a dealer cannot afford to let another dealer step in and take a customer from him.

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FINE large outside rooms. Each with bath from \$3.00 daily. Unrestricted Parking — Splendid Restaurants — Choice Location — New — Modern.



THE REAL TEST

DOLLARS EXPENDED vs. RESULTS

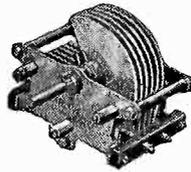
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ELECTRICAL EFFICIENCY—
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CARDWELL CONDENSERS

Will give you the most in real results for your money. They are the choice of those who know condensers.

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Unequaled
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Receiving Condensers in Several Types and
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RADIO BARGAINS

Power Transformers and Condenser Blocks

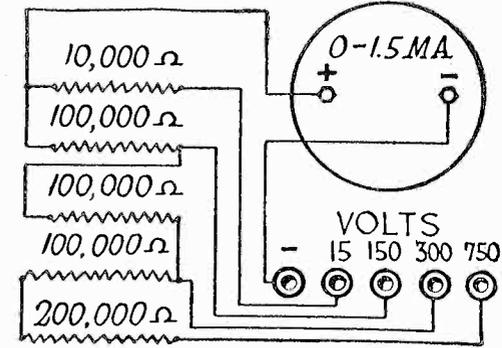
At Less Than Manufacturer's Cost

16 Mfd. Condenser Blocks contains 1-8 mfd. 1000 working volts, 1-4 mfd. 1000 volts, 2-1 mfd. 600 volts, 1-2 mfd. 500 volts. Non-inductively wound.....\$3.90
Short-Wave One-Tube Sets, low loss bread board model. Completely assembled. 30 to 550 meters.....\$4.75
No. 1003 Sec. 600 V. 7½ V. C. T. to first choke, 7½ V. C. T., 2.5 V. C. T. to case 1½ V. 3 chokes. For one 281, one 250, one 227, four 226.....\$5.00
No. 1002 Sec. 450 V. 7½ V. C. T. to first choke, 7½ V. C. T. 2½ V. C. T. to case 1½ V. 3 chokes. For one 281, one 250, one 227, four 226.....\$4.75
No. 875 Secondary, 375 volts—375 volts, 5, 5, 2½, 1½ and 1½. High and low primary and 2 chokes for 280, two 171A, five 226 and one 227.....\$4.25
Audio transformers, 75c; Condensers, 50c; Rheostats, 25c; Crosley cone units, \$2.00; One-tube sets, \$1.95; A-C Filament Transformers, \$1.90; Used 5-tube sets in cabinets, require minor adjustment.....\$6.90
Complete list upon request.

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4240 Lincoln Ave. Dept. A-41, Chicago, Ill

Dealers' Bankrupt Radio Stock



A Voltage Multiplier

The Super Akra-Ohm wire-wound Resistor is especially adapted for use as a Voltage Multiplier as shown in the above diagram. It is carefully designed to insure an accuracy of 1% and a constant permanency of calibration. Its use is also highly recommended for Laboratory Standards, High Voltage Regulators, Telephone Equipment and Television Amplifiers and Grid and Plate Resistors, etc.

BULLETIN 62

contains the first complete chart for the use of accurate resistors with microammeters and milliammeters. Send for your copy today. There is no obligation.



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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.



Read Estes' Article in This Issue

Sir: You have published several articles on jobbers' test equipment and I would like to know whether you can suggest something along those lines, but not so expensive, for a dealer. I am only in a small way of business but it will soon be necessary for me to open a service department, and I would like to know how much I can get by for as a starter.

I expect to employ one good service man and, as this is a country district, expect he would have to use some kind of portable tester. I would not mind getting a couple of meters and building up a small test panel for the shop also, as I like to check over the new sets as they come in.

Please advise me what you think would be the best arrangement and the cheapest.

H. H. BRINKMAN.

Tucson.

Salesmen's Qualifications

Sir: Your amusing article on "Ike—the Service Man" in November RADIO calls to mind another problem that is ever present in radio retailing, namely, the desirable characteristics of salesmen.

At various times I have read the opinions of dealers, some of whom claim that a salesman should know all there is to know about the sets he is selling, and the technical reasons behind the features of design. Others take the view that the less a salesman knows about the technicalities of radio the better he will be able to talk to the average uninformed customer.

So far I have not seen the opinion advanced that if a salesman is well up on the technical side he can handle every class of customer. Because he knows the engineering reasons for a certain design does not mean that he must go into a long technical discussion with every customer. The point is that salesmen should know all there is to know about every set he sells and yet be capable of judging his customers so that he will not bore the non-technical prospect or frighten him away by talking over his head. At the same time he should be able to answer semi-technical questions regarding design and principle.

It seems to me that no customer who is at all technically inclined could have confidence in any salesman who knew less about the fine points of radio than he did himself. I am, however, open to correction.

GORDON BROWN.

Seattle, Wash.

Majestic Replacement Block



NATIONAL CONDENSER Block

For replacement in all Majestic Eliminators

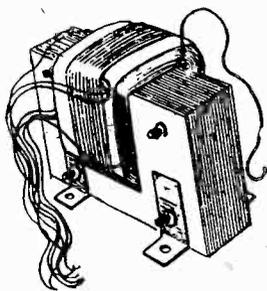
EACH\$3.75
3 at Ea. 3.60
6 at Ea. 3.45
12 at Ea. 3.20

Atwater-Kent Replacement Block for No. 37 Model Set

EACH\$7.00
3 at Ea. 6.50
6 at Ea. 6.00

Zenith Replacement Block

EACH\$4.25
3 at Ea. 4.00
6 at Ea. 3.75



Transformers (Unshielded) (All Ratios)

Boxed, ea.60c
Dozen\$6.60
Splitdorf By-Pass Condensers
.2 Mfd.15c
.25 Mfd.20c

S. S. Jobbing House

20% With Order 152 W. 26th Street
Balance C.O.D. New York City
Send for Our Complete Catalogue

SAVE MONEY!

"Radio Engineering" and "RADIO"—Both for a full year
\$3.00

"Radio News" and "RADIO"—Both for a full year
\$3.00

TWO MAGAZINES FOR A LITTLE MORE THAN THE PRICE OF ONE

SUBSCRIBE NOW!

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1930 Will Be A Dilco Year!



"Better because they're precision built"

That's the story which is helping dealers increase Dilco sales every day! Each and every tube must conform to the most rigid specifications. The Dilco stamp of quality means they must be good.

The makers of Dilco offer this attractive franchise to radio dealers everywhere—a fast selling line of vacuum tubes—less service calls—and a liberal discount. Your distributor will give you full information.

Desirable Territories Are Open to Live Wire Distributors and Jobbers! Write Today!

Dilco
THE TUBE OF MERIT

DILCO RADIO CORP.
HARRISON, N. J.

For Exact Radio Tube Voltage

With micrometer accuracy, AMPERITE automatically controls each tube. Lengthens tube life. A type for every tube. \$1.10 with mounting (in U. S. A.).

AMPERITE Corporation
561 BROADWAY, NEW YORK
FREE—"Amperite Vest Pocket Tube Chart."
Write Dept.

AMPERITE
REG. U. S. PAT. OFF.
The "SELF-ADJUSTING" Rheostat

This symbol in a radio diagram means—

SALESMEN WANTED
To take subscriptions to "RADIO"
Write Today

MODEL
GA-20



PRICE
\$225.00
LESS TUBES

10 POINTS OF SUPERIORITY

1. Self-healing condensers — eliminating trouble from this source.
2. Oversized power transformers, chokes, and resistances—providing a large safety factor.
3. Rugged mechanical construction—component parts securely fastened to a die-cast pressed steel chassis.
4. Provision for line voltage variations—assuring all possible protection for long tube life.
5. Audio units thoroughly impregnated—making units immune from climatic changes.
6. Power supply housed in ventilated compartment—providing protection against overheating.
7. Resistance capacity filter in grid circuit of all tubes—assuring an extremely flat frequency characteristic.
8. High over-all gain—making possible the use of low input signals.
9. Low hum level.
10. UNEXCELLED PERFORMANCE.

combined . . . assures

Write today for bulletin R-12

GENERAL AMPLIFIER COMPANY

562 Washington Boulevard

Chicago, Illinois

FACTORY: 27 COMMERCIAL AVENUE, CAMBRIDGE, MASS.

STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

"RADIO," published monthly at San Francisco, Calif., for October 1st, 1929.

State of California, County of San Francisco, ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared H. W. Dickow, who, having been duly sworn according to law, deposes and says that he is the Business Manager of "RADIO," and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

agers are:

Publisher, Pacific Radio Publishing Co., Pacific

1. That the names and addresses of the publisher, editor, managing editor, and business manager, San Francisco; Editor, Arthur H. Halloran, Berkeley, Calif.; Managing Editor, None; Business Manager, H. W. Dickow, Pacific Bldg., San Francisco.

2. That the owner is:

Pacific Radio Publishing Co., Pacific Bldg., San Francisco; Arthur H. Halloran, Berkeley, Calif.; H. W. Dickow, Pacific Bldg., San Francisco; H. L. Halloran, Berkeley, Calif.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per

cent or more of total amount of bonds, mortgages, or other securities are: None.

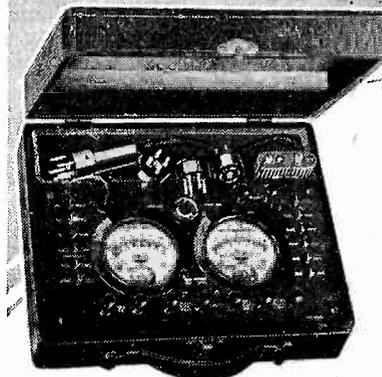
4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

H. W. DICKOW,
Business Manager.

Sworn to and subscribed before me this 8th day of October, 1929.

(SEAL) JOHN L. MURPHY,
Notary Public in and for the City and County of San Francisco, State of California. My commission expires May 30, 1933.

Don't Guess at Set Troubles



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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1642-I Walnut Street, Chicago, Ill.

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

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148 PAGES of outstanding RADIO VALUES

On every page of this big catalog for 1930 you will find radio merchandise of unusual interest—priced at the lowest wholesale quotations. No radio enthusiast or dealer can afford to be without it.

The latest radio devices and improvements are illustrated—sets, accessories, parts and kits—at price-saving reductions that spell the buyer's opportunity. Astounding offerings in new, humless, Screen Grid A. C. all-electric and battery operated sets; beautiful and artistic consoles; dynamic speakers of great volume and rich tone; and everything considered standard in accessories, parts and kits.

The startling values listed in this Catalog are made possible by our tremendous buying power, low cost of operation and willingness to take a conservative profit. Quick service, expert cooperation and unusual satisfaction are assured to every customer.

Don't fail to get this **FREE** wonder book. It will save you big money. Mail the Coupon Today!

New!
SCREEN GRID MODELS

FREE!
CATALOG COUPON!

Chicago Salvage Stock Store
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509 So. State St., Chicago, Ill.

Kindly send me (free of charge and postpaid) your new 148-page Book of Radio Bargains.

Name

Address

City State

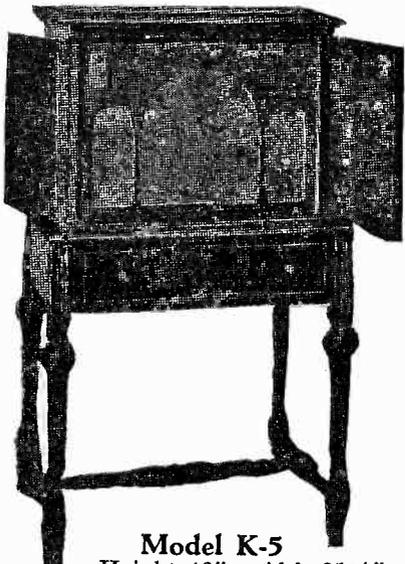
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WORLD'S LARGEST RADIO STORE

509 So. State St. Dept. 132 Chicago, Ill..

Quick Selling! Big Profit-Margin!

Either of these KOLSTER items at less than one-fifth of the original list price



Model K-5
Height 42", width 25½",
depth 19"

SPECIAL OFFER

To give every dealer the opportunity of selling these KOLSTER items with the least investment and the most profit we make this SPECIAL OFFER.

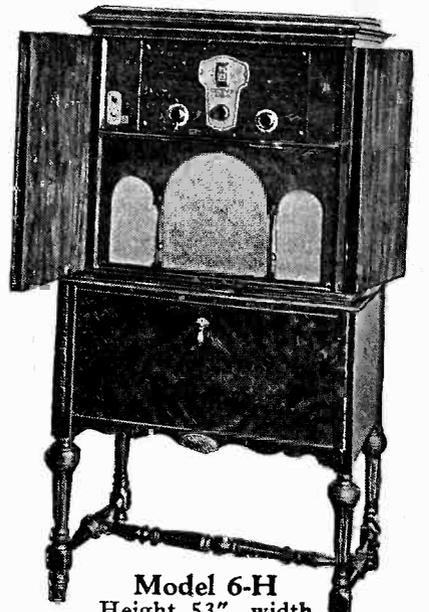
BUY AS YOU SELL

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.

Going! Going! G——!

Wide-awake dealers are reducing the limited stock we have remaining every day. Repeat orders show how fast these items move. Start your first order on the SPECIAL OFFER today.

*Licensed Under Patents of the Radio Corp. of America and
Lectophone Corp.*



Model 6-H
Height 53", width
27", depth 18½"

K O L S T E R

ELECTRO-DYNAMIC REPRODUCER

Combined with 210 Power Amplifier
and "B" Supply Unit

Features

1. Electro-Dynamic Reproducer (10¼ in. dia.)
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-stripped walnut cabinet.

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 in a steel frame. It weighs 45 pounds, without the cabinet. The cabinet itself is of pencil-stripped 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.

This Electro-Dynamic 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. Wherever 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.

The 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 pickup, one additional audio stage is recommended between the pickup and this Reproducer.

A 20-ft. cable is included with each instrument. Operates direct from 50-60 cycle, 110-120 volt A-C current.

List Price, \$175.00 (less tubes)

Going at **\$33.50!**

Lots of 5 or more \$29.50 ea.

K O L S T E R

SIX-TUBE CONSOLE RECEIVER

With Built-in Kolster
Electro-Dynamic Reproducer

Features

1. Beautiful highboy console of burled walnut with maple overlay.
2. Kolster K-5, 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.

The 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. The built-in Electro-Dynamic Power Reproducer furnishes the "B" supply current to the set. A switch snaps the receiver in or out of operation and a pilot light tells instantly when set is in operation. The single dial control makes this the simplest of receivers to operate.

This 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. The 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.

The 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. The receiver uses 6—UX-201A tubes and the Electro-Dynamic Reproducer uses 2—UX-281, 1—UX-210, and 1—UX-874 tubes.

List Price, \$295.00 (less tubes)

Going at **\$48.50!**

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

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BARGAINS ON FILTER CONDENSERS AND CHOKES

AEROVOX or Dubilier 7 Mfd.



Size 6"x5"x3 1/2"

Finest non-inductive High Voltage Filter Block. Made to be used with UX-250 Power Tubes, but can be used safely in filter circuits of eliminators or high power Amplifiers in any combination of capacities desired.

Each Unit is equipped with long, heavy, flexible insulated leads, convenient for easy wiring, and also has mounting brackets. Latest design.

The insulation resistance of these Condenser Blocks is in excess of R.M.A. and N.E.M.A. standard requirements.

Due to the request of the manufacturers of these Condenser Blocks we cannot divulge the high list price of same.

High Voltage Filter Condenser Blocks

Capacity	Rated D.C. Working Voltage
2.0 mfd.	1000 V
1.0 "	800 V
1.0 "	800 V
3.0 "	400 V

Special \$2.50 per block

THORDARSON DOUBLE FILTER CHOKES

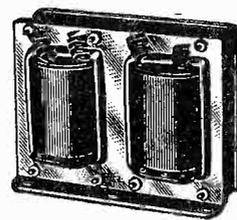
Contains Two 18 Henry 250 Mill Chokes

This heavy duty, rugged, Thordarson Double Choke Coil is ideal for filter circuit in Transmitters, Power Amplifiers and "B" Eliminators and various other purposes.

Each choke has a 2000 Volt insulation and the DC resistance of each choke is 108.5 ohms.

When connected in series this choke coil has a capacity of 36 henries at 250 mills, and when connected in parallel 18 henries with 500 mills carrying capacity.

Weight for shipment 14 pounds. Dimensions 3x7x5 1/2 in. Equipped with mounting brackets.



Model T-2458
List Price \$19.50

SPECIAL \$4.75

Dubilier HIGH VOLTAGE FILTER CONDENSERS

4 MFD. D.C. Working Voltage 600 V.



Model PL-571
List Price \$7.25

An excellent high voltage filter condenser for use in high voltage socket power devices, Power Amplifiers, and Power Packs.

SPECIAL \$1.75

Models 902 and 903

These Dubilier Filter Condensers are tested from 3 to 5 times their rated value. Widely separated soldering lugs are provided to insure long leakage paths.

Each Condenser brand new and packed in individual carton.

Capacity	List price	Special
1	\$2.50 ea.	\$0.50 ea.
2	3.50	.70
4	5.50	1.10

Type 902. Rated D.C. Working Voltage 400 V.

Capacity	List price	Special
1	\$3.50 ea.	\$0.60 ea.
2	5.50	1.10

Type 903. Rated D.C. Working Voltage 600 V.



Faradon

or POLYMET 5 MFD. HIGH VOLTAGE FILTER CONDENSER BLOCKS

This condenser block is ideal for use in "B" eliminators, Power Amplifiers and experimental work.

4 mfd. D.C. working voltage 400 v.
1 mfd. D.C. working voltage 600 v.

SPECIAL \$1.25 per block



MISCELLANEOUS FILTER CONDENSER UNITS

	Special
DUBILIER CONDENSER CORP.	
1 1/4 mfd. 1000 volts D.C. Working Voltage.....	\$1.15 ea.
4 mfd. 600 volts rated D.C. Working Voltage (used, but guaranteed as rated).....	1.50
7 mfd. 600 volts rated D.C. Working Voltage.....	2.50
STROMBERG-CARLSON TEL. MFG. CO.	
3 1/2 mfd. 600 volts rated D.C. Working Voltage.....	1.50
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20 mfd. 250 volts D.C. Working Voltage.....	2.75
RADIO CORP. OF AMERICA	
7 mfd. 600 volts rated D.C. Working Voltage.....	2.75
2 mfd. 300 volts rated D.C. Working Voltage (used, but guaranteed as rated).....	.30

	Special
WESTINGHOUSE ELEC. & MFG. CO.	
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20 mfd. 250 volts rated D.C. Working Voltage.....	2.75
WIRELESS SPECIALTY APP. CO.	
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POTTER BUFFER CONDENSER UNITS	
(Contains two .1 Condensers with center taps.)	
D.C. Working Voltage. 400 volts.	
List price \$1.50.....	.30

order.) All units offered are BRAND NEW, packed in original factory sealed carton and fully guaranteed.

19-21 WARREN ST., NEW YORK

BARGAIN BULLETIN NUMBER 60

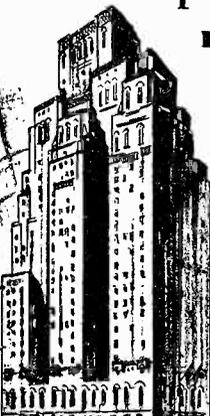
HOTELS FOR RADIO TRAVELERS

Now Open
in New York
The HOTEL
GOVERNOR CLINTON

Opposite Penn. R. R. Station
New York's new hotel truly expressive of the greatest city. 1200 pleasant rooms each with Servidor, bath, circulating ice water and radio provisions.

ROOMS from **\$3.00**

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FINEST

ONE of the Nation's outstanding hotels embodying every modern convenience that so attracts travelers throughout the world.

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CAROLINA CREST HOTEL

LATZ INC.

No Charge!

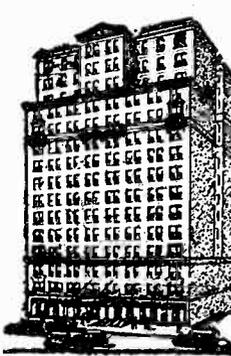
This charming hotel, surrounded by green lawns and sun porches, is the only Hotel in Atlantic City serving breakfast in your room without charge. The bedrooms are built for comfort; each with its own private bath, large closets, modern furnishings, bridge and reading lamps and three or more windows to the room. Everything is cozy and homelike.

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Atlantic City

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New York City

JUST COMPLETED

This new hotel contains every modern appointment

350 Rooms—350 Baths
Every Room Has Private Bath

\$3.00 Per Day

SPECIAL WEEKLY RATES

Situated in the heart of the city; near Railway Terminals. All Leading Shops and Theatres within a stone's throw

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Books That Help Your Product Stay Sold!

Servicing has to be done, and the best guardian of profits is a book that gives accurate, easily understood information and instructions on how to service. Have your service man equipped with the three outstanding books.

"Trouble Shooter's Manual," by John F. Rider

The first comprehensive volume devoted exclusively to the topic uppermost in every service man's mind is "Trouble Shooter's Manual," just published. It is not only a treatise for service men, telling them how to overcome their most serious problems, and fully diagramming the solutions, but it is a course in how to become a service man. It gives all the details of servicing as they have never been given before. Finding the right mode of attack, applying the remedy promptly and obtaining the actual factory-drawn diagrams of receivers always have been a load on the service man's chest. But no more. Rider, expert on trouble shooting, has produced the outstanding volume on servicing, and has taken the load off the service man's chest!

This book is worth hundreds of dollars to any one who shoots trouble in receivers — whether they be factory-made, custom-built or home-made receivers. The home experimenter, the radio engineer, the custom set-builder, the teacher, the student,—all will find this new book immensely informative and absolutely authoritative.

Here are the 22 chapter headings:

SERVICE PROCEDURE
PRACTICAL APPLICATION OF ANALYSIS
VACUUM TUBES
OPERATING SYSTEMS
AERIAL SYSTEMS
"A" BATTERY ELIMINATORS
TROUBLES IN "A" ELIMINATORS
TROUBLE SHOOTING IN "A" ELIMINATORS
"B" BATTERY ELIMINATORS
TROUBLES IN "B" BATTERY ELIMINATORS

TROUBLE SHOOTING IN "B" BATTERY ELIMINATORS
SPEAKERS AND TYPES
AUDIO AMPLIFIERS
TROUBLE SHOOTING IN AUDIO AMPLIFIERS
TROUBLES IN DETECTOR SYSTEMS
RADIO FREQUENCY AMPLIFIERS
TROUBLE SHOOTING IN RF AMPLIFIERS
SERIES FILAMENT RECEIVERS
TESTING, AND TESTING DEVICES
TROUBLES IN DC SETS
TROUBLES IN AC SETS

Wiring Diagrams of All These Receivers

Besides 22 chapters covering thoroughly the field of trouble shooting, this volume contains the wiring diagrams of models, as obtained direct from the factory, a wealth of hitherto confidential wiring information released for the first time in the interest of producing better results from receivers. You will find these diagrams alone well worth the price of the book. The wiring diagrams are of new and old models, of receivers and accessories, and as to some of the set manufacturers, all the models they ever produced are shown in wiring diagrams! Here is the list of receivers, etc., diagrams of which are published in this most important and valuable book:

GREBE MUL, MU2, synchro-phase 5, synchrophase AC 6, synchrophase AC7, Deluxe 428.	ALL-AMERICAN 6 tube electric, 8 tube 80, 83, 84, 85, 86, 88, 6 tube 60, 61, 62, 65, 66, 6 and 8 tube A.C. power pack.	AMRAD 70, 7100, 7191 power unit.
PHILCO Philco-electric, 82, 86.	DAY FAN OEM7, 4 tube, 5-5 tube 1925 model, Day Fan 8 A.C., power supply for 6 tube A.C., B power supply 5524 and 5525, motor generator and filter, 6 tube motor generator set, 6 tube 110 volt D.C. set, 6 tube 32 volt D.C. set.	SPARTAN A.C. 89.
KOLSTER 4-tube chassis used in 6 tube sets, tuning chassis for 7 tube sets, power amplifier, 7 tube power pack and amplifier, 6 tube power pack and amplifier, rectifier unit K23.	MISCELLANEOUS DeForest F5, D10, D17, Super Zenith Magnavox dial, Thermodyne, Grimes 4DL inverse duplex, Garod neutrodyne, Garod EA, Ware 7 tube, Ware type T, Federal 102 special, Federal 59, Kennedy 220, Operadio portable, Sleeper RX1, Amrad inductrol.	R. C. A. 60, 62, 20, 64, 30, 105, 51, 16, 32, 50, 25 A.C., 28 A.C., 41, Receptor S.P.U., 17, 18, 33.

STEWART-WARNER
300, 305, 310, 315, 320, 325, 500, 520, 525, 700, 705, 710, 715, 720, 530, 535, 750, 801, 802, 806.

FEDERAL
Type F series filament, type E series filament, type D series filament, Model K, Model H.

ATWATER-KENT
10B, 12, 20, 30, 35, 48, 32, 33, 49, 38, 36, 37, 40, 42, 52, 50, 44, 43, 41 power units for 37, 38, 44, 43, 41.

CROSLEY
XJ, Trirdyn 3R3, 601, 401, 401A, 608, 704, B and C supply for 704, 704A, 704B, 705, 706.

STROMBERG-CARLSON
1A, 2B, 501, 502, 523, 524, 635, 636, 403AA power plant, 404 RA power plant.

ZENITH
39, 39A, 392, 392A, 40A, 35PX, 35APX, 352PX, 352APX, 37A, 35P, 35AP, 352P, 352AP, 34P, 342P, 33, 34, 35, 35A, 342, 352, 352A, 362, 31, 32, 333, 353A, power supply ZE17, power supply ZE12.

MAJESTIC
70, 70B, 180, power pack 7BP3, 7P6, 7P3 (old wiring), 8P3, 8P6, 7BP6.

FRESHMAN
Masterpiece, equaphase, G, G-60-S power supply, L and LS, Q15, K, K-60-S power supply.

COLONIAL
26, 31 A.C., 31 D.C.
WORKRITE
8 tube chassis, 6 tube chassis.

FADA
50/80A receivers. 460A Fada 10, 11, 30, 31, 10Z, 11Z, 30Z, 31Z, 16, 17, 32, 16Z, 32Z, 13, special, 192A-192S and 192BS units, R80A, 480A, and SF 50/80A receivers. 460A receiver and R60 unit, 7 A.C. receiver, 475 UA or CA and SF45-75 UA or CA, 50, 70, 71, 72, C electric unit for special and 7 A.C. receivers, ABC 6 volt tube supply, 86V and 82W, E180B power plant and E 420 power plant.

FREED-EISEMANN
NR5, FE18, NR70, 470, NR 57, 457, NR11, NR80 DC.

Some of the Questions Settled in This Valuable Book

Securing information from the receiver owner, list of questions, practical chart system of repairs, circuits and operating conditions.

Repairs in the home, method of operation, spare tubes, the process of elimination, recognizing symptoms, examples of practical application, tracing distortion, tracing electrical disturbances; vacuum tube tests; neutralizing systems, filament circuits, grid circuits, methods of securing grid bias, plate circuits; long aeriels, short aeriels, selectivity, imperfect contact, directional qualities, grounds; "A" battery eliminator types, design, operating limitations, requirements for perfect operation, AC eliminators, DC eliminators; "A" eliminator hum, reasons, voltage reasons, noise; full wave, half wave, B battery eliminators, filament rectifiers, gaseous rectifier, dry disc rectifier, wiring, parts used, design, voltage regulation, operating limitations, requirements for perfect operation, combination filament and plate voltage eliminators, AC and DC types; B battery eliminator output current

and voltage, excessive hum, dead eliminator, poor design, reasons for defects, motorboating, punctured condensers, shorted chokes, voltage regulator tubes, function of filter system, C bias voltages, voltage divider systems, filter condensers, by-pass condensers, voltages in the system; determining voltages in B eliminators, AC, DC, voltage drop, effect of shorted filter system, defective rectifiers, defective transformer, defective chokes, defective by-pass condenser, design of filter system, defective voltage divider network, relation between hum and output voltage, isolation of troubles, external filters, noise filters; cone, dynamic, exponential speakers, troubles, dead, weak output, distorted output, rattle, continuity testing, windings, magnets, frequency filters, testing, chokes, condensers, hum elimination; audio amplifier types, transformer, resistance, impedance, auto-transformer, combinations, requirements for perfect operation, operating limitations, tubes, forms of coupling, plate voltage, grid voltage, filament voltage, isolating condensers, voltage reducing resistances, noises, analysis of trouble, plate current, grid current.

"The Mathematics of Radio," a Companion Volume

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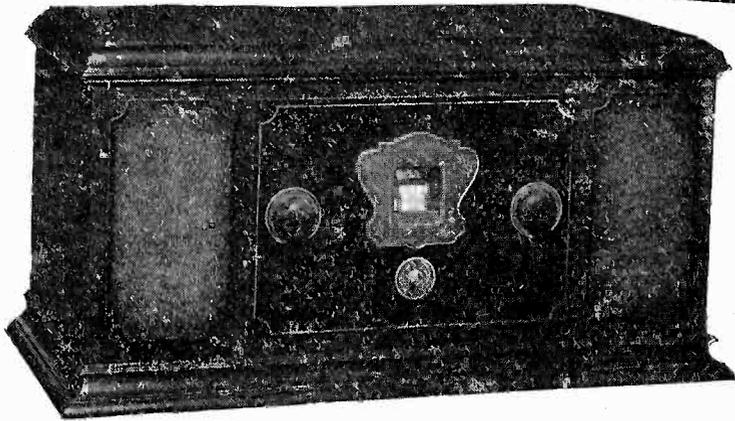
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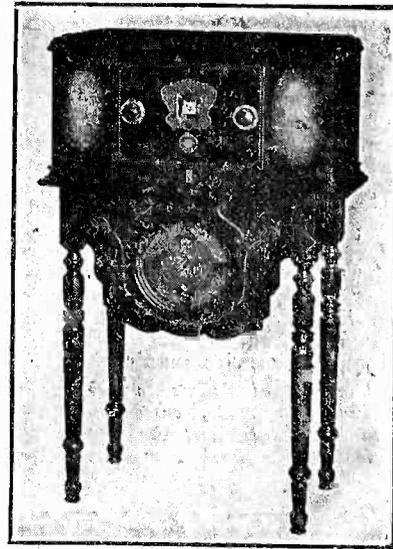
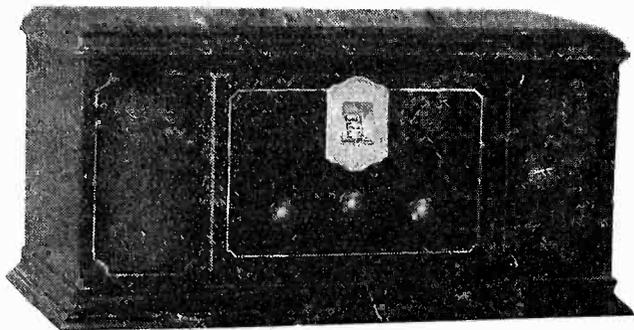


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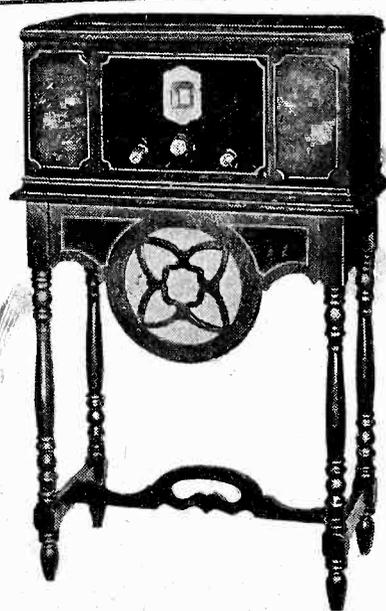


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