

SEPTEMBER, 1929

RADIO

REG. U.S. PAT. OFF.

25 CENTS



Standard Since 1915



Cunningham RADIO TUBES

**SEE PAGES
11 to 14**

in this issue and months
following for our

TRADE MESSAGES

E. T. CUNNINGHAM, Inc.

NEW YORK

SAN FRANCISCO

CHICAGO

DALLAS

ATLANTA

• 14 Years •

196 Page
FREE
CATALOG

The new

**SCREEN
GRID**

**A-C
RECEIVERS**

RADIO
the new **SCREEN GRID** models



WHOLESALE

1930

**RADIO
CORPORATION
116 W. LAKESHORE ST. CHICAGO**

WHOLESALE PRICES!

THIS NEW
big catalog—just off the press—heralds values never before approached in radio merchandising. Prices have never been lower—or quality so high. Send for your copy today. See for yourself the astounding values we offer—the actual wholesale prices at which you can now buy. Our recent purchases totaling over one million dollars (\$1,000,000) in standard radio receiving sets coupled with our tremendous stock of standard accessories, parts and kits has enabled us to make startling price reductions. Write today for the complete story as given in this large 196 page catalog of radio bargains.

**EVERYTHING IN RADIO
AT UNHEARD OF PRICES**

New Screen Grid A. C. Humless All-Electric sets—standard A-C sets as well as battery operated receivers in an attractive array of consoles ranging from small table model types to gorgeous pieces of radio furniture. They represent the finest offerings of the season. The price range is especially attractive presenting unusual values as low as \$15.95.

Get this Allied catalog. Buy low so you can make more profit. Deal with an organization of experts who are trained to render real service in radio.

\$15.95

A
Reliable,
High-grade
Radio House

**ALLIED RADIO
CORPORATION**

Backed by
Resources
totaling over
\$3,000,000

711 W. Lake Street Dept. E Chicago

TRIAD INSURANCE

sells more tubes...protects your profits



Tube insurance — a radically new Triad sales idea! A printed guarantee of six months' perfect service — or a satisfactory adjustment made — with every Triad Tube. Now — for the first time the dealer can be *sure* of greater tube sales and profit protection!

The Triad give extra care is...
If during within six months new tube. This guarantee street's at one

RED TRIAD GUARANTEE CERTIFICATE

No. _____

has been carefully tested at the factory before shipping and should with the instructions accompanying the tube.

good service for a minimum period of six months from date hereof. If unloaded, an average life of one year or more may reasonably be expected.

factory for any cause (except for breakage of glass), and it is returned to the Dealer from whom it was purchased, such dealer will replace it with a new tube of the same type.

TRIAD Manufacturing Co., Inc., of Pawtucket, Rhode Island, rated in Dun's and Bradstreet as your assurance of living up to its promises.

TRIAD MANUFACTURING CO., INC.

George Coby President

DEALER'S NAME _____
ADDRESS _____
DATE _____

Tune in on the "Triadors" — every Friday evening, 8 to 8:30 Eastern Daylight Time — WJZ and associated NBC Stations.



Unique triangular Triad carton. Builds up into a striking attention-getting display. Use Triad cartons in your windows and on your counter to link up with Triad national magazine, newspaper and radio advertising.

When a tube is backed by a printed certificate guaranteeing six months of perfect service, *it must be good!* Tube purchasers realize it — that's the reason for the tremendous popularity of Triad. And that's why dealers are winning greater sales with Triad than they have ever enjoyed before. But that's only the first step — Triad does *more than that* for the dealer — it *protects the profits he has won.* The insured certificate assures him and his customer of absolute satisfaction should an adjustment be necessary. He retains every cent of profit that he has made in the sale! No wonder dealers are enthusiastic about this line. For sales, satisfaction and protected profits, it will pay *you* to stock Triad!

Call your Jobber or write us for complete Triad dealer information

TRIAD MANUFACTURING CO., Inc.
Triad Building Blackstone, Middle and Fountain Sts.
PAWTUCKET, R. I.

West Coast Factory Representatives:
R. J. NOEL CO. 508 Eddy Street San Francisco, Calif.
J. A. CASH Pioneer Bldg. Seattle, Wash.

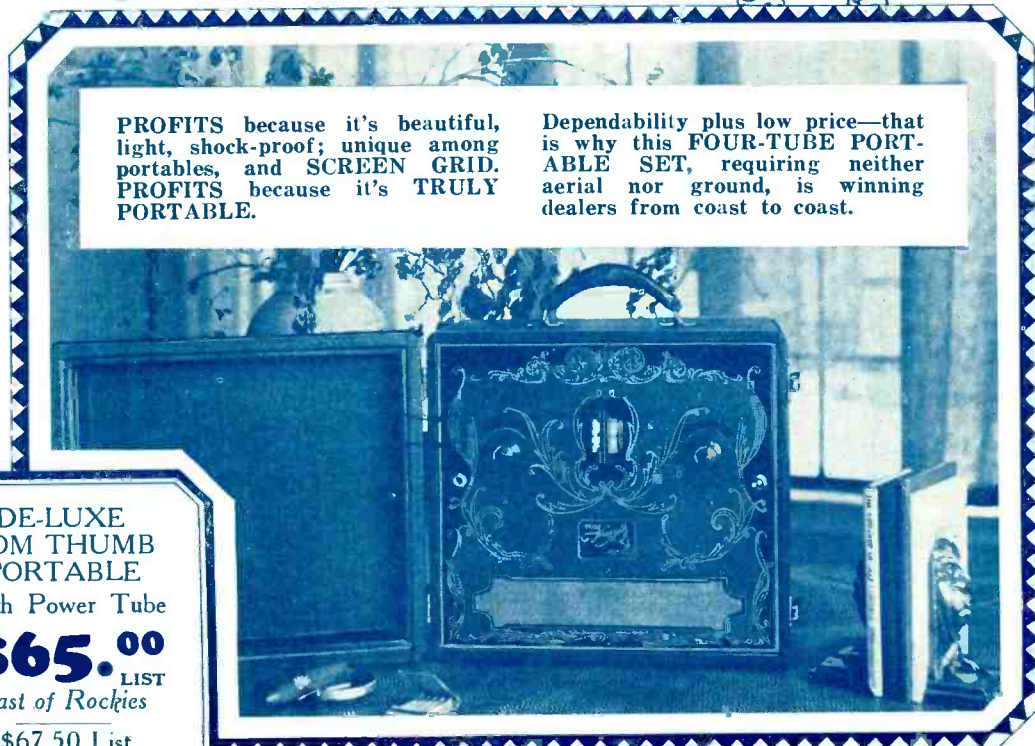
Dealers *Listen!*

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

Tom Thumb

SCREEN GRID PORTABLE RADIO

Speaks in the tone
of PROFITS



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.

It Will Pay
You To
SEND
for
Dealer's
Proposition
Now!
Wire or Write

DE-LUXE
TOM THUMB
PORTABLE
With Power Tube
\$65.00 LIST
East of Rockies
\$67.50 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.

\$95.00 LIST
Less Tubes

\$99.00
West of Rockies

STANDARD BATTERY MODEL, same in appearance as De Luxe battery model, but has air column speaker and no power tube,

\$57.50 LIST
Less Equipment

\$60.00
West of Rockies

ALSO TWO OTHER MODELS

AUTOMATIC RADIO MANUFACTURING COMPANY, INC.

332 "A" STREET, BOSTON, MASS.

Northern California Distributors

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



Modulated
radiator for
testing,
synchronizing,
neutralizing

Self-contained
power plant

Screen grid
socket analysis
without
oscillation.

External
connections
to all appa-
ratus

Tests both
plates 240
type
rectifiers

All tubes
tested
under actual
operating
conditions

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

All
continuity
tests
without
batteries

Universal
analyzer
plug

SUPREME
Radio Diagonometer

Tube Testing Plus---

The only dependable tests on all tubes, including screen grid. Tests each plate separately of 280 type rectifiers. An exclusive feature and of prime importance.

The only commercial means of testing tubes under actual working conditions, revealing all tube deficiencies, many of which cannot be determined by any other service instrument or tube checkers.

Don't rely upon partial or misleading tests. Stop guessing. Use The SUPREME DIAGNOMETER and know to an absolute certainty the condition of all tubes. Saves time and money.

Screen Grid Analysis, etc.

Accurate screen grid analysis without producing oscillations in the set.

Synchronizing by thermo-couple meter or A. C. meter. Easy and accurate. Same method almost universally employed in factory practice.

Neutralizing. External connections to all apparatus.

All continuity tests without the use of batteries.

THE DIAGNOMETER'S COMPLETENESS, RANGE AND FLEXIBILITY WILL PROVE ASTOUNDING.

{ MOST GOOD DISTRIBUTORS CARRY THE SUPREME DIAGNOMETER IN STOCK. }

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

... "a year and

"... but they couldn't copy
our mind,
So we left 'em sweatin' and
stragglin'
A year and a half behind!"

—Kipling.

It is perhaps natural that the remarkable success of the SUPREME DIAGNOMETER would inspire others to copy and imitate.

For eighteen months the slogan, "*Makes Every Conceivable Test*" has characterized DIAGNOMETER advertising. That slogan was employed because it was true, and for the purpose of distinguishing this remarkable instrument from the rather limited range "set testers" then and still in general use. Recently a manufacturer of a "set-tester" adopted the slogan, word for word, "*Makes Every Conceivable Test.*" Will it? Try and see. *The answer is left to your own investigation.*

The first model SUPREME DIAGNOMETER was housed in a carrying case, providing adequate convenient space for all tools and spare tubes and this unusual feature was extensively advertised. Now eighteen months afterwards a "set-tester" manufacturer announces "*A large case with compartments for tools and replacement tubes.*" Colton said, "*Imitation is the sincerest flattery,*" and to which might be added: —"*and the frankest confession of superiority.*"

Eighteen months ago and ever since, the SUPREME DIAGNOMETER has been advertised as "*A complete portable laboratory.*" It was the only way to fittingly describe this remarkable instrument, so unique, and possessing a range, completeness and flexibility that has never been even remotely approached in the service field. *More than a "set-tester"—truly "a complete portable laboratory!"*

Again our advertising is copied, and this manufacturer of "set-testers," apparently with much pride, announces in bold headlines: "*A complete portable laboratory.*" But is it? You ask. Ah! There is the rub. It is much easier to mimic advertising phrases than to recreate the spark of genius so infinitely present in the design of the SUPREME DIAGNOMETER.

Again the answer is left to your investigation.

Note the innumerable tests and functions that others do not even remotely attempt, then—

**watch their further efforts
to copy and imitate--
"A year and a half behind!"**

The SUPREME DIAGNOMETER, the result of several years intensive engineering effort, has in the brief space of eighteen months, come to be recognized as the *outstanding*, in fact, *the only complete portable radio testing outfit ever produced.* Its performance is as distinctive as the name not merely a "set tester" but a carefully designed practical apparatus for *instantly and correctly diagnosing every radio ill.*

Its sweeping success is without parallel. In the brief space of eighteen months this remarkable instrument has been sold in very substantial quantities in every state in the Union, in every province of Canada; in Mexico, Cuba, Panama, Brazil, Spain, Italy, Australia, Hawaiian Islands, Czechoslovakia and China. Wherever radio service penetrates, the superiority of the SUPREME DIAGNOMETER is recognized. Radio technicians and engineers are unanimous in declaring the DIAGNOMETER to be the most complete portable testing instrument ever designed.

The more you know about radio, the more you will appreciate the SUPREME DIAGNOMETER.

Truly the Diagnometer Is SUPREME

SUPREME

Radio Diagnometer

Most Good Distributors Carry the

a half behind"

The "SUPREME DIAGNOMETER" Compared with "Set Testers"

Following is comparison of the Supreme Diagonometer with the three leading set testers, which are designated "A," "B" and "C," and the most popular test board on the market, which sells for more than double the price of the Supreme Diagonometer. "X" indicates YES. Blank space indicates NO.

Tests, Functions and Facilities	Set Tester "A"	Set Tester "B"	Supreme Diagonometer	Set Tester "C"	Test Board
D. C. Filament Voltage Reading	x				
A. C. Filament Voltage Reading	x	x			
Plate Voltage Reading	x	x	x	x	x
Plate Current Reading	x	x	x	x	x
Simultaneous Plate Current and Voltage readings	x	x	x	x	x
Grid Voltage Reading	x	x	x	x	x
Cathode Bias Reading	x	x	x	x	x
Screen Grid Voltage	x	x	x	x	x
Control Grid Voltage	x	x	x	x	x
Analysis Without Use of Adapter	x	x	x	x	x
Line Voltage Reading	x	x	x	x	x
Locate Unbalanced Secondaries	x	x	x	x	x
Reads both positive or negative Cathode Biasing	x	x	x	x	x
Oscillation Test of Tubes	x	x	x	x	x
A. C. Line Tube Testing	x	x	x	x	x
Bias Emission Tube Tester	x	x	x	x	x
Tests 15 Volt Filament Tubes Independent of Radio			x		
Tests Screen Grid Tubes Independent of Radio			x		
Tests Overhead Filament Type Tubes Independent of Radio			x		
Tests Both Plates '80 Type Tubes			x		
Rejuvenates Thoriated Filament Tubes out of Set Without Removing from Set			x		
D. C. Continuity Tester Without Batteries			x		
Furnishes Modulated Signal for Testing			x		
Synchronizing—By Thermal-Meter Method			x		
By A. C. Meter Method			x		
By Audible Method			x		
Neutralizing Signals Provided			x		
Thermo—Couple Meter			x		
Tests Gain of Audio Amplifiers			x		
Measures Up To 250 Mils. A. C. Current			x		
External Use of Meters			x		
Of 750 D. C. Meter	x		x		
Of 750 A. C. Meter	x	x	x		
Of 2.5 Amps. Milliammeter	x		x		
Measures Capacity of Condensers .01 to 9. Mfd.	x		x		
Tests Charger Output by Meter			x		x
Bridges Open Audio Stages for Tests			x		x
Positive Milliammeter Protection for tube testing			x		
500,000 Ohm variable resistor for testing			x		
30 Ohm Rheostat for Testing			x		x
Self Contained Power Plant for all required tests			x		
Percentage of EFFICIENCY	40%	29%	100%	29%	36%

Dependable service is the greatest selling aid in radio distribution. Equip yourself to perform such service at minimum cost.



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

SUPREME DIAGNOMETER in Stock

The only complete portable radio testing laboratory



Showing front view of instrument tray removed from case



Rear view of instrument showing pinjacks affording external access to all apparatus

There is no servicing problem that the SUPREME DIAGNOMETER will not solve easily and quickly. No more returns to factory or distributor for adjustment or repair. All service can be given, right in the customer's home, so quickly that the cost of servicing is negligible compared with antiquated methods. The work is done by scientific analysis, insuring the perfect results that create enthusiastic customer satisfaction and good-will.

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.

Supreme Radio Manual

A most complete loose leaf radio manual accompanies each instrument. Monthly supplements are issued to keep the manual constantly up-to-date. An invaluable aid to the service man.

SUPREME

Radio Diagonometer

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

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

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.

Supreme Instruments Corp.
337 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.

A New Opportunity for Profit!

IN the month of June, this year, the Capehart Corporation opened a great new factory at Fort Wayne, Indiana. Just 17 months before, the business started from a mere idea in a shack at Huntington.

Phenomenal growth based on immediate and widespread public response. Those who have been identified with the Capehart during this period have made big money. And still the business is in its infancy. Merely the surface of the market has been tapped. The opportunities for real big profits are still ahead. The business has grown so fast that many valuable territories still remain untouched.

The Capehart Organization is building its dealer organization carefully. It has a valuable franchise to award—one that is worth big money. It presents a *new opportunity for profit* to established responsible dealers who have the energy and ability to develop its tremendous possibilities.

The Musical Marvel of the Age

The Capehart Orchestrope actually *solves the problem of music* for hotels, restaurants, refreshment parlors, roadhouses — in fact any place of amusement or recreation that caters to the public in any way. The Capehart brings all the advantages and profit of music to establishments which never could afford it before.

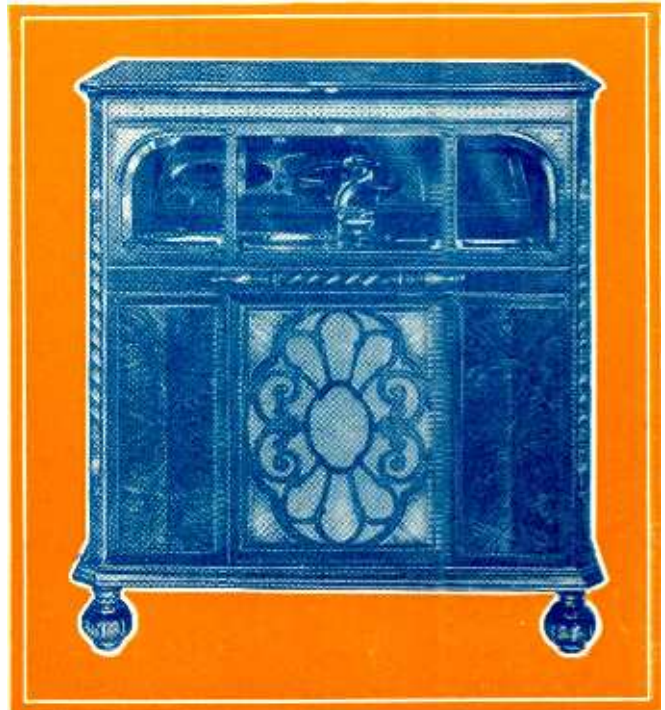
The great sale and tremendous enthusiasm which has greeted the Capehart is proof that the business establishments of the country have been waiting for just such an instrument.

Mail Coupon for Details

If you are interested in a new activity which will not interfere with your present business—one that is bringing a profit of \$2,000 to \$5,000 a month to others, one that will take out the gaps in your yearly sales curve, *one that has so large a dollar margin in every sale that it pays you well for every effort*—send the coupon at once for full details. Those who become identified with the Capehart organization now are getting in on the ground floor, with all that such an opportunity offers. Don't wait until the ground floor is taken. Please write us at once.

THE CAPE HART
Orchestrope

THE CAPEHART CORPORATION
Fort Wayne, Indiana



ARISTOCRAT MODEL.
Exquisitely designed for use in the finest clubs and homes.



OUTDOOR MODEL.
Specially built to meet great volume outdoor requirements. Fireproof and weatherproof.



AUDITORIUM MODEL.
Recommended for public auditoriums, dancing academies, etc.

Plays 56 Selections

The Capehart Orchestrope offers the most complete line of automatic phonographs in the world. Each model plays 56 selections, 28 records on both sides, without repetition. They operate 24 hours a day, if desired, without even a moment's attention. The tone, brought through three stages of audio amplification and a dynamic speaker, is startlingly true to life. The volume is adjustable to any requirement. Supplied with or without coin-operating attachments. Also with as many as five auxiliary speakers.

The Capehart Corporation
Dept. 3486, Ft. Wayne, Indiana

Please send me, without obligation, descriptions of all Capehart Orchestrope models and details of the Capehart Dealer's Franchise.

Name _____

Address _____

City _____

State _____

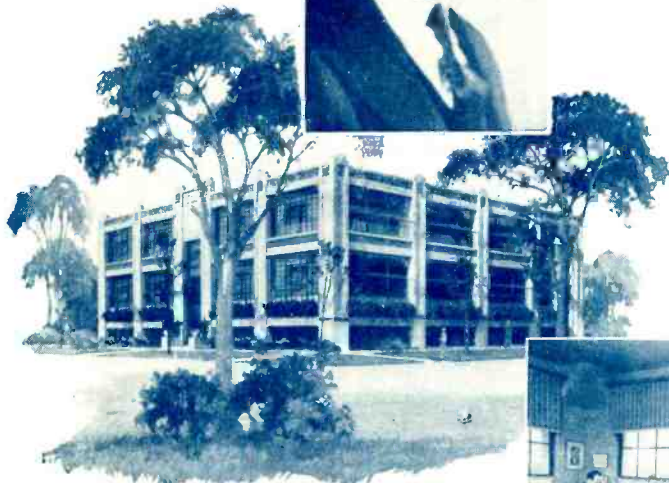
THE FINE THINGS ARE HAND MADE



SCOTT CUSTOM

NATION WIDE FROM A SEED PLANTED FOUR YEARS LISHED THE WORLDS RECORD FOR

E. H.
SCOTT



Corner
of
Studio

FOUR years ago, in the early days of the application of mass-production methods to radio manufacturing, E. H. Scott assumed an attitude diametrically opposed to current thought. He contended that the best product of factory methods could *never* even *approximate* the performance possible to obtain from a receiver custom-made in the laboratory. He gave his thought material form and the resulting instrument, which was destined to become known as the Scott World's Record Receiver, established the world's record for distant reception and the Scott records stand unapproached and uncontested to this date. 117 programs, all 6,000 to 8,000 miles away were received during the thirteen week test period. All were verified.

The idea of custom-built radio made an instant appeal to people who wanted what the best of the "ordinary" sets could not give them—and these people were will-

The World's Records Held by Scott Radio

We repeat our challenge to ANY Radio Manufacturer to show a better *verified* DX record than that listed below.

- 1—A better record for a number of broadcasting stations heard from 6000—8000 miles distant.
 - 6—Stations heard—*distance* 6000 miles.
 - 7—Stations heard—*distance* 7000 miles.
 - 6—Stations heard—*distance* 8000 miles.
- 2—A better record for number of programs heard from stations distant 6000 or more miles over a period of from one to three months.
 - 19—programs from stations 8000 miles away.
 - 19—programs from stations 7000 miles away.
 - 79—programs from stations 6000 miles away.



Research
Laboratory



Experimental
Laboratory

SCOTT TRANSFORMER COMPANY,

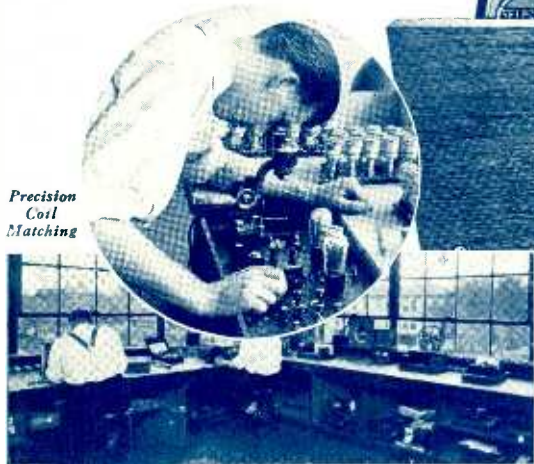
BUILT RADIO

INSTITUTION WHICH HAS GROWN AGO WHEN E.H. SCOTT ESTAB- RADIO RECEIVER PERFORMANCE

ing to pay for the comparatively costly laboratory method necessary to duplicate the performance of the *original* Scott World's Record Receiver. And they are still willing to pay for Scott laboratory precision—more willing than ever before. They are *eager* to pay for Scott custom-building when they experience the tremendous power, the exact selectivity and the tonal perfection made possible thereby. In fact, the market for Scott Custom-Built Radio has grown to such proportions that the Scott Laboratory, where Scott Receivers are laboratory-made, has become the greatest institution of its kind in the world.

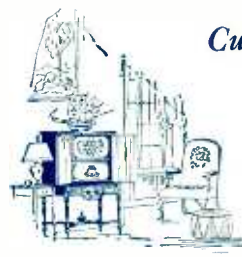
One of the seven thousand qualified Scott sales and service representatives scattered throughout the nation will gladly discuss Scott Radio with you. The price range is between \$300 and \$8,000.

*Write for name of nearest
Scott Representative*



*Precision
Coil
Matching*

*Airtest
Room*



Custom-Built Period Cabinets

To exactly suit the acoustical and mechanical requirements of the Scott Custom Built Chassis, there are fifteen especially designed period cabinets. All are custom-made to the very highest standards of furniture craftsmanship and present a range of design variation adequate to suit every taste. Such fine cabinet work has never been shown in the field of radio furniture before.

Below are sketched a few of the Scott Custom-made consoles which constitute the first line of radio furniture made to the same high standard as your other home furnishings.



CORTEZ



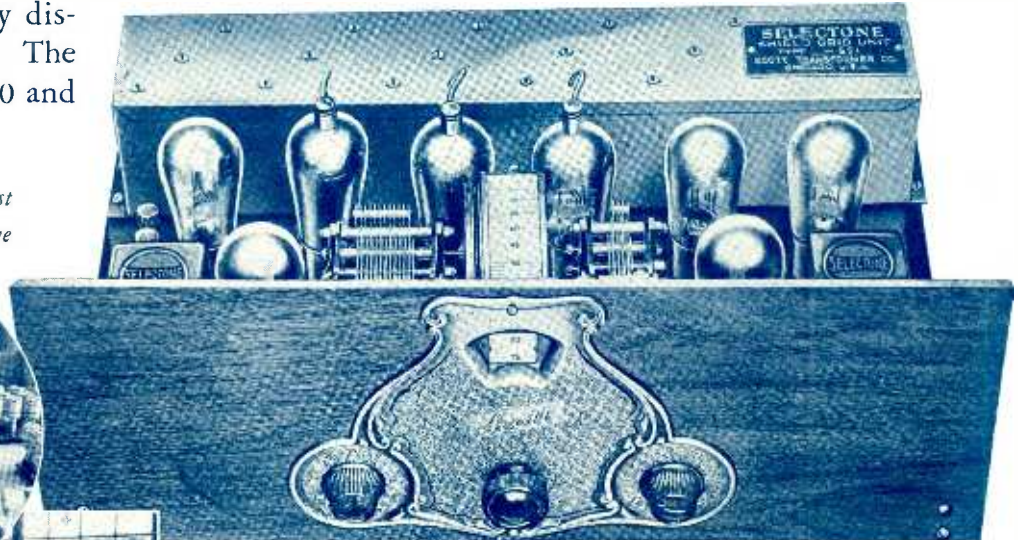
ABBEY



NAPIER



MILFORD



THE SCOTT A. C. SHIELD-GRID 10

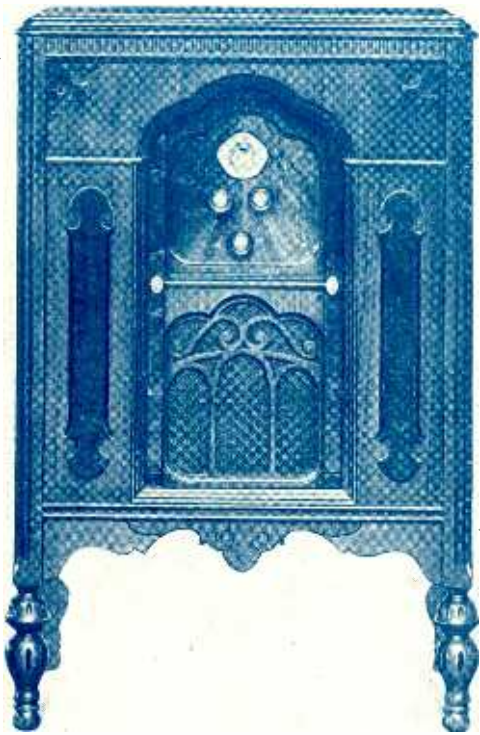
The newest model of Scott World's Record Custom-Built Radio combines the advantages of world's record performance with the convenience of direct A-C operation. "All the world" is on the single dial of the SCOTT A. C. SHIELD GRID 10 and it is certain that you will not only be pleased, but thrilled and amazed at the realism of its tone.

A limited amount of unfranchised territory is still open. If you are interested in selling the best there is in radio and in operating in a protected market, write at once for qualification blank.

4450-66 RAVENSWOOD AVE., CHICAGO



SEE THESE
New Gilfillan Models



that set higher standards
for **TONE** and
SELECTIVITY



Three new cabinet designs—Custom-made chassis—Silent operation—No A-C Hum—Sharpest selectivity with great distance-gaining power—New audio system and 4 stages of Radio Frequency Amplification—Screen grid and latest type Dynamic Speaker—Three attractive cabinet styles over compelling price range—complete with tubes and Dynamic Speaker

\$156.50

\$175.50

\$187.00

Tubes not included in above prices.

Gilfillan Radio

Manufactured under R. C. A., Latour and Hazeltine Patent License
in the Gilfillan Radio Factory—largest radio factory in the West.

GILFILLAN BROS., INC.

Main Office and Factory:

1815 VENICE BLVD., LOS ANGELES, CALIFORNIA

SAN FRANCISCO: 921 MISSION STREET

SEATTLE: 100 ELLIOTT AVE., WEST

— BUILT FOR WESTERN RECEPTION —





Cunningham
RADIO TUBES

are the answer to
Successful **R**adio
Merchandising



You can depend upon their high average dependability and improved reception in the receiving sets you sell.





Safety - First in Merchandising

demands that in radio
essentials you stick to
standard lines

TUBES are such an important part of radio equipment that the alert radio dealer realizes that it is sound business practice to stock and sell only tubes that hold their position of tube-preference with the radio public.

☞ For fourteen years Cunningham Radio Tubes have embodied the latest and finest radio principles with

the result that the name Cunningham has become a symbol of tube reliability.

Ⓒ An integrity invisible as radio waves, yet just as real, is ever present in the manufacture, sale and service of every Cunningham Radio Tube. This integrity controls every step from technical research to ultimate sale. Cunningham Radio Tubes are dominant in millions of homes where tone-quality is valued at its true worth.

14 YEARS

E. T. CUNNINGHAM INC.

NEW YORK CHICAGO SAN FRANCISCO
DALLAS ATLANTA





The Confidence of the Public in Cunningham Radio Tubes

is bound to reflect in no small degree upon the dealer who sold the customer his tubes

¶ In modern business dealers are judged by the quality of merchandise they sell.

¶ The surest way to increase your business and to hold the customers you now have, is to supply them with standard merchandise that will give them the maximum enjoyment and excellent service that Cunningham Radio Tubes provide.

Quality Safeguarded from within

E. T. CUNNINGHAM INC.

NEW YORK

CHICAGO

SAN FRANCISCO

DALLAS

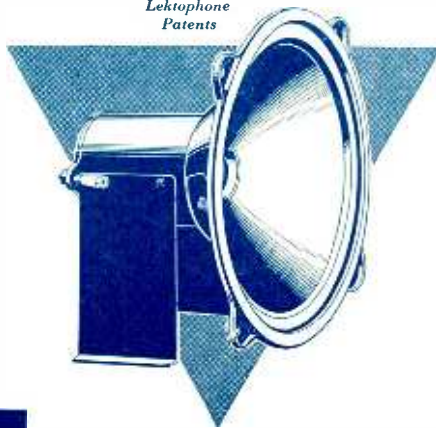
ATLANTA

indisputable

EVIDENCE

THE demand for radio receivers equipped with Jensen Electro-Dynamic Speakers confirms the judgment of America's leading set manufacturers who early in 1929 proved to their satisfaction the superiority of the new Jensen Concert Speaker. These manufacturers' sets are known today as the industry's "best sellers". This new Jensen Concert Speaker with ten inch cone and many other exclusive features has been specifically designed to meet the individual requirements of these manufacturers who know the value of offering to their trade the finest possible tone quality. Each of them found this new reproducer to interpret into sound more faithfully and brilliantly the energy delivered by their receiver. Jensen Electro-Dynamic Speakers are offered in three models, with eight, ten and twelve inch cones, each size available for operation with either 110 volt AC or 110 or 220 volt DC current. Jensen Concert and Auditorium models are also available in the Imperial Cabinet, America's finest and most beautiful reproducer. Radio dealers are finding a ready market and attractive profits with Jensen Dynamic Speakers either sold separately or installed in radio furniture.

*Licensed under
Lektophone
Patents*



Jensen
ELECTRO-DYNAMIC SPEAKERS

JENSEN RADIO MANUFACTURING COMPANY
6601 South Laramie Avenue, Chicago, Illinois

212 Ninth Street, Oakland, California

Make PERFORMANCE Your Guide And You'll Choose ELECTRAD Resistance Units and Voltage Controls

Screen-grid tubes—super-power amplifiers—battery eliminators—practically all modern radio developments depend, for perfect operation, upon the effective performance of their controlling resistances.

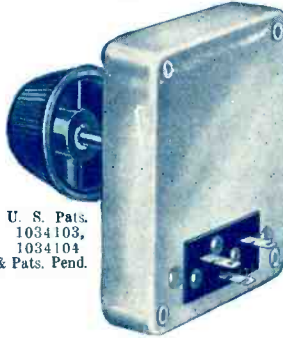
You can depend on ELECTRAD Resistance

Units and Voltage Controls for the dependable, long-lasting service these improvements require.

Finest materials—an experienced engineering and manufacturing staff trained to build the best—and quantity production—insure you of not only getting the *best*, but getting it at a reasonable price.

The Super-TONATROL ELECTRAD'S New High-Voltage Volume Control

A remarkable, long-lasting volume control for handling the heavy currents of modern receivers. Laboratory tests equal to more than ten years' average use show no material change in resistance or effects of wear.

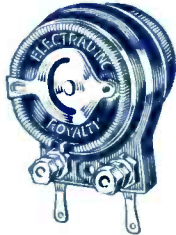


U. S. Pat.
1034103,
1034104
& Pats. Pend.

Special resistance element fused to an enameled metal plate. Practically all metal construction, including cover, insures rapid heat dissipation. Pure silver floating contact gives delightful smoothness. Practically immune to changes in temperature and humidity.

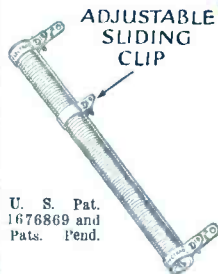
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Radio Corp. Pat.
5/2/16, 7/27/26
and Pats. Pend.

Exclusively licensed by
Technidyne Corp. under
U. S. Pats. 1593658,
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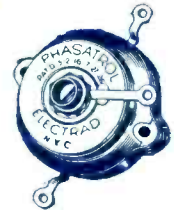
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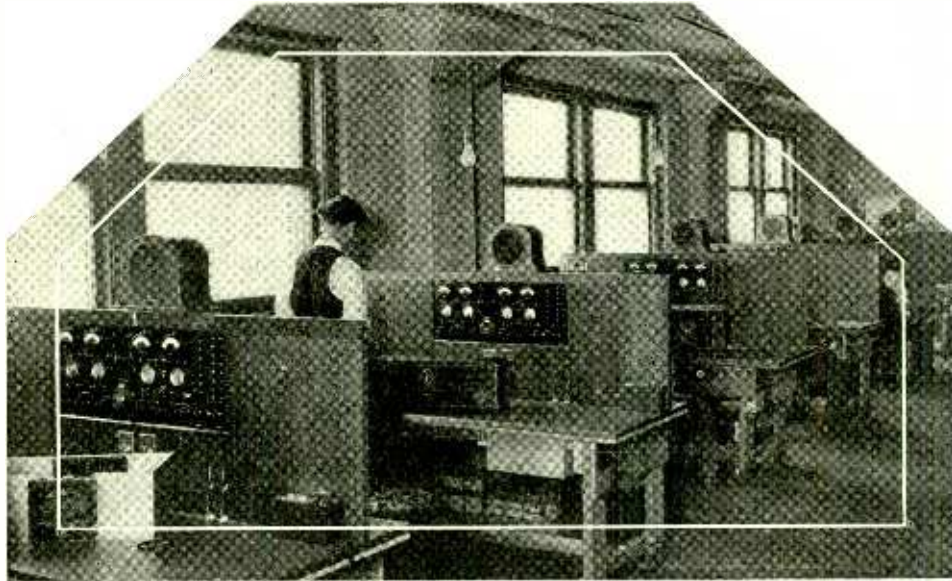
RADIO

for the profession

Vol. XI

SEPTEMBER, 1929

No. 9



—Photo courtesy California Radio Service Co.

A Well-Equipped Radio Service Shop

Increase Your *Shop Business and Prestige* with an *Adequate Test Board*

Whose Design and Inexpensive Construction Is Here Described

By J. GARRICK EISENBERG

TEST equipment in the radio shop, in contrast to the portable kit carried by the service man, should be complete enough to perform any test that a dealer may be required to make. Nor should it be regarded merely as a supplement to the portable kit, which is likely to be out on call at crucial times. An independent test board for shop use may be built at minimum expense and with minimum duplication of equipment by recalibrating inexpensive meters as multi-range instruments.

Every part of the complete board whose design and construction is here described will be found of use in this day of custom building and knock-down shipment of receivers. As many of its

parts can be resurrected from the junk-heap, its cost, aside from labor charges, should not exceed \$50. Its design may be modified to suit individual requirements. Its essential parts, as shown in the schematic diagram of Fig. 1, comprise a milliammeter of low-high range, a high-resistance voltmeter of low-high range, a resistance meter, an emission tester, a tester of condenser leakage and breakdown, a modulated oscillator, and an a-c continuity tester.

The milliammeter can consist of a 0-10 ma instrument which can be shunted with a low resistance so as also to give a 0-100 ma reading. This shunt must be of such resistance as to bypass (100-10)=90 ma so that the remain-

ing 10 ma will pass through the meter to give full scale deflection. Calculation shows that for this multiplication the resistance of the multiplier should be .944 ohms for an 8.5-ohm milliammeter. This can be realized in practice for any milliammeter by shunting an old 6-ohm rheostat across the meter, varying it until the proper scale reading is secured, cutting off the right length of wire with a little extra allowance for safety, and re-calibrating until the resistance is exactly right. For absolute reliability the calibration should be checked with another meter of known accuracy.

The milliammeter connections are brought to pin jacks on the front of the board and the 100 ma shunt is connected

so that it is open-circuited unless its corresponding jack is used. The diagram shows a contactor which does away with a separate meter switch. This consists of a small piece of springy phosphor bronze which is screwed to the back of the board close enough to the jack to make contact with the inserted plug. The contact blade should be about 1½ in. long and bent into an L-shape so that its shoulder affords a smooth wiping contact.

The high resistance voltmeter is a 0-1.5 milliammeter calibrated with various resistors of 10,000, 100,000, and 200,000 ohms connected as shown in the diagram to give maximum readings of 15, 150, 300 and 750 volts. The resistors should be of a type which is guaranteed to an accuracy of at least 1 per cent. Separate scales may be plotted and marked directly on the meter or a chart may be prepared to show the correct voltages for corresponding ma readings. Connections are brought to pin jacks on the front of the board.

The resistance meter is used for testing short circuits in variable condensers, locating open circuits in the r-f stages, and checking the matching of coils. It consists of the 0-10 milliammeter and a separate resistance circuit. The scheme permits a fixed current to flow through the meter and resistance in series, and then observing the drop in current when the meter is shunted by an unknown resistance. This part of the

board consists of two circuits, one of which gives fairly accurate readings down to ½ ohm and the other gives relative readings for resistances between 100 and 5000 ohms. By using a 5000-ohm limiting resistor with an 8.5-ohm milliammeter the current from the 45-volt tap of the oscillator battery can be held down to 9 ma. The meter readings can either be plotted so as to show resistances or used only for comparative purposes.

Even without calibration, this circuit can be made to show whether a variable condenser touches at some point by connecting the test picks across each stage while the condenser is slowly rotated. The average r-f coil has a d-c resistance of about 4 ohms, which permits about 4 ma to flow through the meter winding. When the circuit is shorted by a momentary contact the current drops to zero.

An open circuit due to poor contact of an r-f coil is likewise quickly located by a variation from the normal resistance that may be disclosed by the meter. Similarly it is possible to check the fact that two coils have approximately the same number of turns.

The emission tester gives comparative values only. Thus when it is known that a tube of a certain type should cause a certain milliammeter reading, the relative emission of any other tube of the same type is compared with this as a standard. The different values of bias-

ing resistor permit the emission to be checked for different conditions, and it is even possible to calculate the mutual conductance to within 85 per cent of its strictly accurate rating. Plate current in ma times the grid resistance in ohms will give the voltage drop, and from this the applied voltage to the grid is readily determined. Means are provided for measuring rectifier tube emission also, but in the case of the full wave type each plate must be measured separately—which test will incidentally show up the results of any bad filament sag. The small flashlight bulb in series with the plate is a safeguard in case of accidental overloads. Care should be exercised in using the proper scale reading of the milliammeter when measuring the emission of the larger type of tubes.

With the condenser breakdown test it is possible not only to locate badly broken down condensers, but also those which show only periodic leakage spurts and which are almost impossible to locate by any other method. The peculiar characteristics of the 874 glow tube are used for this purpose. This tube, when "cold," has a voltage drop across it of nearly 90 volts, but once ignited, will operate on currents of about 2 ma. Since the starting voltage must be something higher than 90, a switch which cuts the lamp across the 110-volt a-c line is provided. Once ignited, the tube will operate satisfactorily on the 90-volt battery, which also supplies the oscillator

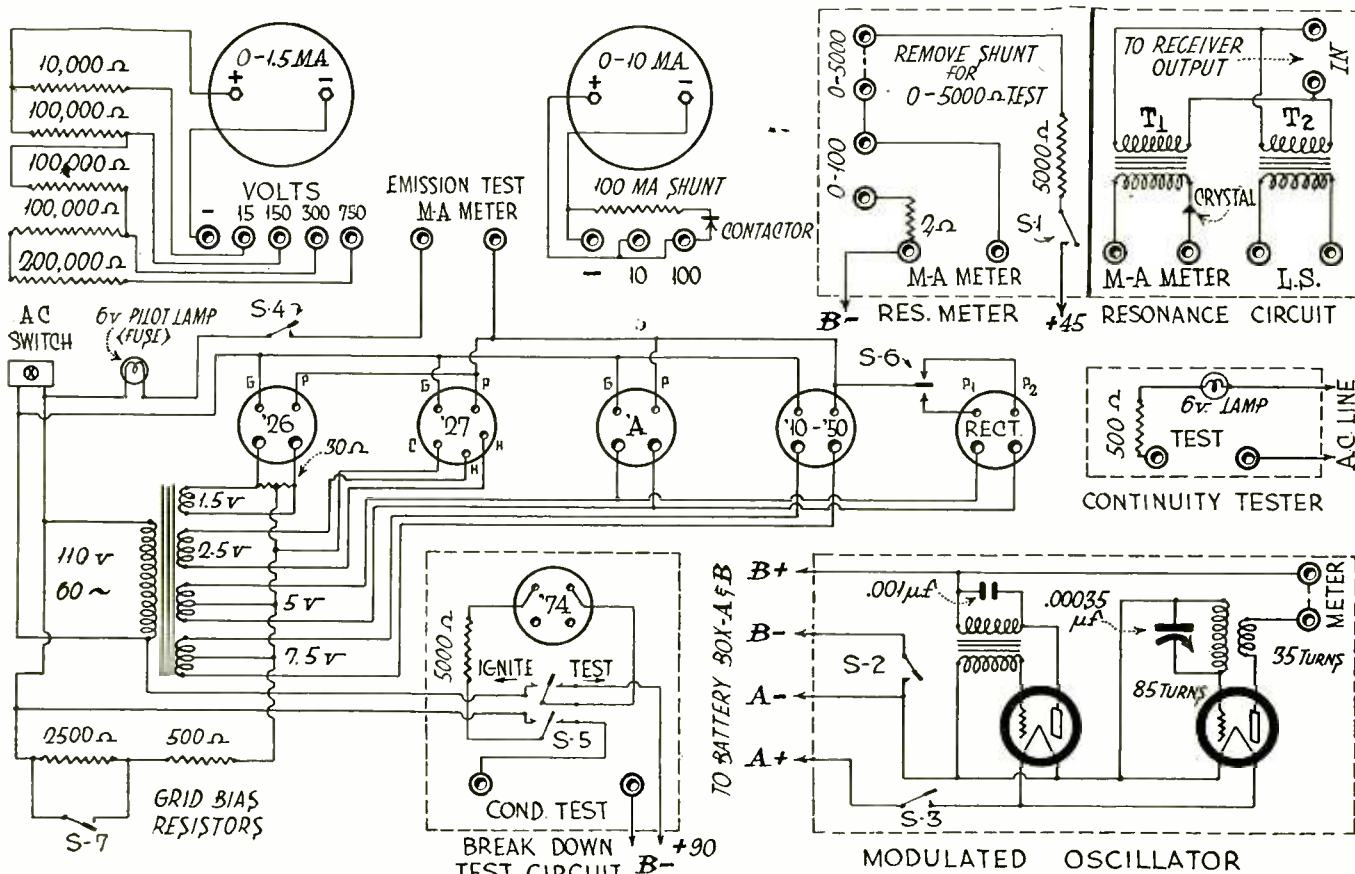


Fig. 1. Circuit Diagram of Test Panel

with *B* power. A limiting resistance of 5000 ohms is placed in series with the lamp, so that peak current will not exceed 50 ma. After igniting the tube, the switch is thrown to the off position, which puts the tube and its limiting resistor in series with the test picks and the 90 volts d-c. The picks are then placed across the terminals of the condenser under test; even a large filter condenser should have a d-c resistance of several megohms, so of course a perfect one will not allow any current to pass through the tube. A badly shorted one will pass current easily, while one which has only momentary leakage peaks will cause the tube to glow for just the fraction of a second during which the condenser discharges through itself. Obviously such a condenser will cause faulty operation of the radio receiver.

By-pass and blocking condensers can also be measured safely with this device. Probably the most desirable arrangement is to mount the glow tube on a separate sub-panel placed just far enough back from the test board so that the top of the tube fits into an observation hole cut into the board for this purpose. The layout diagram (Fig. 2) shows a convenient placement for this hole. It might be mentioned that these tubes vary considerably in characteristics, so that it may be advisable to ascertain its actual flash voltage or to arrange for exchanges, at the time of purchase.

The modulated oscillator is a standard self-modulating circuit, fed from d-c supply, through a common impedance (the primary of the transformer). This transformer may be of the old high ratio type, which usually peaks at about 900 cycles with a .001 mf condenser across the primary. The ma meter can be cut

Parts required for building test board:

- S₁, S₂, S₃, S₄ and S₅—S. P. S. T. Yaxley jack switches.
- S₆—D. P. D. T. Yaxley jack switch.
- S₇—S. P. D. T. Yaxley jack switch.
- 10 Super-Davohm Resistors—2 500 ohms, 1 2500 ohms, 2 5000 ohms, 1 10,000 ohms, 3 100,000 ohms, 1 200,000 ohms.
- 1 0-1.5 milliammeter.
- 1 0-10 milliammeter.
- (1 0-3, 0-15, 0-150 volt a-c meter—optional).
- 28 tip jacks—Yaxley type.
- 1 type 874 glow tube.
- 1 Filament transformer.
- 1 .00035 mf. variable condenser.
- 2 6-volt pilot lamps.
- 2 Output transformers—old type.
- 1 10:1 ratio audio transformer.
- Incidentals: tube sockets, a-c snap switch, etc.

into the circuit to give an indication of the output of the circuit, and in fact the circuit may be utilized in this way to give an indication of the oscillating qualities of any particular tube. Filament and plate voltages may be checked by connecting in the voltmeter through its pin jack terminals.

The unit described here utilizes '99 type tubes, which give an adequate output; the oscillator coils are made up of 85 turns for *L*₁ wound on a 2-in. form, and 35 turns for *L*₂ wound on a 1½-in. form and slipped directly inside *L*₁. The tuning condenser was a Cardwell .00035 mf and with these constants the oscil-

lator covered the broadcast band nicely. The entire unit measures 3 x 6 x 8 in. overall. It should be entirely shielded so as to give a sharp signal with a minimum of harmonic interference.

The uses for this device are legion, although its greatest value is perhaps as a driver, when balancing or neutralizing a receiver. For this purpose it makes use of the auxiliary circuit shown on the print as the resonance indicating circuit. This is simply a current transformer with a crystal rectifier in its secondary, making use of the 0-10 scale of the milliammeter as the resonance indicator. An ideal transformer for this purpose is one of the old output type whose secondary is in the neighborhood of 5000 ohms. This approximately matches the crystal impedance. Somewhat better rectification can be secured by using a push-pull transformer and full wave rectification (2 crystals), but this refinement is not considered necessary. A very sharp peak indication is secured by this method and with fairly loose coupling to the oscillator a rectified current of from 5 to 6 ma should be secured.

If an audio check is desired another transformer should be cut in parallel to the current transformer and its secondary brought out to the loudspeaker terminals. This latter transformer may be of any type, depending on the sort of speaker to be fed, but its primary should match fairly closely the primary impedance of the current transformer, otherwise the peak indication on the meter is apt to be sluggish. The manner in which this equipment is used is as follows:

(1) *Neutralizing the receiver.* The oscillator is set in action somewhere around the middle of the broadcast band, and its output measured by connecting in the milliammeter in place of the short-circuiting clip in the plate circuit. A pair of phone cords make an excellent duplex connector for this board, by the way. Then the short-circuiting clip is replaced, the meter is plugged into the resonance circuit and the input terminals of this circuit connected to the loudspeaker terminals of the receiver under test. A dead tube, having one of its filament prongs sawed off, makes an ideal "neut" tube; it must of course be of the same type as those used in the receiver. An insulating rod fashioned as a screwdriver or as a wrench, as requirements demand, will serve as the neutralizing tool. Now tuning the receiver to the oscillator, and with all the tubes in, a strong signal should be picked up, as indicated on the meter or in the monitoring horn. With a receiver which is badly out of balance it may be necessary to couple to the oscillator, in which case a piece of bus-bar may be plugged into the oscillator jack marked "out" and a length of wire, one end of which connects to the antenna binding post of the

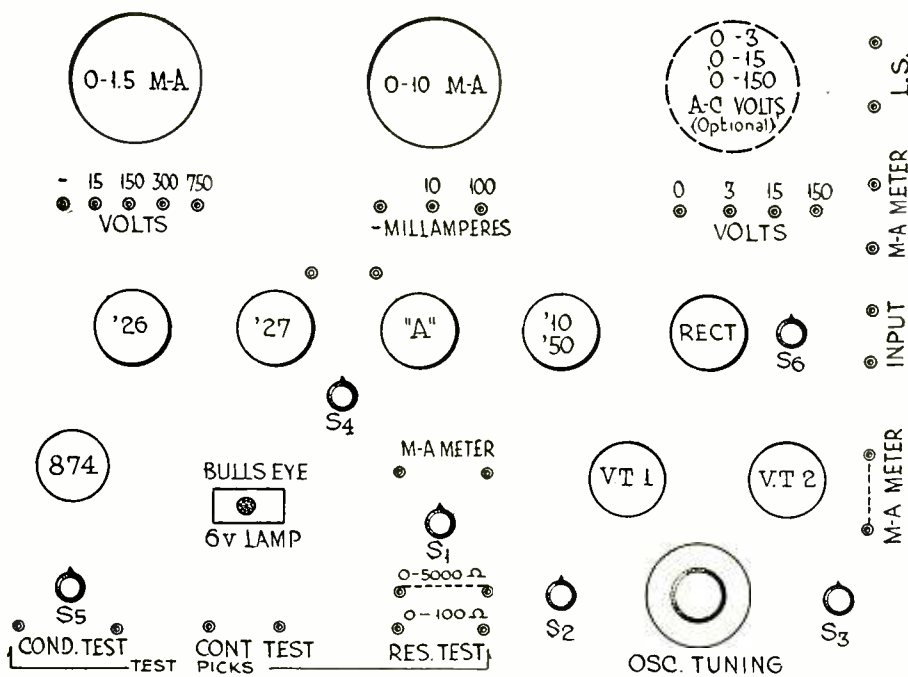


Fig. 2. Suggested Panel Layout

receiver, brought in close proximity to this bus. Coupling should be as loose as possible, thus permitting sharpest adjustment of the neutralizing condensers. It will probably be found easiest to neutralize from the last stage back towards the antenna, so this tube is removed and the neut tube inserted in the socket and minor tuning readjustment made for maximum pick-up. The neutralizing condenser is then varied until the signal disappears or is reduced to a minimum. Failure to neutralize properly may be due to shorted neut condenser, poor connections to coil, an open circuit, or too much pick-up from the oscillator. The latter can be taken care of by loosening the coupling to the receiver. The procedure outlined is carried through the successive stages, and then it might be a good plan to check back again, as in some receivers varying the neut condensers of the previous stages has the effect of throwing the last stage slightly out of balance. In the case of shielded circuits, all the shields should be around the respective coils when neutralizing, except of course the particular stage which is being worked on. This business of neutralizing properly is incidentally a lot more important than the average service man seems to think. It *cannot* be done properly with a metal screwdriver. A monitoring horn is almost essential for this work, as it is not too easy to read absolute minimum on the meter, with low input voltages.

(2) *Balancing the receiver.* Since most condensers do not have an absolutely straight line characteristic, it is usually necessary to balance the receiver at both the low and high end of the range. To this end, the oscillator is tuned to say 1500 kc as is also the receiver. The receiver gain is then set to give some convenient reading on the resonance indicating meter, and then the midjet condenser across the last r-f stage varied until maximum signal is indicated. This procedure is then carried out through the various preceding stages. If the set is not fitted with compensating midjet variables, it will be necessary to loosen the rotor set screw and slip these plates the amount necessary to achieve peak resonance. With the receiver adjusted at the high frequency end, the oscillator setting is changed to about 600 kc, and the receiver retuned to this frequency but the procedure of balancing is varied somewhat. A bakelite strip is used to spring the rotor plates backward and forward a trifle, the peak indicator being watched meanwhile for variation from maximum. When it has been determined whether the capacity for some particular stage must be increased or decreased for exact resonance, this is accomplished by bending one of the rotor plates the required amount. It will usually be found advisable to bend back the last plate if the capacity is to

be decreased; in any case the plates should never be bent to such a degree as will introduce any danger of short-circuiting the condenser. Should any considerable readjustment of condenser capacity seem necessary at the lower frequencies it will probably be found that one of the coils in the receiver does not match. The increased power and sensitivity resulting from a properly balanced receiver, even though the adjustments made seem minute, are sometimes surprising; it is usually necessary to go over the neutralizing process in the case of a receiver which has required such readjustment.

The continuity tester requires little description. It requires only the 110-volt a-c supply, and a 6-volt .25-ampere dash lamp as the indicating device. A series resistance of 500 ohms is needed to give the required drop. The actual current flow in this circuit is about .21-a, which will light the lamp to practically normal brilliancy. (The actual value of resistance for a .25-a. load would be 416 ohms, but a standard 500-ohm resistor is used for convenience.) The lamp itself can either be mounted directly on the test bench, or can be set back into the test panel in the same manner as is the glow tube. A covering face plate having a red glass bulls-eye gives a neat finish if the latter arrangement is used. The lamp will glow, though dimly, on very tiny currents, so that it is possible to check through circuit resistances up to about 5000 ohms. Because of the limited maximum current there is not much danger of burning out any device when using this method of continuity checking.

The terminal picks for this tester may be made of two pieces of No. 10 hard drawn copper wire each about 10 in. long, and covered to within an inch of their ends with cambric spaghetti. The ends may be filed down to points if desired. The picks are soldered to lengths of flexible No. 14 lamp cord, and the spaghetti secured in place by a strip of tape. If desired, they may be brought up through the bottom of the test bench through insulating bushings, and a pulley and weight arrangement rigged up under the bench so that they fall back in place when released. The same sort of terminal picks are suggested for the condenser test circuit and ohm-meter also.

Dimensional figures depend entirely upon individual requirement and available space, whether the board is to be modified or expanded from the design data given here, and very probably, by the desire to utilize the present shop board as an integral unit. A sample layout is shown in Fig. 2. It will be noted that this includes an a-c meter which has not been shown in the schematic diagram. This is a desirable but optional addition, although some sort

of a-c meter should be kept around the shop. If it is to be mounted in the test board, the connections are simply brought out to pin jack terminals, as are those of the d-c meters.

No doubt a number of improvements over the original design will suggest themselves to the shop man. One which comes to the author's mind is the possible recalibration of the 0-1.5 milliammeter as a 0-15 scale meter, so that it can be plugged into the plate circuit of the oscillator and used as an output indicating device when the other milliammeter is being used in the resonance-indicating circuit.

A shunt of 2 ohms will be necessary for the Weston type of meter. In some service shops, where the volume of business—and bank balance—justifies the expenditure, separate meters are used for each of the functions outlined here. But the average service shop is rather sadly under-equipped, and it is hoped that in outlining the design of an adequate test board which may be constructed at very nominal cost, these may be encouraged to make the necessary improvements. Write the cost off against advertising if you wish, for the well equipped shop soon becomes well known, and in the very nature of the game the investments made will pay handsome dividends in increased volume of business and in prestige.

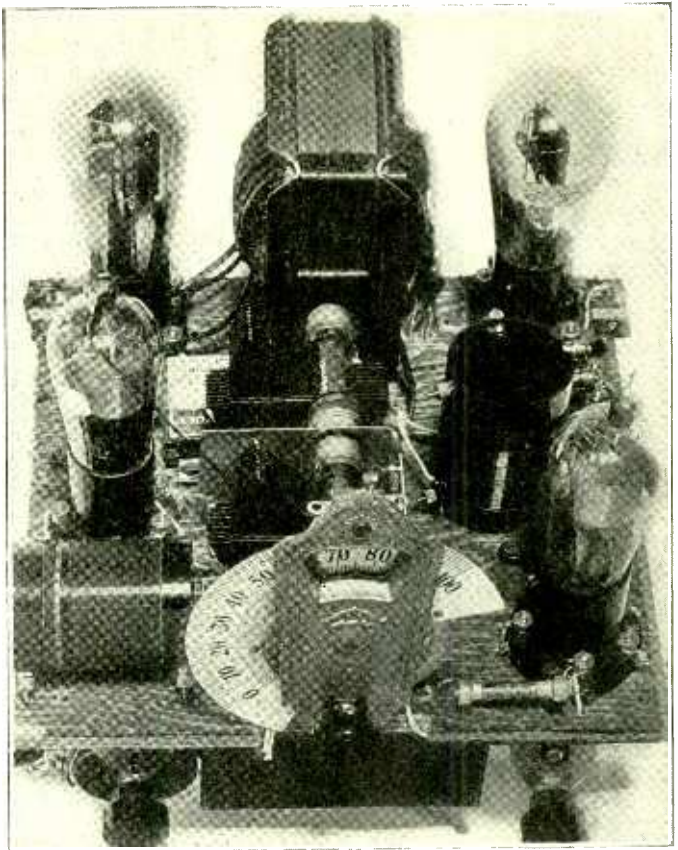
CHECKING OF GANG CONDENSER ALIGNMENT

ALIGNMENT of gang condensers can be readily checked with a simple tool made from a 5-in. piece of bakelite rod with a 1¼-in. heavy copper wire ring fastened to one end and an old condenser plate fastened to the other end. This tool may be used to add an extra plate to the rotor of each condenser in the gang by placing its condenser-plate end in parallel with the stator plates and touching the rotor. If the signal then increases in strength, the condenser is low in capacity and its trimmer should be tightened. If the signal decreases in strength the condensers are approximately in alignment. After checking for low capacity, insert the ring end of the tool in the center of each r-f coil. This should decrease the signal strength. If the signal increases, the capacity is too high and should be lowered by adjusting the trimmer or bending the outside plate until a decrease in signal is experienced. The condenser-plate test should then be repeated so as to be sure that the capacity is not too low.

An Experimental Set for Local Reception

Constructional details for the best inexpensive receiver you ever tried. Uses a-c screen-grid tubes in r-f and power detector stages, and '45 tube in audio stage.

By FRANK C. JONES



Upper Baseboard Arrangement of Completed Receiver

MANY city people want an inexpensive receiver which will give extremely good quality on local reception. Such a receiver can be built with only three tubes. The cost is kept down by the fact that there are only two tuned circuits, no audio transformers, and relatively few parts.

From the circuit as shown in Fig. 1, it can be seen that there is one r-f stage, power detector, and one audio stage. Screen-grid tubes are used for the r-f and detector stages and a '45 power tube in the audio stage.

The a-c screen-grid tube is about

three times as efficient as the d-c model, since the plate impedance at normal voltages is about 400,000 ohms and the amplification constant about 420. The corresponding d-c tube values are about 850,000 ohms and a mu of 250 to 300. The tube, like the '27, is less microphonic than its d-c counterpart.

Due to the increased efficiency, this tube makes an ideal r-f amplifier and power detector, so that the three-tube set gives plenty of volume on local reception and will even play a little dx of a few hundred miles. It should be remembered, however, that this re-

ceiver is designed primarily for reception from stations not over 20 or 30 miles away.

The '45 tube has a maximum output of 1.6 watts, which is about the same as that of a '10 tube. However, this tube operates at about one-half the plate voltage of a '10 tube, and has about the same plate impedance and amplification constant as a '50 power tube.

The '71A tube is rather unsatisfactory in a-c operated receivers due to its small output and also to a-c hum trouble. The '45 tube operates on 2.5 volts for the filament so the chances for

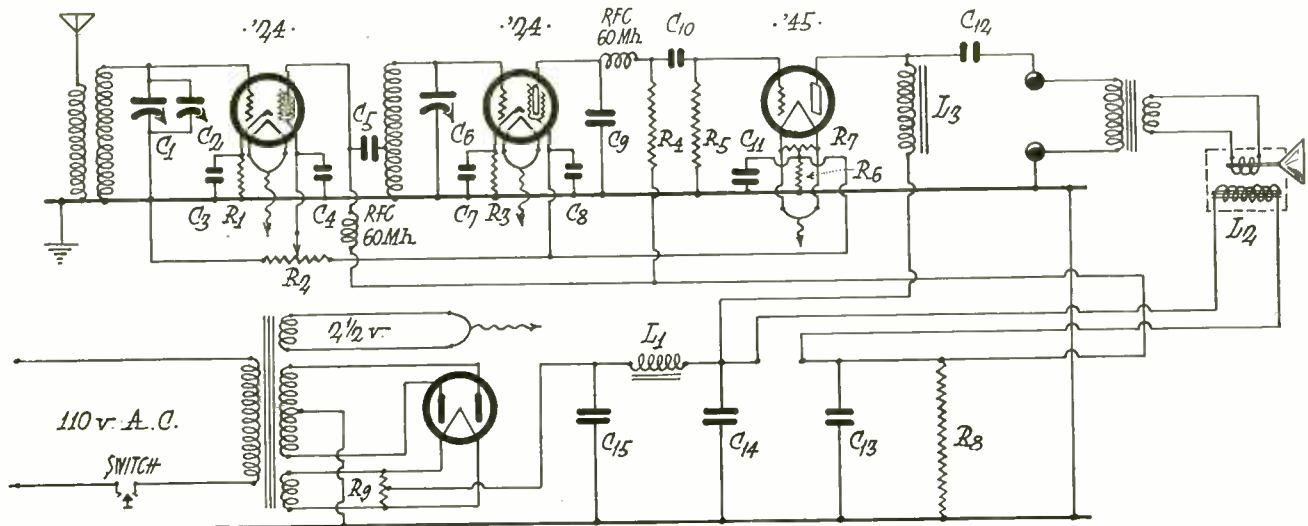


Fig. 1. Circuit Diagram of Experimental Three-Tube Set

- | | | | | |
|-----------------------------------|-------------------------------|--------------------------------------|---------------------------------|-------------------------------|
| R_1 —800 ohms. | R_5 — $\frac{1}{2}$ megohm. | R_9 —60 ohms. | C_5 and C_{10} —.1 mf. | C_{14} and C_{15} —4 mf. |
| R_2 —0-50,000-ohm vol. control. | R_6 —1500 ohms. | C_1 and C_6 —.00035 mf variable. | C_7 , C_8 , C_{13} —1 mf. | L_1 —40-henry, 75 ma choke. |
| R_3 —25,000 ohms. | R_7 —60 ohms. | C_2 —50 mmf trimmer. | C_9 —.00005 mf. | L_2 —Dynamic speaker field. |
| R_4 — $\frac{1}{4}$ megohm. | R_8 —5000 ohms. | C_3 and C_4 — $\frac{1}{2}$ mf. | C_{11} and C_{12} —2 mf. | L_3 —30-henry, 40 ma choke. |

hum trouble are nearly eliminated from that source. There is another convenience in this value of filament voltage since it is the same as is used for the heaters of either the '24 or '27 tubes. This means that one filament winding will serve for all the tubes except the rectifier.

Resistance coupling is used between the detector and power tubes because of cheapness and good frequency characteristic. A 500-henry audio choke is better in some ways but more costly for plate feed. The plate impedance of the '24 tube as a detector may run up to 1 or 2 megohms, so the coupling unit has to be of some form which has a linear frequency characteristic. The total plate load is something less than 200,000 ohms, which is considerably less than the tube output impedance. The four element tube, or five elements in this case, is a little different in its operation, as it does not operate on a plate characteristic loop, as would an ordinary three-electrode tube connected to a plate circuit

load of less than its internal impedance.

The baseboard layout, Fig. 2, should be followed, as a little more room is allowed in the location of parts, whereas in the pictured set everything was crowded into as small a space as possible. Allowing a little more space eliminates oscillation difficulties and also any a-c hum problems of induction from the power transformer. The set was designed to fit into any console type of cabinet with the three controls sticking through the panel. The dial escutcheon should be mounted on the panel. The set may be constructed as shown or with only two controls through the panel. In such case the volume control should be located directly below the tuning control since the trimmer condenser is not necessary if matched coils are used.

The selectivity of the set is quite good if good r-f coils are used and small antenna coupling is used. The power detector input circuit is quite selective in comparison to the usual grid-leak detector except where a great deal of

regeneration is used. The set has nearly the same selectivity as an ordinary Browning-Drake receiver when used for local reception.

Various types of r-f coils have been tried in the set. The coils shown are 2 in. in diameter and wound with 75 turns of No. 30 enameled wire, spaced to cover about $1\frac{3}{4}$ in. of winding space. These were obtained at one of the low-priced chain stores and gave good results. The plate tap was taken at a point 20 turns from the filament end.

Another set of coils tried were 2 in. in diameter, space wound with 90 turns of No. 28 D.S.C. wire. In this case the coils were about 3 in. in length and the plate tap was taken at 18 turns, since the losses were lower and more trouble was had from oscillation. The antenna winding in all cases consisted of 7 turns of wire wound near or over the filament end of the first r-f coil. Another set of coils consisting of 100 turns of No. 30 enameled wire, close wound on $1\frac{1}{4}$ -in. tubing had greater

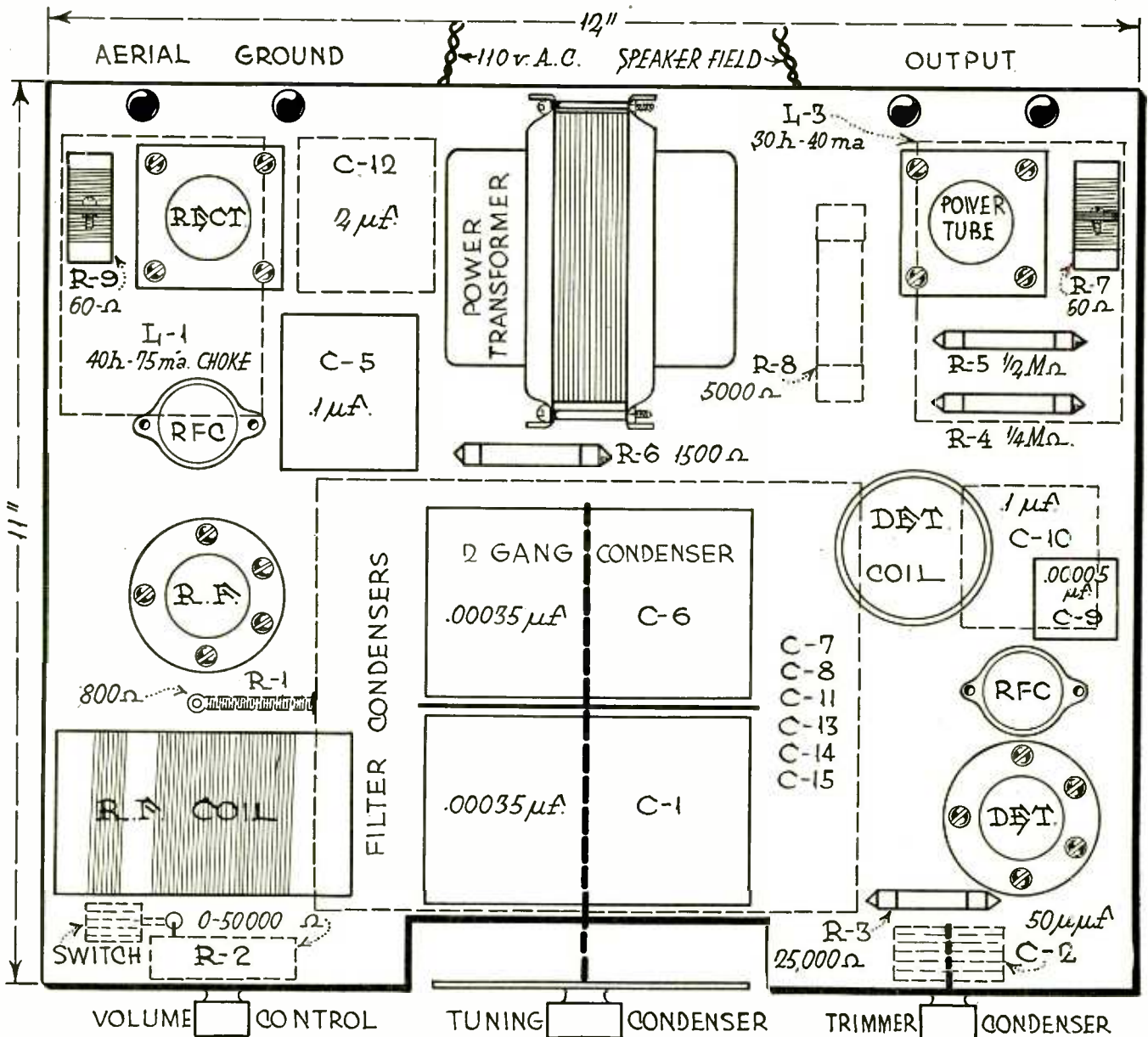


Fig. 2. Baseboard Layout of Experimental Three-Tube Set

losses, but the field was also reduced, so no trouble was had from oscillation wherever the plate tap was made.

The most satisfactory coils, considering selectivity, gain and oscillation trouble from the unshielded coils, were two coils of 100 turns of No. 30 D.C.C. wire wound on a 1½-in. diameter. The plate tap was made at 25 turns with small taps made at 15 and 20 turns for testing after the set was hooked up to a given antenna. The antenna winding consisted of 10 turns wound over the filament end of the first r-f coil.

The tuning condensers consisted of a two-gang .00035 mf variable condenser sections. The trimmer condenser consisted of a 50 mmf midget variable condenser. To make it effective it was necessary to pull two turns from the first r-f coil secondary in each case. This is the reason for the statement that the set would be satisfactory without the trimmer condenser if matched coils were used.

The antenna is so loosely coupled that it does not materially affect the tuning of the first circuit. An overall length of 75 ft. was used in conjunction with the experimental set. This was satisfactory in a location about 7 miles from a 5 kw broadcast station and about 10 miles from several 1 kw stations.

Looking through the circuit shown in Fig. 1, the various values of resistances should be approximately as shown. R_1 provides the necessary C bias for the r-f tube and consists of a wire-wound "grid resistor" of 800 ohms. The bypass condenser shunting it may be of any value of from .01 up to 1 mf. The volume control resistance R_2 should consist of a 50,000-ohm tapered potentiometer with the lowest resistance increase end at the ground connection. The bypass condenser connected from the moving arm to ground should be at least ½ mf in order to insure quietness of operation when adjusting the volume control. This method of volume control varies the screen-grid potential and so varies the amplification. In this receiver the a-c line switch was mounted on the volume control so that it snaps off at the zero resistance position.

R_3 provides a high bias voltage for the power detector and consists of a 25,000-ohm grid leak. The plate and screen-grid current has to flow through R_3 to return to the cathode and this provides the necessary bias of from 10 to 15 volts. The bypass condenser shunting R_3 should be about

1 mf in order to bypass audio as well as radio frequencies.

The resistance coupling unit consists of a grid leak of ¼ megohm and another of ½ megohm values. The grid condenser is a .1 mf 1000-volt test. It is essential that this condenser should have a low leakage in order to function properly. The grid leak R_5 returns to the common ground connection and bias voltage will be provided by the resistance R_6 . This resistor should be capable of dissipating several watts, as about 30 to 35 milliamperes flow through it. The power tube draws about that much current when operated at 250 volts plate potential and 50 volts negative grid potential. The resistance R_6 of 1500 ohms provides the necessary grid potential of 50 volts if 300 volts are available from the filter output.

The resistance R_6 also furnishes 50 volts positive potential for the screen-grids of the two '24 tubes. Since the power tube filament is run from the same filament winding as the screen-grid tube heaters, the latter will have a positive value of 50 volts with respect to the cathodes. This apparently does no harm, in fact it may tend to eliminate any hum. In order to provide the filament return of R_6 to the center of the power tube filament, a center-tap resistance R_7 of any value from 10 up to 60 ohms should be used. Similarly a 30 to 60-ohm center-tap resistance should be used on the rectifier filament for R_8 .

R_8 provides sufficient current drain to properly operate the field of a dynamic loudspeaker L_2 . This is the so-called 90-volt field type and functions when the current through it is at least 40 milliamperes. Since approximately 300 volts are available at the output of the first choke L_1 , the voltage available at the junction of the speaker field and R_8 will be approximately 180 volts. R_8 should be a 40-watt rating resistance of 5000 ohms if the speaker field resistance is 2500 ohms or slightly less. R_8 can be any value down to 4000 ohms and the field resistance down to 1900 ohms before the current drain on the rectifier becomes too large for efficient filtering.

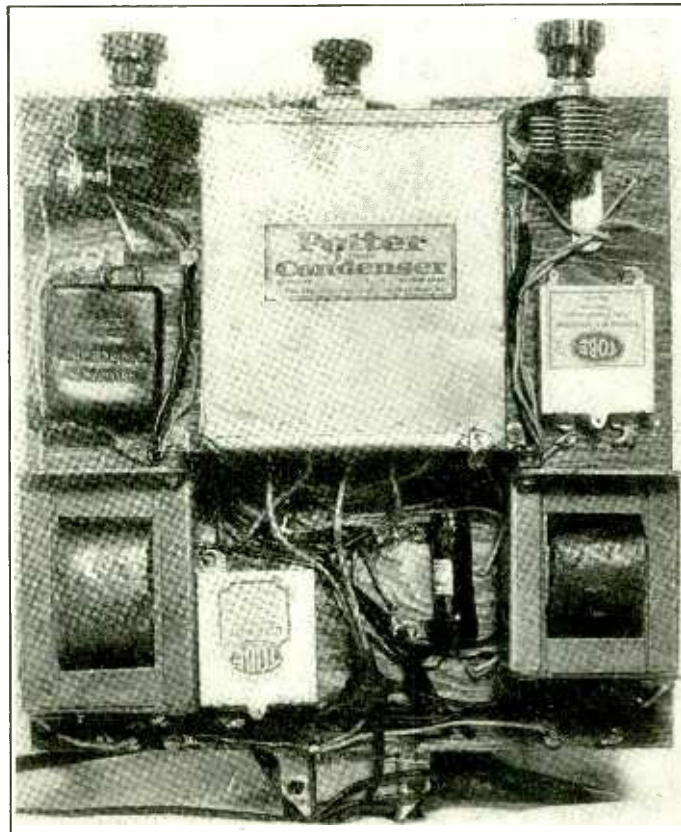
The filter condenser block should consist of two sections of 4 mf, one section of 2 mf, and three sections of 1 mf for convenience in mounting and wiring. The two 4 mf sections should have a d-c rating of 500 volts and the other sections 200-volt ratings. This loudspeaker filter condenser should also be of 500 volts rating with a capacity of 2 mf. In addition to these condensers there are two ½ mf condensers mounted in one can, and two separate .1 mf condensers for the plate coupling units.

The choke coil L_1 should have a rating of 40 henries at a d-c load of 75 milliamperes unless two small chokes are used. The other audio choke L_3 may consist of a 30-henry choke with a 40 ma rating. The loudspeaker filter consisting of the choke L_3 and the 2 mf condenser may be omitted since a dynamic loudspeaker has an output transformer incorporated into the unit. The latter will generally give a better low frequency response if the power tube direct current is not passed through the primary winding of the output transformer.

In the set shown the two chokes and filter condenser block act as feet or supports for the set in the chassis form. No brackets were necessary, since the dimensions of these items were correct to allow their use as such.

In mounting the r-f coils care should be taken to mount them at right angles on opposite sides of the variable tuning condenser since these coils are not shielded. The tube sockets should be mounted not less than 2 in. from the tuning condenser stators in order to reduce these feed-back capacities. It

(Continued on Page 58)



Lower Baseboard Arrangement

Why Use *Push-Pull* Audio Amplification?

A theoretical discussion and practical demonstration of why and how it is used to give humless reproduction at minimum cost of equipment.

By G. F. LAMPKIN

A PUSH-PULL amplifier stage requires one more tube and socket than is required by a single power stage. For the same operating voltage, the allowable power output is increased by a factor that is closer to three than to two. The filtering necessary to reduce hum to an unobjectionable level is tremendously reduced. This item, particularly in the case of high-power, high-voltage amplifiers, gives rise to a considerable economic saving. A lower voltage power transformer is then satisfactory, since the reduction in filter minimizes the internal voltage drop. The usual audio-frequency filtering required for proper cascade operation of the ordinary amplifier is made unnecessary. And finally, an actual increase in the overall gain of the push-pull over that of the single stage amplifier is realized.

A two-stage a-c power amplifier with the '45 tubes working at rating off a 275-275 volt transformer, with a filter of not more than 3 mf capacity, an overall gain of 275, and an irreproachable frequency characteristic, is the summation in practice of the preceding paragraph. Its construction is described herein after discussing its theory.

The increase in the maximum power output inherent with such connection is rather well known. It has been shown that harmonic distortion caused by overloading in an amplifier is mitigated in the push-pull connection to the extent that the even harmonics are removed from the output. The third harmonic, next in order of magnitude to the second, is present in the output and now determines the overload point. The nominal ratings of 5 watts undistorted power output from a single '50 tube, and of 15 watts from two of the tubes in push-pull, indicate how high this new overload point is.

To make a complete statement about the extraneous harmonics produced in a push-pull amplifier: the even harmonics from the separate tubes are of such phase as to be canceled at the output terminals of the amplifier, but are additive in the common plate supply lead; the phases of the odd harmonics, fundamental, third, etc., are such that these components add and appear at the output terminals, but neutralize and are absent in the common plate lead.

Ordinarily an audio by-pass condenser, or condenser-resistance combina-

tion, must be connected around the *C*-bias resistor in the negative plate lead. However, since in the push-pull stage no fundamental frequency components flow in the plate supply circuit, such a by-pass around the bias resistor is superfluous. There are neither regenerative nor degenerative feedbacks from plate to grid due to coupling in the bias resistor.

It is convenient to remember that any voltage, or voltage variation, applied in phase to either the grids or plates of the push-pull stage has no effect at the output terminals. By in phase is meant that if the instantaneous polarity on one grid be negative, that on the other grid is also negative. Contrarywise, if the voltage be applied out of phase, a counterpart is had in the output. It was stated above that the even harmonic currents do add up to flow in the plate supply circuit, and necessarily in the *C*-bias resistor; and it may have been thought that there would be a feedback from these currents to the grids of the tubes. There is such a feedback, but inspection will show that when one grid is forced positively as a result, the other grid is affected likewise, and hence no effect is made on the output.

The d-c voltage for the plates of the push-pull tubes is supplied in phase—it therefore has no effect on the output. A loudspeaker can be connected across the output chokes, say, and there will be no resulting flow of d-c in its windings. The action might be viewed in the light of voltage drops. The only d-c potential possible across the speaker terminals would be that due to voltage drops in the chokes—at the most only about 25 volts. But the currents come into the chokes at the common point, and then diverge in opposite directions. Apparently the d-c drops from outside to outside of the chokes must cancel, and there is left no potential to force d-c through the speaker. Such is another economic advantage of the push-pull system, in that no blocking condenser is required in the output filter.

Perhaps it is well to remember, however, that the speaker terminals and windings are still at high d-c potential above ground, and must be treated with the same respect that is accorded the positive *B* lead.

An output choke in a speaker filter is seldom suspected of lowering the overall gain of an amplifier. To cite illustrative

figures, however, a single 112 tube on all-battery supply was connected directly into a 10,000-ohm resistance load and the gain measured. With other conditions unchanged, a well-made speaker filter was then put between the tube and the load, and the gain measured only 0.74 times that of the former condition. The explanation lies in the a-c impedance of the output choke, which in the theory of the speaker filter is assumed infinite. Actually, in the best of usual chokes carrying direct current, the impedance averages only 8000 or 10,000 ohms, which is low enough to shunt the output load and cause a loss in voltage. The push-pull connection permits that the output chokes be wound on a single core; and since the directions of the two d-c plate currents are divergent, there is no net d-c magnetization of the core. The impedances of the chokes are, as a result, high and the shunt on the load is definitely reduced. The gain of the push-pull stage may thus be greater than that of a corresponding single-tube stage.

Again, the overall gain on a certain amplifier using two '71 tubes in the output stage was 210. The output chokes were two heavy *B*-eliminator chokes, the load was 4000 ohms. Changing only the *B*-eliminator chokes to a Silver-Marshall 248 output choke jumped the gain to 275. The 248 chokes have the two halves of the winding on one core.

If the voltage supply to the plates of the push-pull stage is not filtered, no hum will result in the output if the two tubes are well matched. This action may be explained by the previous statement concerning in-phase voltages. As the current in one tube increases, due to fluctuation in the plate potential, the current in the other tube does likewise, and there is no net result in the output. This means that little or no filter is required for the *B* supply on push-pull stages. Actually two well-matched '50 tubes can be supplied with 450 volts of full-wave rectified voltage, but not filtered in the least, and the hum in a loudspeaker connected to the output will be indistinguishable. Such a stage will allow as good quality reproduction as one supplied with pure d-c, excepting possibly when a sustained reproduced frequency comes within one or two cycles of a harmonic frequency in the supply voltage. Should this happen, very noticeable variations in the volume level

would occur at beat frequency. The action is apparent when the amplifier is supplied with a single frequency, but in speech or music the happening is most improbable.

In practice it is rather difficult to obtain well-matched tubes, particularly of the '50 type. One does not usually have a large stock of these from which to select. It is sufficient, however, in balancing out hum, simply to balance plate currents on the two tubes. The obvious method is to make either plate or grid operating voltage on one of the tubes adjustable.

In Fig. 1, where is shown the overall schematic for a '45 push-pull amplifier, is depicted one method of doing this. The push-pull '45's are supplied from an audio input transformer with split secondary. Normally both the grids return to bias through the secondary windings and center tap. In order to make independent adjustment of the bias on

speaker rather than for equal plate currents; and if with one arrangement of tubes in the sockets no null point is found, the tubes are interchanged. Even with badly matched tubes this arrangement will allow the use of poorly or non-filtered supply voltage on the push-pull tubes.

It is comparatively easy to make the push-pull stage hum-free. The problem, then, is to add the preceding stages without bringing up the hum level. An excellent line of attack in building up any power pack and amplifier is to begin at the power stage and build onto it. Assuming that the push-pull stage alone has been balanced to zero hum, then add the input transformer to the set-up. If the hum level comes up, try orienting the transformer, grounding the case, or other remedies till the hum is lost. Then add the stage ahead, work with it till the hum is gone, and so on.

The power stage, with '45 or '50

it in a π section and as good filtering obtained as with a choke. Better filtration is obtained as the resistance goes up, and high resistances can be split up into multi-section resistance-capacity filters.

The complete filter system for the '45 push-pull pack uses 3 mf of capacity, placed as shown on the schematic. The 1 mf condenser on the supply to the '45 tubes is so placed because, in reduction of overall hum, the third condenser is most effective at this point. Two '26 tubes are used to feed the '45's, their plate voltage coming through 30,000 ohms in the resistance capacity filter. An SM-257 audio transformer on the input, an SM-227, and a 248 choke comprises the audio apparatus. The supply transformer gives 275 volts r.m.s. on each side of center tap. The total d-c output at the 245 tubes is 300 volts, dividing into 250 volts for plate supply and 50 volts bias.

The hum voltage at the output is 1.1 volts. This statement should not be taken too seriously, however, since no mention is made as to the frequencies contained in the hum. On a speaker devoid of low note reproduction the resultant sound might be undetectable. On a WE-540AW cone the noise was much below ordinary record scratch from a phonograph pickup.

The use of the Clough system transformers not only contributes to an excellent frequency characteristic, but since the physical dimensions of the transformers are small, there are not many turns on the windings to pick up hum. A noticeable decrease in hum results from changing only an SM-230 push-pull input transformer to the SM-257. The low-frequency resonance scheme can be applied to almost any transformer, in a variety of ways, and usually with uniform success.

In Fig. 2a is the straightforward Clough connection as applied to an interstage transformer. It is used as an autotransformer, and the secondary terminals should be tried reversed to determine the connection for maximum gain. The higher the resistance R the higher is the overall gain of the set-up. It

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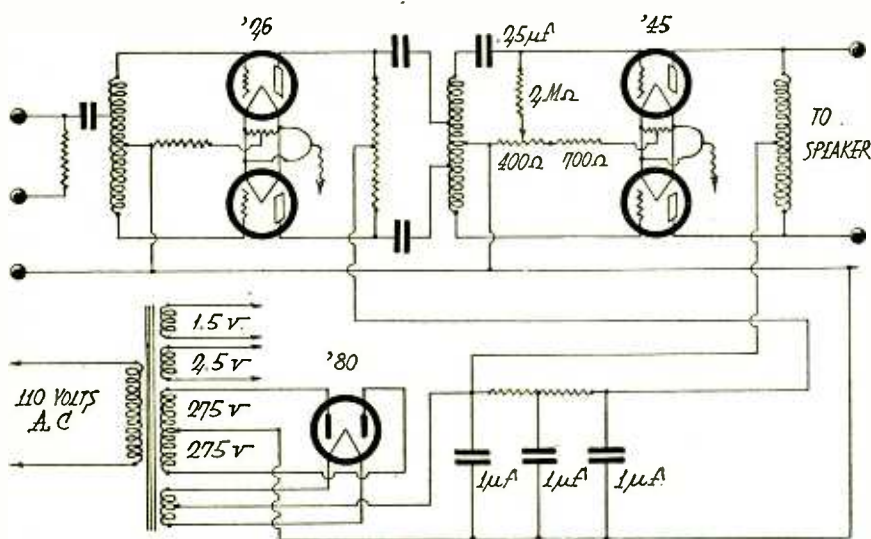


Fig. 1. Circuit Diagram of Humless Push-Pull Amplifier With Minimized Filter

one grid, it is isolated by a condenser and then returned through a grid leak to a potentiometer tap on the bias resistor. The isolating condenser is 0.25 mf, the grid leak 2 megohms. A 400-ohm potentiometer is added in front of the regular bias resistor and the adjustable return made to its tap. The adjustment is made for minimum hum in the

tubes, requires from two to four times the plate voltage of the initial stages. In making the voltage cut for the initial stages, any necessary filtering may be done at the same time. As stated above, the a-c impedance of eliminator chokes averages about 10,000 ohms. If the voltage reducing resistor runs as high, the filter capacities may be connected across

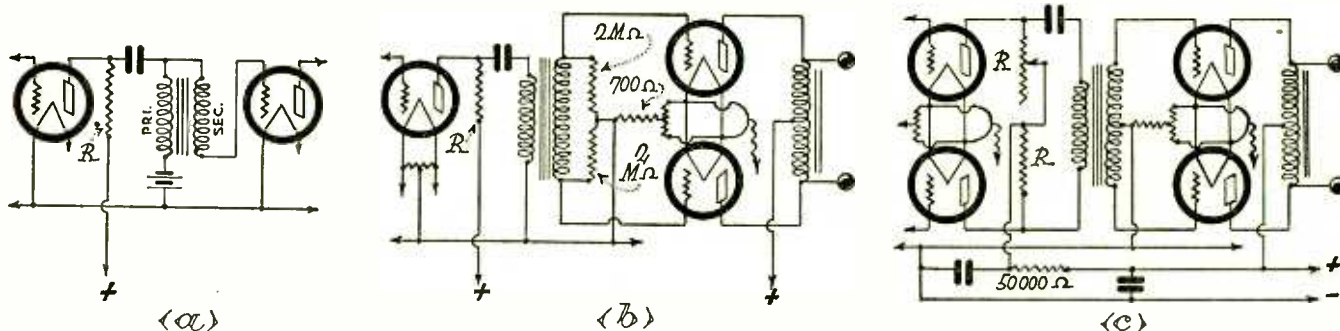


Fig. 2. Interstage Transformers in Low-Frequency Resonant Connections

Functions of the Plate By-Pass Condenser

By R. RAVEN-HART

EXPERIMENTERS who want to know what the plate bypass condenser in the detector plate circuit is for, are usually told that it bypasses radio-frequency currents; i. e., the small portion of unrectified current in the detector plate circuit. They are informed that there can be no regeneration unless there is a path for this current back to the filament through the tickler and they naturally assume that this condenser is not needed when regeneration is not used. Which assumption is far from the fact.

For, while one of its duties is to make regeneration possible, an equally important duty is to help keep the r-f currents out of the audio-frequency side of the set and also to assist the rectifying action of the tube. Thus in the cases of detection with grid-leak and condenser followed by an audio-frequency transformer, as shown in the circuits of Figs. 1 and 2, it should be obvious that however the regeneration condenser C_1 may be connected, it is parallel to the bypass condenser C_2 , and consequently that it is the sum of the capacities of these two condensers that must be taken into consideration.

If this total capacity is too small, radio-frequency currents will get into the audio-frequency transformer, despite the choke, because they have no alternative path; but if it is too large, quite a noticeable proportion of the audio-frequency currents will go through it instead of through the transformer primary, and so be lost as far as the loudspeaker is concerned. Further, these lost audio-frequency currents will be chiefly those of the higher notes and consequently it is these that will suffer most.

Apart from this, one portion of this total capacity (that of the regeneration condenser) is variable, so that these high notes will be better reproduced on some wavelengths than on others; that is, better on those where but little regeneration is needed, and where therefore, the regeneration condenser is kept small, using the ordinary circuit (Fig. 1).

Worse still, if we use our regeneration condenser as a volume control, which is a frequent practice and in suitable circumstances a good one, the proportion of high notes will be changed as we change the volume, because in increasing the volume (by increasing the regeneration condenser) we are increasing the total bypass capacity and hence helping the high notes to "escape."

Add to this the further effect, that

An explanation of how it helps regeneration, keeps r-f out of the a-f circuits, and assists rectification.

an increase of regeneration cuts down the effective resistance of the grid circuit; this means that we are increasing the selectivity of this circuit, which

balance. Now suppose that we cut down the volume in such a way that the balance is maintained; our ears will insist that it has been lost, that the low notes have been cut down more than the high ones!

If we have reduced the volume by that "Volume" knob, the regeneration condenser, we shall have decreased the regeneration and therefore the selectivity of the grid circuit, and so favored the high notes; we shall have decreased the total bypass capacity, hence again favor-

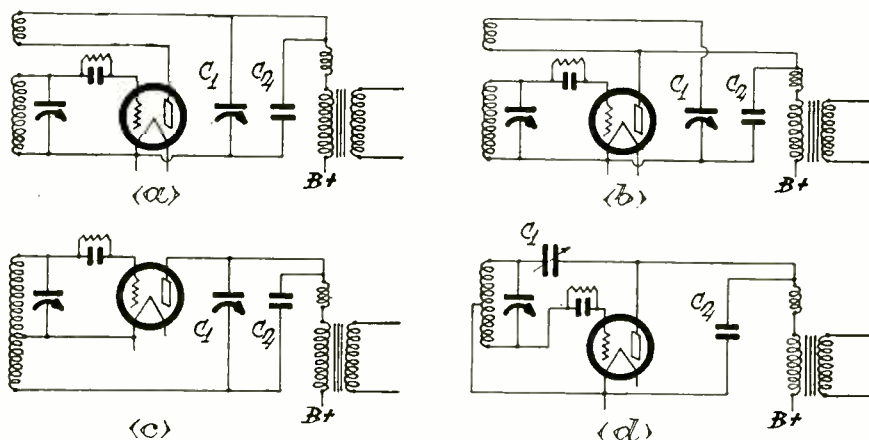


Fig. 1. Standard Regenerative Circuits

means in turn that the high notes are reduced here, before detection. Can it now be wondered that volume control by regeneration is usually so unsatisfactory with the "standard" circuit (Fig. 1) despite makers who label the regeneration condenser knob with the word "Volume."

And if this were not enough, there is yet another difficulty which is almost always overlooked. Suppose that the sender is putting out perfectly balanced signals, neither high nor low notes predominating, and that we are reproducing the transmission at the full power of our set, still with the same perfect

ing the high notes; and the ear will insist that we have triply favored them.

The remedy is of course perfectly simple, but astonishingly little used; instead of the "stock" circuit (Fig. 1), use the "reversed" circuit (Fig. 2).

Names are hopeless—everyone seems to have his own ideas as to the proper names for the circuits; but what I mean is, instead of having the regeneration condenser in such a position (Fig. 1) that the r-f current passes through it and the tickler in series, and that this condenser must therefore be increased to increase regeneration, put it where

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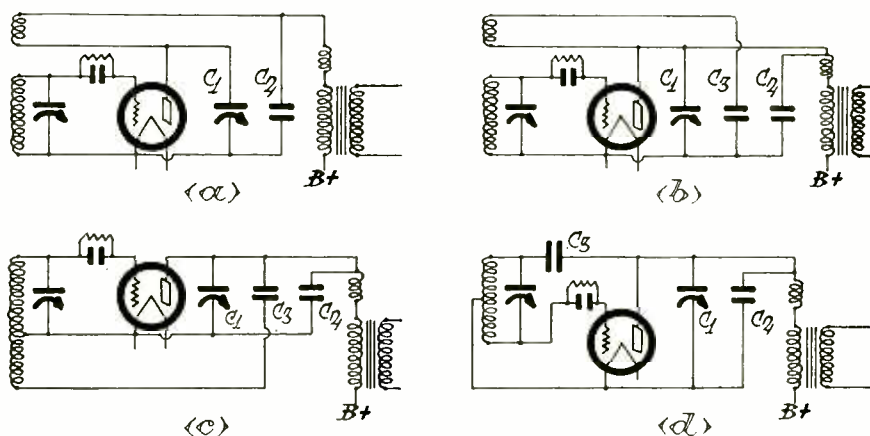


Fig. 2. Reversed Regenerative Circuits

Inside FACTORY BUILT RECEIVERS . .

By "RADIO" LABORATORY STAFF

SPARTON EQUASONNE MODEL 301

THIS latest Sparton model is similar to its predecessors except for a few refinements in coil construction. The receiver consists of three separate and removable units; namely, the selector, r-f amplifier, and power unit, the latter containing the a-f amplifier. Six Cardon 484 heater type tubes are employed in the r-f and detector circuits, two '50s in the single audio stage and two '81 rectifiers in the power unit.

All tuning is accomplished in the selector unit which precedes the first tube. This unit consists of four tuned circuits and is controlled by a four-gang condenser and an antenna trimmer. The four circuits are conductively coupled by a small section of the third winding, operating on the theory of the band pass selector. Trimmers are located on each section of the condenser gang and each

circuit is properly balanced before leaving the factory.

The r-f amplifier unit is untuned, even to the detector. The full responsibility for selectivity depends upon the selector, allowing the amplifier to be operated so that maximum gain may be obtained without affecting the frequency of the selected signal. The idea is not new but is very interesting in the way it has been worked out.

All r-f stages are coupled by r-f chokes, as shown in the circuit diagram. The "feeder" choke in the plate circuit of the first tube is wound single with a reversal of direction in the middle, and a resistor is included in series with it in order to equalize the reactance of the parallel winding. The latter is the pri-

mary of another choke, which is wound like a radio frequency transformer, the primary and secondary being coupled as tightly as two coils can be coupled. In fact, just as the diagram indicates, each turn of the primary and secondary lies side by side. This system, of course, is designed for maximum gain and can only be employed when selectivity in the r-f amplifier is of no consequence.

The coupling between the second and third stages is accomplished by another paralleled pair of chokes, although in this case the windings have not been reversed in the middle. The following two stages are similar to the first except that no "feeder" circuit has been supplied, the d-c flowing direct through the primary. The coupling between the last r-f stage and the detector is accomplished by means of a pair of paralleled chokes in which four reversals are made, plus an added choke, also reversed, in series with the secondary.

Plate detection is used, the grid being biased by means of a 20,000-ohm resistor in the power supply. This resistor is re-

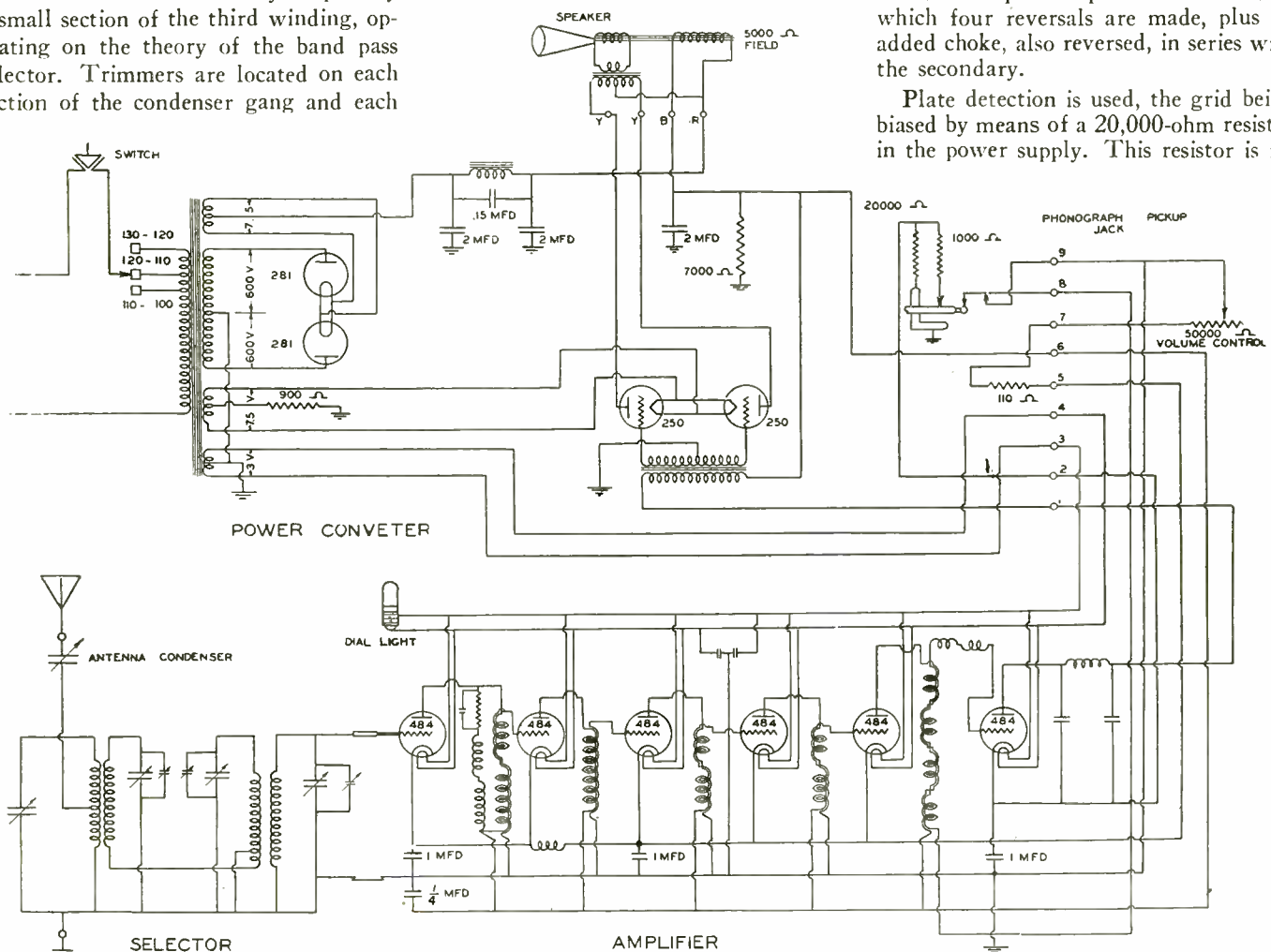
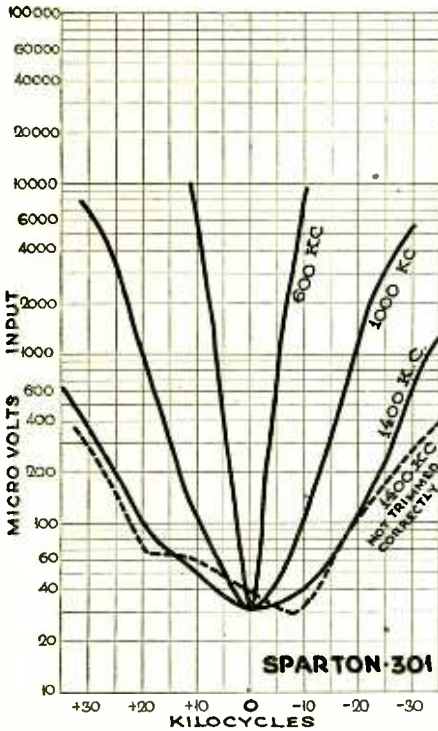


Fig. 1. Circuit Diagram of Sparton No. 301

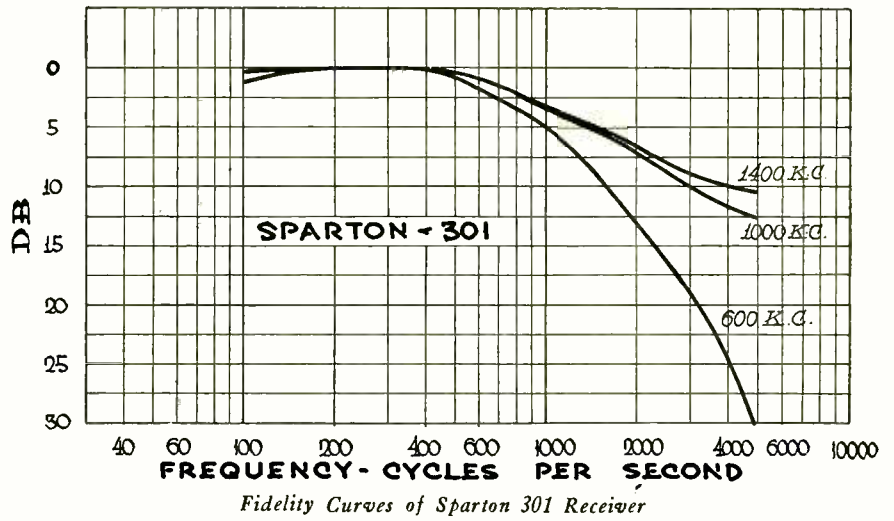
placed with one of 1000 ohms when the detector tube is used to amplify the output of the phonograph pickup. A 1 mf condenser is used to bypass the first two cathodes to ground, while another condenser of the same size bypasses the remaining three r-f cathodes. The latter are isolated from the first two by means of an r-f choke. The detector cathode is also bypassed to ground through a 1 mf condenser, while the r-f plate lead, common to all, is bypassed through a ¼ mf condenser. An r-f filter is connected in the output circuit of the detec-



Selectivity Curves for Sparton 301 Receiver

These curves indicate the relative strength necessary for an interfering broadcast station to produce the same output from the receiver as the station to which the set is tuned. In general, they show that the set tunes more broadly at the higher frequencies than at the lower. First the receiver was tuned to 600 kc and the sensitivity adjusted so that an input of 30 microvolts would give the standard output of 50 milliwatts. Then other signals above and below 600 kc were put into the receiver just as it stood, and the strength of these signals from an oscillator was increased until the same 50 milliwatts output was indicated. The 600 kc curve shows that a signal at 610 kc (corresponding to another broadcast station on that frequency) would require 6000 microvolts energy to produce the output equal to that of the station to which the receiver was tuned.

From the similar curves for 1000 and 1400 kc it will be noticed that on the 1400 kc curve a station 10 kc above resonance (1410 kc), would require only 50 microvolts to produce 100 per cent interference. Although this spells disaster to the reception of distant stations within 10 or 20 kc of a local, it need cause no concern for local reception, for local stations have been separated by at least 60 kc. It may be seen that a signal at 1430 kc requires 400 microvolts to compete with the 30 microvolt signal on 1400 kc.



Fidelity Curves of Sparton 301 Receiver

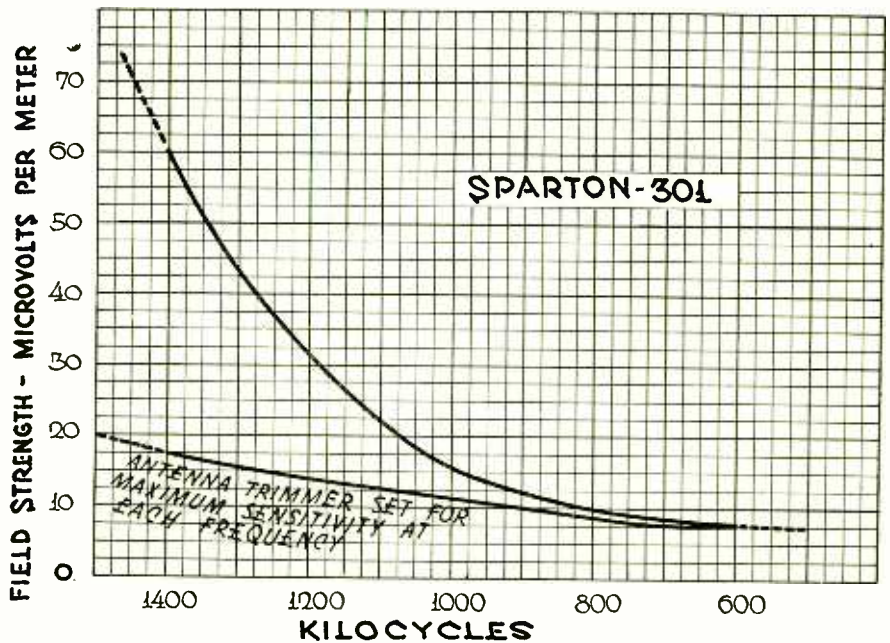
These curves indicate the loss in strength and consequently in the relative loudness of the various audio frequencies from 100 to 5000 cycles per second when the receiver is tuned to 600, 1000 or 1400 kc. They show that the low frequencies lose less of their strength than do the high frequencies. At 1000 and 1400 kc a 1000-cycle note is 3 db less than a 200-cycle note, and at 600 kc it is 5 db less. The db (decibel) is the unit used for expressing transmission loss or gain.

A change of 1 db is hardly perceptible to the normal ear, and a difference of 10 db between the highest and lowest note causes little difference in their quality of reproduction. However, with a difference of 30 db between the 200-cycle and the 5000-cycle notes of a 600 kc signal, the bass note is greatly emphasized as compared with the treble. This is merely another method of stating that the sidebands are cut more at 600 kc than at 1400 kc.

tor, and a 50,000-ohm resistor serves as a volume control by varying the bias on the grids of the r-f tubes.

The power transformer has four secondaries; one supplying 3 volts to the filaments of the 484 tubes, one 7½-volt secondary for the '81 filaments and another for the '50s. The high voltage secondary is wound for 600 volts on each

side. This voltage is rectified by the two '81 tubes and filtered through one π section, the choke of which is shunted with a .15 mf condenser. The field coil of the dynamic speaker and another 2 mf condenser constitute the remainder of the filter circuit, while a 7000-ohm resistor is shunted across the entire high voltage output for stabilization.



Sensitivity Curve for Sparton 301 Receiver

For maximum sensitivity this curve shows how many microvolts for each meter length of the antenna are required at the input of the set to produce an output of 50 milliwatts, the RMA standard for measurements. The higher curve is the true record of the receiver's sensitivity if the antenna trimmer were adjusted when installed as in ordinary practice. The lower curve gives an indication of the importance of the trimmer, and tells what can be done at the time of installation.

At 1400 kc it will be seen that 120 microvolts per meter were required. At 600 kc the gain of the receiver was great enough to allow the required output of 50 milliwatts with an input of only 7½ microvolts per meter. In the testing equipment employed an antenna with an equivalent length of 4 meters was used so that 7½ microvolts per meter is indicative of a field strength of 4x7½ or 30 microvolts.

RADIOLA 44 AND 46

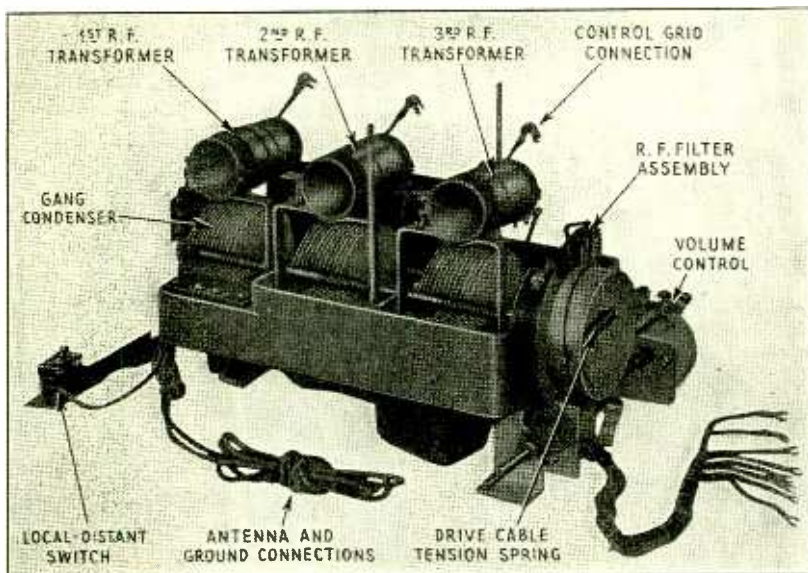
By "RADIO" Laboratory Staff

THE Radiola 44 and 46 use the same type of chassis, one being a table cabinet and the other a console model. It is the first RCA production to use a-c screen-grid tubes in two r-f and

supply the impedance necessary to match the high plate resistance of the tube so that maximum amplification may be obtained, and a single turn in series with the former and closely coupled to the secondary so that a maximum amount of energy may be transferred without destroying selectivity.

The grid returns of both r-f tubes and the detector are grounded, plate rectification being employed in the detector circuit. The r-f cathodes are grounded through an 80-ohm resistor which supplies the necessary grid bias. Each cathode is individually bypassed to a screen grid, ground and plate voltage lead through .1 mf condensers. The r-f screen grids are supplied with a positive potential from the movable arm of a 2900-ohm potentiometer across the cathode lead and a point in the voltage divider.

Grid bias is supplied to the detector by means of a 2000 ohm resistor between the cathode and a point in the voltage divider, plus a 540 ohm section of the latter. The cathode is bypassed to ground through a .75 mf condenser, to the plate through a .25 mf condenser and again to ground (in the power supply unit) through a 1.25 mf condenser. The r-f filter in the plate circuit consists of two r-f chokes and two .00005 mf condensers. One of the condensers connects the plate side of the first choke to the cathode while the second connects the high voltage side of the same choke to cathode. The coupling reactor, forming a part of the impedance-resistance coupling a-f unit, is located in the tuning section. The grid resistor of this unit is located in the

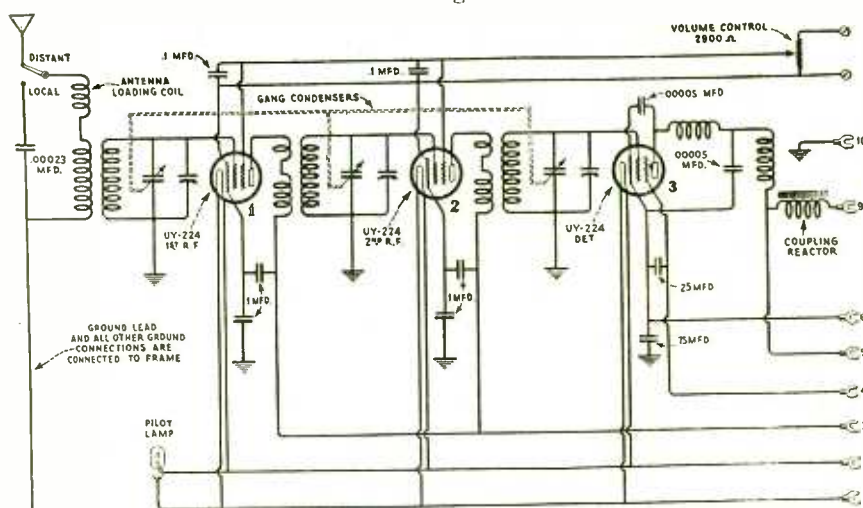


Radiola 44 Receiver with Shields Removed

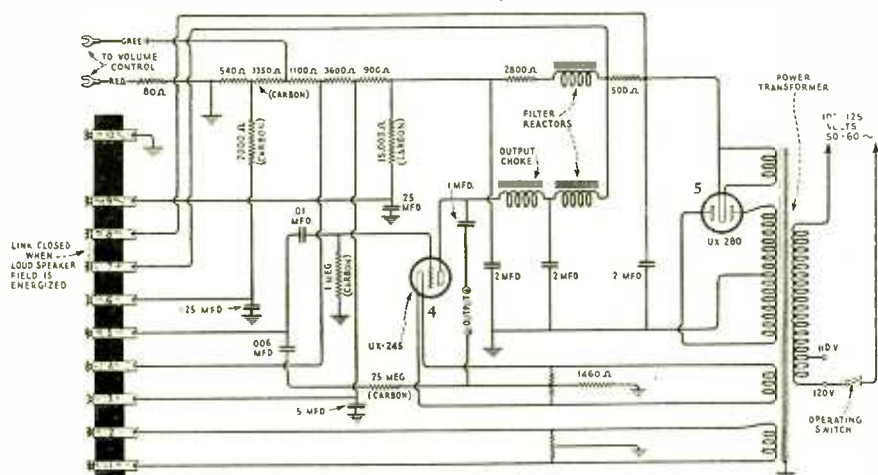
the detector stages. It has one stage of impedance-coupled audio amplification in which a '45 tube is used.

A high inductance loading coil is used in the antenna circuit so that variations in antenna constants have little effect on the tuning of the circuits. This eliminates the necessity for a coupling tube or an antenna trimmer. A "local-distance" switch is included in this circuit for the purpose of disconnecting the antenna and closing the circuit with a .00023 mf fixed condenser when local reception is required.

The secondaries of the three r-f transformers are identical, each being tuned with one unit of the three-gang condenser. The primaries of the second and third transformers consist of two sections; a high inductance section, loosely coupled to the secondary, designed to



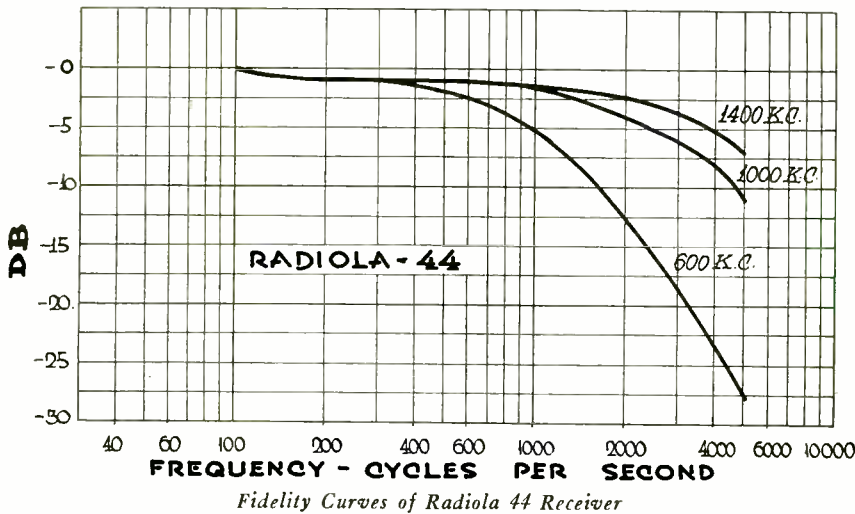
Circuit Diagram of Radiola 44 R-F Tuner and Detector Using Screen-Grid Tubes



Circuit Diagram of Radiola 44 A-F Amplifier and Power Plant

power supply and is coupled to the detector output circuit by means of a .01 mf condenser. This 1 megohm resistor, of course, closes the a-f amplifier grid to ground circuit.

The grid voltage is supplied to the audio tube by the drop through a 1460 ohm resistor connected between the filament center tap and ground. A .006 mf condenser in series with a .25 megohm carbon resistor between this lead and the detector output lead provides a further elimination path for the remaining r-f component. The audio plate is supplied with its positive potential after the latter has passed through a 500 ohm resistor (when the speaker field is not energized in this circuit), through a filter choke and an output choke. The output of this



The hump at 100 cycles indicates that the bass has been emphasized slightly in this receiver. At 5000 cycles the 1400 and 1000 kc curves show a drop of 7 and 11 db respectively. The 600 kc fidelity curve shows that at 2500 cycles the signal strength has dropped over 15 db. The corresponding selectivity curve (600 kc) shows that at 2½

kc off resonance a little more than twice as much input voltage is required to get an equal output. Thus the high audio frequencies are not amplified as much as the lows, due to sideband cutting. The same comment applies at 5000 cycles, where the fidelity curve shows a drop of 27½ db and the selectivity curve shows a requirement of 800 microvolts input instead of 100.

other 2 mf condenser being connected across the junction between the filter choke and the output choke and ground. Instead of being taken from the output of this filter system the voltage supply for the r-f and detector tubes passes through the same 500 ohm resistor, through a choke of its own, a 2800 ohm resistor and is shunted with a third 2 mf condenser. At this point it is again divided, going to detector plate through one resistor as mentioned above, and into the voltage divider for use on the r-f plates, detector screen-grid, r-f screen-grids, detector cathodes and r-f cathodes. The circuit diagram makes the matter very plain if the system of voltage division is kept in mind.

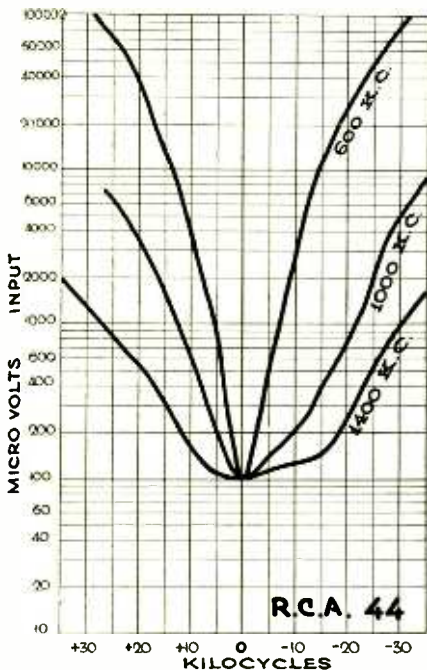
The accompanying curves tell a very definite story of the performance of a typical Radiola 44 or 46 taken from a dealer's stock. The complete description and explanation of each will be found in the caption beneath the curves.

THE RIGHT WAY TO CONNECT SPEAKER COILS

By ASHTON BROWN.

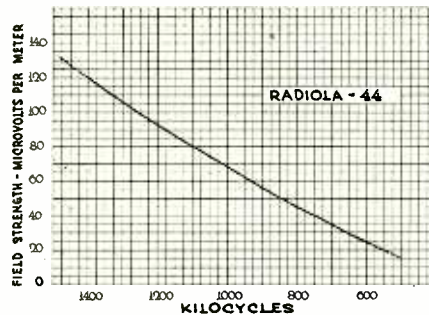
When the coils of a magnetic speaker unit or headphone are incorrectly connected, the magnetic flux induced by the coil will buck that furnished by the permanent magnet. This reduces the volume and injures the quality of reproduction.

A simple test for determining whether the coils are properly connected is ac-



These curves indicate fine selectivity at the lower frequencies and reduced selectivity at the high frequencies. The installer may slightly counteract this by trimming the receiver for best results at 1400 kc, or by employing a smaller antenna. As the high-powered stations are generally found on the lower frequencies, and as these stations usually use a higher percentage of modulation which increases the "broadness" of their modulated waves, greater selectivity is usually needed at the low frequencies.

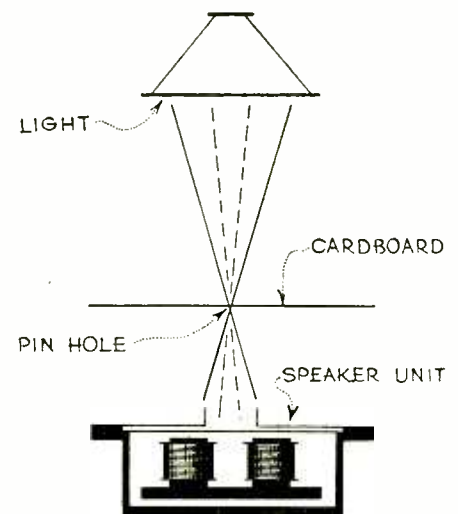
Where 100 microvolts are required to produce an output of 50 milliwatts when the receiver is tuned to 600 kc, it requires an input of 4000 microvolts when the impressed signal is changed to 610 kc and the receiver is left tuned to 600 kc. At this frequency of 600 kc the ratio for the power required from an interfering signal 10 kc above resonance to that from a signal at resonance is 40 to 1. But at 1400 kc this ratio drops to about 170 to 100, or 1.7 to 1.



This receiver is designed to give greater overall gain on the low broadcast frequencies than on the high. At 1400 kc a field strength of 120 microvolts per meter is required to produce the 50 milliwatt output. As the receiver is tuned to lower frequencies the sensitivity increases (shown by the drop in required microvolts) until at 600 kc only 25 microvolts input are needed. A dummy antenna, designed to be the equivalent of an antenna 4 meters high, was used in the testing equipment; therefore, where 120 microvolts per meter are required at 1400 kc a total field strength of four times that amount, or 480 microvolts, is necessary to produce the 50 milliwatt output at this frequency. While 50 milliwatts may be considered a minimum output capable of giving ordinary room volume, it should also be considered that the field strength from an average broadcast station may be between 1000 and 5000 microvolts at a point 50 miles from the station.

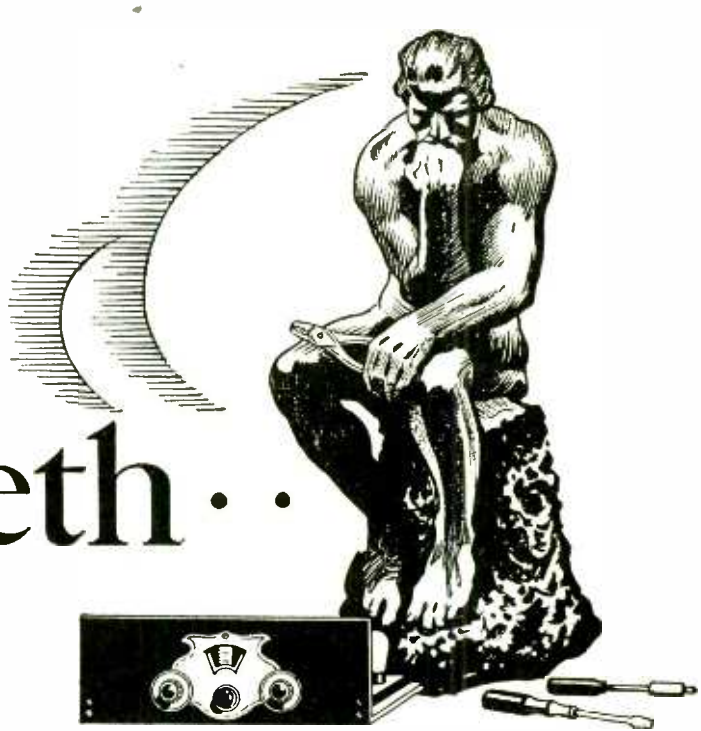
tube is put on the voice coil of the speaker through a 1 mf condenser.

The voltage supply arrangement of this receiver is a little unusual in arrangement, but fundamentally similar to the ordinary. The filament secondaries explain themselves. The high voltage output is first rectified through an '80 tube, then filtered through a system which is divided in two parts. The first 2 mf filter condenser shunts the total voltage supply. From here the audio plate voltage is filtered as explained, an-



complished by looking at a beam of light which is thrown on the diaphragm as illustrated herewith. When direct current is sent through the windings, the coil connections are right if the image becomes larger, due to the fact that the diaphragm is drawn toward the pole pieces. If the image becomes smaller the coil connections should be reversed, as the diaphragm springs away from the pole pieces when the fluxes are in opposition.

As The Trade Thinketh..



ROBERT A. MILLIKEN:

California Institute of Technology.

"Human progress grows out of measurements made in the sixth place of decimals."

E. J. MILLEN:

Treasurer, Colonial Radio Corporation.

"In the industrial history of the United States, radio will be recorded as the most rapidly developed and most stabilized of all the important industries."

B. H. BAKER:

Sales Manager, A. H. Grebe & Co.

"The radio receiver has passed from the stage of a novelty or a thing to be played with to a position where everyone regards it as an acceptable addition to a well-furnished home."

A. J. CARTER:

President, Carter Radio Company.

"Radio has been simplified to the point of one-dial control. The next radical change will be electric automatic tuning and remote control so that the stations may be selected at the radio set or at a distance by merely pressing a button."

W. C. FUHRI:

Vice-President and General Sales Manager,
Columbia Phonograph Co.

"By selling phonograph records the radio dealer can duplicate the success of the phonograph dealer who sells radio sets. The radio-phonograph set thus affords another means for spreading the sales peak throughout the year."

PROF. WALLACE C. SABIN:

Harvard University, as quoted by V. Ford
Greaves, Kylelectron engineer.

"The theoretically ideal diaphragm for sound reproduction should be a plane area of infinite rigidity without mass, freely suspended in air, without friction, tension or stress."

M. F. BURNS:

Vice-President and General Sales Manager,
E. T. Cunningham, Inc.

"Tube sales indicate that the present year will prove the greatest in radio history. Production for all manufacturing units in the United States during 1929 is expected to reach 110,000,000 radio tubes."

H. S. TENNY:

President, The Rola Company, Oakland,
California.

"There is a great future for the radio manufacturer and dealer in the talking movie field, provided that many technical drawbacks in the design of this equipment can be eliminated. The main obstacle to overcome is the response range and time-lag of sound in different parts of a room or a theater."

CAPT. FRANK M. HAWKS:

In comment on his 37-hour coast to coast
return flight with radio-equipped plane.

"Had I not been able to receive the weather picture on the flight from Los Angeles to New York as I approached the Pennsylvania mountains at night, with adverse weather conditions ahead of me, I would never have been able to continue on to a successful completion of my record flight."

J. D. R. FREED:

President of the Freed-Eisemann Radio Corporation,
Sponsor of the National Radio College.

"As long as radio represents entertainment solely, the ultimate achievement in radio sales can never be reached. Education and information (news) are two great facets which broadcasting must consider just as vital as entertainment if we are to arrive at the radio millennium."

C. W. BURTON:

President and Manager, Burton-Rogers Company.

"Radio sets are better made today than they have ever been. But accidents may happen and radio receivers, like all other electrical equipment, require service. The radio industry needs closer supervision over its service and better tools with which to work. Better equipment for the serviceman is a crying need today."

C. A. EARL:

President, Chas. Freshman Co., Inc.

"The problem that radio manufacturers face today is as great as that which the automotive executives faced ten or fifteen years ago, when 'backward looking' men explained that the industry had reached its saturation point. Saturation is a word that need not disturb far-seeing radio manufacturers, for it is at least a decade distant."

H. B. RICHMOND:

President, Radio Manufacturers' Association.

"Once a year the radio industry goes on parade. It is the time of the public radio shows. Here, under one roof, the consumer may compare the engineering activities of the past year of each manufacturer, as expressed by his new methods. Thus are these shows of value, not only as a sales stimulus, but also as a catalyzer for improved engineering design."

McMURDO SILVER:

Radio manufacturer.

"Within one year the a-c screen-grid tube will become the general purpose tube, used alike for radio and audio amplification, for detection, and for other purposes which were formerly performed by the '01A type of tube. So great is its versatility and merit that it is destined to bring a distinctly improved order of radio reception to the average user."

ERNEST KAUER:

President, CeCo Manufacturing Co.

"A radio plant can be no stronger than its engineering personnel. The engineers furnish the heart-action to the radio body. No institution, no matter how great its prestige, its public acclaim, its capital structure, its sales organization, its advertising program, can keep moving forward unless it maintains the vigor and imagination of its engineering department."

WILLIAM J. BARKLEY:

De Forest Radio Co.

"There will be a serious problem in providing the necessary complement of tubes at the height of the selling season on radio sets this fall, particularly in the '24 and '45 types. Last fall, when radio merchandisers were unable to obtain better grade tubes, many set sales were lost and inferior tubes had to be used. Tubes in stock mean more than money in the bank to the radio merchandiser."

HARRY W. HOUCK:

Chief Engineer, Dubilier Condenser Corp.

"The worker or experimenter is urged to discharge the condensers of a power supply unit before attempting any changes or adjustments in the wiring of 'live' components. This can be done by shorting each condenser section with any metallic conductor and will save troublesome shocks. Just as one should not have an exposed flame about the gas tank of an automobile, so should the radio worker make sure to discharge condensers before handling them."

D. N. DULWEBER:

Treasurer, Supreme Instruments Corporation.

"The future of radio largely depends on the character of service rendered, for service determines the degree of satisfaction the public derives from its radio investments. In the coming days of keener competition, the well-equipped, well-managed service department will contribute materially to individual dealer success. The dealer not so equipped will rapidly pass from the picture."

W. B. BIZZELL:

President, University of Oklahoma, in comment to Fada.

"Radio is extending the range of knowledge to the remote places of the earth and has greatly increased the responsibility of the educational agencies of the country. If wisely directed, it should extend appreciation for the finer things of life and raise the level of intelligence throughout the nation. It should improve the quality of its citizenship and quicken the conscience of the masses of people concerning their civic obligation."

JAMES MILLEN:

General Manager, National Company, Inc.

"The person who got a thrill in the past from picking up a program broadcast from a station a thousand miles or so away, has now a real thrill in store for him when he finds that, with a modern short-wave set, reception from stations in Australia, Java, London, Holland and other distant points is obtainable most any time of the year. Such receivers need no longer be laboratory instruments, but attractive single-control table models costing even less than the most inexpensive broadcast receiver."

J. E. SMITH:

President, National Radio Institute.

"Radio is proving more vital to the airman than to the navigator on water. Every airship engaged in commercial transportation must soon be equipped with suitable radio apparatus in order to guide the aerial navigator from one air port to the next. While much of the equipment is certain to be of such nature as to require no radio operator, such as the automatic direction finder and the radio telephone, there will nevertheless be need for the radio technician in the aviation industry. Indeed, commercial aviation can develop only as rapidly as suitable radio apparatus can be developed, applied and operated."



New S-M Custom Receiver Designs Shatter All Records

Single Control

Perfect convenience in operation, with a tremendous gain in selectivity and sensitivity—that's what has been accomplished in the new S-M receivers. Newly developed shielded coils make possible, with straight single control, a degree of selectivity never before achieved, even with multiple controls or verniers. One tuning control, one volume control, an on-off switch—that's all. All these receivers have push-pull 245 output stages, and both broadcast receivers embody the latest band-selector tuning.

All-A. C. Operation

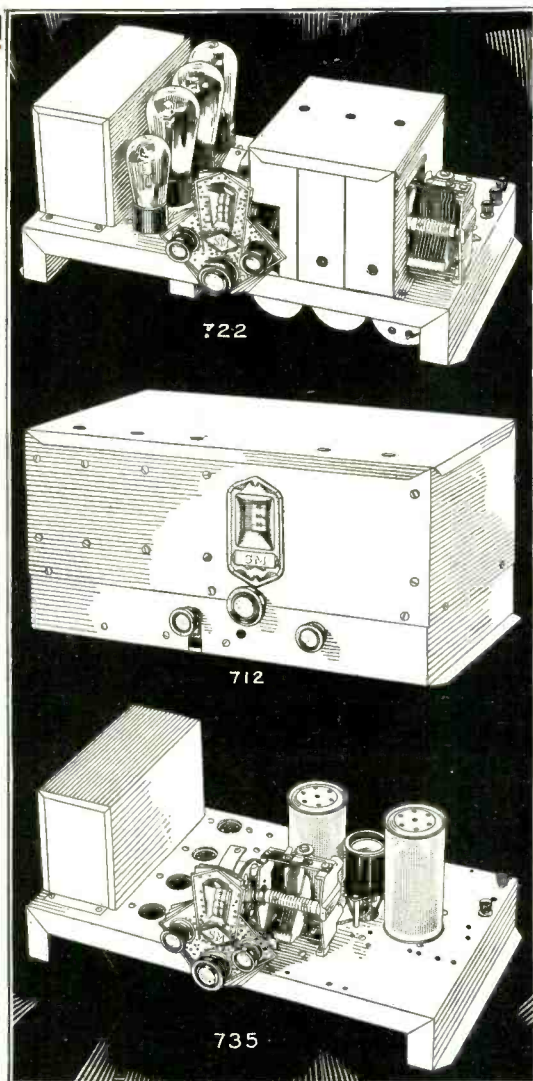
These receivers are absolutely all-electric—even the 735 short-wave set, the first of its kind ever offered on the market. Power supplies are built into the receivers—not separate. The full advantages of the new a. c. screen-grid tubes are secured. The characteristic superior S-M tone quality, distance-range, and selectivity are in these receivers as never before, due not alone to band-selector tuning but also to still greater refinements of design and accuracy of manufacture.

S-M Speakers and Power Amplifiers

Nothing more beautiful in sound reproduction has ever been heard than the new S-M dynamic speakers, when supplied from a powerful S-M push-pull audio amplifier—giving straight-line amplification from 5000 cycles down even to below 50. These new medium-voltage high-power two-stage amplifiers, using 245 tubes in push-pull are built into the 722 and 735, and an extra high-grade Clough-system amplifier is obtainable separately, as the 677.

Beautiful Cabinets

The handsome new 707 table model shielding cabinet, finished in rich crystalline brown and gold, suitable for 722, 735, or 735DC, is only \$7.75. Special arrangements have been made whereby these receivers may be housed in magnificent consoles especially adapted to them. Be sure to send for the new Fall S-M General Parts Catalog, for details of these cabinets.



722 Band Selector Seven

Providing practically all 1930 features found in most new \$200 receivers, the S-M 722 is priced absurdly low in comparison. 3 screen-grid tubes (including detector), band-filter, 245 push-pull stage—these help make the 722 the outstanding buy of the year at \$74.75 net, completely wired, less tubes and cabinet. Component parts total \$52.90. Tubes required: 3—'24, 1—'27, 2—'45, 1—'80.

712 Tuner

Far more selective and sensitive even than the Sargent-Raymont 710, the new single-control 712 with band-filter and power detector stands far beyond competition regardless of price. Feeds perfectly into any audio amplifier. Tubes required: 3—'24, 1—'27. Price, only \$64.90, less tubes, in shielding cabinet. Component parts total \$40.90.

677 Amplifier

Superb push-pull amplification is here available for only \$58.50, less tubes. Ideal for the 712. Tubes required: 2—'45, 1—'27, 1—'80. Component parts total \$43.40.

735 Short-Wave Receiver

A screen-grid r. f. stage, new plug-in coils covering the bands from 17 to 204 meters, regenerative detector, a typical S-M audio amplifier, all help to make this first a. c. short-wave set first also in performance. Price, wired complete with built-in power unit, less cabinet and tubes, only \$64.90. Component parts total \$44.90. Tubes required: 1—'24, 2—'27, 2—'45, 1—'80. Two extra coils, 131P and 131Q, cover the broadcast band at an extra cost of \$1.65.

Adapted for battery use (735DC) price, \$44.80, less cabinet and tubes. Component parts total \$26.80. Tubes required: 1—'22, 4—'12A.

Did You Get the Red-Hot News in the July RADIOBUILDER?

Keep up-to-date on Silver-Marshall progress; don't be without THE RADIOBUILDER. New products appear in it in advance of public announcements—all of the receivers and cabinets above were described in detail and illustrated in THE RADIOBUILDER for July. Many hints on operating and building appear in it. Use the coupon.

It Looks Like a Big Year For S-M Service Stations

Custom-builders using S-M parts have profited tremendously through the Authorized S-M Service Station franchises. Silver-Marshall works hand-in-glove with the more than 3000 professional and semi-professional builders who display this famous insignia. If you build professionally, let us tell you all about it—write at once!

SILVER-MARSHALL, Inc.

6415 West 65th St., Chicago, U. S. A.

Silver-Marshall, Inc.
6415 West 65th Street, Chicago, U. S. A.
Please send me, free, the new Fall S-M Catalog; also sample copy of The Radiobuilder.

For enclosed in stamps, send me the following:

- 50c Next 12 issues of The Radiobuilder
- \$1.00 Next 25 issues of The Radiobuilder
- S-M DATA SHEETS** as follows, at 2c each:
 - No. 3. 730, 731, 732 Short-Wave Sets
 - No. 4. 255, 256, etc., Audio Transformers
 - No. 5. 720 Screen Grid Six Receiver
 - No. 6. 740 "Coast-to-Coast" Screen Grid Four
 - No. 7. 675 ABC High-Voltage Power Supply
 - No. 8. 710 Sargent-Raymont Seven
 - No. 9. 6781'D Phonograph-Radio Amplifier
 - No. 10. 720AC All-Electric Screen-Grid Six
 - No. 12. 669 Power Unit (for 720AC)
 - No. 14. 722 Band-Selector Seven
 - No. 15. 735 Round-the-World Six
 - No. 16. 712 Tuner (Development from the Sargent-Raymont)
 - No. 17. 677 Power Amplifier for use with 712

Name

Address

Out of the "red"

With

Silver

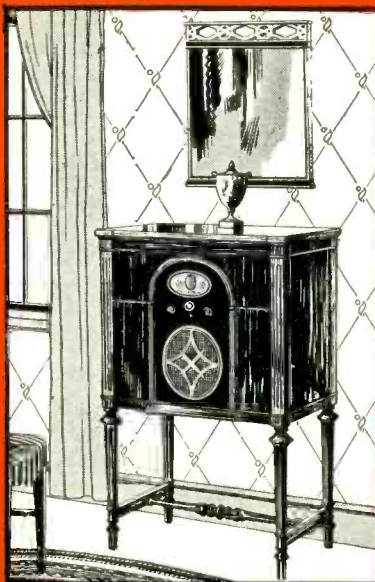
(Below) . . . Lowboy with identical 8-tube chassis, including 4 screen-grid and two 245 tubes, Matched-Impedance dynamic speaker—a value with precedent—\$160⁰⁰ complete, less tubes

(Slightly more west of the Rockies)

Unusually beautiful and distinctive are the console cabinets of SILVER RADIO—chaste and simple such as invariably distinguishes the creation of a great designer . . . All over America, from women of taste and interior decorators of note come endorsements of our effort to get away from the "gingerbread" of the average radio cabinet.

SILVER RADIO blends harmoniously with any American home-setting, especially the Colonial and modern.

Highboy with sliding doors, 53 inches high; lowboy with open front, 43 inches high—these consoles are antique in finish, hand-rubbed and polished, of American walnut veneers.



(Above) Highboy of Sheraton period, distinguished for its simple beauty and dignity—8-tube all-electric chassis, including 4 screen-grid and two 245 tubes, Matched-Impedance dynamic speaker—complete, \$195⁰⁰ less tubes

(Slightly higher west of the Rockies)

SM



SILVER · ON · RADIO ·

into the "blue"

Radio

Summer months have been "red" months to most radio dealers. Slow-moving sets, cut prices, chain store competition and unprotected territory—all make losses mount.

That was yesterday—today, throughout every month of the year, a path leads straight to profit) . . . Silver Radio dealers are making money—today—in spite of the heat!

Because—here are radios that gain instant public attention—for Silver-Marshall has the engineering experience to use FOUR of the new screen-grid tubes in an 8-tube chassis so as to eliminate the need for aerial or loop. Power to spare—and in addition band selector tuning, a Matched-Impedance dynamic speaker and an Overtone Switch which brings out all the beauty of ordinarily lost high notes as does no other radio.

SILVER RADIO dealers have a clean start—no obsolete stock—no discontinued models. They have ample assurance against ruinous competition, and protected territory.

SILVER RADIO dealers have the support of a dominant factory newspaper campaign—plus a most generous co-operative advertising allowance.

The public is sold on "screen-grid"—what they want is a screen-grid set whose actual superior performance proves screen-grid superiority.

SILVER RADIO is able to supply that demand—because of the nearly two years of screen-grid experience that are built into it.

And that's what has taken the summer months "out of the red" for SILVER dealers.

If you have not already a Silver Radio franchise—if you would have every month show "blue"—then ask your Silver Radio distributor for complete information and profit facts. Wire us for distributor's name if you are not acquainted with him.

SILVER-MARSHALL, Incorporated, 6453 West 65th Street, Chicago, U. S. A.

IS · LIKE · STERLING · ON · SILVER

AGAIN

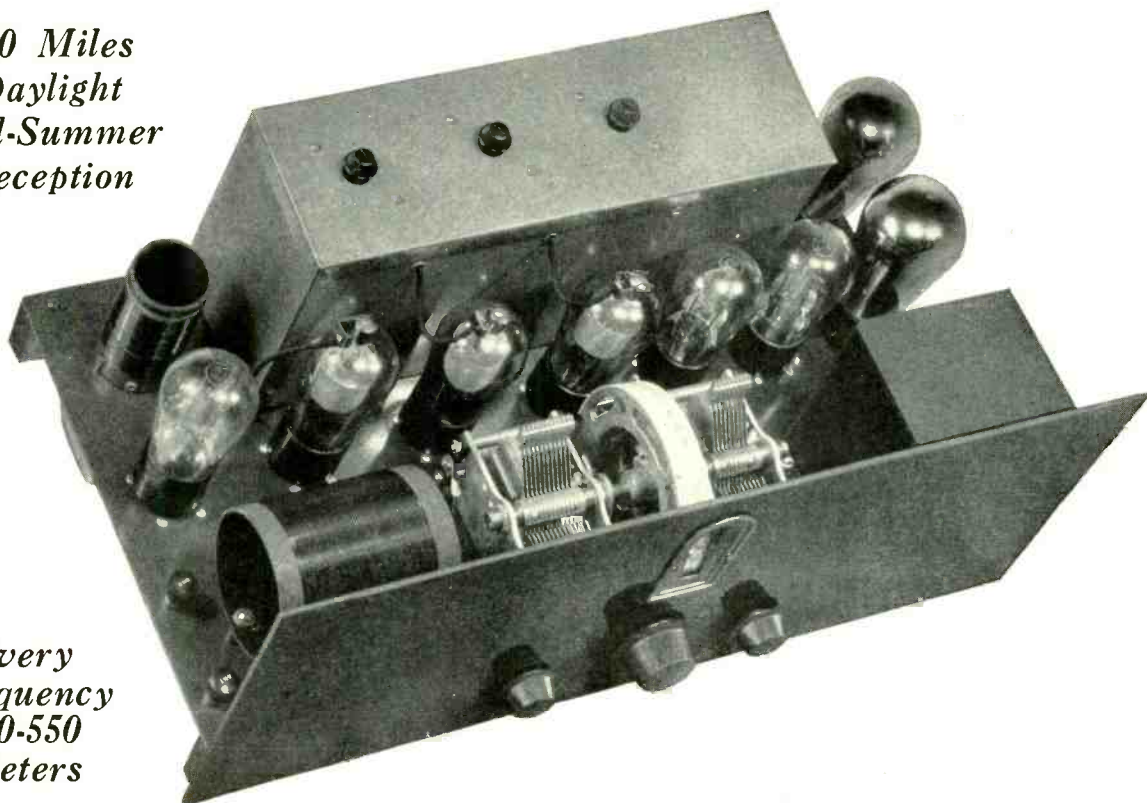
LINCOLN SETS THE PACE WITH THE

Lincoln

8-40

THE GREATEST ENGINEERED SCREEN GRID SUPER IN RADIO HISTORY

*800 Miles
Daylight
Mid-Summer
Reception*



*Every
Frequency
180-550
Meters*

NO HIGH-PRICED POWER PACK REQUIRED—Operate this high-powered Super on a small "B" supply only—No other equipment necessary.

MARVELOUS TONE—Heavy register on low musical frequencies.

ONE SPOT—Absolutely no interference from a single harmonic.

A NEW I-F AMPLIFIER

Covering a period of six months of intensive study of high screen-grid amplification, Lincoln engineering has produced the highest gain I-F transformers known; with tremendous high gain perfectly controlled without oscillation at any amount of power.

TUNABLE STAGES so operative that a slight movement of one control will tune out your local station, producing extreme selectivity which causes stations to actually explode in as dial passes frequency. **THIS MEANS RECEPTION YOU HAVE NEVER DREAMED OF.**

One noted radio engineer states: "I have tested every make of modern intermediate transformer and could not believe my findings of the I-F transformers in the Lincoln 8-40 when my test showed over three times the gain over all other makes."

LINCOLN SUPERS have never been sold on high pressure advertising. We could have headlined many reports of consistent reception from stations in Europe, Japan, Australia and other foreign countries. We could tell you of customers who were dissatisfied because they could not get three 10 KC bands, when every other channel came in perfect, in the whole broadcast band from 200 to 545 meters.

Set builders, remember LINCOLN performance means repeat sales for you. Write at once for complete information on the greatest receiver ever developed, and give qualifications for selling this equipment in your territory.

Representatives—Australia, New Zealand, Union of South Africa:

JENTS, YORE & WHITEHOUSE
46-48-50 Haig Street Melbourne, Australia

Western Representatives:

LINCOLN RADIO SALES AGENCY
200 Davis Street San Francisco, Calif.

Write Today to Department R

LINCOLN RADIO CORPORATION

329 SOUTH WOOD ST. — CHICAGO - ILLINOIS.

The *Right Kind* of Aerial for *Minimizing* Interference

Copyright by
EARL BORCH

CONSTRUCTION of aerials was formerly far better than the usual practice today, because with limited amplification then available it was necessary to preserve as much as possible of the initial energy picked up by the aerial from the passing radio wave. If the erector will remember that any leak will cause a decrease in signal strength, reception should be greatly improved.

Bare copper, when exposed to the atmosphere, will in time corrode and this corrosion will cause a tremendous increase in the high frequency resistance and corresponding reduction in the efficiency. It is therefore best to use some sort of insulated wire, preferably enameled. Insulators should be of ample size to prevent any leaks and so placed that at no point will the aerial touch any surrounding objects.

The lead-in is part of the aerial and must be treated as such and not run any old way through the window sash or doors. Bare wire should not be used as a lead to the set, for as the aerial is grounded through the coil in the set, a contact with any part of a power line in or out of the set, may cause the fuses and tubes to blow out and become a fire menace. The aerial wire should never be run close and parallel to the ground wire, as this will set up a condenser effect between the two, and cause loss in signal strength and detuning of the antenna stage of amplification.

Hum is very often encountered where the aerial is run parallel and close to the loudspeaker leads, or single power leads, i. e., leads not twisted together, or when an unshielded audio amplifier is placed so close to a power lead that inductive coupling takes place between them. It does not come in over the power leads.

Construction of aerials will vary with different conditions and different receivers. In general, follow out the manufacturer's specifications as to length.

Shielded lead-in wires will often prevent pickup of re-radiated impulses of interference from power, telephone or other wires in the building. Such a lead-in should be run from the receiver to the junction of the lead-in with the horizontal portion of the aerial. The shield of the lead-in wire must, to be effective, be grounded to a cold water pipe, and not to the ground binding post in the receiver. If a shielded lead-in is used, the aerial length must, in order to

retain the same sensitivity as with ordinary unshielded lead, be increased from 1 1/3 to twice its original length. This is done to counteract the capacity between the lead-in and its shield.

In districts which are congested with power wires, the best procedure in erecting an aerial is to place the flat top portion as far away from the power wires as is possible, and then run a shielded lead-in to the set. The longer the lead-in, the longer must the flat top portion be in order to counteract the shield-wire capacity.

Local interference may be reduced as much as 80 per cent by so shielding the lead-in and ground leads that the only

pickup to the set is from the flat-top portion. Capacity coupling to the power line in lieu of aerial is permissible where great sensitivity is not desired. The main drawback to the use of this aerial is the direct pickup from the power line of stray impulses, which will make the reception noisy.

Points to Remember

Never attach aerial to poles carrying power wires.

Keep the aerial as far away from power wires as possible.

Place the aerial as nearly at right angles to the power lines in the street as possible, particularly from high ten-

(Continued on Page 90)

WHAT THE INSTALLER SHOULD ASK HIMSELF

1. Is the aerial of proper length and in one piece?.....
 2. Is the aerial properly insulated from the extreme end to where it enters the receiver?.....
 3. Is the ground wire as short as possible, in one piece, and attached firmly to a cold water pipe or independent ground?....
 4. Does the aerial and ground installation comply with local city ordinance?.....
 5. Have you inspected the attachment plug contacts and light globes in house to make sure they are making good contact?.....
 6. Have you inspected the service switch and branch fuse blocks, making sure all connections are tight and all fuses tight in their sockets?.....
 7. Is the service meter of ample capacity to handle complete load of all electrical devices and lights in the house?.....
 8. Is the neutral service wire properly grounded to water pipe?.....
 9. Are the service wires to building touching anything between pole and building?.....
 10. Have you reversed attachment plug in socket to reduce hum in speaker?.....
 11. Have you checked voltage in house, making sure it is correct for the receiver?.....
 12. Have you noticed more than 5-volt fluctuation in voltage?.....
 13. Are any of the following appliances in use in building: Elevators.....; Ice Machines.....; Ventilating Motors.....; Dish Washers.....; Sewing Machines.....; Vacuum Cleaners.....; Washing Machines.....; Hair Dryers.....; Vibrators.....; Furnaces (Automatic).....; Water Heaters.....; Violet Ray.....; Diathermy.....; Electro-Therapy Devices of any other kind.....; X-ray.....; Electric Heating Pad.....; Electric Blanket.....; Fire Alarm Systems.....; Battery Charger (full or trickle charge).....; Electric Flashers of any kind.....; Neon Signs.....; Radio Amateur Transmitter.....; Automatic Electric Iron.....
 14. Are these devices (if any) properly equipped with filters?.....
 15. If so, are you sure these filters are not broken down?.....
 16. Are other sets in vicinity having same interference?.....
 17. Have you personally checked tubes before inserting in receiver?.....
 18. Are you sure aerial and ground connections are not reversed?....
 19. Is the loudspeaker lead separated from the aerial?.....
 20. Is the aerial lead separated from the ground lead?.....
 21. Is the aerial separated from the power leads?.....
 22. Do any of the tubes seem to make improper contact to the sockets?.....
 23. Is the voltage correct on (a) filaments (b) grids (c) plates of all the tubes?.....
 24. Is the voltage control (if any) set at the proper tap?.....
 25. Is there any extraneous noise in the loudspeaker when the aerial and ground is disconnected?.....
 26. Is there any noise in the speaker when one of the r-f tubes is removed from the socket while the set is in operation?.....
 27. Is the customer satisfied with the reception?.....
 28. Are you satisfied with the reception?.....
 29. Can anything be done to improve the reception?.....
 30. If so, have you notified the customer to this effect?.....
 31. If outside interference is present, have you notified the proper authorities?.....
- Date.....
Service Man

Radiotorial Comment

By the Editor

THIS is the beginning of the open season for those people who go to radio shows. Just why the genus homo sap is willing to pay for a chance to see what is already on sale in his neighborhood store is just another one of those things that make us behave like human beings. Perhaps it is the convenience of being able to see things without having to hunt around for them; perhaps it is the opportunity to compare different makes on display at one and the same place; perhaps it is the lure of possible novelty, or perhaps it is the various spectacular attractions provided by the managements. But whatever the reason may be, the fact remains that great crowds of people will again attend the various radio expositions throughout the country during the next few months.

The public radio show of today is vastly different from that of eight or even five years ago. Then, the exhibits consisted chiefly of parts and accessories; the visitors were mostly boys. Later, accessories and factory-built receivers were more in evidence and parts played a minor rôle; the boys were accompanied by their parents. Now the shows are made up almost entirely of complete factory-built receivers, with accessories in the background and parts hardly in the picture; most of the visitors are parents, present and prospective, and the boys are few and far between.

This rapid change in the character of the exhibits and visitors is a mirror of the correspondingly great change which has occurred within the radio industry, an industry in which great corporations give nationwide distribution to standardized products.

While all these changes have been taking place, the radio shows persist in continuing one old custom that should be discarded. The exhibits still appeal mainly to the eye. Emphasis is placed upon the beautiful appearance of a console rather than upon the beauty of the music which it is capable of reproducing. While a radio set may be made a part of the harmonious furnishing of a home, it is essentially a musical instrument. As such it is not being adequately demonstrated at radio shows. While the casual woman may be interested in seeing a handsome console, the discriminating man wants to hear the tone and note the lack of a.c. hum. His particular interest cannot be satisfied without an audition test.

This need cannot be met with the usual form of open booth construction. Open audition tests throughout a large auditorium would produce a veritable bedlam which would drive away instead of attracting crowds. A few out-of-the-way soundproof rooms are ordinarily provided for speaker demonstrations. But these are insufficient and inconvenient. Each exhibitor should have the option of a soundproof room as an integral part of his exhibit. Thus he could make simultaneous appeal to the ear and to the eye.

This comment is in no way intended to discount the value of fine appearance in a radio set. Fine design in color and form is an indispensable aid to selling. The day of the artist is at hand in the radio industry. But as people have become better educated in their taste for form and color they are also more discriminating of musical values.

While discussing radio shows it is well to again call attention to the lost time and motion between the RMA trade show and the various consumer shows throughout the country. This lapse serves to intensify a slump in summer sales. To obviate it, the Pacific Radio Trade Association plans to hold its 1930 San Francisco exhibition in June, soon after the RMA show, thus helping to start the season two months earlier than heretofore. The outcome of this experiment should be watched by other localities wherein there is an interest in stimulating the summer sales of radio.

ONE of the most profitable side-lines for the expert radio man is the installation of audio amplifiers and loudspeakers in places of large public assembly, whether in or outdoors. These require the application of the same principles as are used in radio equipment. In fact it is the development of radio which has made them possible, not only in the equipment employed, but also in habituating the public to their sound. This latter movement has also been accelerated by the use of the talkies in the movie houses.

The Market for Sound Amplifiers

Yet five out of six of the moving picture theaters are not equipped for sound amplification. Many of the smaller theaters which cannot afford the standard synchronized equipment are good prospects for appa-

ratus to provide incidental music and sound effects from phonograph records. Several record-makers are specializing on sound effects which will produce anything from the wail of a newborn babe to the roar of an express train. The use of loudspeakers in such houses not only provides an additional attraction, but also promotes economy of operation.

Then again the acoustical conditions in many halls, churches and lodge rooms can be greatly improved by the use of suitable amplifiers and speakers. The same comment applies to outdoor amusement places and stadia where it is difficult to hear a speaker.

A good radio man has no difficulty in assembling the control and amplifying equipment for use with microphones and loudspeakers. A number of manufacturers are supplying everything that is needed to do the job. And every town has several prospective users.

This is the forerunner of similar smaller jobs in the home. The synchronized talkie-movie for home use will soon be almost as common as a radio set. In fact the two can be combined to good advantage. The experience gained by the installation of a few big jobs will be invaluable in making the hundreds of small installations which will soon be required. Why not go after this work? Even if permanent installations cannot be made there is always a demand for rented equipment.

PERFORMANCE curves which show the sensitivity, selectivity and audio frequency characteristics of radio receivers are fully in accord with that part of the Einstein theory which says that all measurements are relative. For several good reasons they cannot even approximate to absolute accuracy, no matter how carefully the observations are made or how competent the observer.

Value of Receiver Performance Curves

The particular receiver on which the tests are made may be better or worse than the average receiver of that make. The various constants and adjustments of the testing equipment are not necessarily identical for each test. The personal equation of the observer enters into the problem. Only by making thousands of tests on hundreds of supposedly similar receivers could even an approximately accurate average be attained.

Nor is it to be expected that such curves are comparable to any ideal that may be figured and plotted on paper. It is one thing to draw lines on graph paper and another thing for the engineer, working under many handicaps, to attain anything near that degree of perfection.

Incidentally, a certain manufacturer has adopted the infamous blindfold test to demonstrate the realism of sound reproduction from his radio sets. This is interesting and clever, but, without the precision instruments used in the laboratory, a man, whether

blindfolded or open-eyed, has about as much chance of discriminating between the fine points of a receiver by ear as of selecting the right cigarette by nose.

Yet the curves of receiver performance which are published in these columns serve a most useful purpose. A set of these curves is given for two new receivers each month in connection with a circuit diagram and analysis. From a study of them it is possible for a dealer or service man to determine how well one make of receiver may perform in comparison with some other make. When enough of them have been printed it will no longer be necessary to accept claims for performance on faith.

Furthermore, the man who installs a certain receiver can be prepared to compensate for any inherent weakness that its performance curves may show. Thus if he knows that a set is more sensitive and selective on the lower frequencies than on the higher he may partially overcome this deficiency by trimming the condensers at the higher frequencies. Or he may use a shorter antenna to balance this lack of equality. In such ways the frequencies at which the receiver is weakest may be favored by the conditions of the installation.

WHEN by itself, a radio aerial is as safe as a dead guy wire. But when carelessly located near a power line it seriously menaces life and property. Any small wire mounted on an insecure pole may readily be broken by a wind-storm and blown into near-by power wires. Then the fireworks start. These hazards may be avoided by a few simple precautions. For instance, when installing an aerial never throw it over a power line, for it may make contact with a live wire and electrocute the installer. Such accidents have happened, just as boys have been killed by letting a wire kite string drop across a power line.

Making the Aerial Safe

Nor should an aerial ever be strung over telephone or power wires or across a public highway, and under no circumstance should it be attached to an electric light pole. An aerial attached to a tree is also dangerous unless provision is made against the swaying of the tree, using a spring support or a counterweight and pulley. Another good precaution is to use no wire smaller than No. 14 copper. But the most important point is to be sure that the support is secure.

Many aerials have been installed in a most slipshod fashion. That they have not yet been responsible for accidents is due to chance rather than design. Without waiting for the enforcement of some local ordinance the owner should have them made safe by some competent man who realizes that it may be just as dangerous to take them down as to put them up.

Eventually a standard code on aerial installation will be enforced nationally. But in the meantime public safety requires that these simple precautions be taken voluntarily. "It is better to be safe than sorry."

Policing RADIO Advertising

An account of the National Better Business Bureau's work in checking and preventing fraudulent claims and in protecting the buyer of radio equipment.

EMPHASIS in our work in the radio field this past year has been placed largely on loudspeaker advertising, descriptive terms applied to various types of radio receivers, exaggerated copy, and bait advertising. A survey was also made of the advertising of each exhibitor at last year's New York Radio Show in order to check the literature with the Standards of Practice already set up within the industry.

With the advent of the a-c set, some advertisers misrepresented earlier models in order to compete with the modern set. The Bureau found that others were confusing the public by using vague descriptions which did not differentiate the various types of sets they were selling. We discussed this subject with prominent engineers within the industry and with trade associations and individual advertisers. Tentative nomenclature was submitted to our contacts and the adoption of definitions was urged. Finally standard descriptions were agreed upon by the trade and adopted by national advertisers. The nomenclature adopted follows:

1. Battery operated set.
2. Socket-powered set.
3. Electric set.
4. A-C Tube Electric set.
5. D-C Tube Electric set.

Our survey of Radio Show sales literature indicated a closer adherence to the standards of advertising practice which had been adopted by the industry previously. The principal points of deviation from the standards consisted of inaccurate designation of cabinet woods, incomplete price quotations and misleading loudspeaker descriptions.

Specific claims which were investigated during the course of our individual case work involved inaccurate claims of automatic tuning, misleading descriptions applied to loudspeakers, incorrect price quotations, unwarranted claims of superior performance, unjustified claims for superior set design and performance, marketing of tubes in cartons calculated to stimulate products of well-known tube manufacturers, misleading description of the number of tubes required, unwarranted attempts to sell neon tubes for television purposes, claims for tubes alleging superior power, and inability of

"A radio receiver designed to utilize not less than two screen-grid tubes in tuned radio frequency circuits may be properly classified as a screen-grid receiver."—Tentative definition formulated by RMA executives at request of National Better Business Bureau.

mail order advertisers to furnish the equipment ordered by dealers. Where investigation showed that objectionable advertising was employed, the Bureau's negotiations with radio advertisers usually caused the elimination of the objectionable practices.

"Dynamic" Speaker Advertising

CONSIDERABLE attention has been given to the advertising of loudspeakers. This has been caused by the increasing popularity of "dynamic" speakers and the large sale of this type of speaker by dealers. Early advertising of the dynamic speaker caused some manufacturers and dealers to offer as "dynamic speakers" products which were of the magnetic type of construction. The National bureau discussed inaccurate descriptions of these products with advertisers and succeeded in obtaining corrections.

It was apparent from this work that definitions of the various types were needed in order to differentiate the products in the minds of the public and of dealers. The Bureau again contacted with engineers in the industry and with trade associations urging the early adoption of such definitions. We also investigated the patent situation in order to help clarify the issues at hand. The result was the recommendation of the popular description "dynamic" and "magnetic" based on technical definitions of "moving coil" and "moving iron" speakers as adopted by the Institute of Radio Engineers. National advertising has been checked against these definitions for violations.

"Bait" Advertising Still Prevalent

AS THE latter pages of this report will show, complaints are still being received regarding "bait" advertising and

similar unfair selling practices on the part of retailers. Shoppers from the National Bureau and from local bureaus have obtained first hand evidence of the use of bait and have sought the assistance of the courts. Continued attention will be given to this type of unfair competition and public deception. It would assist the bureau if radio manufacturers would call our attention to any complaints which they receive.

In one of the investigations described in the second section of our report it will be noted that a mail order radio concern was declared fraudulent by the Post Office Department and denied the use of the mails. Later, inquiries were received indicating that the same individual was attempting to do business again under a different firm name. His activities were checked through the coöperation of the local Better Business Bureau in that city and the Post Office Department was notified of our findings. This resulted in an extension of the fraud order to cover the new firm name and the fraudulent practices of this individual were stopped.

During the past few months we have learned of the existence in the retail market of three makes of tubes put up in boxes simulating closely in color scheme and lettering the cartons used by two leaders in the industry. Letters have been addressed to the concerns whose names appear on the containers as manufacturers of the tubes, but two of them were returned by the Post Office marked "Not Found." Attempts are being made at the present time to locate the responsible parties through dealers, after which full discussion of the matter will be held. Negotiations are now pending with the third manufacturer.

The bureau is investigating the construction features and reception characteristics of "screen-grid tube sets" with a view toward building up sufficient information to check the claims made by manufacturers of such sets. We plan to take up with advertisers all questionable claims and descriptive phrases in order to prevent unfair competition and to protect the set buyer. We shall be glad to investigate any inaccuracies which manufacturers call to our attention.

Design and Construction of I-F Transformers 45 to 500 KC. ~ ~

By R. WILLIAM TANNER

This practical information for the experimenter should interest many service men whose home laboratory investigations are the basis of their successful work in their shops.

THE most important development in the reestablishment of the superheterodyne receiver has been in the choice of new frequencies for the intermediate frequency amplifier. Upon this choice depend the selectivity and the sensitivity of the super; and the subject opens a wide field of experiment for the owner or prospective builder of one of these receivers. The object of this article is to explain how i-f transformers may be wound for any frequency between 45 and 500 kc at a cost of less than one dollar each.

The first factor in the design is the determination of the frequency which is most suitable for the service to which the super is to be put. For code signals the greatest sensitivity and selectivity will be secured by using a sharply tuned amplifier peaked somewhere between 45 and 75 kc. For speech and music, the amplifier should be less sharply tuned so as not to cut the side-bands and should be peaked to some frequency between 75 kc and the lowest broadcast frequency to be received.

In general, the lower the i-f frequency, the easier it is to obtain stable operation and the greater the gain per stage. However, the gain does not increase as much as might be expected below 100 kc and above 300 kc the selectivity and gain fall off very rapidly. A frequency of 450 to 500 kc which may be employed to give one-spot tuning gives poor selectivity and reduced sensitivity. Better results are generally secured by using a selective tuner or r-f amplifier ahead of the first detector, together with any i-f down to 100 kc, which will give two spots so widely separated that by the time the upper one is reached the r-f tuner is far enough out of resonance to prevent the signal from coming in.

Harmonics, while not absent, do not cause much trouble above 200 kc. Distortion, due to side-band cutting by sharply tuned transformers, is also unnoticeable above this frequency.

When designing an i-f transformer there are four points to be kept in mind:

First. The ratio of turns between primary and secondary should be correct for the tubes employed, a tube with a high plate impedance requiring a lower ratio than one with a low impedance.

Second. The electro-static or capacity coupling between the two windings should be kept as low as possible by using small wire in the primary and concentrating the turns at the low potential end of the secondary.

Third. The secondary should be wound with as large wire as is practical to reduce the high-frequency resistance, a matter of importance from the selectivity standpoint.

Fourth. The external magnetic field should be as small as possible to reduce feedbacks to a minimum. This means that the windings will have to be on a form of small diameter.

The Silver-Marshall type 130-T plain midget coil forms are ideal for i-f transformers. The primary may be wound in the slot near the bottom, the space provided being sufficient to wind the secondary in two or three banks or in plain layers. The diameter is small enough to prevent the magnetic field from "straying all over the set." These forms are provided with five contact prongs, requiring UY tube sockets as mounting bases.

The tubes generally employed in the i-f stages are the '01A, '99, '26 and '22. The accompanying table gives the practical turns-ratio for these tubes. If the theoretical values were used, the ampli-

fier oscillations would be rather troublesome and the super would tune broadly. Therefore we must increase the turns ratio to a point where selectivity and stability of oscillations are at a satisfactory value.

PRACTICAL TURNS-RATIOS

Tube	Ratio
'01A	3.5 to 1
'99	2 to 1
'26	3.8 to 1
'22	1.4 to 1

KC	Secondary turns	Type of winding	Shunt capacity	Primary turns			
				'01A	'99	'26	'22
500	112 No. 28 enameled	Single layer	.00035 μf	32	56	29	80
300	112 No. 28 enameled	Single layer	.001 μf	32	56	29	80
250	213 No. 28 D. C. C.	3 banks	.00025 μf	60	106	56	152
200	213 No. 28 D. C. C.	3 banks	.0005 μf	60	106	56	152
166	213 No. 28 D.C.C.	3 banks	.0008 μf	60	106	56	152
150	213 No. 28 D. C. C.	3 banks	.001 μf	60	106	56	152
100	400 No. 30 D. C. C.	5 layers	.00065 μf	114	200	105	285
75	400 No. 30 D. C. C.	5 layers	.001 μf	114	200	105	285
45	630 No. 32 D. C. C.	7 layers	.001 μf	180	315	165	450

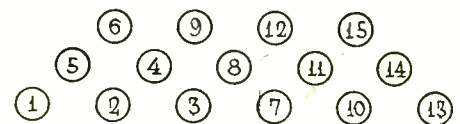


Fig. 1. Details of Three-Bank Winding

+5 kc secondary, 93 turns. As each layer is finished apply a few drops of collodion to hold the winding in place. The lower or slot end of the secondaries is soldered to the F_1 prong and the upper or flange end to the G prong.

The primaries are all wound in the same direction as the secondaries. No. 36 enameled wire is used where the number of turns is under 200. Over 200, a smaller size wire will be necessary to be able to wind them all in the slot. No. 40 enameled wire will be about right. The start of the primary goes to the F_2 prong and the finish to the P prong.

It will be interesting to learn how the turns ratios were found. Each transformer was wound with an oversize primary and placed in the circuit. Then turns were removed, a few at a time, until the selectivity was satisfactory or until a certain local broadcast station could be tuned out within two degrees on the oscillator dial. A 25-ft. antenna was employed during these tests. With a longer one the selectivity may not be great enough. In this case it will only be necessary to remove a few more turns from the primaries until the tuning is sharp enough.

It is sometimes desirable, on the higher frequencies, especially when using the '22 screen-grid tubes as amplifiers, to employ some form of regeneration in the second detector circuit. This is an absolute necessity if the super is to be used for code reception.

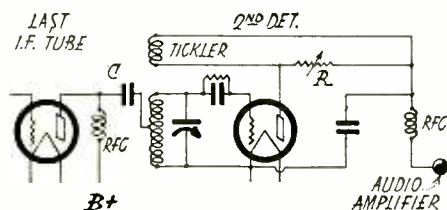


Fig. 2. Circuit for Employing Regeneration with the Second Detector

Regeneration may be accomplished by the circuit in Fig. 2. A tickler coil, about one-third the number of secondary turns, is coupled to the grid coil. This is wound in the slot with the leads connected to the prongs in a manner just opposite to that of the primaries. No primary is used, the r-f energy in the plate circuit of the last i-f tube being fed through a .0005 μ f mixed coupling condenser, C , to a tap taken off the secondary. The number of turns between

the tap and the filament end should be the same as would be employed in a primary. This gives a step-up in voltage. The tap is soldered to the C prong.

The radio frequency chokes, RFC , should be those designed for use on frequencies below the broadcast band, many of which are on the market at a very reasonable price. If the builder cares to make these himself, he may do so very easily. A total of 800 turns of No. 36 enameled wire on a common thread spool approximately $\frac{3}{4}$ in. in diameter will be effective from about 500 to 100 kilocycles. Below 100 kc 1400 turns will be needed. The turns should be "scrambled" with no attempt made to wind in layers.

The variable resistor R , may be almost anything from 2000 to 50,000 ohms. Its use is to control regeneration for greater sensitivity on weak broadcasting signals and to cause the tube to oscillate for the reception of continuous wave code.

When connecting the coil sockets into circuit, P goes to the plate, G to the grid, F_1 to the filament, F_2 to the B positive and, in the case of the last or output transformer, C goes to the plate through the condenser, C .

Relations of *Current* and *Voltage* in the Tuned *Circuit*

A simplified explanation and picture of how resonance is secured.

By C. B. HORSLEY

TO GAIN a clear understanding of what is really meant by a tuned circuit, in place of the usual rather hazy notions about resonance, it is necessary to study the time relation between the voltage and current in the various

a-c circuits represented in Fig. 1. Circuit A is that for an alternating current flowing through a resistance; B through a pure inductance; and C through a pure capacity. For each circuit there is also a graphic illustration of the time

relation between the voltage and current. In A it will be noted that the current changes at the same instant that the voltage changes.

In B a current i causes in the coil an interlinking magnetic flux that varies as the current varies. This varying flux generates in the circuit a voltage of varying strength, the maximum voltage occurring at the time of maximum flux variation, which is when the current passes through its zero value. This counter voltage e' is opposite the voltage e producing the current and, neglecting losses, the two voltages are equal. Consequently the current i lags behind the impressed voltage e by 90 degrees or one-quarter of a complete cycle.

In circuit C the maximum current flows when the voltage is changing most rapidly (passing through zero). As the voltage reaches the peak value, where there is a moment of no change, the

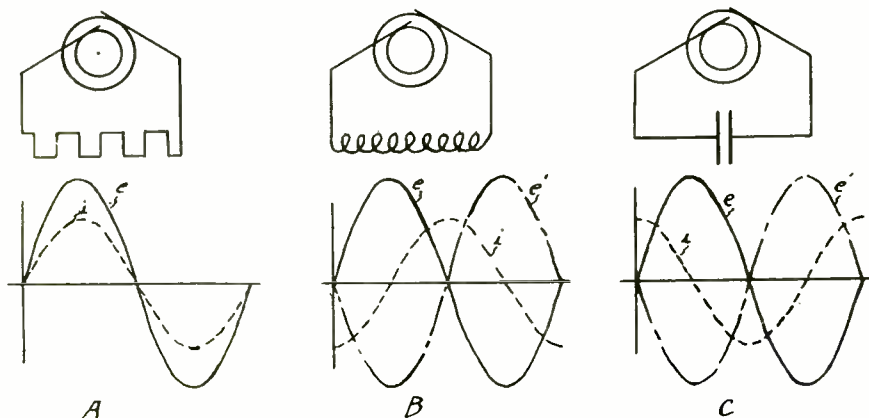


Fig. 1. A-C Circuits and Current-Voltage Relations

current is zero, and, as the voltage decreases, the current must necessarily flow in the opposite direction, for, in effect, the electricity that went into the condenser in order to fill it to the point

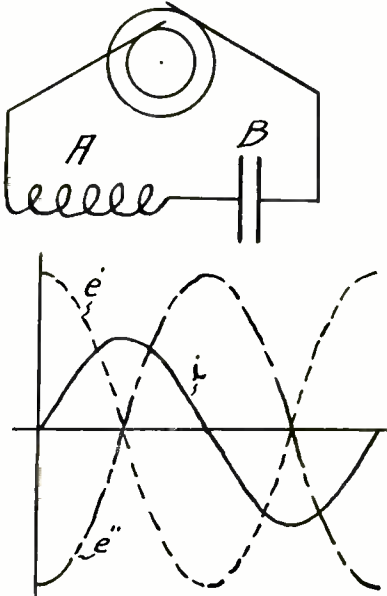


Fig. 2. Circuit with Inductance and Capacitance in Series

of peak voltage must necessarily come out of the condenser in order for this voltage to be lowered. Thus it can be seen that in a condensive circuit, the current is 90 degrees ahead of the impressed voltage.

In Fig. 2 a current i flows in a circuit consisting of a coil and condenser in series. The counter voltage e'' built up by inductance A is maximum, not when current i is maximum, but when this current is changing at a maximum rate of speed, for it is then that the magnetic field permeating the windings is changing at greatest speed. When the current is maximum, this voltage is at zero, for then there is no change in flux, but when the current starts to decrease, this counter voltage increases from zero, but in the same direction as that of a voltage in phase with the current, for the magnetic field is collapsing and tending to keep the current going in the same direction. The counter voltage built up by the condenser B when a current i is passing through (filling and emptying) the condenser is indicated by e' . This counter voltage is maximum when the current is zero, for then the condenser is filled to its highest level; and zero when the current is maximum. When the current starts to decrease, this counter voltage increases from zero, but this time it is in the opposite direction to the voltage in phase with current, for the condenser is filling up.

It can be seen that these counter voltages are opposite in sign (direction in which they would cause a current to travel) at all times, and, if they are of equal magnitude, they will neutralize

each other. Thus, if resistance were not present, there would be nothing to block the passage of current through this circuit, so that for even a small impressed voltage the current would be infinite, no matter what size the condensive and inductive elements were, as long as the condensive reactance was equal to the inductive reactance (dielectric and hysteresis losses not being considered).

Actually, there will always be a certain amount of resistance in the circuit, as shown in Fig. 3. Thus the current is always in phase with the impressed voltage in a tuned circuit, since resistance is the only obstacle to the passage of the current. If the resistance of the circuit is 1 ohm an impressed 5 volts will cause a flow of 5 amperes when the circuit is tuned to the supply frequency. If the condenser is of such value that in order to pass 5 amperes at that frequency it must have 20 volts impressed upon it, the voltage across the condenser will be 20, but the voltage

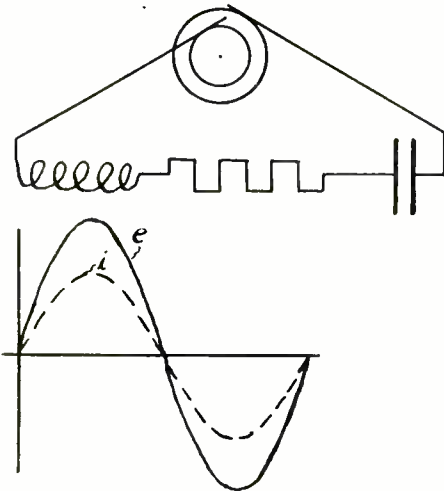


Fig. 3. Circuit with Inductance, Resistance and Capacitance in Series

across the inductance will be 20 also, and opposite in sign. Thus it is possible to have a much higher voltage across either the condensive or inductive element than is impressed on the two in series.

The higher the frequency is (the more rapid the change in voltage) the more current will flow through a condenser at a given voltage, and therefore the lower the condensive reactance. On the other hand, the higher the frequency, the more rapidly will the magnetic flux vary, and thus the higher the inductive reactance. Thus, to keep a circuit in tune, either the inductive reactance must be increased or the condensive reactance decreased for a decrease in frequency, and the inductive reactance decreased and the condensive reactance increased for an increase in frequency. To increase the inductive reactance, the inductance must be increased; but to increase condensive reactance, the capacity of the condenser must be decreased.

It can be seen that every circuit con-

taining condensive reactance and inductive reactance will be in tune for some frequency.

If the inductive element has an iron core, the inductive reactance will vary with the current through it as the iron core approaches and passes through its saturation point. Thus a circuit may

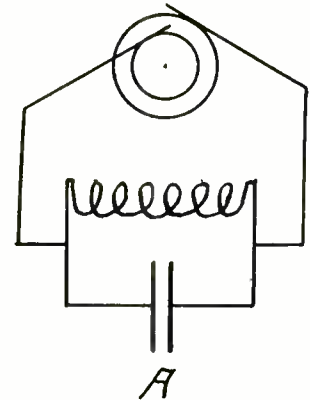


Fig. 4. Circuit with Inductance and Capacitance in Parallel

be in tune at a certain impressed voltage and out of tune at both above and below this voltage, though the frequency remains the same. This principle is used in the design of some line voltage stabilizers.

It may be noted that, as shown in Fig. 2, if the condensive and inductive elements having the same reactance for the particular frequency are connected in series, their combined impedance to current flow will be low, while if they are connected parallel as in Fig. 4, their impedance is high. In Fig. 2 the lower the resistance, the higher will be the amperage, provided the voltage is constant, while in Fig. 4 the lower the resistance, the lower will be the amperage.

CARE OF VACUUM TUBES

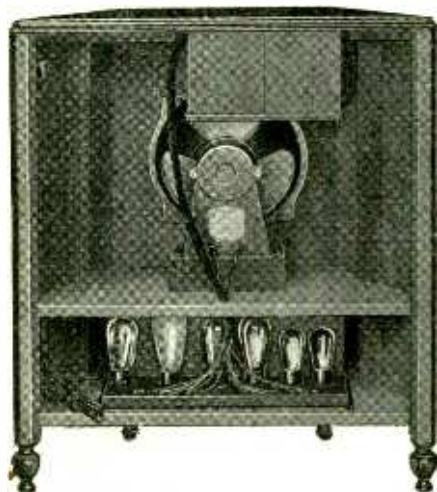
TO GET the best service out of a vacuum tube it should never be jarred. While jarring seldom destroys the filament or heater, it will often derange slightly the relative position of the elements, which will change the amplifying characteristics of the tube. When tubes are repeatedly short lived in a set, the A , B and C voltages should be checked by an expert, and an efficient voltage regulator installed if necessary. Trouble of this order may be expected in suburban districts. When tubes are noisy, they should be removed from the sockets, and the prongs cleaned with a nail file. Be sure that all tubes are placed in the proper sockets. If in doubt, find the higher voltage sockets first, by inserting the required number of five volt tubes into different sockets until they light brightly. Always turn off the set before removing one or more tubes. Never, except under the direction of an expert, have the power turned on unless all tubes are in the sockets, is the advice of Arcturus engineers.

Kit Reviews



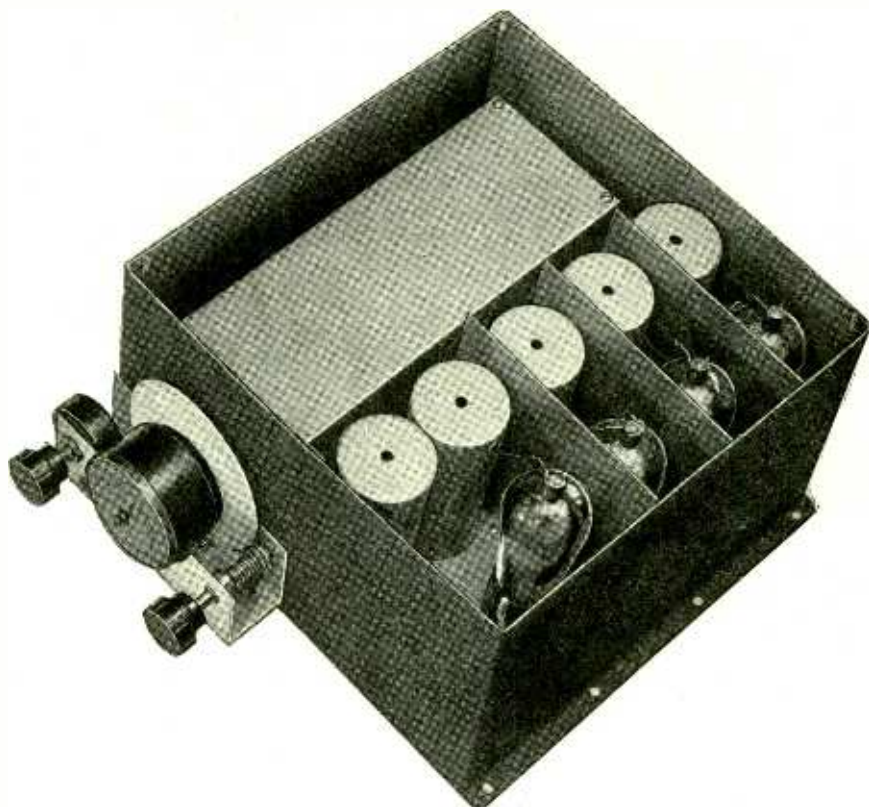
REMLER SCREEN-GRID KIT NO. 111

THE enterprising radio dealer who either creates or has to meet a demand for a finer receiver than he ordinarily carries in stock, can readily do so by inserting standard units in a dynamic speaker console which is designed to hold them. Thus a jobber or retailer may sell a private brand set consisting of standard equipment for which consumer satisfaction can be assured.



Remler No. 111 Kit in Jensen Imperial Console

The Jensen Imperial cabinet with its 10-inch speaker is admirably adapted to this purpose. Its requirement of ample baffle space allows sufficient room to sup-

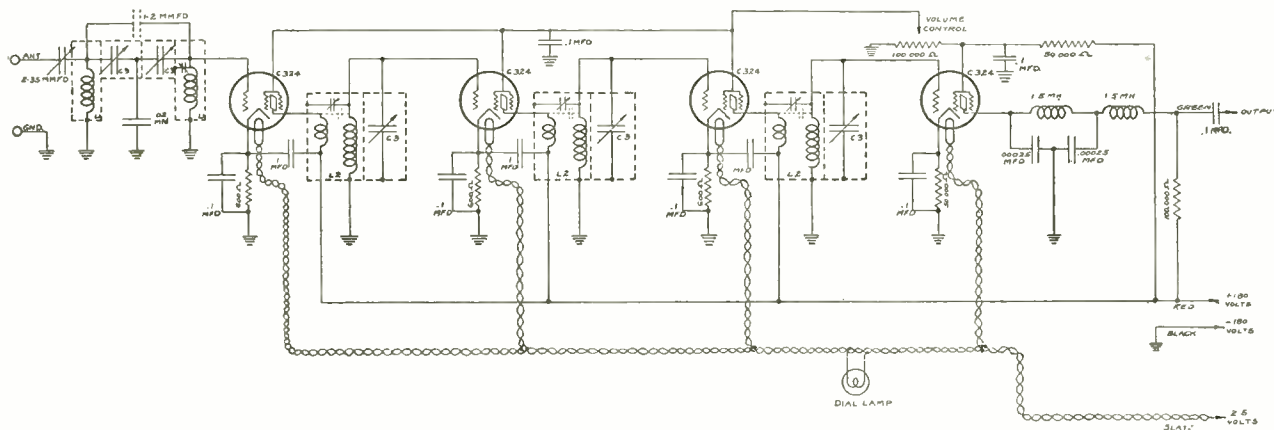


R-F Component of Remler No. 111 Kit

port a radio-frequency unit from the top of the cabinet, which is drilled to receive a standard escutcheon, with dial and controls. When used for this purpose a special offset tuning dial is necessary. In the bottom of the cabinet is a shelf

for holding the audio amplifier and power plant.

Two units which are suitable for such an installation have just been announced by the Remler Manufacturing Co. One is a three-stage r-f and detector unit



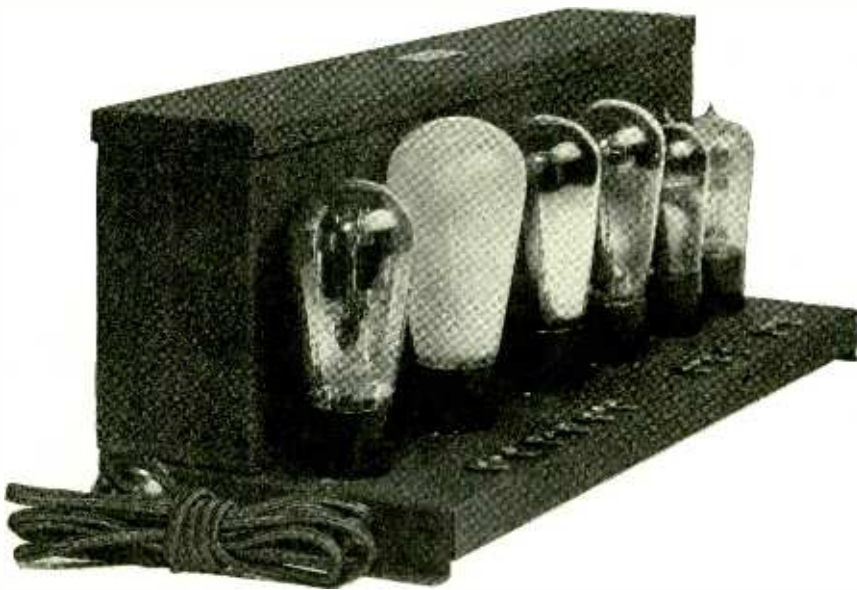
SCHEMATIC CIRCUIT DIAGRAM
REMLER #111 CHASSIS KIT

which uses screen-grid tubes. The other is a complete power pack and two-stage audio amplifier with two '27 tubes in parallel in the first stage and two '45 tubes in push-pull in the second stage. Each unit is enclosed in a copper box so as to be completely shielded and ready for installation after it has been assembled. The r-f detector unit is mounted above the speaker by means of four screws attached to the bottom of the upper shelf. The amplifier unit is screwed to the shelf below.

shielded compartment. In series with each variable condenser, each forming a part of one closed circuit, is a .02 mf fixed condenser which lowers the maximum and raises the minimum capacity but slightly. An antenna trimmer and a trimmer across the second coil make perfect alignment possible.

The input of the first r-f tube is fed directly from the bandpass selector. Grid bias, as in the case of the two following tubes, is supplied from the drop through an individual 600-ohm resistor

positive terminal, through a .1 mf condenser, while another .1 mf condenser serves to bypass the screen-grid lead which is common to all three r-f tubes. These screen-grids are supplied with a positive potential by means of a 100,000-ohm potentiometer connected between the detector screen-grid supply and ground. The detector screen-grid voltage is taken from the positive 180-volt line and reduced to the proper value by means of a 50,000-ohm fixed resistor. This lead is also bypassed to ground through a .1 mf condenser.



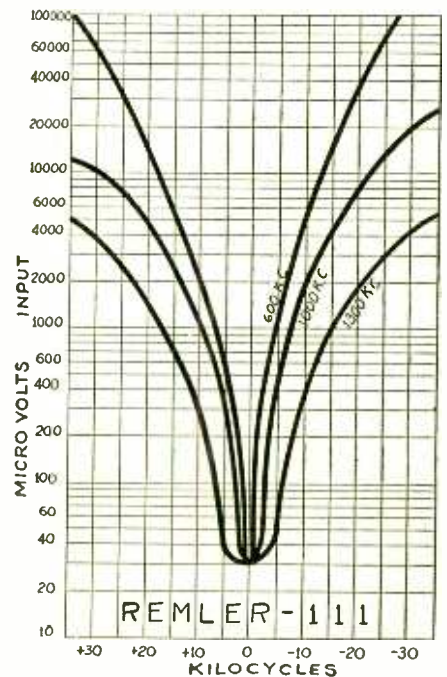
A-F Component and Power Unit of Remler No. 111 Kit

The selectivity, sensitivity and tone quality of this combination are shown in the accompanying performance curves. The technical details of the circuits in conjunction with the diagrams, follow:

From the diagram of the r-f detector unit it will be noted that two of the five condensers in the gang are in a band-pass filter which precedes the first tube. Each of the two closed circuits in this selector is enclosed in an individual

between cathode and ground. This is bypassed in each case by a .1 mf condenser.

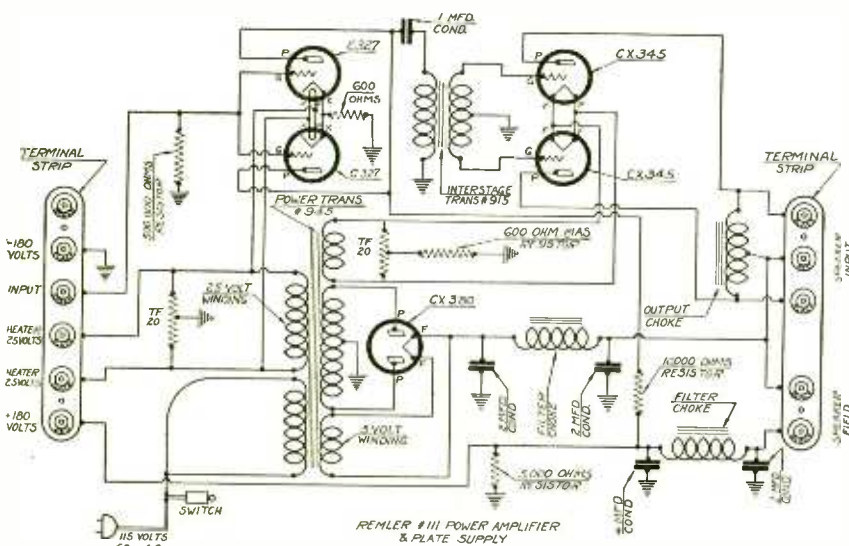
The interstage tuning system consists of three inductively coupled transformers, each enclosed in an individual shield and tuned by one of the shielded condensers in the gang. A trimmer is connected across each secondary and mounted in the transformer shield. Each primary is bypassed to ground, at the



Selectivity Curves for Laboratory Model of Remler 111 Kit

These curves show the difference in antenna input required to produce a 50 milliwatt output to the loudspeaker for 600, 1000 and 1300 kc at resonance and at points 10, 20 or 30 kc off resonance. The 600 kc curve is so sharp that a 5000 cycle note is cut off unless it has 600 to 1000 microvolts to give it a 50 milliwatt output, corresponding to a 30 microvolt input for the bass notes. An interfering station 10 kc off resonance would have to have a strength of 2000 to 5000 microvolts to give the same volume of sound as the 600 kc station to which the set is tuned. At 1300 kc it would have to have a strength of 300 to 400 microvolts. On local reception this cutting of the sidebands is not as serious as it looks as the curves will broaden out when the receiver is operated at a point of less sensitivity because of increased input.

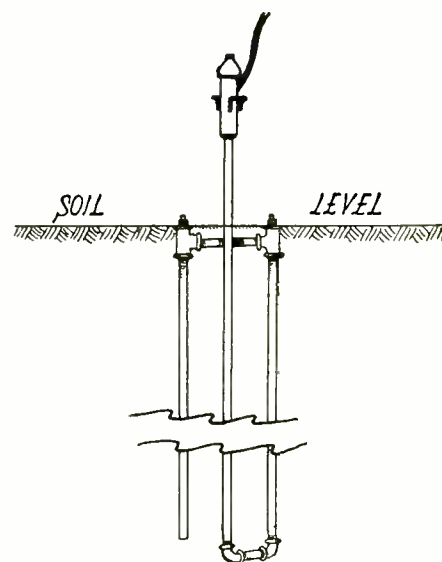
Plate detection is used, grid voltage being provided from the drop through a 50,000-ohm resistor, bypassed through a .1 mf condenser, between cathode and ground. A 100,000-ohm resistor in series with the plate and the 180-volt line serves as the "primary" of the resistance-coupled amplifying unit. An r-f filter in this lead, for the purpose of eliminating any r-f current that may have seeped through, consists of two 1.5 millihenry chokes, one of which is shunted with two



A RADIO GROUND FOR AN ARID LOCATION

THE difficulty in securing a satisfactory ground for radio reception in an arid region has been overcome by W. G. Rosenbaum of Hayden, Ariz., by means of the construction illustrated herewith. He and a number of his friends who have installed similar grounds are getting better volume than with other types of grounds they have tried.

It is made of several sections of galvanized pipe, which are filled with water by a hose connected to a bell reducer.

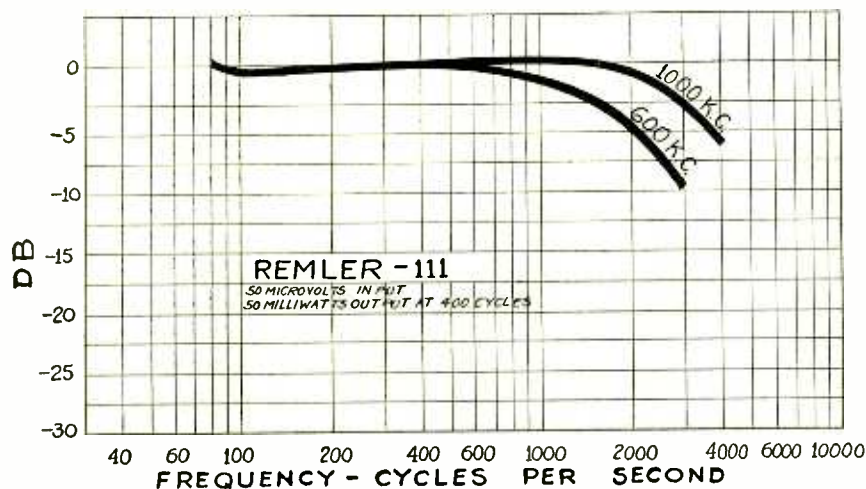


These are placed in a hole 8 ft. deep and 18 in. in diameter. All stones and gravel should be removed from the soil before using it for filling and enough ashes, cinders or lime waste added to fill the hole. Following is the material required for constructing the ground:

- 1 pc. 3/4-in.x7 1/2 ft. galvanized pipe.
- 1 pc. 3/4-in.x6 1/2 ft. galvanized pipe.
- 1 pc. 3/4-in.x6 1/4 ft. galvanized pipe.
- 1 pc. 3/4-in.x9-in. galvanized pipe.
- 1 pc. 3/4-in.x4-in. galvanized pipe.
- 1 3/4-in.x 1/2-in. galvanized bell reducer.
- 2 3/4-in. galvanized ells.
- 2 3/4-in. galvanized tees.
- 2 3/4-in. galvanized plugs.

All connections should be tightly screwed while on the surface, but no substance should be used to wipe the joints. Three or four wires should be wrapped around the pipe and the ground wire soldered to one of them, the others being spares. Do not connect the water pipe directly to the ground as it may cause considerable noise.

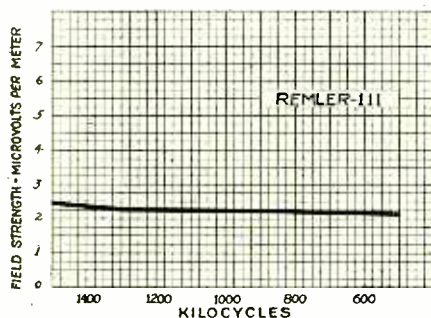
The ground should be kept moist but no water should be allowed to stand around the pipe on the surface as it tends to increase the resistance. The tees at the surface may be used to contain salt, which tends to hold the moisture.



Fidelity Curves for Laboratory Model of Remler 111 Kit

Fidelity curves give a very excellent check on the accuracy of selectivity curves of the same receiver. In this case the 600 kc fidelity curve begins to drop at 1000 cycles just as the 600 kc selectivity curve begins to flare. At 3000 cycles the fidelity curve is

down 10 db while the selectivity curve passes the 300 (on one side) and 600 (on the other) microvolt line. The 1000 kc fidelity curve is quite a little better than that taken at 600 kc, and the 1300 kc curve, although not plotted, was naturally better than both.



Sensitivity Curve for Laboratory Model of Remler 111 Kit, Showing an Average Sensitivity of 2 1/2 Microvolts Per Meter Over Entire Tuning Range

.00025 mf series condensers, the common lead of the two being grounded. An .1 mf condenser couples the a-f output of the detector to the grid circuit of the first audio stage.

The audio amplifier and power supply are contained in another copper box, and with the exception of the tubes are completely enclosed. An '80 rectifier, a ballast tube, two '27s and two '45s are lined up on the outside of the can so that the heat radiated from them may be quickly dissipated. The two '27 tubes comprising the first stage are connected in parallel. A 500,000-ohm resistor between grids and ground forms the "secondary" of the detector coupling unit and a 600-ohm resistor between cathodes and ground supplies the bias to the grids of these tubes.

The second stage, in which two '45s are employed, is in push-pull, and is coupled to the first by means of a push-pull transformer. Grid bias for these tubes is obtained from the drop through another 600-ohm resistor located near the power transformer and connecting the center tap of the filament secondary to ground. The primary of the audio transformer is isolated from the high-

voltage circuit by means of a .1 mf condenser. A center tapped output impedance is connected across the two power tube plates.

Four secondaries are located on the power transformer; one supplying 2 1/2 volts to the r-f, detector and first a-f filaments, one furnishing the same voltage to the '45s, another lighting the filament of the rectifier tube and the last providing the high voltage to be rectified for the plates and screen-grids. The rectified voltage is first filtered through a π section consisting of two 2 mf condensers and a choke. From here it supplies the power tube plates and passes through the speaker field. Thence through another π section of filter, this one consisting of a 2 mf condenser, a choke and a 4 mf condenser. From here one lead takes it through a 10,000-ohm resistor to the plates of the first a-f tubes and another leads it direct to the 180-volt outlet, to be divided as mentioned above in the treatment of the r-f component. A 5,000-ohm resistor across the filtered high-voltage supply tends to stabilize the flow.

The internal resistance of a milliammeter which is to be used with a multiplying resistance can be learned from the manufacturer by advising him what the meter's serial number is. Weston 301 milliammeters have the following internal resistances:

Range in ma.	0-1	0-1 1/4	0-2	0-5	0-10	0-15	0-20	0-25
Resistance in ohms	27	18	18	12	8.5	3.2	1.5	1.2

The exact resistance of Jewell Meters may be obtained from the factory by submitting the serial number. The approximate resistances of Jewell type 88 milliammeters are as follows:

Range in ma.	0-1	0-1.5	0-2	0-3	0-5	0-10	0-15	0-25
Approximate Resistance in ohms	30	30	25	20	12	7	5	3

Multiplying Usefulness of a Single Meter by Means of Resistors

By BORIS S. NAIMARK

THE usefulness of any meter can be greatly increased by means of a few simple resistors. Thus the range of a voltmeter may be extended by placing a resistance in series with it. Likewise an ammeter or milliammeter may be used as a voltmeter if put in series with a resistor or may be extended in range by shunting it with a suitable resistor.

Fig. 4 is the same whether we consider the internal meter resistance or the shunt resistance, as is evident from transposing it so that $R(I-i) = ir$.

If it is required that a given milliammeter be used as a voltmeter a resistor is placed in series with the instrument. Its value may be determined from the following equation: $R = 1000E \div I$, where R is the value of the required

range of a milliammeter is to set up a circuit which will pass sufficient current to give a maximum scale deflection on the meter, and then shunt the meter so as to reduce its readings by a definite amount such as $1/2$, $1/3$ or $1/10$. In order to determine the actual current flowing in the circuit when the shunt is connected, merely multiply the indicated meter reading by 2, 3 or 10, as the case may be.

This is the arrangement shown in Fig. 5, where a voltage source E is

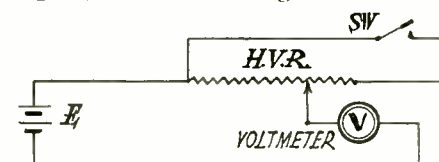


Fig. 6. Practical Means for Extending Range of Voltmeter Without Calculation

connected in series with a high variable resistance HVR and a milliammeter M ; the meter is shunted by a variable low resistance SR which can be disconnected by a switch SW . The actual current value can then be obtained as explained in the preceding paragraph.

Fig. 6 shows a similar practical means for extending the range of a voltmeter without calculation. First note the meter reading when HVR is short circuited. Then adjust HVR until the deflection is reduced to $1/2$, $1/3$ or $1/10$ the original reading. With this definite resistance in circuit the voltmeter will indicate 2, 3 or 10 times the original full-scale reading.

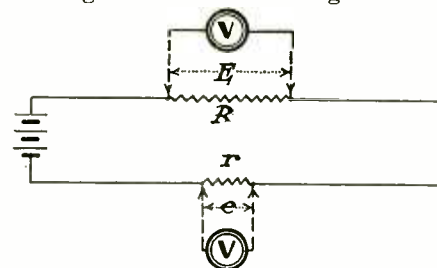


Fig. 7. Means for Determining Unknown Low Resistance

Fig. 7 shows how the value of an unknown resistor R of low resistance may be determined with an accurate voltmeter and a known resistance r . Measure the voltage drop e across r and E across R . Then $R = rE \div e$.

Fig. 8 shows a method for determining the value of an unknown resistor R of high resistance. In this case it is

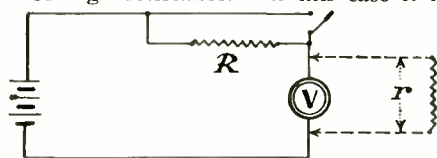


Fig. 8. Means for Determining Unknown High Resistance

necessary to know r , the internal resistance of the meter. Let E be the voltmeter reading when R is shorted and e be the reading when R is in circuit. Then $R = r(E/e - 1)$.

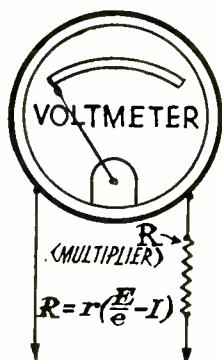


Fig. 1. How to Extend the Range of a Voltmeter

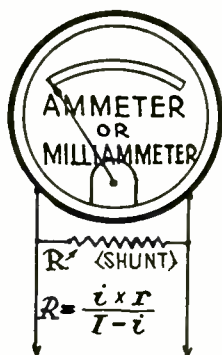


Fig. 2. How to Extend the Range of an Ammeter or Milliammeter

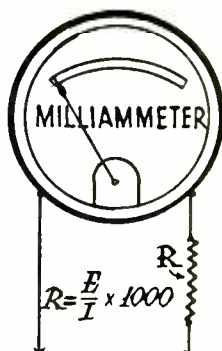


Fig. 3. How to Use a Milliammeter as a Voltmeter

The value R of such a resistor, when used to increase the range of a voltmeter of resistance r , is obtained from the formula $R = r(E/e - 1)$, when E is the desired maximum scale reading, and e the present maximum scale reading. The value of the internal meter resistance may be obtained, upon request, from the manufacturers of the meter.

To determine the value of the necessary shunt resistance in order to extend the range of an ammeter or milliammeter the following formula may be used: $R = ir \div (I - i)$, where R is the required shunt resistance, i is the present maximum scale reading of the meter on hand, r is its internal resistance, and I the desired maximum scale reading. In solving the above formula

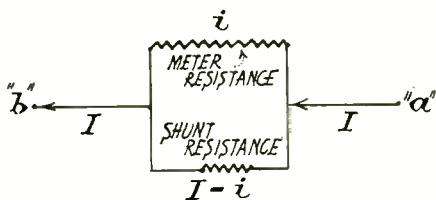


Fig. 4. Principle Used in Extending Range of Ammeter

it is important that the values of I and i be both in the same units. This formula simply expresses the fact that the voltage drop between a and b of

resistance, E is the desired maximum voltage scale reading, and I the present milliamper maximum scale reading.

It must be understood that in every one of the above suggested methods of extension of range or utility the actual values measured will not correspond with the indicated scale readings. To obtain a correct reading with an extended range voltmeter multiply the indicated scale reading by the ratio of E/e . To obtain a correct reading with an extended range ammeter or milliammeter multiply the indicated scale reading by the ratio of I/i . To obtain a correct voltage reading when the voltmeter consists of a milliammeter in series with a resistor, as explained above, multiply the indicated milliamper reading by the ratio of E/I .

When it is not possible to learn the value of the internal meter resistance, a practical method for extending the

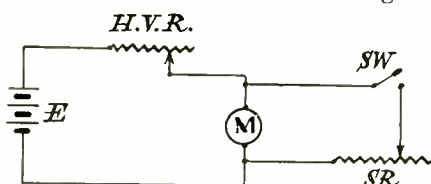


Fig. 5. Practical Means for Extending Range of Milliammeter Without Calculation

With the Amateur Operators

SOME IMPROVEMENTS IN THE CONSTANT REGENERATION S. W. RECEIVER

By R. WILLIAM TANNER

SINCE writing the article, "A Constant Regeneration Short-Wave Receiver," a few improvements have been added, such as a two-stage screen-grid r-f amplifier and a very efficient audio unit. Many short-wave receivers have been built at W8AD, including the different types of regeneratives, with and without r-f amplifiers, and superheterodynes, but this little set "walked circles" around all but the supers and with an ease of control beyond comparison.

At first an untuned r-f stage was connected ahead of the constant regeneration detector in accordance with the construction of nearly all of the factory made sets. While this gave a slightly greater gain over that obtained from the detector alone, it left a lot to be desired, especially on long distance stations. A tuned stage was then interposed between the detector and the untuned stage, and proved to be almost ideal, the sensitivity being great enough for even the most exacting operator.

The complete schematic circuit of the r-f end is shown in Fig. 1. The first stage makes use of a variable resistor to couple the antenna to the grid which may be anything from 1000 to 10,000 ohms maximum. This is adjusted when the receiver is placed in operation and then left alone. A negative bias of 1.32 volts is obtained by means of a 10-ohm resistor in the negative side of the filament across which is shunted an .01 mf bypass condenser. Only about half of the possible amplification is realized in this stage.

The second r-f amplifier is tuned by a condenser exactly like the one in the detector circuit. The plug-in coils in the grid of the '22 are constructed with the same number of turns, wire size, etc., as the detector coils. The manner of connecting the

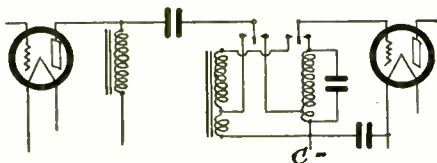


Fig. 1. Adding R-F Amplification to the Constant Regeneration Receiver

variable condenser across all of the coils with the center tap to the filament results in a surprising increase in selectivity. This can be appreciated in highly congested districts where there are many amateurs and where harmonics from the many broadcasting stations are bothersome. The tuning condenser will have to be mounted in the same manner as the one in the detector circuit if the r-f units are enclosed in metal shields. The grid bias for this tube is also obtained from a 10-ohm fixed resistor.

It will be seen from the diagram that each stage has two r-f chokes. These should be designed especially for short-wave reception. The bypass condensers connected from the screen-grids to the negative side of the filament are each of .5 mf. The filament current is regulated by means of fixed resistors placed in the positive leads so that the negative side could be directly grounded.

The coupling condensers connected from the plate of one tube to the grid of the next

are of the fixed type and have a capacity of .00015 mf. Volume is controlled by a 100,000-ohm variable resistor in the positive lead to the screen-grids.

As yet the r-f units have not been placed in shielded boxes. All of the parts are mounted on a wooden baseboard in order to facilitate experiments in working out the "kinks." In the near future, the entire set will be placed in four separate aluminum boxes.

Due to the fact that the additions have been completed only a few days, no foreign broadcast stations have been heard. However a number of amateur and commercial code stations have been logged from Canada, South America, Mexico and Australia. A great many amateur phones on both 85 and 160 meters have been picked up from distances up to 800 miles at night and 500 miles in daylight.

The audio addition to this receiver is quite novel in design. A peaked or tuned amplifier is almost a necessity for code reception due to the fact that so many stations are transmitting in our now narrow bands, although this type is absolutely worthless for receiving the broadcast programs.

It is possible to construct an audio amplifier which will amplify over a very narrow band for telegraph and over a very wide band for speech and music. The schematic circuit is shown in Fig. 2. Two stages are employed, a '40 high-mu tube in the first stage and a '12A in the last. The input transformer is one of the high quality, high gain broadcast types, across the secondary of which is a three-terminal high-resistance potentiometer. This serves as a fringe howl eliminator as well as an additional volume control. Due to the great amount of amplification obtainable when the tuned unit is in the circuit, this is not a luxury but a real necessity.

In the plate circuit of the '40 tube is an a-f choke, with an inductance of 30 to 50 henries, through which is fed the high voltage. This choke blocks the a-f currents which pass on through the .5 mf coupling condenser to the grid of the second tube. Two grid impedances are employed in the last stage, a tuned air core type for code work and an iron core type for the reception of speech and music. A single pole, double throw jack switch makes possible the use of either at will. An open circuit jack is connected in the plate circuit into

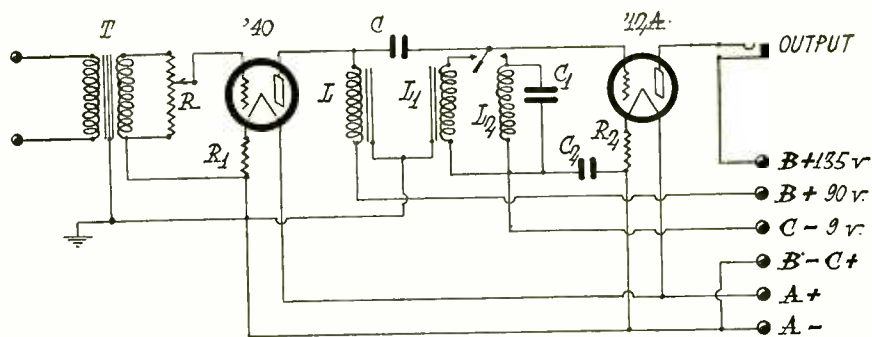


Fig. 2. Complete Audio Amplifier Circuit

T—Audio-frequency transformer.
L—30 to 50-henry audio choke.
L₁—Secondary of audio transformer.
L₂—Air core audio choke (see text).
R—500,000-ohm potentiometer.

which may be plugged a loudspeaker or a pair of headphones.

A voltage of 90 is applied to the plate of the '40. This may seem rather low but it must be remembered that the 135 volts specified by the makers is for use with a plate resistor of 250,000 ohms. A voltage of 135 may be used with no ill effects but as the amplification is no greater 90 is to be recommended. In this case a negative bias of 1 volt is sufficient and may be obtained by taking the drop in voltage across the 4-ohm filament resistor. The plate of the '12A tube is supplied with 135 volts but may be increased to 157 if desired. The grid bias is obtained from a 9-volt C battery. A 4-ohm resistor is used in the filament circuit of this tube also.

The iron core grid impedance may be the secondary of a regular a-f transformer with the primary left open or it may be one designed for this purpose. The tuned choke cannot be bought ready made, therefore it will have to be constructed by the builder. The secondary from nearly any type of ignition coil will work but it is usually better to wind one especially for this service. Taps may then be taken off and, by means of a number of different capacity fixed condensers, the peak frequency and the width of the peak varied to suit the individual operator.

The impedance employed in the writer's amplifier will be described as it proved to be quite satisfactory. It should not be considered "the last word," however, due to the possibility of greatly improving upon its construction. The winding form is a length of wood 2½ in. in diameter by 4½ in. long, with six slots cut on a lathe as shown in Fig. 3. The slots should be ½ by ½ in.

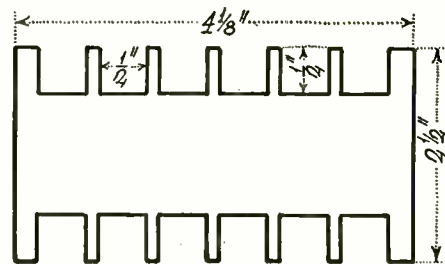


Fig. 3. Details of Air Core Impedance Winding Form

R₁—4-ohm filament resistor.
R₂—4-ohm filament resistor.
C—5 mf coupling condenser.
C₁—0.015 mf audio tuning condenser.
C₂—1 mf bypass condenser.
S—Shield.

If it is possible to obtain six bakelite or wooden disks $1\frac{1}{4}$ in. in diameter by $\frac{1}{2}$ in. thick, they may be bolted together with $\frac{1}{8}$ in. carboard or fiber separators between each disk and at the ends. It will be necessary to use a brass bolt, as an iron one would act as a core and broaden the peak.

If the wooden form is to be employed, it should first be boiled in paraffine to exclude all moisture before the winding is started. After this has been done, wind 1500 turns of No. 36 enameled wire in each slot, or a total of 9000 turns. Taps are taken off at 5000, 6000, 7000, 8000 and 9000 turns. Solder a short length of flexible wire to each of the leads and taps and tie them solidly to the form so that they cannot be pulled loose. After putting into service, each of the taps are tried until satisfactory operation is secured.

This unit is tuned by means of one or more fixed condensers to the frequency best suited to the ear of the operator. In most peaked amplifiers 1000 cycles are used. In this case a condenser of about .015 mf is required. Other condensers from .005 to .05 mf should be experimented with in conjunction with each tap on the impedance. Some operators will want the peak to be only 2 kc wide while others will prefer a greater width. By increasing the shunt capacity and lowering the inductance, the peak is narrowed and vice versa.

Care must be taken in the placing of the transformer, plate choke and impedance coils with respect to each other. All except the two grid impedances should be so mounted that their fields are at right angles. As the grid impedances never function at the same time, they may be located close together.

An improvement in the grid circuit of the second stage is shown in Fig. 4. This will

d.p.d.t. jack switch will be needed in place of the s.p.d.t. type.

No provision has been made to use only the first stage for headphone reception on code signals. The additional gain from two stages is often needed on very weak stations. It has not been found practical to place the tuned impedance in the grid circuit of the first tube, therefore the tuned feature would not be obtained if only one stage were employed. If the audibility is too great, the volume control across the secondary of the transformer will bring the signal down to a satisfactory value.

This audio amplifier has been in use for two months with not only the constant regeneration receiver but with other types as well. It is indeed a pleasure to be able to tune in code stations with a selectivity of 2 to 5 kc and by simply turning a switch, bring in speech and music with a quality as good as the best receivers can give.

Another very useful idea that may be successfully applied to this set is to replace the two small midget tuning condensers with the regular size used in broadcast receivers. These usually have a maximum capacity of .00035 mf which is far too large for easy tuning on the high frequency channels. By connecting one or more fixed condensers in series with the main tuning condenser, the effective capacity will be lowered. A capacity of .00014 mf is about right for waves above 60 meters, and may be obtained by connecting a .00025 mf fixed condenser in series.

If a lower capacity than this is required for tuning below 60 meters, an additional condenser of .00015 mf in series will result in an effective capacity of .000074 mf.

A clip arrangement may be easily devised by the builder whereby the variable con-

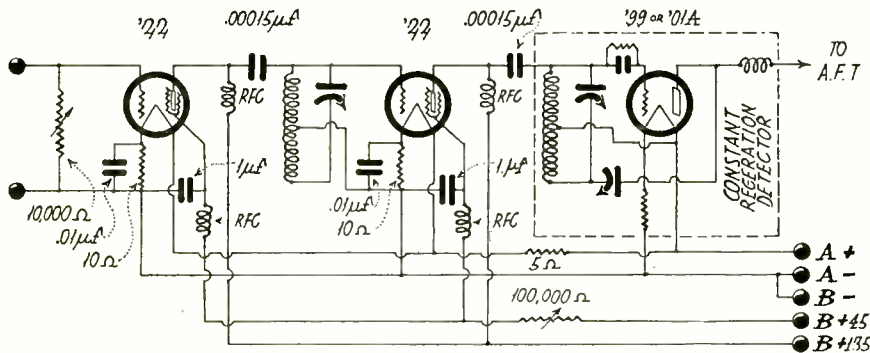


Fig. 4. Circuit for Voltage Step-up

result in a higher degree of amplification as well as make it easier to tune the air core inductance. The iron core coil is a 3 or 4 to 1 ratio a-f transformer with the primary and secondary connected in series to obtain a step-up in voltage. The plate terminal of the primary and the C negative of the secondary are connected together and made common to the lead from the .5 mf coupling condenser. The B positive terminal goes to the C negative, and the G terminal, of course, goes to the grid. A good grade, high inductance transformer should be employed or best results will not be obtained.

The air core impedance is very easily changed to work with this circuit, it only being necessary to take an additional tap off the 3000th turn. This gives a 3 to 1 ratio when the full 9000 turns are in the circuit.

Tuning is done in the same manner as with the circuit in Fig. 2, although the peak will be found to be much sharper and

denser may be used alone for the regular broadcast waves or with one or two series condensers for the short waves. The plug-in coils will, of course, have to be of the correct inductance value. This will be left entirely to the individual to work out for himself.

The Ray-dio-Ray Corporation of Wenatchee, Wash., is making high-frequency apparatus for sterilizing the eggs of the coddling moth and other insect pests. Aerials are strung above infested areas so as to charge the plant surfaces subject to egg deposits for a few moments each morning. The high-frequency current is also claimed to stimulate plant growth. The antenna system is energized by a 3 kw rotary spark transmitter. Hours of operation are restricted to between 4 and 7 a.m. on 101 kc, so as not to interfere with radio communication. The equipment is operated under an experimental license from the Federal Radio Commission.

This station first came on the air in 1926 in Aberdeen, Washington. At that time a '01A with 200 volts of B battery was used. This transmitter and power supply was lent through the kindness of 7BM. The call used at this station was 7HE.

In August, 1926, the station was moved to its present location. The station is owned and operated by Leo G. Sands, 2119 McDougall Avenue, Everett, Washington. The station has changed transmitters many times. A '01A with plenty of a.c. on the plate was used. Next a UV202 5-watter was used. A chemical rectifier was added to the outfit. So it has changed until now it uses:

A UX210 in a Hartley circuit, using a Thordarson power pack giving about 450 volts. Half wave rectification using a UX216B tube is used. With this power supply and transmitter the reports are nearly always pure dc.

The antenna is a Zeppelin type, $65\frac{1}{2}$ ft. long, with 32 ft. feeder wires, spaced 8 in. with glass towel rods. The high voltage end of the antenna is about 48 ft. above the ground. The other end is about 25 ft. high. For 20 and 80 meter work an additional 16 ft. of feeder wires is used, making it 48 ft. long for 20 and 80 meter bands, and 32 ft. long for the 40 meter (7000 kc.) band. For ten meter work a Zeppelin antenna 16 ft. long with 8 ft. feeder wires is used.

The receiver is a Grebe CR18, with plug-in coils from 10 to 200 meters. A Seattle Radio Laboratory wavemeter is used with coils from about 3 to 1200 meters.

This station is primarily a relay station, being an official relay station and an official broadcasting station of the A. R. R. L. It has worked 30 states, all U. S. districts, Canadian fourth, fifth and ninth districts, Alaska, Chile, Japan and Australia, also Mexico.

Radiophone has been used in the 85-meter fone band. Loop absorption modulation and a Frost hand microphone are used. A report of R7 and very good modulation has been received from a station about 800 miles away. This station is always glad to QSP or test with any other station. Reports on the signals will be appreciated and answered.

Its O. B. S. schedule, daily except Sunday, is 14,000 kc., CW, 4 p. m. P. S. T., 7000 kc. CW, 7 p. m. P. S. T., and 3500 kc. fone, 8 p. m. P. S. T.

QRA'S

W7AGL—George Aspman, Box 55, East Stanwood, Wash.

W7RM—Richard Albert, 3421 Tulalip Avenue, Everett, Wash.

W7RW—Burman Winter, 2717 Hoyt Avenue, Everett, Wash.

W7JR—Roy Peterson, 1814 Hoyt Avenue, Everett, Wash.

W7MW—J. Theodore English, 2201 Virginia Avenue, Everett, Wash.

W7YE—North Junior High School, Everett, Wash.

W7RK—Everett High School Radio Club, Vocational Building, Everett, Wash.

W7KZ—Everett High School (portable), Everett, Wash.

W7PG—Arthur Griffiths, Oak Grove, Ore.

W7AZ—A. F. Hazel, 3109 South Ninth Street, Tacoma, Wash.

CM2SH—Silvio Hernandez Godinez, Call 27, No. 89 Vedada, Habana, Cuba.

W7ZB—Jack Ahearn, Milton, Ore.

W7NF—R. M. Nicholas, 1925 North Fortyninth Street, Seattle, Wash.

New Equipment From the Radio Manufacturers

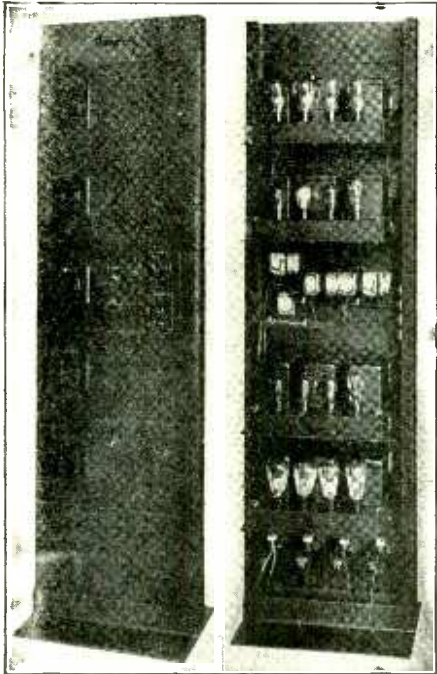
Contributions to This Department Are Invited

The Jewell set analyzer, pattern 198, is available in a portable cabinet provided with a drawer and compartment for tools



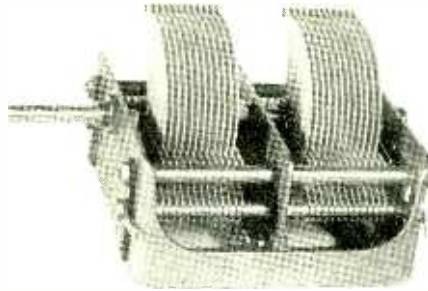
and extra tubes. It is otherwise identical with pattern 199 and makes all tests including those necessary in servicing screen-grid sets.

Powerizer amplifier racks and control panel equipment for use in auditoriums are made up in various assemblies. A two-channel assembly, as illustrated herewith, comprises six panels with a monitoring loud-speaker and distortion meter on top, a switch and pilot light for power output unit as the second panel, a switch and pilot lamp for the voltage amplifier as the third panel,



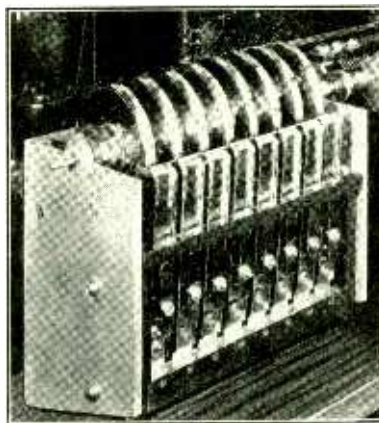
main and throw-over switches as the fourth panel, a second voltage amplifier and switch as the fifth panel, and the power output unit and switch as the sixth panel. The two voltage amplifiers are PXP-171 powerizers and the power unit is a PXP-250. Any panel may be removed, and another, such as a monitor or radio set with amplifier and microphone panel, may be substituted. All audio units are carefully shielded to give quiet operation.

Precise new variable condensers, whether dual, 3-gang or 4-gang, are of the "bath-tub" type. They are furnished with or without compensating plates to vary the minimum capacity of each unit. The shielding between the stators of each unit acts as a



support for the condenser case and shaft. The case is drawn from 1/16 in. strip steel and is provided with a 3-point mounting that raises it 1/16 in. off the subbase. The blades are shaped to give a 10 kc separation over 40 per cent of the range. They are made in .00035 and .0005 mf sizes.

The Carter automatic control unit for tuning a radio set consists essentially of a series of slotted drums and contact segments which are attached by a small motor to one side of the condenser gang. The movement of a contact segment, and consequently the tuning to a station, is controlled by a push-button tab in a selector unit on the panel and, if desired, from a number of remote points. The call letters of a number of stations are inscribed on the tabs in the selector.



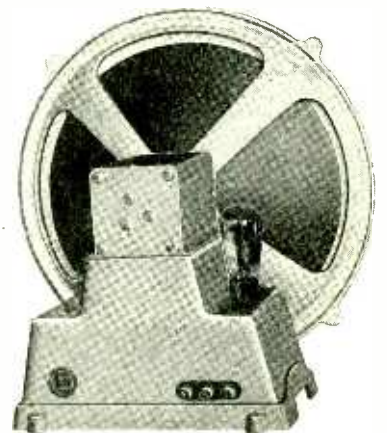
Pressing a tab causes a corresponding contact to make wiping contact with its drum and starts the motor which rotates the condenser gang and drum until the contact segment reaches a slot in the drum which breaks the circuit and stops the motor. The remote control selectors operate through relay switches which turn the set on or off and tune in a desired station. The device is easily adjusted for tuning in any desired eight stations. It is quick, accurate, and noiseless, and does not interfere with hand-tuning. It is not intended as an accessory, but is to be engineered into the set by the builder.

The Burton-Rogers Flewelling tube checker is a compact and accurate instrument for testing all types of vacuum tubes which are used in receivers, including both a-c and d-c screen-grid tubes. The tube is placed in one of the four sockets on the instrument panel, no adapters being necessary.



Tip jacks and flexible leads are also provided for connecting to external heater contacts such as on Kellogg tubes. The instrument is ready for use when it is plugged into a 110-volt, 60-cycle source; special models are also available for 110-volt, 25 cycle and 220-volt, 50-60 cycle current. The condition of a tube is clearly indicated by referring to a table engraved on the panel.

The Victory electrodynamic speaker employs a unique type of construction with four pole pieces instead of a shell around the field coil to concentrate and intensify the magnetic flux which drives the moving coil. This is claimed to give a more powerful drive and to avoid eddy currents. Concentration of energy at four points on a heavy top plate enables the use of heavy construction in the movable coil and cone. These speakers are made in two models, one with 8 3/8-in. cone and one with 16-in. cone, the latter being illustrated herewith. The smaller model uses



a high voltage disc rectifier to energize the field from 110 volts a-c and the larger model uses an '80 tube, together with transformer. The field windings are made to any desired specifications. Input transformers have a center tapped primary for direct connection to the output tubes, whether single or push-pull, and are mounted inside the cover, which is designed to give good ventilation and to carry any stray magnetic flux.

THE NATIONAL "THRILL BOX"

This is a battery operated receiver designed for all frequencies from 550 to 16,600 kc. It is built in accordance with the design preferred by amateur operators; namely, with interchangeable coils offering a minimum of resistance; and is suitable for reception of code signals as well as of broadcast programs.

The set consists of one untuned r-f stage in which a '22 screen grid tube is used, detector employing a '00A, and two stages of resistance-impedance coupled a-f amplification in which the National Duo Couplers are used in conjunction with a '40 and a '71A tube.

The first tube is coupled to the antenna by means of an r-f choke across the input cir-



The National "Thrill Box"

cuit of the tube. A 15-ohm fixed resistor between the filament of this tube and the grid return serves the double purpose of reducing the voltage to the required 3.3 and supplying the remaining 1.7 volts to the circuit between grid and filament. Another resistor reduces the voltage from a 6-volt battery to 5. The screen grid is supplied with 45 volts and is bypassed to ground through a .5 mf condenser. The plate is similarly bypassed, being inductively coupled to the following grid circuit and supplied with 135 volts.

The tuning condenser is divided into two parts, a throwover switch being provided so that part of the tuning capacitor may be eliminated when reception of high frequencies is desired. When the coils for the broadcast band are used this switch is closed, making the entire condenser operative and shunting it with a .0001 mf fixed condenser for additional capacity. The detector is regenerative, of course, and the tickler is mounted in the same coil form as the primary and secondary. Regeneration is controlled by means of a variable resistor in the detector plate circuit.

A 50,000-ohm resistor is used in the Duo Coupler, between the detector and first audio stage, while the second stage uses a 500,000-ohm resistor in the plate lead. In other respects the Duo Couplers are identical.

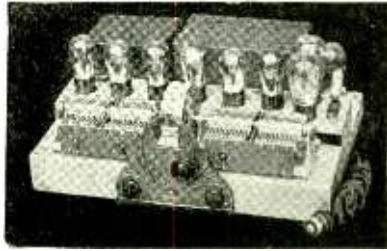
The receiver is mounted in a metal cabinet with a deep brown crackle finish. The single tuning control is fitted with a handsome escutcheon through the window of which may be seen the figures on the illuminated dial. A shelf in the rear of the chassis is fitted with sockets to hold the five extra coils, and a cable for all battery connections makes its exit through the rear wall.

This compact and easily operated receiver should meet the demand for an instrument which will give loudspeaker reproduction of the various short-wave broadcast programs that are on the air.

THE MANDEL CHASSIS

The Mandel Electric Co. of Chicago is making a high-grade eight-tube chassis for private brand sale. It takes six '27 tubes, two '45 tubes, and an '80 rectifier. It has three stages of tuned r-f, detector, and three stages of audio, the last being push-pull.

This chassis was designed by Lieut.-Commander R. H. G. Mathews, formerly chief engineer for the Zenith Radio Corp. He has designed the variable gang condenser and r-f coils so as to cover the range from 175



Mandel Chassis for Private Brand Radios

to 550 meters with high amplification per stage without oscillation. He employs a bridge type of circuit without lossers and having single control of tuning. Bypass condensers, hum adjusters, etc., are combined in a few large units so as to minimize the possibility of trouble. All parts where coupling might occur are shielded, extra large shields being placed around the coils, and all parts being carefully placed to avoid coupling.

The power unit is designed to operate with from 85 to 130 volts, 50-60 cycles. The filter choke and condensers are oversize. A single rod-molded resistor is used in the voltage divider. A cartridge fuse protects against burn-out.

The set may be used with either a magnetic or electro-dynamic speaker, being particularly adapted for use with the Mandel electro-dynamic speaker which is operated with 110-volt, 50-60 cycle, alternating current. It is claimed to give unusually natural reproduction of speech and music. A phonograph attachment and switch are built in for use with any type of pick-up unit.

NEW RADIO CATALOGS

B-I Rectifiers are the subject of a loose-leaf bulletin from the Benwood-Linge Electric Mfg. Co. of St. Louis, Mo. The rectifiers are of the dry-disc type and are made in styles to operate either as full-wave or half-wave rectifiers. Standard sizes supply from 1 to 4 amperes at from 2 to 10 volts. They are made as replacement units for electrolytic rectifiers, as chargers, and for dynamic speakers.

The "Supreme Radio Manual" is a 100-page loose-leaf booklet which is furnished by the Supreme Instruments Corporation of Greenwood, Miss., to users of Supreme Diagnostics. These are portable instruments which may be used as a tube tester, modulated radiator, resonance indicator, neutralizer, analyzer, continuity tester, and rejuvenator. Each of these uses is explained in the Manual.

Herbert H. Frost, Inc., Elkhart, Indiana, are distributing an illustrated folder which shows the new Frost Radio parts. These are carbon element volume controls made with resistance progression to suit various circuits, wire-wound resistors, tandem constant resistance units, sockets, jacks and fixed and center-tap resistors.

TOM THUMB PORTABLE

The Tom Thumb portable is a four-tube set complete with loudspeaker in a carrying case, the r-f stage using a screen-grid tube. It is made in two battery-operated models, one using three '99 tubes and the other two '99 tubes and a 120 power tube, and in two light-circuit-operated models, one for 110 volts d-c with three '01A tubes and the other for 110 volts a-c with '26, '27 and '71A tubes, as well as a rectifier tube. It uses a loop aerial and has single-drum control.



Tom Thumb Portable

BOOK REVIEWS

"Elements of Radio Communication," by John H. Morecroft, 269 pp., 6 by 9 in., published by John Wiley & Sons, Inc., New York City, price \$3.00.

To the well informed radio man, a book from Professor Morecroft, like fine wine, needs no bush, a bush being a spray of ivy which was formerly displayed over a tavern door as an announcement that wine was there sold. But while his "Principles of Radio Communication" is the standard text on radio, it is admittedly hard to read. So this new text may be regarded as an introduction to his more comprehensive work.

But it is also a sound and thorough explanation of the theory which underlies the transmission and reception of radio broadcasts. Starting with a review of the laws of the electric circuits which are used in radio he then develops the general idea of communication by radiation. Specific treatment is given to the vacuum tube and its application in radio telegraphy and telephony, followed by an analysis of the various types of receiving sets.

No mathematical knowledge is needed beyond simple algebra and trigonometry. The treatment is modern enough to include electrodynamic speakers and screen-grid tubes. This first edition is marred by a few typographical errors which may be corrected in the future editions to which this work seems destined. It should be of particular value to the ambitious service man or experimenter who is sincerely interested in securing a theoretical foundation for his practical work with balanced circuits, push-pull amplifiers and improvements in the selectivity, sensitivity and fidelity of broadcast receivers.

Research Paper No. 70 from the Bureau of Standards by T. Parkinson, associate physicist, is devoted to "Some Observations of Short-period Radio Fading." The author tentatively concludes that considerable fading is caused by variations in the intensity of the indirect or "sky" ray between the broadcast station and the receiving aerial. He also finds evidence of fading due to interference between the indirect and the ground rays. He found no proof that fading is caused by fluctuation in the height of the ionized layer.

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FACTORY LIST PRICES USING SCREEN GRID TUBES

NOTE.—Rectifier Tubes are Not Included in Listings Below.

MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE
*ACME 78	6	130.50	BAIRD PORTARADIO	8	139.50	*RCA Radio Victor	4	110.00
*ALL AMERICAN "LYRIC" SG-L	7	187.50	*BROWNING DRAKE 53 Table	9	102.50	SILVER 60	7	160.00
BOSCH 48 Tbl.	6	119.50	54	9	142.50	95	7	195.00
48-J	6	168.50	55	9	172.50	STERLING A260	7	129.50
48-L	6	240.00	COLONIAL Cavalier	7	235.00	A360	7	149.50
48-17	6	230.00	Modern	7	270.00	B260	7	187.50
48-18	6	240.00	*KENNEDY 220	7	159.00	STROMBERG CARLSON 641	5	155.00
48-R	6	280.00	320	7	107.00	25 cv. 641	5	155.00
48-19	6	280.00	*CROSLEY 40-S	7	80.00	DC 635	9	185.00
AMRAD Aria	7	198.00	42-S	7	135.00	642	5	247.50
Duet	7	295.00	82-S	7	160.00	25 cv. 642	5	247.50
Symph. Seren.	7	245.00	41-S	7	85.00	DC 638	9	370.00
*ANDREA "FADA" 25	6	165.00	COURIER 65 Tbl.	7	85.00	*SENTINEL 444	6	89.50
35	6	245.00	681	7	140.00	445 Tbl.	6	55.00
75	7	360.00	652	7	165.00	*SONORA 34	6	150.00
Comb. 77	7	675.00	653	7	165.00	Hi-Boy	6	190.00
ARCO Chassis	8	75.00	*ERLA 30	6	165.00	LEUTZ	7	410.00
ATWATER KENT 55	6	88.00	31	6	147.00	*PHELCO 65 LoBoy	5	119.50
60	7	100.00	32	6	139.50	65 HiBoy	5	139.50
61	7	100.00	*EVEREADY 52	5	155.00	65 De Luxe	5	259.00
Batt. 67	7	77.00	53	5	220.00	65 Tbl.	5	99.50
*AUDIOLA Chassis	6	85.00	*GRAYBAR 500	4	110.00	WARE Table	5	195.00
AUTOMATIC "TOM THUMB" PORTABLES B	4	57.50	550	4	179.00	Cons. 10	5	280.00
De Luxe DC	4	65.00	GREBE 285-A	6	285.00	*PIONEER 66	7	99.50
AC	4	87.50	270-A	6	270.00	68	7	125.00
	4	95.00	270-B	6	270.00	70	7	135.00
	4	95.00	270-C	6	270.00	72	7	150.00
	4	95.00	LoB. A	6	219.50	41 Tbl.	6	100.00
	4	95.00	LoB. B	6	219.50	42	6	175.00
	4	95.00		6	219.50	422	6	185.00
	4	95.00		6	219.50	462 Tbl. 25 cv.	6	100.00

NEW SETS RECENTLY ANNOUNCED

Each month some manufacturer—somewhere—announces new models, changes in prices and additions to his line. Watch these pages in each issue of "RADIO." Here you will find the last minute announcements of newest radio offerings. Prices shown on these sheets are FACTORY PRICES as advertised by the manufacturers themselves. Many manufacturers add from 5% to 10% to these prices for the territory west of the Rocky Mountains. In a later issue we will publish an exclusive set of GREEN BOOK SHEETS for prices of radio receivers in the western territory.

SEE REVERSE SIDE FOR ADDITIONAL DATA

FACTORY LIST PRICES USING HEATER & FILAMENT TUBES

NOTE.—Rectifier Tubes are Not Included in Listings Below.

MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE	MAKE	No. of Tubes	LIST PRICE
A-C DAYTON B-4-98	7	\$79.00	COLUMBIA C11	7	179.50	*EVEREADY 31	7	115.00
AC-98	8	108.00	CONTINENTAL "Star Radiator"	9	435.00	32	7	175.00
AC-99	8	148.50	R-20	9	475.00	33	7	210.00
AC-9970	8	165.00	R-20	9	525.00	34	7	235.00
AC-9980	8	188.00	R-20	9	525.00	34	7	235.00
AC-9990	8	188.00	R-20	9	525.00	34	7	235.00
AC-99100	8	234.00	R-105	9	1,600.00	44	7	230.00
*ACME 77	6	115.00	*CROSLEY 33	7	90.50	*FADA Radio-Vic. 33	6	69.50
88	7	139.50	33	7	125.00	Legs Batt 33	6	79.50
*All-Am. LYRIC 93	8	169.50	82	7	150.00	Legs 8	8.00	
95	8	199.50	83	7	150.00	Legs 8	8.00	
*APEX 36	6	43.00	DAYFAN 66	8	115.00	FREED Inctuc. Dyn. 55 Batt.	7	55.00
30	6	69.95	67	8	169.50	36 Tbl.	7	75.00
60	8	119.95	68	8	169.50	NR55	7	99.50
70	8	69.95	72	8	175.00	NR58	7	139.50
*AUDIOLA 8430	7	95.00	EARL 21	8	175.00	NR59	7	139.50
BALKEIT "C"	8	175.00	22	7	117.25	NR78	7	104.50
BRANDES B-10	6	85.00	31	7	161.50	NR79	7	169.00
B-15	7	125.00	41	7	250.00	NR95	10	795.00
B-16	7	165.00	EARL Induct. Dyn. 21 Batt.	6	89.50	NR95	10	495.00
BREMER TULLY 80 Batt.	6	164.00	21 Tbl.	7	75.00	NR95	10	395.00
81	7	195.00	21 DC	7	80.00	NR95	10	274.50
82	7	195.00	21 25cy	7	99.50	NR95	8	189.50
*BROWNING DRAKE 63 Table	9	98.00	22 DC	7	99.50	NR95	8	179.50
64	9	137.50	22 25cy	7	104.50	NR95	8	179.50
65	9	167.50	31 DC	7	144.00	NR95	8	179.50
BRUNSWICK 14	7	148.00	31 25cy	7	169.00	NR95	8	179.50
21	7	174.00	Electro-Dyn 32	7	169.00	NR95	8	179.50
31	7	272.00	32	7	174.00	NR95	8	179.50
BUSH & LANE 20	7	125.00	32 25cy	7	174.00	NR95	8	179.50
21	7	169.50	41	8	235.00	NR95	8	179.50
30	7	179.50	41 25cy	8	235.00	NR95	8	179.50
32	7	179.50	EDISON R1	6	260.00	NR95	8	179.50
40	7	179.50	R2	6	225.00	NR95	8	179.50
50	7	197.50	R4	6	197.50	NR95	8	179.50
60	7	199.50	R5	7	167.50	NR95	8	179.50
70	7	207.50	*ERLA 10C	7	250.00	NR95	8	179.50
80	7	217.50	11C	7	290.00	NR95	8	179.50
90	7	217.50	12C	7	297.50	NR95	8	179.50

TRADE-IN NEWS OF THE MONTH

What Price for Trade-Ins?

By putting the trade-in value of an old set at one-half of what he can sell it for, a dealer allows an equitable margin to take care of reconditioning, advertising, overhead, salesman's commissions, and his own profit. One or more of these expenses must be cut before the dealer can safely afford to offer more.

Many dealers make it a general rule to allow 3 per cent of the original list price of any battery-operated model which is in good condition and not more than four years old, unless it is in a very fine cabinet for which a greater allowance should be made. Another rule-of-thumb is to allow 5 per cent of the value of the new set against which the old one is to be traded-in.

SEE OCTOBER "RADIO" FOR SOME SUGGESTED TRADE-IN VALUES OF SETS BY NAME

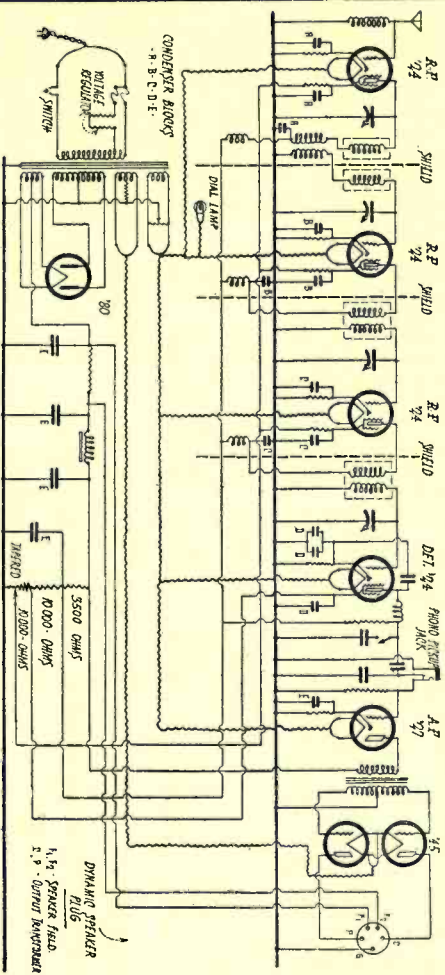
*Denotes this Manufacturer also makes Screen Grid Models.

CIRCUIT DIAGRAMS OF FACTORY-BUILT SETS

Two Pages or More in Each Issue of "RADIO" Hereafter

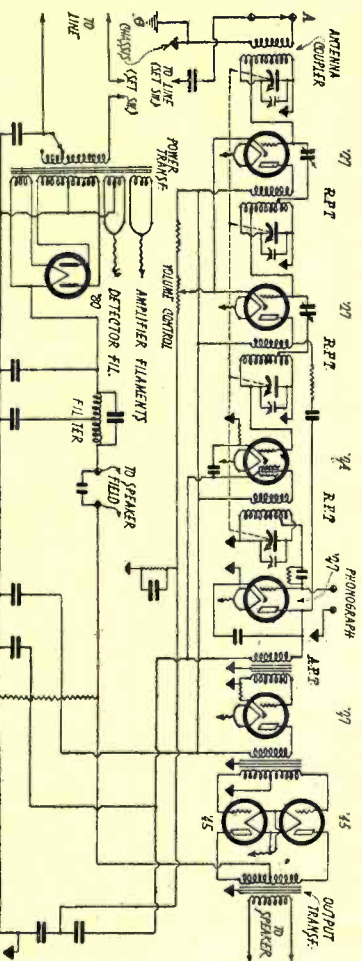
SILVER No. 30 Screen-Grid Receiver

Using four Screen-Grid Tubes, One '27, two '45's, one '80.



FADA No. 25 Screen-Grid Receiver

Using one '24, four '27's, two '45's, one '80.

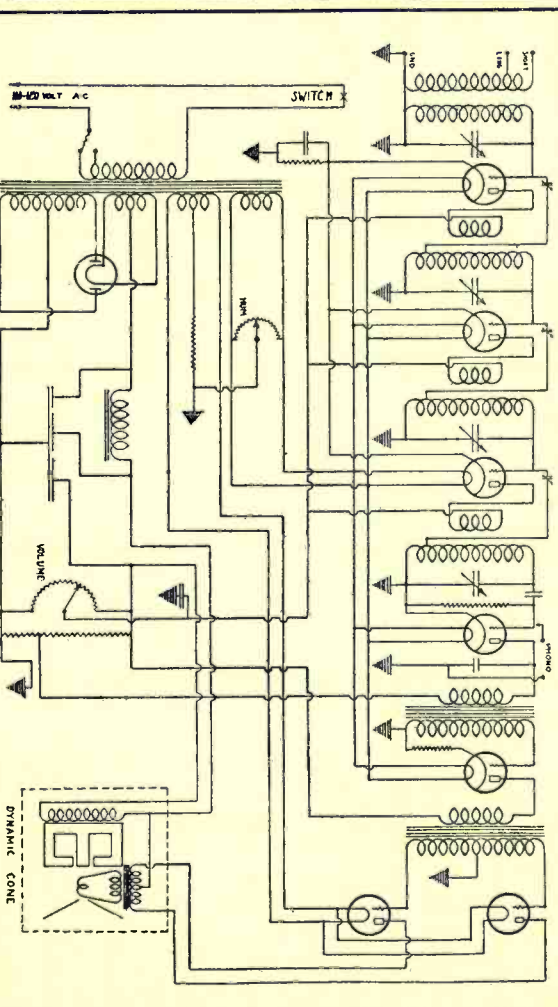


CIRCUIT DIAGRAMS OF FACTORY-BUILT SETS

See Next Month's "RADIO" for the Latest Diagrams

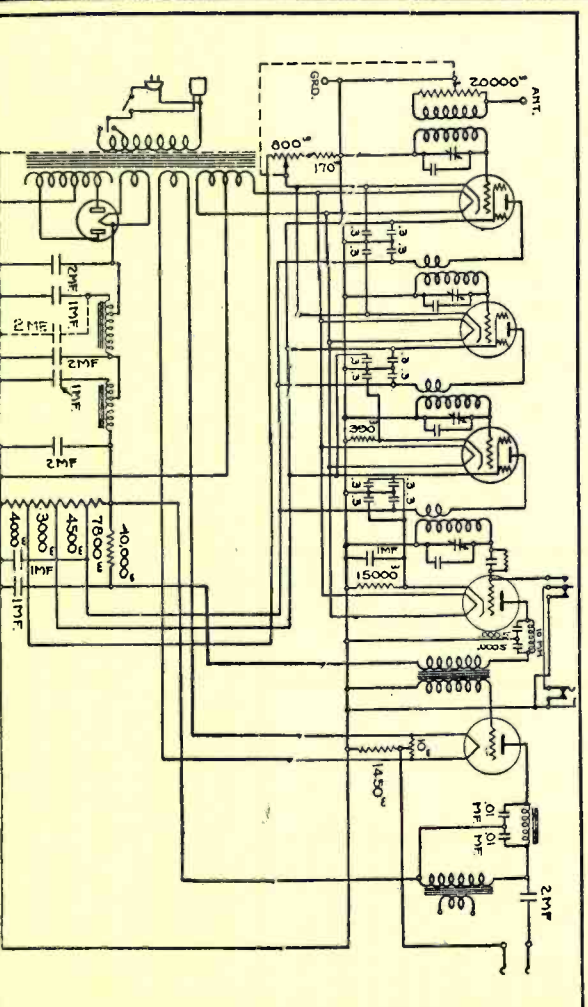
KENNEDY "Royal" Receiver

Five '27 tubes, 2 '45, one '80



STROMBERG-CARLSON No. 641 Screen-Grid Receiver

Using three '24's, one '27, one '45, one '80.



NEW SETS ANNOUNCED IN AUGUST

Make	Model	List Price	Tubes Used	General Data
RCA "60" Series Superheterodyne (4 New Models)	60 Table	\$147.00	6-UX-227 1-UX-245 1-UX-280	Tubes, \$21.50 additional for this model.
	66 Console	\$225.00	"	Automatic Tuning.
	64 De Luxe	\$550.00	?	Electro-Dynamic Reproducer.
	67 Phono Radio Comb.	\$690.00	?	Electro-Dynamic Reproducer.
Stromberg Carlson (1 New Model)	No. 846 Half Octagonal Cabinet	\$347.50	3-124 2-227 2-445 2-80	Three screen-grid tubes. Linear power detection giving pure tone at all frequencies. Automatic volume control. Meter for visual tuning. Half-octagonal cabinet. Phonograph jack.
	Zenith (4 New Models)	\$175.00 \$275.00 \$395.00 \$700.00	3-24 2-45 " " " "	Automatic station indicator. Remote control on model 55. Automatic volume control. Automatic phonograph switch. Automatic tuning. Linear power detection, double push-pull.
Gilfillan (3 New Models)	Console	\$156.50	6-27 1-45 1-80	Uses screen-grid tube as power detector. Four stages of R.F. Phonograph jack.
	Console	\$175.50	" "	"
	Console	\$187.00	" "	"
Acme (Chassis)	88-SG	\$77.00	3-24 2-45 2-80	Mershon Condenser. Current supply for speaker. Illuminated dial.
Mandel (Chassis)	140	\$110.00	3-24 2-45 1-80	Operates without loop, aerial or ground.
Premier (Chassis)	724	On Request	4-24 2-45 1-80	Private brand radio chassis.

The publishers of "RADIO" will supply you with complete details regarding these new models in future issues of the magazine.

Other new devices, such as tubes, speakers, theater amplifier equipment, chassis, cabinets, pick-ups, short-wave receivers, etc., will be given prominent notice on these data sheets in future issues of "RADIO."

CHANGES IN PRICES AND NEW ACCESSORIES

As Announced by the Manufacturers

Magnavox Reduces Prices August 3

A substantial reduction in price of the following Magnavox Dynamic Speakers is now in effect. Here are the new prices:

No. 200, 7 3/4" cone	\$22.00
No. 201, 10 1/2" cone	24.00
No. 400, 7 3/4" cone	31.00
No. 401, 10 1/2" cone	33.00
No. 402, 7 3/4" cone	32.00
No. 403, 10 1/2" cone	34.00
No. 404, 7 3/4" cone	32.00
No. 405, 10 1/2" cone	34.00
No. 106, 7 3/4" cone	21.00
No. 107, 10 1/2" cone	23.00
No. 108, 7 3/4" cone	21.00
No. 109, 10 1/2" cone	23.00

New 16-in. Victory Speaker

An electro-dynamic speaker unit for radio set manufacturers and for use with heavy duty amplifiers will be on the market in about 30 days. It is being manufactured by Victory Speakers, Inc., an Oakland, California, Corporation. In addition to the large speaker with 16-inch cone, a smaller speaker will also be placed on the market. Prices and specifications will be announced in these columns next month. The 16-inch speaker uses one tube, type '80, for the rectifier.

Trav-Ler Portable Set Prices Changed

Trav-Ler Mfg. Corp., of St. Louis announces the following prices on portable receivers:

New Standard Model	\$ 65.00
New De Luxa Model	75.00
New Aristocrat Model	100.00

These new portables have a screen-grid circuit, use a power tube in the audio circuit and have built-in speaker and loop. A-C Power Packs for these portables can be purchased for \$35.00. D-C Power Packs, \$30. Prices are somewhat higher west of the Rockies.

Automatic Non-Set Stops for Phonograph Records

American Sales Co., 932 Wrightwood Ave., Chicago, announces non-set stops for all types of standard phonograph records. This device stops the phonograph motor when the record has been played. This non-set stop can be built into the base of a tone arm.

Kennedy Screen-Grid Models Now Ready

Power Detection Screen-Grid models of the Colin B. Kennedy Company are now ready. Two console models are announced. Royal Model 320, Screen-Grid, \$197.00; Royal Model 220, Screen-Grid, \$159.00. These prices are the same as the Royal Neutrodyne Models not using screen-grid tubes.

Rola Will Soon Announce New Amplifiers

New large heavy duty audio amplifiers with "directional speakers" will be announced shortly by the Rola Company, Oakland, California, makers of ROLA speakers. These amplifying devices are intended for use in theaters, cafes, dance halls, outdoor use, etc. An entirely new principle of amplifier design is being developed.

COMING IN FUTURE ISSUES OF "RADIO"

Among Other Things—In Data Sheet Form—

Complete list of all makes of tubes, type number and prices

Tube characteristics and specifications

Service notes for repairmen. Diagrams of various test panels for service men.

Cabinet specifications and prices.

Send \$2.00 now for a one-year subscription to "RADIO" . . . which includes the price and data sheet service . . . and a binder for holding the sheets.

SEPTEMBER 1929

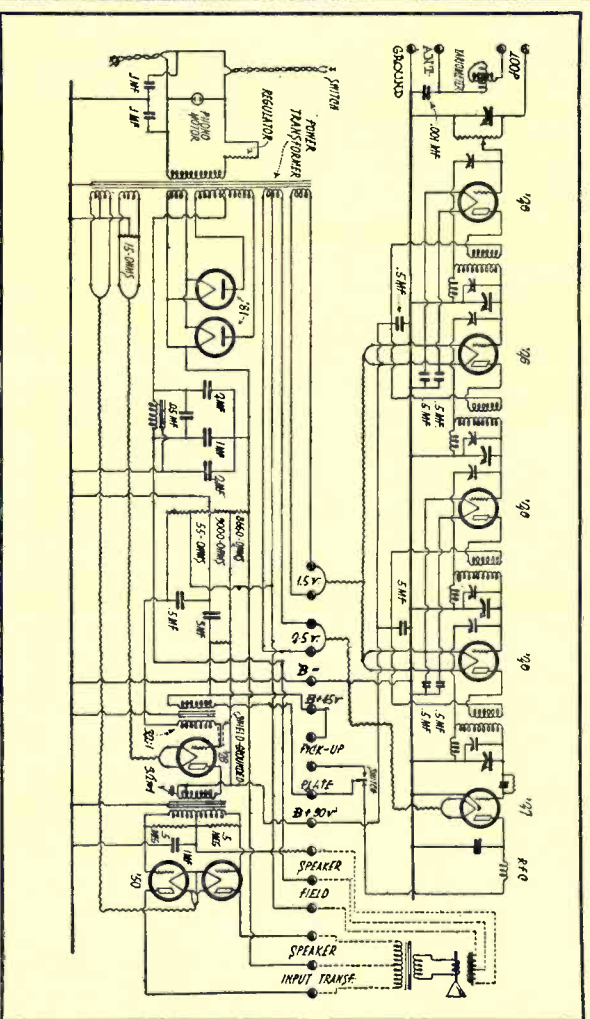
"RADIO"

CIRCUIT DIAGRAMS OF FACTORY-BUILT SETS

All diagrams shown on these pages are reprinted on heavy paper. Holes are punched in proper places so that you can readily insert these sheets into a looseleaf binder.

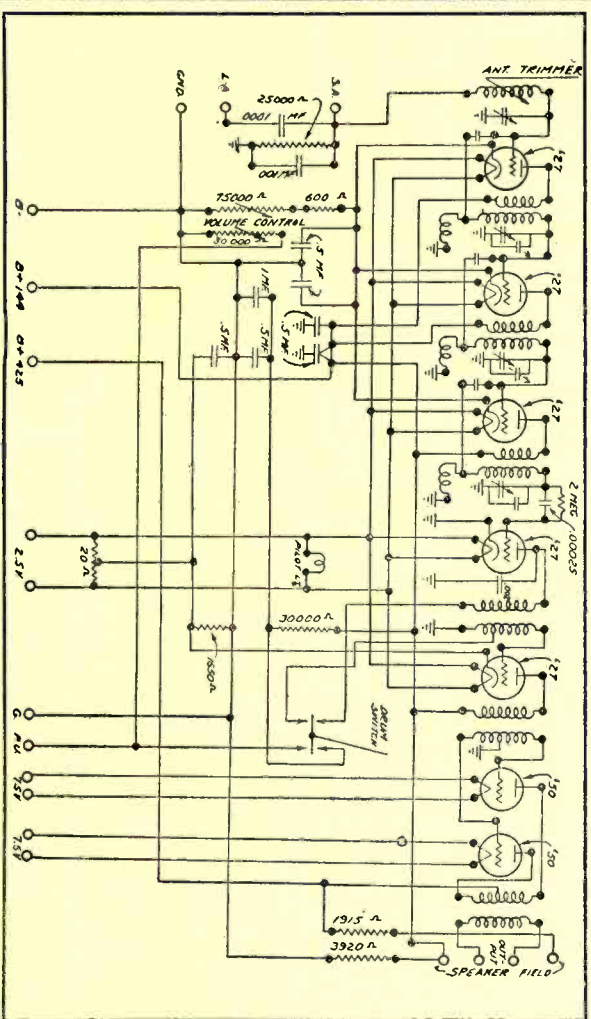
ERLA Model R-1 Receiver

Using four '26's, one '27, two '50's, two '81's



MAJESTIC No. 180 Phono-Radio Combination

Using five '27's, two '50's, '81 tubes in rectifier.

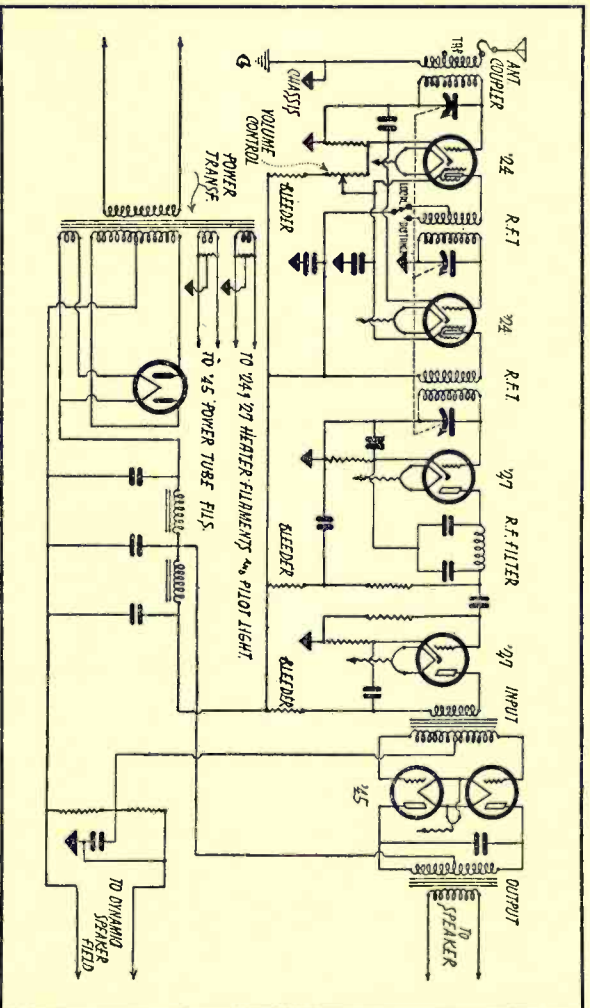


CIRCUIT DIAGRAMS OF FACTORY-BUILT SETS

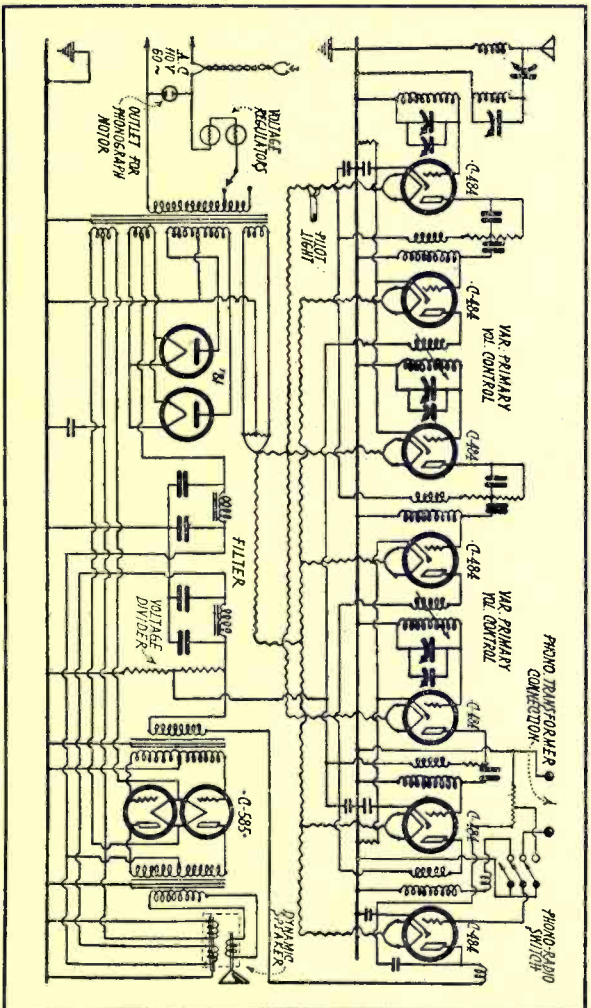
Don't miss next month's issue of "RADIO." It will contain numerous circuit diagrams of the latest sets.

ATWATER KENT Model 55 Screen-Grid Receiver

Using two '24's, two '27's, two '45's, one '80



Continental "Star Raider," Using Special "Cardon" Tubes



TOBE Filterette

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VOL. 1 NO. 5

SEPTEMBER, 1929

CANTON, MASS.

FEDERAL RADIO COMMISSION REVIEWS INTERFERENCE LAWS; COOPERATION, NOT COERCION, BEST

WITH the growing list of cities and towns which have been passing interference legislation, and the heightening controversy which has been raging about the constitutionality of some articles of the laws, it is indeed gratifying to find that the Federal Radio Commission has, after exhaustive research, issued a comprehensive and extremely interesting booklet on the subject, edited by Paul M. Segal and Paul D. P. Spearman, of the legal division, both eminently qualified to compile an authoritative résumé of the situation as it now stands.

The outstanding impression conveyed in a reading of this booklet is that interference laws, like prohibition laws, apparently carry in their wake certain contingent evils which make it difficult to strike a reasonable and yet effective mean.

Communities rushing without protracted deliberation into legislation of this nature, would do well to peruse a copy of this work, and take to heart especially the paragraph which reads:

Practically all these devices can be cured of their interference effects by repair or the addition of filtering attachments. In this connection, each industry is greatly concerned with the maintenance of public good will as well as efficiency in its own processes. The occasion when a manufacturer refuses to correct an abuse once it is called to his attention is so rare that certainly mere local legislation is not the most effective weapon. Instances are known to every radio trades association where manufacturers have gone to expense aggregating thousands of dollars purely for the purpose of eliminating radio interference. Surely, it would not be expected that merely because of the passing of an ordinance by a community, an industry should go to prohibitive expense.

(Continued on Page 52)



James H. S. Moynahan, Filterette Editor

TOBE ESTABLISHES LABELING SERVICE

IN RESPONSE to a rising public demand for apparatus which will not interfere with radio reception, the Tobe Deutschmann Corporation has designed the accompanying label for issue to approved apparatus.



Electrical apparatus which has been personally inspected and passed by Tobe engineers will carry this label. It is an assurance of satisfactory electrical service without the needless annoyance of interference with radio reception.

Manufacturers who are desirous of equipping their product with this label should communicate with the Tobe Deutschmann Corporation for particulars as to how they may receive the metal label for attachment to their apparatus.

INADEQUACY OF "STOCK" FILTERS RETARDED WORK. NOT DESIGNED FOR INTERFERENCE PREVENTION

WHY is it," asks the average man, "that we are just beginning to hear so much about Radio Interference Prevention? It can't be a new problem. How is it nothing has been done about it in the years that radio experimentation has been going on?"

Not an illogical question, and one that is heard often. Let us look into the matter, and analyze some of the causes:

First: The tremendous increase in sales of popular-priced electrically operated household apparatus within the past two years—oil burners, refrigerators, vacuum cleaners, to name a few.

Second: The increase in pick-up of power line disturbances resulting from the widespread adoption of the electric set.

Third: The comparative excellence, the increased sensitivity of modern receivers, making interference more noticeable.

Fourth: The impracticability or unsightliness of outdoor antennas, necessitating the use of short antennas, generally indoors, and a consequent increase of antenna pick-up from power lines—where the lines themselves are not employed as antennas.

Fifth: The general practice of grounding the sets to the water system, the common side of almost all electrical disturbances, which are thus made common to the ground side of the set.

Before the notable increase in interference which may be said to be an outgrowth of the past few years, isolated attempts were made to utilize such filter knowledge as was at hand to prevent some types of interference—oil burners

(Continued on Page 52)

ELECTRIC Traffic Signals

Radio Interference Created by Flashing Traffic Beacons Becoming Serious Problem

By W. K. FLEMING

Chief Engineer, Tobe Deutschmann Corporation

IN A recent survey to determine the relative amounts of radio interference created by various types of electrical apparatus, electric traffic blinkers and traffic signals were found to be among the most serious offenders. In fact, in some localities it was found impossible, due to the disturbances set up by such devices, to receive even local programs satisfactorily. As the intensity of the interference varied in certain localities, as well as with different types of apparatus, it was necessary to undertake considerable field and laboratory research to determine the source of the interference and the methods of its distribution.

Intensity of Interference

IN THE tests conducted under actual operating conditions, it was found that the intensity of the interference very often depended upon the method of installation of the signal and its control mechanism. When the operating mechanism was installed directly in the apparatus, the interference was not nearly as great as when it was installed some distance away. This is due to the fact that the interference was radiated not only from the power supply lines but also from the load lines between the signal and the operating mechanism. In fact, the load lines, under these conditions, seemed to act as a transmitting antenna with consequent increase of radiated interference.

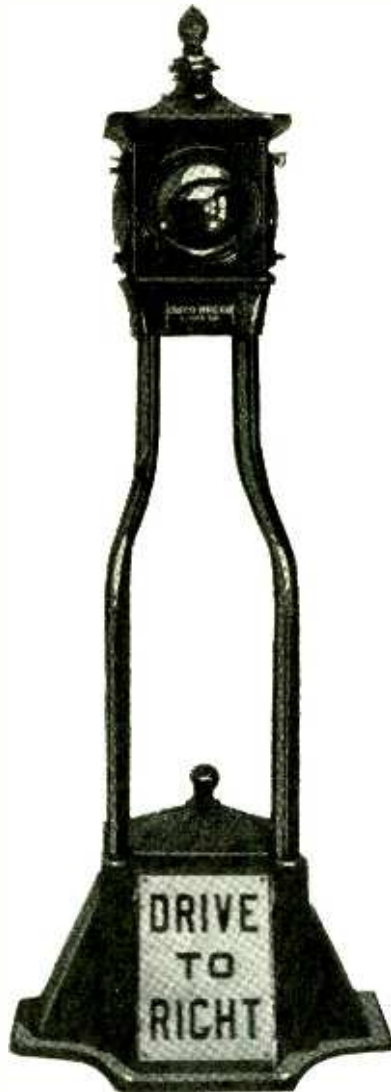
In the laboratory, it was found that the intensity of the disturbance was largely dependent on the type of operating mechanism and the circuit of the entire system.

Control-Mechanisms

THE operating mechanisms commonly used were divided into three classes: One type employing an induction motor; another, a synchronous motor, and a third, a solenoid magnet.

The switch mechanism in the units tested consisted of two general classes; one in which the switch was of the mercury type, the other in which the switch was of the point-to-point contact type.

While the type of switch mechanism employed did not seem to have any particular effect on the intensity of the interference, the type of operating mechanism employed was quite important in this regard.



Typical Traffic Signal

The circuit shown in Fig. 1 is the basic circuit arrangement of the motor-operated type mechanism. The circuit shown in Fig. 2 is the basic circuit arrangement of the solenoid magnet-operated mechanism.

Upon examining the circuits closely, it can readily be seen why one of the circuits will cause more interference than the other. In Fig. 1, it will be noted that

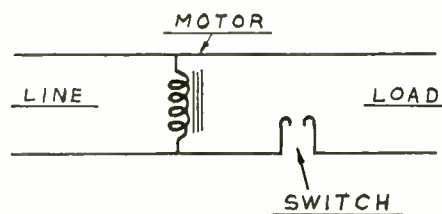


Fig. 1. Basic Circuit of Motor-Operated Traffic Signal

the operating motor mechanism, which is shown in the diagram in the form of an inductance, is connected permanently in the circuit while the mechanism is operating. In Fig. 2, it will be noted that the operating solenoid magnet, which also is shown in the form of an inductance, is connected in the circuit only when the switch is closed. The re-

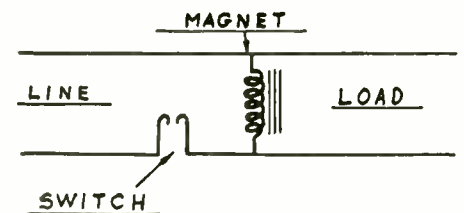


Fig. 2. Basic Circuit of Solenoid-Operated Traffic Signal

sult is that, owing to the inductance being operated in the switch circuit, a greater disturbance is set up in the circuit shown in Fig. 2.

While the difference in the intensity of the disturbance created by these two circuits is not great, it was found necessary, to develop a special type of filter for this circuit.

Types of Installation

THE circuit shown in Fig. 3 is the simplest type of traffic signal installation, the signal and operating mechanism being closely associated in one hous-

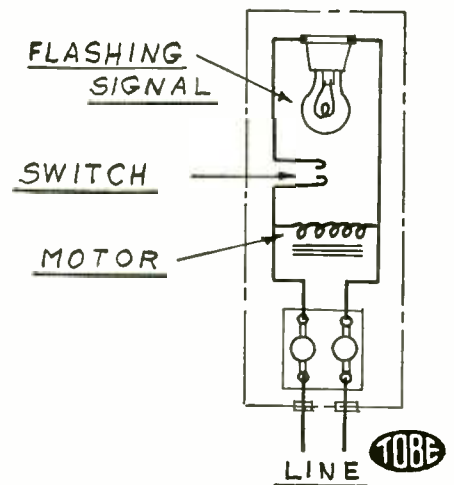


Fig. 3. Simplest Type of Traffic Signal Installation

ing. The interference set up in this type of installation may, in many cases, be corrected by the application of an inductive capacitive filter.

The circuit shown in Fig. 4 consists of a standard blinker mechanism with the addition of a signal which is lighted

steadily during the night. It would seem that this arrangement would not materially affect the interference set up by the blinker mechanism. A specially designed filterette, however, is necessary where this arrangement is used.

The circuit shown in Fig. 5 differs from that shown in Fig. 3 in that the operating mechanism is located at some distance from the signal. As previously mentioned, the interference created by this arrangement is much greater than with the unit construction type, and a special filter is therefore required for this type of installation. However, the type of filter required will largely depend upon the extent and distribution of the interference.

Distribution of Interference

THE interference created by even the simplest type of flashing signal, such as is shown in Fig. 3 and Fig. 4, is very often distributed over a considerable distance. The area affected by the disturbance is largely dependent upon whether overhead or underground wiring is employed in the secondary network of the distribution system.

If overhead wiring is used, the area affected will be that immediately adjacent to the power lines between the signal and the secondary of the distribution transformer. If underground wiring is used, the disturbance will not be so noticeable except in close proximity to the signal.

The interference created by blinkers which are not of the self-contained type

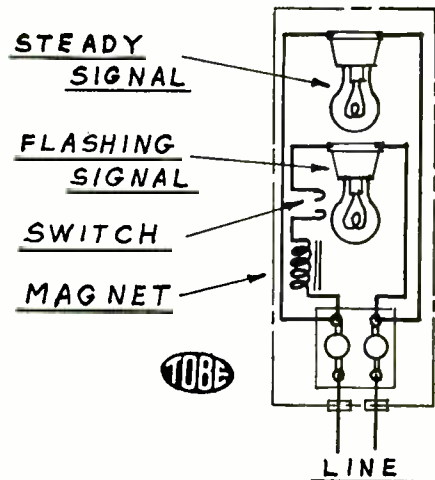


Fig. 4. Circuit of Blinker and Steady Signal

is much more intense in the immediate vicinity of the signal. In addition, a much larger area is generally affected, due not only to the disturbances set up in the power supply lines to the blinker, but also to the direct radiation of the disturbances, from the load lines of the signaling device. In this manner interference is often transferred to telephone and other associated circuits which then

aid in the distribution of the interference. The intensity of this disturbance will depend to a very great extent upon the distance between the blinker and the operating mechanism. This disturbance is entirely independent of that radiated from the power supply lines, and may therefore be present even though the signal is connected to an underground distribution network.

As a general rule, it is a simple matter to identify this type of interference. The characteristics of the disturbance are so pronounced that it is rarely confused with the disturbance created by other types of apparatus. In general, the interference is in evidence as a steady clicking noise, occurring at approximately one second intervals. However, although some types of blinkers are operated much more rapidly, the same steady clicking

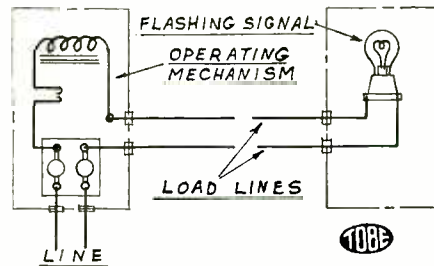


Fig. 5. Circuit of Remote Control Blinker

readily identifies the source of the interference.

Locating Interference

TO LOCATE the beacon which is causing the interference is a comparatively simple matter. The best procedure is to note the intervals of clicking and then check this with the nearest flashing beacon in the neighborhood, even though it may be at a distance of several thousand feet.

After once having located the signal which is causing the interference, the first thing to do is to determine whether it is of the self-contained or remote control type. If it is of the self-contained type, the filter should be installed in the same housing as that containing the operating mechanism. If it is of the remote control type, the filter should be installed in the housing with the remote control mechanism. If this is not pos-

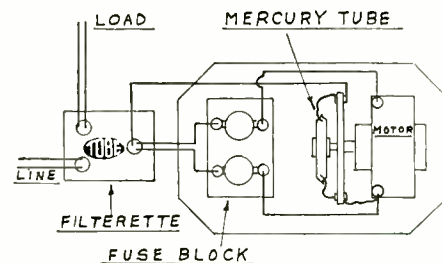


Fig. 3F. Protection Against Self-Contained Blinker by Tobe Filterette Type 1 D.O.G.

sible, the filterette must be installed immediately adjacent to the mechanism. The leads between the filter and the mechanism must be shielded, and must

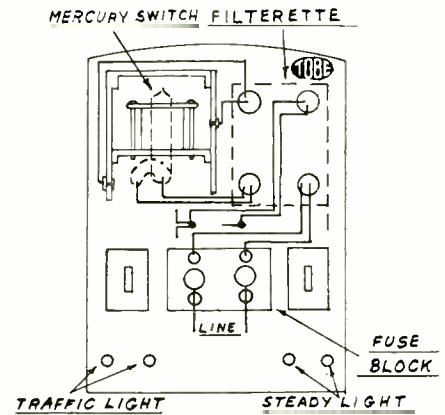


Fig. 4F. Protection Against Blinker and Steady Signal by Tobe Filterette Type 1 D.O.A.

not be more than 18 in. long. If the filter is exposed to the elements, it must be contained in a weatherproof housing.

The filter required for the self-contained unit, shown in Fig. 3, may be attached directly to the supply lines. However, better results will be obtained if a filter as shown in Fig. 3F is used.

The filter required for use with the unit shown in Fig. 4 is of special con-

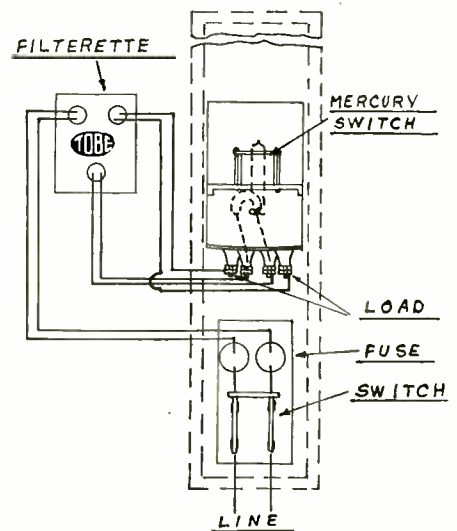


Fig. 5F. Protection Against Remote Control Blinker by Tobe Filterette Type 1 D.O.E.

struction and must be connected as shown in Fig. 4F.

The filter required for the installation shown in Fig. 5 must be connected in both the load and line circuits. (Fig. 5F.)

In conclusion, it is evident that while an inductive-capacitive type filter may be satisfactory for use in simple installations, in general a much more complex filtering arrangement is required for application to most flashing signals.

INTERFERENCE LAWS

(Continued from Page 49)

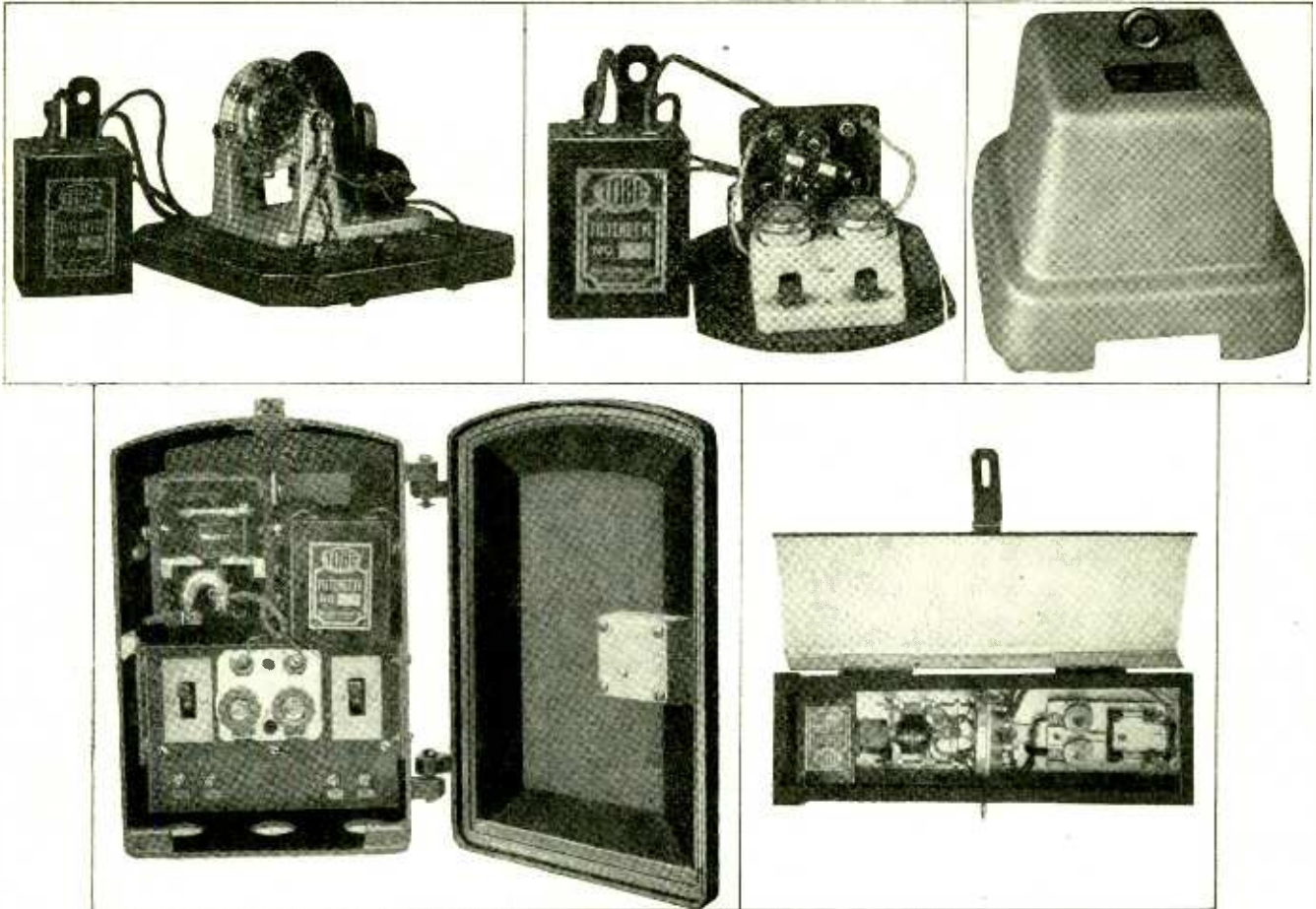
We have recently quoted, and we reiterate for emphasis, the statement of Edgar H. Felix, radio consultant of N.E.M.A., "There is a real field for engineering effort in eliminating interference by household equipment such as electric fans, oil burners, cash registers, electric refrigerators, vacuum cleaners, and violet ray machines. All of these

The Tobe Deutschmann Corporation will be glad to send upon request to all readers of "Radio-Filterette" a copy of this pamphlet, or any information requested about the elimination of radio interference from electrical apparatus.

If your community is considering action on this problem, let us help you. We can give you authoritative information on the ease or difficulty of filterizing specified electrical apparatus.

actual apparatus. Examination of these hastily devised circuits shows, in many instances, that the size of wire and type of condenser recommended are *wholly unsuited* to the type of work for which the filters were devised.

There was no precedent in this field. The problems were new, and could be worked out by experimentation only. To instance but one finding; the constant duty required of these new filtering de-



TYPICAL TRAFFIC SIGNAL EQUIPMENT

Upper left: Solenoid-Operated Mercury Switch. Upper center: Synchronous Motor Driven Mercury Switch. Upper right: Solenoid-Operated Mercury Switch for Steady Signal. Lower right: Induction Motor-Driven Mercury Switch. Lower left: Weather-Proof Housing for Remote Control Flasher

must be designed with elimination of radio interference in mind."

Recent advertising trends, playing up the claim that the product "does not interfere with radio reception," bear out the truth of these statements. The solution, which is probably far more imminent than the uninformed suppose, will come through public demand for non-interfering electrical apparatus and thus the gradual elimination of obsolete types which cause interference.

For those communities which are desirous of passing restrictive legislation, the booklet contains two model ordinances, one prohibiting electrical interference, and the other restricting the operation of mechanical devices . . . to amplify the human voice . . ."

These ordinances, the commission believes, will be found reasonable, fool-proof, and constitutional.

INADEQUACY OF STOCK FILTERS

(Continued from Page 49)

and series-wound motors, for example. These filter circuits, however, had been devised specifically for use in telephone work for certain types of frequency filtering or for use in smoothing pulsating d-c. Now the problem was a new and entirely different one—the suppression of r-f disturbances in a-c power lines.

As a result of this sudden wave of interest, attempts were made to publish filter circuits to cope with this new problem. Writers rushed into print with revamped filter circuits. But work of this nature cannot be done scientifically and accurately without research and without specific experimentation on the

vices made the application of an ordinary condenser out of the question. An entirely new type of constant duty a-c condenser had to be developed to meet these operating conditions.

To meet general electrical requirements a line of filters, suitable for installation in standard wiring systems, was then designed. These had to be built to conform to the standards of the Underwriters' Laboratories, and were protected with fuses. The filters were constructed of approved wire and fittings only, and were subjected to exacting tests.

In addition to these filters, a special household line was developed so that today the householder who is desirous of correcting interference in his own home can purchase one of the new line of plug-in filterettes and install it in a few minutes.

Latest Filterette Catalog showing new models gladly sent upon request.



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TOUR THE AIR
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Speedy as the magic carpet, ARCTURUS A-C Tubes

Get programs in 7 seconds

plus these features:

Perfect tone because ARCTURUS Tubes are consistently uniform

Clearer reception — hum is decreased

Efficiency unmarred by current changes

L-o-n-g l-i-f-e — A world's record for long life has been established by ARCTURUS Tubes.

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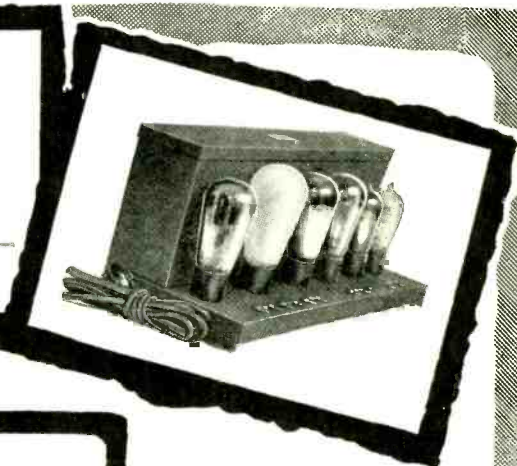
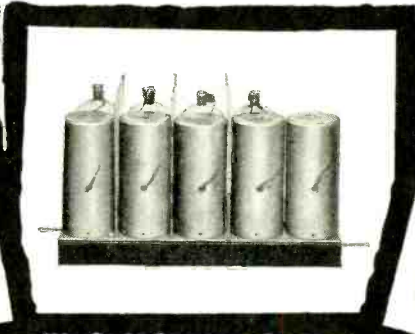
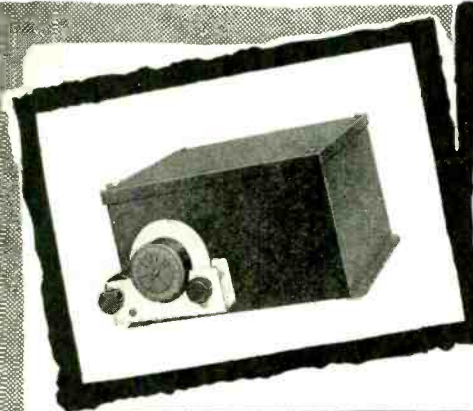
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 SCREEN-GRID**

No. 124

Envy the receiver equipped with ARCTURUS Screen Grid Tubes . . . built with a full year's experience. Its owner secures all these advantages . . . given only by ARCTURUS A-C Tubes.



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ARCTURUS
 BLUE ^{A-C} LONG LIFE TUBES



111

THE BIG IMPORTANT NUMBER IN 1930 RADIO

Number 111 is Remler's masterpiece, the components which combine to give you \$300 worth of radio equipment for \$80.

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| Shield-Grid Power Detector | Parallel First Audio Tubes |
| Band-Pass Selector | Two "45's" in Push-Pull |
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Check these Features

against any and all competition. What more could you ask? And every feature is employed as only Remler can employ it—to give you the finest possible radio performance.

A NEW DEAL for the Experimenter

Here is a group of components that you can handle with real pride . . . no more apologies in competing with factory-built receivers.

The Number 111 sells on its outstanding superiority. Selectivity without loss of quality such as only a band-pass selector properly used can give. Tone quality the inevitable result of the combination of "45" tubes in push-pull and Remler Audio Components.

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of Radio Information
in 128 pages for only

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THE 1930 REMLER MANUAL AND DATA BOOK

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No. 915 Push-Pull Input Transformer. List Price, \$6.00. Net Price, \$4.20.

ARE YOU SATISFIED



No. 945 Power Transformer. List Price, \$18.00. Net Price, \$12.60.

—with the reproduction of your radio?

OR IS SOMETHING LACKING

—something you can't define but know should be there

WHY not give your receiver new life—why not realize the possibilities of radio for entertainment? It has ceased to be just a novelty and has become an integral part of everyday life—and yet reproduction is being slighted everywhere to a surprising degree. You need only to grasp the opportunity to combine Remler Audio Components, which have gained universal recognition as the best to be had, with push-pull amplification which provides twice the undistorted power output at the same plate voltages, freedom from even harmonic distortion and a minimum of A-C hum even though the tube filaments are supplied from an A-C source. No matter what your amplifier requirements, there are Remler Components that will just fill the bill.

Build Your Own Amplifier

DO YOU want clear, brilliant reproduction with ample volume for the home or a small hall? Then build an amplifier with a single '27 tube in the first stage and '45's push-pull in the power stage. Use a Remler No. 920 First-Stage Transformer, a No. 916 Push-Pull Input Transformer and a No. 925 Push-Pull Output Transformer. The Remler No. 945 Power Transformer will supply all necessary plate, grid bias and filament voltages.

For Your Auditorium

ARE you interested in high quality reproduction at loud volume for an auditorium? Then build a double push-pull amplifier using two '27's push-pull in the first stage and two '50's push-pull in the power stage. Or build a three-stage amplifier with a single '27 working into two '27's push-pull in turn working into '50's push-pull. For the two-stage double push-pull amplifier use a No. 916 Push-Pull Input Transformer, a No. 917 Push-Pull Intermediate Transformer and a No. 925 Push-Pull Output Transformer. A No. 955 Power Transformer will supply the necessary plate, grid-bias and filament voltages.

A Less Expensive Amplifier

AGAIN, if you are interested in a less expensive amplifier with an excellent frequency characteristic, there are Transformers Nos. 915 and 924. Remember that Remler Components are known for their superior performance.

The Remler Manual and Data Book described on the opposite page will contain complete information on Power Amplifiers. It is scheduled to be ready about August 20. You will want a copy.

NEW—THE 945—NEW

THE Remler No. 945. It is the power transformer you have been wishing someone would build. Have you a battery set you would like to rewire for A-C heater-type tubes such as the '27 or the new '24? The No. 945 Transformer will supply filament current for as many as six such tubes. It will also supply plate current for the set and field current for a dynamic speaker of the 90-110 volt D-C concert type.

45'S IN PUSH-PULL

WOULD you like to install the latest type of power amplifier using '45 tubes in push-pull? The 945 Transformer will deliver the proper voltages for them. It is very simple to install and use; complete directions are supplied with each transformer. Small in size, the No. 945 Transformer is easily located in a limited space. The No. 945 Transformer is designed for operation from a 110-volt, 50-60 cycle source. These specifications cover the usual house lighting circuit.

GRAY & DANIELSON MANUFACTURING CO.

260 First Street

San Francisco

THE DATA BOOK

REMLER engineers have compiled and edited a Radio Manual and Data Book which every experimenter needs. Read the Table of Contents on the opposite page. Then mail the coupon below, with 50 cents in stamps, coin or money order. We will do the rest.

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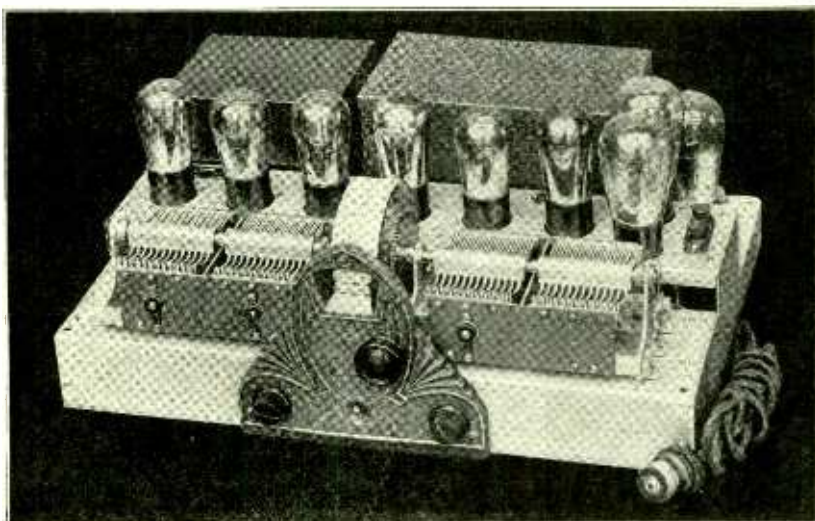
New 1930 MANDEL Chassis

— the Latest Triumph of a Great Engineer!



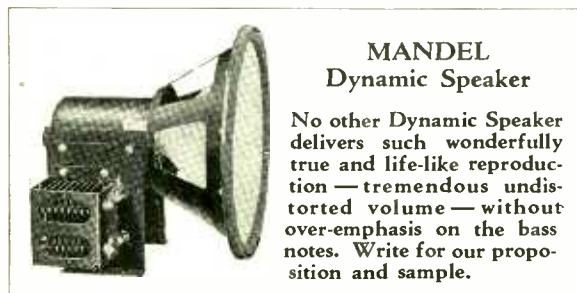
R. H. G. Mathews, Lt. Commander, C-V (S) United States Naval Reserve, Ninth Naval District—formerly chief engineer of the Zenith Radio Corp. Designer of the Mandel Chassis and Mandel A.C. Dynamic Speaker, and under whose supervision these products are manufactured.

STARTLING realism! Unbelievable till you hear it yourself. This 9-tube A-C Super-Bridge Circuit represents a most remarkable achievement in radio set design and construction. Selectivity, tone, volume, distance—these take on a new meaning when you hear the MANDEL perform.



5 New Features Place the MANDEL Chassis in a Class by Itself!

- 1 **EXCEPTIONALLY FINE CONDENSER CONSTRUCTION.** Plates of extra heavy gauge aluminum, infinitely accurate, die cast into stators and rotors. Electrically balanced and equalized before assembly in set.
- 2 **HOW TROUBLE IS AVOIDED.** A multiplicity of small unnecessary parts such as by-pass condensers, hum adjusters, etc., have been eliminated by our improved design. Troubles in radio sets usually have their origin in these frail parts, whereas in the Mandel Chassis they have been consolidated and combined into a few larger and less troublesome units.
- 3 **SPECIAL TYPE OF EQUALIZER.** Gives perfect balance from lowest to highest broadcasting frequencies. No adjustment necessary after shipment.
- 4 **FILTER CONDENSER BLOCK** of highest grade construction, and of sufficient size to cut hum to a minimum. Factor of safety is 2½ times that ordinarily used.
- 5 **TRANSFORMERS AND CHOKES BY THOR-DARSON.** Best made, highest efficiency. Operates on line voltages between 90 and 125 volts.



MANDEL Dynamic Speaker

No other Dynamic Speaker delivers such wonderfully true and life-like reproduction—tremendous undistorted volume—without over-emphasis on the bass notes. Write for our proposition and sample.

Unusual Opportunity for Dealers

The Mandel Chassis is built to give satisfactory service and performance. Link your name with a high quality product that will save you trouble and expense—a radio that will satisfy your customers.

Write immediately for sample and our proposition.

West Coast Representative
WM. G. LANDIS SALES CO.
905 Mission Street, San Francisco, Calif.

MANDEL ELECTRIC CO.
2161-69 North California Avenue Chicago, Ill.

EVEREADY RAYTHEON TUBES YOU CAN HEAR THE DIFFERENCE ...AND SEE THE REASON



FIND OUT for yourself what people mean when they say that Eveready Raytheon Tubes give greater distance, more volume, better tone—try them in any standard A.C. receiver!

Then look at one of these tubes. See the solid, four-cornered glass stem, supporting four rigid pillars which hold the elements. This patented *4-Pillar construction* is anchored at the top as well—by a stiff mica plate. No other tube can be built like this, for it is patented.

These elements can't be distorted by the jolts and jars of shipment, or by the necessary handling of the tubes.

You can easily understand, now, why these tubes come to you, and go to the radio receivers of your customers, in perfect condition. All their added power is intact! They run uniform, too, and the A.C. tubes are quick action. The wonderful performance of Eveready Raytheon Tubes means greater satisfaction for your customers. And a minimum of

replacements for you to bother with.

No legal troubles with Eveready Raytheons. No canceled deliveries or "frozen" stock.

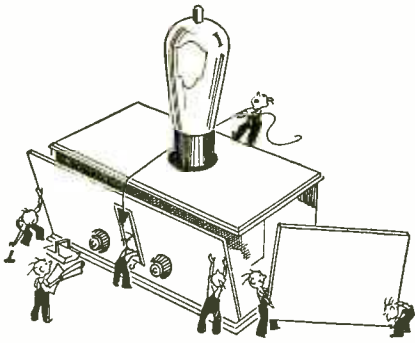
Television too!

The Eveready Raytheon line is complete—with standard receiving tubes, battery and A. C. operated, rectifying tubes, Kino-Lamps, and Foto-Cells for talking pictures and television. In addition, we developed and make the original gaseous rectifying tube for "B" eliminators—the famous B-H tube—for which there is an enormous sale.

NATIONAL CARBON CO., INC.

General Offices: New York, N. Y.
Branches: Chicago Kansas City
New York San Francisco

Unit of  and Carbon Corporation



They had to build a new kind of set around this tube

When CeCo developed the now famous A. C. Screen Grid Tube in April, 1928, it was merely an experimental product. Before it could be used set manufacturers had to be interested in its future possibilities. They were quick to respond. Now, almost every manufacturer is building sets around this tube.

Briefly, the chief difference between the Screen Grid tube and the conventional radio tube is two circular screens, one placed between the grid and the plate, and the other outside the plate.

These screens reduce the grid-to-plate capacity to a minimum. This removes the greatest stumbling-block to the development of more sensitive circuits. With the screen grid tube the amplification step-up conservatively is raised from 6 to at least 25 and more per stage.

This reduction of capacity has many advantages, both from the point of view of the set manufacturer in simplifying his sets and from that of the user in getting clearer and better reproduction.

The next time you buy tubes try CeCo's and see if they do not give you clearer, sharper reception, greater sensitivity, and longer life.

CeCo
Manufacturing
Company, Inc
PROVIDENCE, R. I.

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

There is a CeCo tube
for every kind of set

EXPERIMENTAL LOCAL SET

(Continued from Page 23)

would be better to use a make of tuning condenser which has more of a grounded frame than the type shown in the picture. To prevent induction the power transformer should be mounted at least 2 in. back from the tuning condenser and at least 4 in. from the nearest r-f coil or screen-grid tube.

Binding posts are provided for aerial and ground connections and loudspeaker output connections. The speaker field and 110-volt line leads are of flexible lamp cord. The receiver was designed to handle a dynamic loudspeaker in order to obtain the best possible quality of reproduction. The distortion present in this receiver is practically negligible and the frequency characteristic is nearly a straight line for all audio frequencies. In order to minimize loudspeaker cabinet resonance on low frequencies, the speaker should be mounted with the set in a fairly large console cabinet. The front of the loudspeaker compartment should have a heavy board as the baffle.

The power transformer is a special one constructed as follows:

Primary—430 turns No. 22 enameled wire wound in 9 layers of length 1 $\frac{5}{8}$ in., with 3 mil paper between layers and a turn of copper sheet wound over the completed primary to act as an electrostatic shield. This open circuited turn is grounded as is also the core.

Secondary—2800 turns center-tapped to obtained two 350-volt windings. Coils were wound with No. 31 enameled wire in layers with 3 mil wax paper insulation between layers. The winding length is 1 $\frac{5}{8}$ in. and is insulated from the other windings with heavy paper. All windings are insulated from the others by means of .02 in. paper wrappers. The rectifier filament winding consists of 20 turns of No. 18 enameled wire wound over the high voltage secondaries. The 2 $\frac{1}{2}$ -volt filament winding consists of 10 turns of No. 14 D.C.C. wire wound over the other filament winding with heavy paper insulation between the two windings. The completed coil with paper insulation, etc., is 1 $\frac{7}{8}$ in. long and about 3 $\frac{3}{4}$ in. outside diameter. The inside diameter or rather square opening is 1 $\frac{1}{2}$ x 1 $\frac{1}{2}$ in. to fit over the core.

The laminations should be of the best transformer laminated silicon steel obtainable. The sections consist of *E* laminations with *I* sections inserted at the sides opposite the *E* openings. The *E* sections are staggered so as to minimize leakage. The core, after assembly in the coil, should be clamped very tightly to prevent audible hum. These clamps should have mounting feet for mounting on the baseboard. Soaking

(Continued on Page 62)

The New Model 547 Radio Set Tester



—saves time
—simplifies testing
—increases sales

Service men remember the time when radio set testing required hours of time and satchels full of equipment. The model 537 reduced radio set testing to its utmost simplicity and made radio servicing a profitable business instead of a necessary evil.

NOW—Model 547—for A.C. and D.C. Receivers meets the service testing requirements of radio's latest developments, even taking into account the number of new tubes, sets and circuits. Handsome in appearance, it is light, but rugged, convenient and complete.

Provided with three instruments, carrying case, removable cover, panels and fittings of sturdy bakelite.

A.C. Voltmeter—750/150/16/8/4 volts. Only one selector switch is necessary.

D.C. Voltmeter—high range increased to 750 volts. Other ranges—250/100/50/10/5 volts.

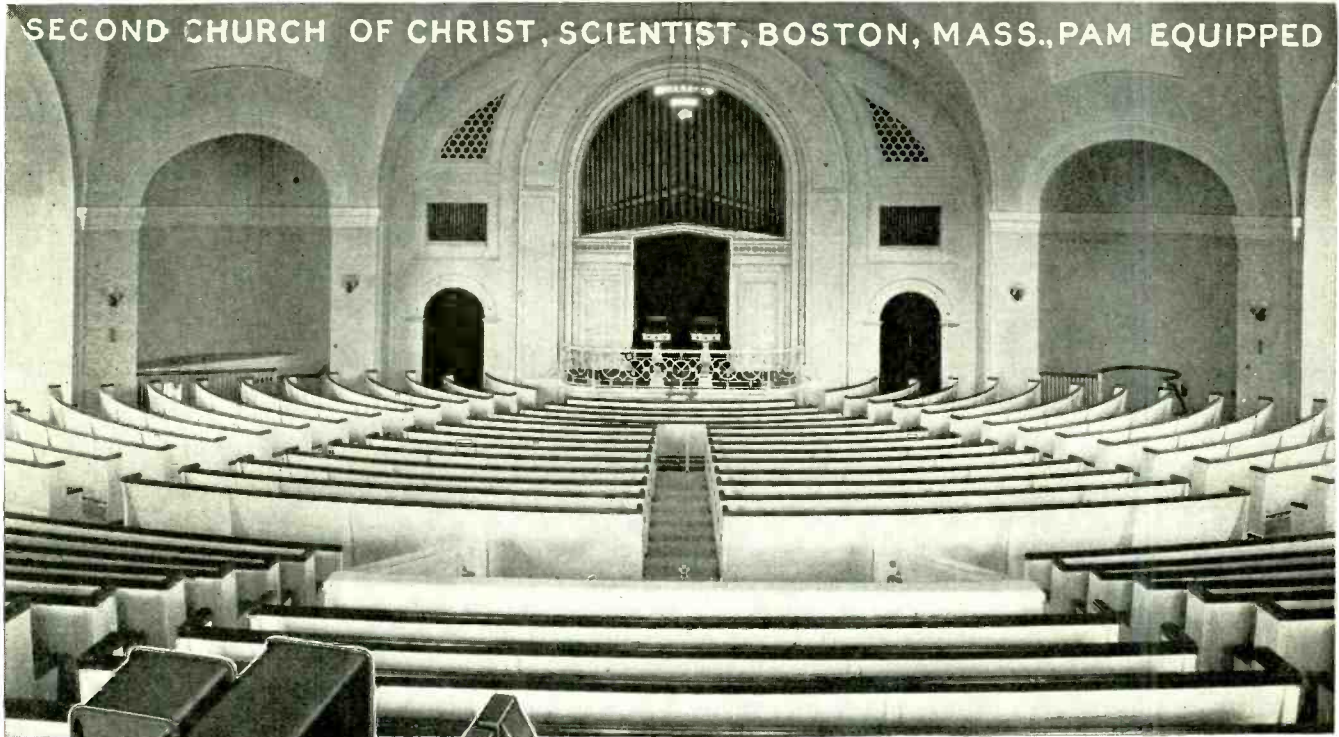
D.C. Milliammeter—double range 100/20 M.A. provides for lower readings with better scale characteristics.

Tests—On A.C. sets the heater voltage and plate current can be read throughout the test while the D.C. voltmeter may be indicating plate bias or cathode voltage.

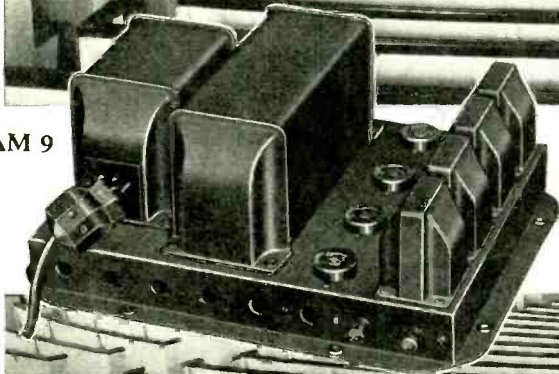
Self-contained, double-sensitivity continuity test provided. This can also be used for measuring resistance as well as testing for open circuits. Grid test can be made on A.C. or D.C. screen-grid tubes—also the '27 tubes when used as a detector—without the use of adapters. Two sockets on the panel—UY tube adapters eliminated.

Weston
PIONEERS
SINCE 1888
INSTRUMENTS
WESTON ELECTRICAL
INSTRUMENT CORP.
600 Frelinghuysen Ave.
Newark, N. J.

SECOND CHURCH OF CHRIST, SCIENTIST, BOSTON, MASS., PAM EQUIPPED



PAM 9



PAM

increases seating capacity



BECAUSE of the PAM installation, no one need stand or be turned away for lack of seats at the Second Church of Christ Scientist, Boston, as long as there is a seat available in the Sunday School room or other parts of the church.

Every word of the speaker is picked up by microphone and PAM amplified for the loudspeakers, which deliver it crystal clear to the overflow assemblages.

Every church or parish house is a logical prospect for PAM equipment for this or entertainment purposes, and every radio dealer should see to its installation.

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. R11.

Samson Electric Co.

MEMBER
RMA

Main Office
Canton, Mass.

Factories: Canton and
Watertown, Mass.

Manufacturers Since 1882

PACIFIC COAST OFFICES:

327 Tilden Sales Bldg.
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2607-11 Second Avenue
SEATTLE, WASH.

637 East Broadway
PORTLAND, ORE.

Tell them you saw it in RADIO

All Around the World!

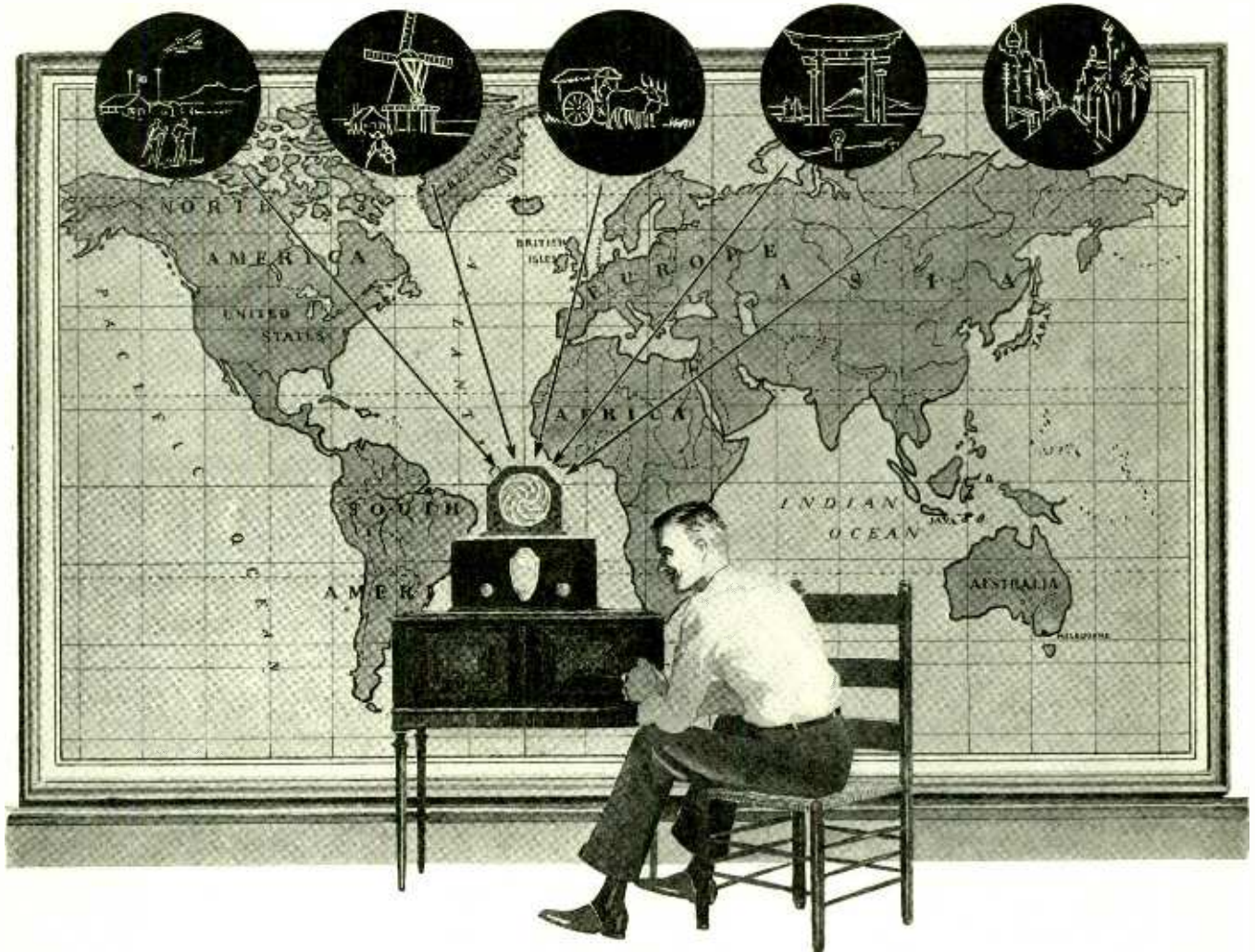
ANTARCTICA

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 shortwave 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.



See Us at Booth No. 82, San Francisco Show; Booth No. 175, Los Angeles Show

NATIONAL THRILL BOX

SCREEN-GRID SW-4

PERRYMAN

RADIO TUBES

A Perryman Tube for Every Purpose

PERRYMAN A. C. TUBES

and accompanying Rectifiers and Power Amplifiers

DETECTOR-AMPLIFIERS

P. A. 227—heater type, for use with unrectified A. C. current direct on the filament through stepdown transformer. Exclusive Perryman processes have eliminated excessive hum and produced far above average life for this type of tube.

***P. A. 226**—for use with unrectified A. C. current direct on the filament in radio frequency amplification stages and first audio frequency stages.

POWER AMPLIFIERS

All tubes in this group are equipped with exclusive Perryman process oxide coated filaments. A product of Perryman chemical laboratories, unusually rugged, active and long-lived.

***P. A. 245**—This is the new power tube with longer life and greater undistorted output.

***P. A. 112-A**—a general purpose tube for radio frequency and audio frequency amplification. Can also be used as a detector. Filament current, one quarter-ampere.

***P. A. 171-A**—for last stage audio amplification. Quarter-ampere filament current.

***P. A. 210-A**—Super-power amplifier, delivers full volume of undistorted output. Especially suitable as an oscillator for amateur radio transmission.

***P. A. 250**—Super-power amplifier specially designed for amplifying circuit devices. Used in last audio stage of many new A. C. receivers.

***P. A. C. 224**—This is a new radio frequency amplifier of the screen grid type for A. C. operation.

RECTIFIERS

***P. R. 280**—a full wave rectifier, employing exclusive Perryman process oxide coated filament, insuring long life, satisfactorily used in power plants of most A. C. sets. Maximum D. C. output 125 mils.

***P. R. 281**—a half-wave rectifier, using exclusive Perryman process oxide coated filament, delivering an output of 110 mils. Used chiefly in the power plant of power amplifiers and B eliminators.

PERRYMAN D. C. TUBES

DETECTOR-AMPLIFIERS

***R. H. 201-A**—a general-purpose tube famous for its long life and fine quality.

R. H. 199—built in two type bases, miniature (small U. V.), long pin (standard V. X.). Rigidly made and especially reinforced.

P. A. 120—for last audio stage operated with 3-volt dry battery supply.

P. A. 200-A—a super sensitive detector tube of soft vacuum (gaseous) type. Pronounced ability to strengthen weak signals. Uses 45 volts on plate.

***P. A. 240**—especially designed for first audio resistance coupled amplification. It is a high mu tube and may also be used as a detector.

(*) Perryman Tubes equipped with the Patented Perryman Bridge.

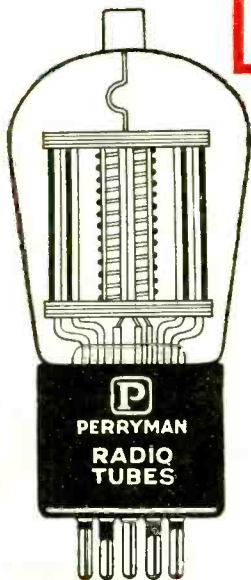


The Patented Perryman Bridge

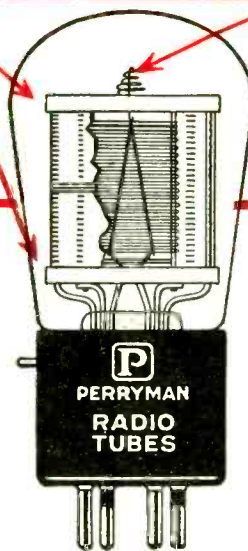
... holds the filament, plate and grid, top and bottom, in permanent, parallel alignment. This sturdy construction feature is exclusive to Perryman Tubes.

The Perryman Spring

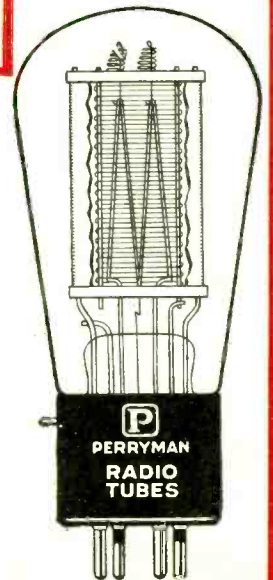
... allows for the uniform expansion and contraction of the filament due to temperature changes. Another construction feature exclusive to Perryman Tubes.



***P. A. C. 224**
The new screen-grid type of radio frequency amplifier for A. C. operation in the new screen-grid sets. Note the exclusive Perryman Bridge construction. This assures longer life and uniform characteristics.



***P. A. 245**
The new A. C. power tube with the exclusive Patented Perryman Bridge and Tension-spring on each filament. Longer life and higher volume of undistorted output are the result of this sturdy and exact construction.



PERRYMAN ELECTRIC COMPANY, INC.

4901 HUDSON BOULEVARD, NORTH BERGEN, N. J.

▶▶▶

MANY OF
YOUR CUSTOMERS
NEED NEW B-H
RECTIFYING
TUBES
FOR "B" ELIMINATORS!



Carton of four Eveready Raytheon B-H Tubes

EVEREADY
RAYTHEON B-H

MANY of your customers are using "B" eliminators built for the original gaseous B-H rectifying tube. Millions of such units were sold during the past few years. Tell these customers what a big improvement in reception a new Eveready Raytheon B-H Tube will make. The replacement market for these tubes is enormous.

Eveready Raytheon B-H Tubes come in handy cartons of four tubes each. Always keep at least one full carton on hand.

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



EXPERIMENTAL LOCAL SET

(Continued from Page 58)

the whole transformer in varnish and baking for several hours in an old oven is a good idea, as it protects the windings from moisture and prevents either the coils or core laminations from buzzing when the transformer is operating.

Rubber covered wire should be used in wiring up the set where any high voltage leads are concerned. Other leads may be run with No. 18 double or triple covered bell wire. Separate twisted leads should be run from the heater or filament terminals of each tube socket to the power transformer.

PUSH-PULL AUDIO

(Continued from Page 25)

should be at least two or three times the a-c impedance of the tube, but is limited by the voltage drop, which subtracts from the B supply to give the plate voltage on the tube. Fig. 2b shows how a simple interstage transformer can be resonated and in addition be worked into a push-pull stage. The center tap on the secondary is made by means of two 2.0 meg resistors. The capacity requisite for resonance at 100 cycles is usually .1 or .2 mf for any of the connections shown.

In Fig. 2c a push-pull interstage coupling is shown, for an ordinary push-pull input transformer. The 0.1 mf condenser resonates the primary; the plate resistor and filter condenser take voltage from the power-stage supply and fit it for the preceding stage. One of the coupling resistors R_1 is fixed; the other is variable so that hum balance may be had by plate voltage variation. All the above set-ups have been used and have shown that the low-frequency tuned audio system is a practical and worthy addition to an amplifier.

When a phonograph pick-up is connected to the input of a tuned transformer its inductance adds to that of the tuned circuit and changes the resonant point to a new and much lower frequency. The frequency is as a rule too low to be of use. The remedy is to put a condenser in series with the pick-up to neutralize the added inductance and so bring resonance back to the original frequency. A capacity of 0.2 mf was correct to do this on an Erla pick-up. Ordinarily where a tuned transformer works out of a tube the tube's internal resistance is in effect included in the series tuned circuit. It cuts down the height of the peak at resonance. In the case of the phonograph pick-up tuning there is no such resistance included in the tuned circuit and the response may be tremendously boosted at the low frequencies.

Potter
Electrochemical
Condensers

(Edelman Patents)

for

High and Low Voltages

IDEAL FOR FILTER BLOCKS

The Potter Electrochemical Condensers are characterized by proven durability, permanence of capacity value, low energy loss and small bulk. They are substantially free from surge breakdown troubles due to inherent self-healing properties.

Difficulties due to instability of dielectric film and evaporation common to "wet" type condensers have been overcome.

The Potter Co.
North Chicago, Illinois
A National Organization of Your Service

LOS ANGELES



Convenience
Comfort ↔ Hospitality

You will appreciate the excellent service and moderate rates. The city's most centrally located hotel. One block from Pershing Square — convenient to all leading shops, theatres, financial institutions and electric depots for all resorts.

Garage adjoining.

All Outside Rooms—Each With Bath
One Person - - \$2.50, \$3. \$4
Two Persons - - \$3.50, \$4. \$5

Unexcelled Food—Friendly Prices

FRANK SIMPSON, JR., Director

Hotel Savoy
Sixth & Grand

This New Set and This Old Name

offer unusually
profitable business
to live dealers



Browning-Drake
Model 54

IN THE 1930 Model Browning-Drake you can offer your trade a degree of selectivity, distance-getting, tone quality and pleasing appearance unsurpassed by any set within its price range. In fact, we welcome serious comparison with any set on the market.

Bearing a name that has always stood for quality in radio, this new set was eagerly received by both wholesalers and retailers as soon as they heard it.

It will have ready acceptance among all dealers who know what constitutes saleable quality in a radio receiver.

Six models, table and console, heater and screen-grid types.

*Send for full information
and territories still open.*

Some Details You'll Want to Know

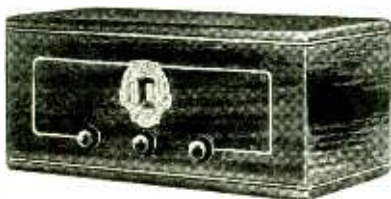
- | | |
|--|--|
| 1. Semi-automatic tuning—both kilocycles and call letters on dial. | 9. Voltage regulation adjustment. |
| 2. Five tuned circuits—nine tubes. | 10. Power unit integral part of chassis. |
| 3. Tuned antenna. | 11. Large size (12 in.) dynamic speaker. |
| 4. Push-pull audio (245 power tubes). | 12. Phonograph, short wave and television connections. |
| 5. Power detection (plate rectification). | 13. Selected walnut and American gum wood cabinet. |
| 6. Hum eliminator. | 14. Hand-rubbed satin Duco finish. |
| 7. Band-pass filter effect (10 KC selectivity). | |
| 8. Mershon trouble-proof condenser. | |

Model 54—(Screen-Grid) Small Console—
(38x26x14) \$142.50 less tubes.

Model 64—(Heater Type) Small Console—
(38x26x14) \$137.50 less tubes.

Prices slightly higher west of Rockies

BROWNING-DRAKE CORPORATION
224 Calvary Street Waltham, Mass.
Builders of quality radio for five years



Model 53—Table Model, Screen-Grid Type.
List \$102.50 less tubes.
Model 63—Table Model, Heater Type.
List \$98.00, less tubes

Browning-Drake

RADIO

Nearly 1,500,000 People Are Using Browning-Drake Sets

Tell them you saw it in RADIO



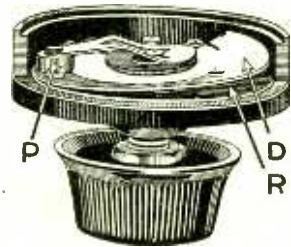
FOR WANT OF A NAIL

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

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

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

THIS shows the exclusive rocking disc construction of Centralab volume control. "R" is the resistance.



Contact disc "D" has only a rocking action on the resistance. Pressure arm "P" together with shaft and bushing is fully insulated.



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



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

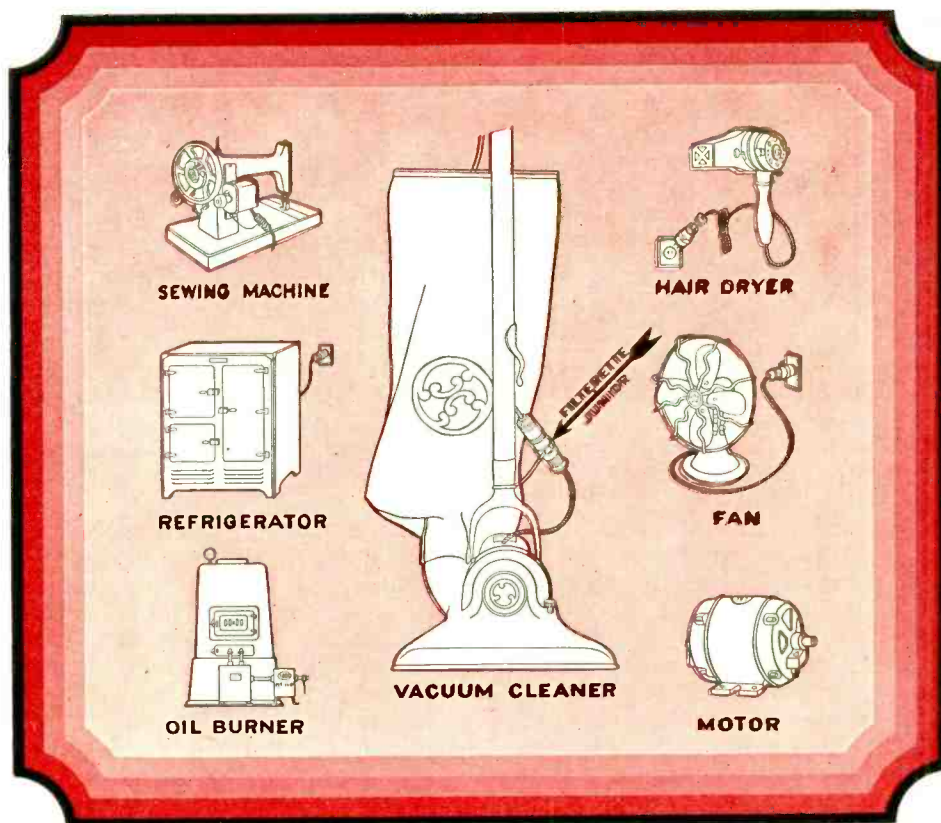
Centralab

CENTRAL RADIO  LABORATORIES

20 KEEFE AVENUE

MILWAUKEE, WIS.

TOBE
Filterette
STOPS RADIO NOISES

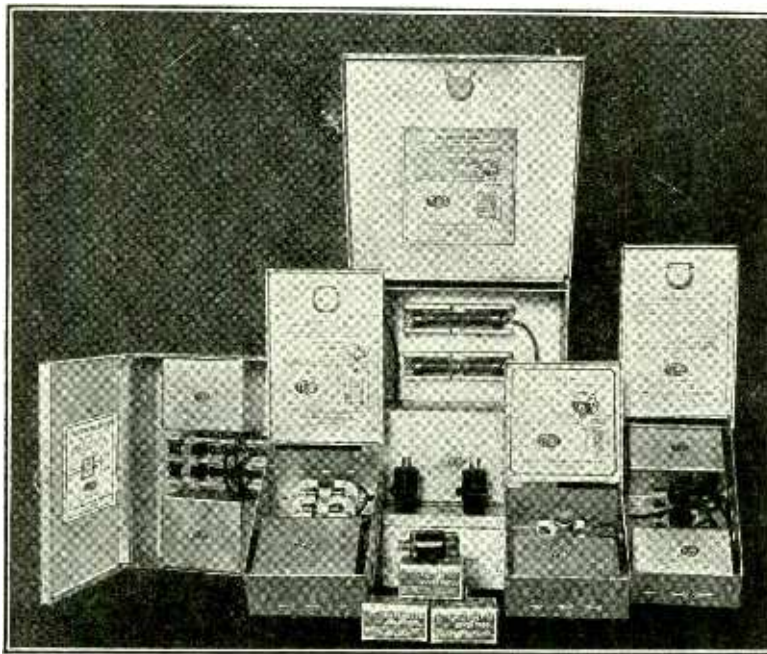


Copyright 1929 by

Tobe Deutschmann
Corporation

FILTERETTE DIVISION
CANTON, MASS.

What is a **TOBE** Filterette?



"A Filterette is a carefully balanced arrangement of resistance, capacity and inductance designed to prevent radio interfering electrical impulses created by electrical apparatus from being transmitted by or radiated from the power lines or associated circuits."

Many types of electric motors and other apparatus when operated in the vicinity of a radio set give off electric discharges which the set picks up either through the house wiring system, or in some instances through the air itself, just as it would a broadcast. No doubt you have tried to tune out such noises by turning the dials or the volume control. If you have, you know that turning the selector dials only cuts off the music, but that the noise usually continues, especially on the lower wave lengths. Cutting down the volume reduces the noise, but it also reduces the music. This is the reason why nothing can be put on the set to stop the noises. If something could be invented that would magically distinguish which sounds were music and which were noises the problem would be solved. But so far no device has been constructed to do this.

Engineers have come to the conclusion that the only sure way to stop these disturbances from electric apparatus is to muffle the source of the trouble, the motor or apparatus itself.* And this is the purpose of the *Filterette*.

The *Filterette* is a sort of electrical muffler, which is placed on electric motors or apparatus so that it checks discharges which, if unchecked, would be heard in the speaker as crackling, frying, roaring or such interference.

* "Whether the device causes interference through lack of "choke" or "filter" attachments or through improper design, the cure for the interference lies in the education of the manufacturer. Many brands of devices have become specifically known as interference producers and this reputation is compelling manufacturers to improve their construction. Already a large number of such appliances carry the guarantee of the maker that they will not produce interference with radio reception. The importance of the work along this line of trades associations has been tremendous and the time will soon arrive when this type of interference will no longer exist." From "State and Municipal Regulation of Radio Communication" by Paul M. Segal and Paul D. P. Spearman of the Legal Division Federal Radio Commission. "There is a real field for engineering effort in eliminating interference by household equipment such as electric fans, oil burners, cash registers, electric refrigerators, vacuum cleaners, and violet ray machines. All of these must be designed with elimination of radio interference in mind." From statement by Edgar H. Felix, Radio Consultant of National Electrical Manufacturers' Association.

Recommended and used by the Massachusetts State Highway Commission.



CONVENIENT PLUG-IN TYPE **TOBE** FILTERETTES

TOBE FILTERETTE JUNIOR



An ideal Filter for small motors such as are used for electric fans, hair dryers, barbers' clippers, vacuum cleaners, cash registers, etc. Plugs into the line, and it is necessary only to run a small wire from the binding post on the Filterette to any part of the motor frame. Interference is eliminated at once.

Maximum potential 110 volts A. C. or D. C. Maximum load 500 watts. Price \$3.50.

TOBE SENIOR FILTERETTE TYPE T. O.



Designed for application to household apparatus creating a more intense type of interference than that which may be suppressed by use of a Filterette

Junior. This Filterette is designed to be connected in the attachment cord of the interference creating apparatus and is provided with screw terminals to facilitate such connection.

Maximum potential: 110 volts D. C. or A. C.
Maximum load: 500 watts
Maximum current: 5 amperes

Price\$7.50

TOBE SENIOR FILTERETTE TYPE P. O.



Designed for application to household apparatus creating a more intense type of interference than that which may be suppressed by use of a Filterette Junior. This unit is provided with a

cord and attachment plug to facilitate connection to the power line.

Maximum potential: 110 volts D. C. or A. C.
Maximum load: 500 watts
Maximum current: 5 amperes

Price\$7.50

TOBE FILTERETTE NO. 110 P. O.



Is designed for application to all types of 110 volt A. C. or D. C. apparatus, which require a combined capacitive or inductive type Filterette. This Filterette is recommended for application to certain

types of refrigerators, battery chargers, electric signs, heating pads, dish washers, barbers' clippers, drink mixers, washing machines, and other types of household apparatus.

Maximum potential: 110 volts A. C. or D. C.
Maximum load: 500 watts
Maximum current: 5 amperes

Price\$12.50

TOBE FILTERETTE 110 D. P. O.



For application to rotary machines, commonly called inverted converters, used for changing D. C. to A. C. for operation of A. C. radio receivers or phonographs.

Outside Dimensions: 7"x6"x3"

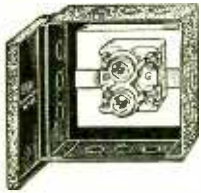
Price\$25.00

The Enemy of good Radio Reception is invariably the interference caused by electrical appliances.



TOBE Filterettes For Installation In Standard Wiring Circuits

TOBE FILTERETTE No. 10



For 110 volt D. C. motors, generators, chargers, house lighting plants, etc. For use in D. C. circuits only. Must not be used in A. C. circuits.

Maximum load: 5,000 watts.
Outside dimensions:
7"x6 3/8"x3 1/8"

Price\$10.00

TOBE FILTERETTE No. 11

For 110 volt A. C. motors, generators, chargers, transformers house lighting plants, etc.

Maximum load: 5,000 watts.
Outside dimensions: 7"x6 3/8"x3 1/8"

Price\$10.00

TOBE FILTERETTE No. 20

For 220 volt D. C. motors, generators, chargers, house lighting plants, etc. For use in D. C. circuits only. Must not be used in A. C. circuits. Maximum load 10,000 watts. Outside dimensions 10"x6 3/8"x3 1/8".

Price \$15.00

TOBE FILTERETTE No. 22



For 220 volt A. C. motors, generators, chargers, transformers, house lighting plants, etc. Maximum load 10,000 watts. Outside dimensions 10"x6 3/8"x3 1/8".

Price \$15.00

TOBE FILTERETTE No. 23

For 220 volt 3 phase A. C. 110-220 volt single phase, 3 wire A. C. or 110-220 volt 3 wire D. C. systems. For use in applications similar to the No. 22 where 3 wires are required instead of 2.

Maximum load 15,000 watts.

Outside dimensions

13"x6 3/8"x3 1/8".

Price \$20.00



TOBE FILTERETTE No.55

For 440 or 550 volts A. C. motors, or other electrical apparatus requiring capacitive type filters capable of operation on potentials between 250 and 550 volts A. C. Maximum load 25,000 watts. Outside dimensions 13"x12 3/8"x4 1/8". Price \$25.00.

TOBE FILTERETTE No. 56



For 440 or 550 volts 3 phase A. C. systems. For use in applications similar to the No. 55 where 3 wires are required instead of 2.

Maximum load 30,000 watts.

Outside dimensions

13"x12 3/8"x4 1/8"

Price \$35.00

TOBE FILTERETTE No. 60

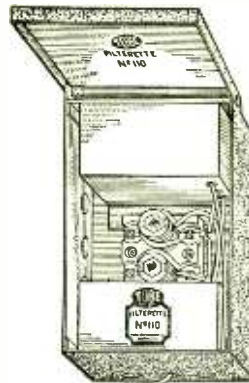
For 600 volt D. C. motors, generators or other electrical apparatus requiring capacitive type filters capable of operation on potentials between 250 and 600 volts D. C. For use in D. C. circuits only. Must not be used in A. C. circuits.

Outside dimensions 13"x12 3/8"x4 1/8"

Maximum load 25,000 watts

Price \$25.00

TOBE FILTERETTE No. 110



For all types of 110 A. C. or D. C. electrical apparatus which require a combined inductive and capacitive type filter. Essential for certain types of refrigerators, oil burners, chargers, electric signs or blinkers, electric heating pads, dental motors, and properly shielded violet ray and diathermy apparatus.

Maximum current
5 amperes

Maximum load 500 watts.

Outside dimensions

10"x6 3/8"x3 1/8"

Price \$15.00

TOBE FILTERETTE No. 221

For all types of 220 volt A. C. or D. C. electrical apparatus which requires a combined inductive and capacitive type filter. For use in applications similar to the No. 110 where a Filterette capable of operating at a higher potential is required.

Maximum current 5 amperes.

Maximum load 1,000 watts.

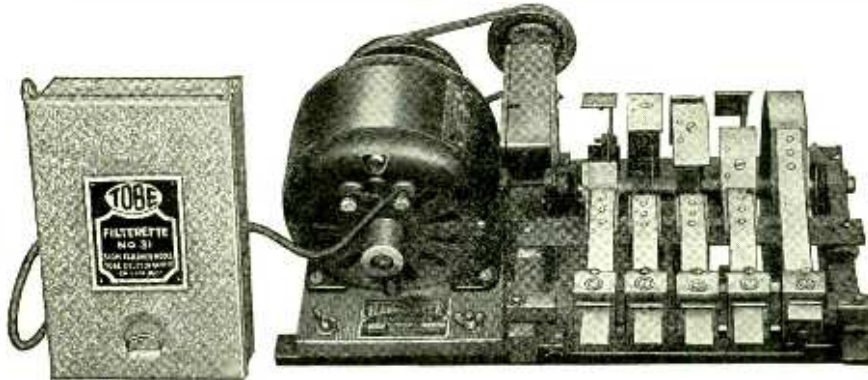
Outside dimensions 13"x9 3/8"x3 1/8"

Price \$20.00

*Thousands are thankful to Tobe for originating these devices.
Man-made static eliminated.*



TOBE FILTERETTE SIGN FLASHER MODELS



No. 131 Sign Flasher Model

Tobe Filterettes in series 131 to 135 are designed for application to 110 volt motor driven sign flashers to suppress radio disturbances set up by the motor and rotary contacts of such flashers. These Filterettes may be used for any application, within the rating of the unit, which requires a combined inductive and capacitive type filter.

No.	Maximum Current	Maximum Load	Outside dimensions	Price
131	10 amperes	1,000 watts	13"x9 3/8"x3 1/8"	\$20.00
132	20 amperes	2,000 watts	13"x9 3/8"x4 1/8"	30.00
133	30 amperes	3,000 watts	19"x12 3/8"x6 1/8"	42.50
134	40 amperes	4,000 watts	19"x12 3/8"x6 1/8"	57.50
135	50 amperes	5,000 watts	19"x12 3/8"x6 1/8"	75.00

SPECIAL TOBE FILTERETTES

TOBE FILTERETTE

RITTER DENTAL TYPE 1 B. P. O. R.

Designed especially for application to Ritter Dental Motors.

Maximum potential: 110 volts A. C. or D. C.

Maximum load: 110 watts

Maximum current: 1 ampere

Price, includes both units,\$15.00



TOBE DIATHERMY FILTERETTES



Designed for use in conjunction with Tobe Hi Frequency Screen for eliminating radio interference created by Diathermy apparatus.

Maximum potential: 110 volts A. C.

Maximum load: 660 watts

Maximum current: 6 amperes

TOBE HI FREQUENCY SCREEN FOR DIATHERMY USE



Specially designed for preventing direct radiation of radio interference created by Diathermy apparatus. Must be used in conjunction with Tobe Hi Frequency Type Filterette.

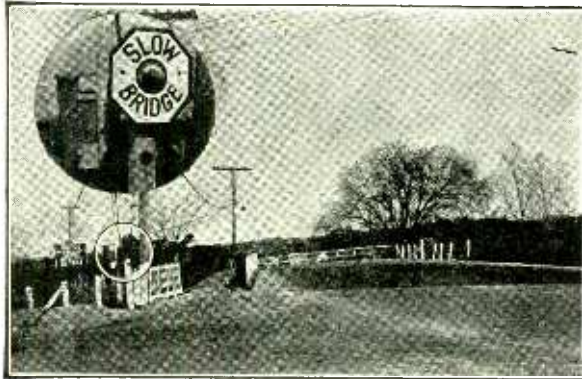
Outside Dimensions: 7'x6'x6'6"
Net price \$75.00

- | | | |
|----------------|--|---------|
| 1 H. F. O. E.: | For Engeln Diathermy apparatus, | \$20.00 |
| 1 H. F. O. V.: | For Victor Diathermy apparatus | \$20.00 |
| 1 H. F. O. A.: | For Acme-International Diathermy Generator | \$20.00 |
| 1 H. F. O. F.: | For Fischer Diathermy apparatus | \$20.00 |
| 1 H. F. O. M.: | For McIntosh Diathermy apparatus | \$20.00 |
- Size of above models 7"x6"x5"

Our engineering Department is at the disposal of all manufacturers, cities and towns on any interference problems.



TOBE FILTERETTES FOR FLASHING TRAFFIC BEACONS



In many suburban districts the flashing beacons, which are installed at danger points, prove a source of radio interference. This interference is usually in the form of a periodic clicking which may be in evidence for a distance of a mile or more from the beacon.

After obtaining the name of the manufacturer of the offending device and obtaining the data as to the current and voltage rating of the switch mechanism, the correct Filterette may be determined by reference to the list below.

Filterettes in weatherproof housings are available for external application to beacons whose construction does not permit the installation of a Filterette within the separate beacon.

All Flasher Filterette ratings are based on continuous current operation.



TOBE FILTERETTE A.G. A. TYPE 1 D. O. A.

Designed especially for application to mercury switch mechanism of the A. G. A. Flashing Traffic Beacon.

Outside Dimensions:
2 $\frac{7}{8}$ "x3"x3 $\frac{1}{2}$ "

Price\$15.00

TOBE FILTERETTE ESSCO TYPE 1 D. O. E.

Designed especially for application to mercury switch mechanism of the Essco Flashing Traffic Beacon.

Outside Dimensions: 4 $\frac{1}{4}$ "x3"x4 $\frac{3}{8}$ "

Price\$15.00

TOBE FILTERETTE ESSCO TYPE 1 W. D. O. E.

This Filterette is similar to Tobe Filterette Essco Type 1 D. O. E. except that it is housed in a weatherproof case.

Price\$20.00

TOBE FILTERETTE A. G. A. TYPE 1 W. D. O. A.

This Filterette is similar to Tobe Filterette A. G. A. Type 1 D. O. A. except that it is housed in a weatherproof case.

Price\$20.00

TOBE FILTERETTE G. E. Type 1 D. O. G.

Designed especially for application to mercury switch mechanism of the G. E. Flashing Traffic Beacon.

Outside Dimensions: 4 $\frac{1}{4}$ "x3"x4 $\frac{3}{8}$ "

Price\$15.00

TOBE FILTERETTE G. E. TYPE 1 W. D. O. G.

This Filterette is similar to the Tobe Filterette G. E. Type 1 D. O. G., except that it is housed in a weatherproof case.

Price\$20.00

TOBE FILTERETTE CROUSE-HINDS TYPE 1 D. O. C.

Designed especially for application to mercury switch mechanism of the Crouse-Hinds Flashing Traffic Beacon.

Outside Dimensions: 4 $\frac{1}{4}$ "x3"x4 $\frac{3}{8}$ "

Price\$15.00

TOBE FILTERETTE CROUSE-HINDS Type 1 W. D. O. C.

This Filterette is similar to Tobe Filterette Crouse-Hinds Type 1 D. O. C. except that it is housed in a weatherproof case.

Price\$20.00

TOBE FILTERETTE TYPE 1 D. 1 B.

Designed especially for application to Betts Flash-O-Lite single circuit mercury switch thermostat-controlled flasher.

Price\$20.00

Filterettes are recommended exclusively by practically all of the radio manufacturers in the interests of better radio reception.

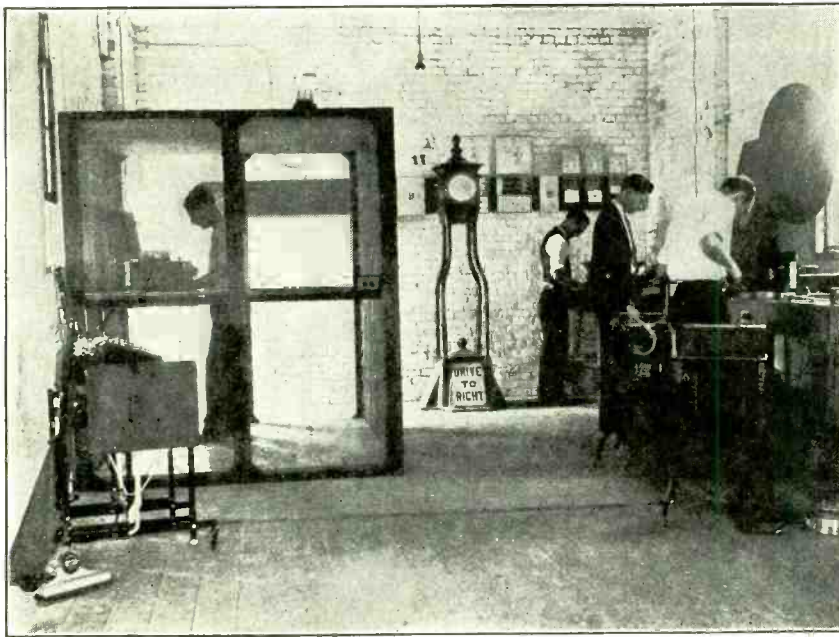


MANUFACTURERS' LABORATORY SERVICE

As authorities on the subject of Radio Interference Elimination, we cannot emphasize too strongly the fact that within a few years no manufacturer will think of issuing under his trade mark an electrical appliance which interferes with radio reception.

Radio is one of the largest industries in the United States. Millions of American homes today boast sets which only a few years ago would have been thought miraculous. And these millions of set-owners are demanding that the ether roads be cleared for maximum reception. It does not seem unreasonable to prophecy that they are going to have their way.

Pick up any magazine today. You will find in the advertisements of certain refrigerator and oil-burner manufacturers



the vacuum cleaner, the three different sign flashers, the dictaphone, the adding machine, the electric fan, and by no means least, the diathermy machine, shown in the screened compartment at the left.

TOBE will gladly examine your products, suggest minor modifications to aid filtering, design and build into your product a sample filterette, and return the whole at no cost to you. Break down your sales resistance with this label.

the reassuring statement, "this apparatus WILL NOT INTERFERE WITH RADIO RECEPTION." Study the statements, on the inside cover of this catalogue, made recently by Edgar H. Felix, of N. E. M. A., and Paul M. Segal and Paul D. P. Spearman of the Federal Radio Commission. The inference is clear. Radio interference must go.

The Tobe Deutschmann Corporation maintains a special laboratory, a section of which is shown above, devoted exclusively to the examination of electrical appliances and apparatus, and the designing of suitable Filterettes therefor. Note, in the illustration, the diversity of apparatus sent in by manufacturers—the dental engine,



WHAT IS A FILTERETTE?

A Filterette is a small plug or steel cabinet, placed on electric apparatus to keep them from giving off electrical disturbances which will be heard in the radio speaker. Some apparatus are like miniature broadcasting stations, but unlike a regular station they broadcast, not on a given wavelength, but all over the dial. This is the reason we can not tune them out by placing some device on the set, but must go to the source of the noise and choke it off there.

The Filterette, once installed, requires no further attention. Many of the models can be instantly attached. It employs combinations of two scientific electrical principles known as inductive or capacitive filtering. It is positively guaranteed to work to your satisfaction or your money will be cheerfully refunded.

QUICK REFERENCE CHART

DEALER: KEEP THIS HANDY; YOU WILL NEED TO REFER TO IT FREQUENTLY.

Model No.	APPLICATIONS FOR FILTERETTE	Maximum Load in Watts	Outside Dimensions	List Price
Junior	An ideal Filter for small motors such as are used for electric fans, hair dryers, barber's clippers, vacuum cleaners, cash registers, etc. Plugs into the line, and it is necessary only to run a small wire from the binding post on the Filterette to any part of the motor frame. Interference is eliminated at once. Maximum potential 110 volts A. C. or D. C.	500		\$ 3.50
Senior P O	For application to household apparatus creating a more intense type of interference than that which may be suppressed by the use of a Filterette Junior. Provided with cord and attachment plug to facilitate connection to the power line. 110 volts A. C. or D. C.	500		\$ 7.50
Senior T O	For application to household apparatus creating a more intense type of interference than that which may be suppressed by use of Filterette Junior. Designed to be connected in the attachment cord of the interference-creating apparatus and provided with screw terminals to facilitate such connection. 110 volts A. C. or D. C.	500		\$ 7.50
110 P O	For application to all types of 110 volt A. C. or D. C. apparatus which require a combined inductive and capacitive Filterette. For application to certain types of refrigerators, battery chargers, electric signs, heating pads, dish washers, barber's clippers, drink mixers, washing machines, and other types of household apparatus. 110 volts A. C. or D. C. Provided with cord and attachment plug to facilitate connection to the power line.	500	5½" x 3½" x 4½"	\$12.50
10	For 110 volt D. C. motors, generators, chargers, house lighting plants, etc. For use in D. C. circuits only. Must not be used in A. C. circuits.	5,000	7" x 6¾" x 3½"	\$10.00
11	For 110 volts A. C. motors, generators, chargers, transformers, house lighting plants, etc.	5,000	7" x 6¾" x 3½"	\$10.00
20	For 220 volt D. C. motors, generators, chargers, house lighting plants, etc. For use in D. C. circuits only. Must not be used in A. C. circuits.	10,000	10" x 6¾" x 3½"	\$15.00
22	For 220 volt A. C. motors, generators, chargers, transformers, house lighting plants, etc.	10,000	10" x 6¾" x 3½"	\$15.00
23	For 220 volt 3 phase A. C., 110-220 volt single phase, 3 wire A. C., or 110-220 volt 3 wire D. C. systems. For use in applications similar to the No. 22 where 3 wires are required instead of 2.	15,000	13" x 6¾" x 3½"	\$20.00
55	For 440 or 550 volt A. C. motors, or other electrical apparatus requiring capacitive type filters capable of operation on potentials between 250 and 550 volts A. C.	25,000	13" x 12¾" x 4½"	\$25.00
56	For 440 or 550 volt 3 phase A. C. systems. For use in applications similar to the No. 55 where 3 wires are required instead of 2.	30,000	13" x 12¾" x 4½"	\$35.00
60	For 600 volt D. C. motors, generators or other electrical apparatus requiring capacitive type filters capable of operation on potentials between 250 and 600 volts D. C. For use in D. C. circuits only. Must not be used in A. C. circuits.	25,000	13" x 12¾" x 4½"	\$25.00
110	Same as 110 P. O. but in cut-out box for connection to building wiring.	500	10" x 6¾" x 3½"	\$15.00
221	For all types of 220 volt A. C. or D. C. electrical apparatus which require a combined inductive and capacitive type filter. For use in applications similar to the No. 110 where a Filterette capable of operating at a higher potential is required.	1,000	13" x 6¾" x 3½"	\$20.00
131	For 110 volt A. C. or D. C. motor driven sign flashers to suppress radio disturbances set up by the motor and rotary contacts of such flashers. May be used for any application, within the rating of the unit, which requires a combined inductive and capacitive type filter.	1,000	13" x 9¾" x 3½"	\$20.00
132		2,000	16" x 10¾" x 4½"	\$30.00
133		3,000	19" x 12¾" x 6½"	\$42.50
134		4,000	19" x 12¾" x 6½"	\$57.50
135		5,000	19" x 12¾" x 6½"	\$75.00
Inverted Converter 140 D. P. O.	For rotary machines converting D. C. to A. C.,—inverted converters.	500	7" x 6" x 3"	\$25.00
Essco 1 D O E	For mercury switch mechanism of Essco Flashing Traffic Beacon. 110 volts A. C. or D. C.	150	4¾" x 3" x 4¾"	\$15.00
Essco 1 W D O E	Similar to Essco 1 D O E but housed in a weatherproof case.	150		\$20.00
A. G. A. 1 D O A	For mercury switch mechanism of A. G. A., Flashing Traffic Beacon.	150	2¾" x 3" x 3½"	\$15.00
A. G. A. 1 W D O A	Similar to A. G. A. 1 D O A but housed in a weatherproof case.	150		\$20.00
Crouse-Hinds 1 D O C	For application to mercury switch mechanism of Crouse-Hinds Flashing Beacon.	150	4¾" x 3" x 4¾"	\$15.00
Crouse-Hinds 1 W D O C	Similar to Crouse-Hinds 1 D O C but housed in a weatherproof case.	150		\$20.00
G. E. 1 D O G	For mercury switch mechanism of G. E. Flashing Traffic Beacon.	150	4¾" x 3" x 4¾"	\$15.00
G. E. 1 W D O G	Similar to G. E. 1 D O G but housed in a weatherproof case.	150		\$20.00
1 D 1 B	Betts Flash-o-Lite—For application to single circuit mercury switch—thermostat—controlled flasher.	150		\$20.00
Ritter Dental 1 B P O R	For application to Ritter Dental Motors. 110 volts A. C. or D. C.	100		\$15.00
1 H F O E	For Engeln Diathermy apparatus with Tobe high frequency screen.	660	7" x 6" x 5"	\$20.00
1 H F O V	For application to Victor Diathermy apparatus in conjunction with Tobe high frequency screen.	660	7" x 6" x 5"	\$20.00
1 H F O A	For application to Acme-International Diathermy Generator in conjunction with Tobe high frequency screen.	660	7" x 6" x 5"	\$20.00
1 H F O F	For application to Fischer Diathermy apparatus in conjunction with Tobe high frequency screen.	660	7" x 6" x 5"	\$20.00
1 H F O M	For application to McIntosh Diathermy apparatus in conjunction with Tobe high frequency screen.	660	7" x 6" x 5"	\$20.00
Hi Frequency Screen	Specially designed for preventing direct radiation of radio interference created by diathermy apparatus. Must be used in conjunction with Tobe Hi Frequency Filterette.		7" x 6" x 6"	\$75.00 Net

ALL STOCK MODELS. IMMEDIATE DELIVERY. SPECIAL, TEN DAYS TO TWO WEEKS ON ORDER. PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

TOBE DEUTSCHMANN CORPORATION
FILTERETTE DIVISION, CANTON, MASS.



TRADE MARK

A Manufacturer can have no greater faith in his products than to guarantee their faithful operation, and with such guarantee Tobe products are sold

1930

In consequence of repeated reports from dealers and service men that they have been unable to obtain immediate delivery of Tobe condensers and replacement blocks—a result, doubtless, of decreasing jobber interest in and failure to stock parts—we are compelled to announce that when this circumstance is reported to us, we shall make shipment direct to you on items covered in this section of our catalog.

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Tobe Deutschmann
Corporation

ENGINEERS, MANUFACTURERS AND IMPORTERS OF TECHNICAL APPARATUS

CANTON, MASS.

Prices subject to change without Notice



TOBE TIPON VACUUM MICA CONDENSER

Everyone knows the advantages of the TOBE Tipon Vacuum Leak, sealed in a high vacuum. Here is a TOBE Mica Condenser of standard grid-leak size, fitting the ordinary grid-leak clip. It contains an accurately calibrated Mica-insulated Condenser element, sealed into a glass tube in a high vacuum, and thus permanently protected from change or deterioration. Easily identified by the sealing tip. Complete with two mounting clips.



0.0002	200	mmf.	.....	40c	0.0005	500	mmf.	.....	40c	0.0015	.....	50c
0.00025	250	mmf.	.....	40c	0.0008	800	mmf.	.....	40c	0.0025	.....	50c
0.0003	300	mmf.	.....	40c	0.001	.....	.....	.....	50c	0.003	.....	60c
0.0004	400	mmf.	.....	40c	0.002	.....	.....	.....	50c	0.004	.....	60c
					0.005	.....	.....	.....	70c	0.006	.....	80c



TOBE TINYTOBE CONDENSERS

TINYTOBE Condensers are made for constant operating voltages up to 1000 volts D. C. They are of extremely small size,—a very valuable feature in use, because of the small space often allowed for by-passing condensers. Moreover, because of their smallness and lightness, they require no support other than that of the wiring to which they are attached.

.00007 Mfd., .0001 Mfd., .00015 Mfd., .00025 Mfd., .0003 Mfd., .0004 Mfd., .0005 Mfd., .0007 Mfd.,	.....	35c each
.001 Mfd., .0015 Mfd., .002 Mfd., .0025 Mfd., .003 Mfd., .004 Mfd.	.....	40c each
.005 Mfd., .006 Mfd., .0075 Mfd., .008 Mfd.,	.....	45c each
.01 Mfd.	.....	55c each
.02 Mfd., .03 Mfd., .04 Mfd., .05 Mfd.	.....	60c each



BY-PASS FILTER CONDENSER

This model of the TOBE By-Pass Filter Condenser superceeds a former type. The case is more compact, easier to mount, and is made of metal instead of Bakelite or compound. This makes it possible to ground the case, something which cannot be done with an insulating material. Dimensions: 2½ inches x ½ x ¾ inches. 300 volts D. C. Type 350 A, .5 Mfd. \$0.90 Type 301 A, 1.0 Mfd. \$1.25 The Official Browning-Drake Set Specifies a 0.5 Mfd. of this rating



BY-PASS CONDENSERS AND FILTER CONDENSER



For BY-PASS work, noiselessness is essential and these condensers are noiseless and unchangeable. They stand extremes of heat and cold without alteration and are distinguished by—

Their ability to stand much higher voltages without breakdown.

A marking on each condenser showing that it is individually tested, with date of test and initials of tester.

Thickness of insulation.

The TOBE By-pass condensers are for use where working voltage does not exceed 200 volts. TOBE Filter Condensers are for use in filter circuits on plate supply units, in B-Eliminators and in power amplifiers where the D. C. working voltages run up to 300 volts. The 4.0 Mfd. is especially adapted for use in output devices where voltage does not exceed 300 volts.

Bi-Pass			Filter		
Types	Sizes	Price	Types	Sizes	Price
210	0.1 Mfd.	\$0.60	310	0.1 Mfd.	\$0.70
225	0.25 Mfd.	.70	325	0.25 Mfd.	0.75
250	0.5 Mfd.	.75	350	0.5 Mfd.	0.90
201	1.0 Mfd.	1.00	301	1.0 Mfd.	1.25
202	2.0 Mfd.	1.75	302	2.0 Mfd.	1.75
204	4.0 Mfd.	3.50	304	4.0 Mfd.	3.50



TOBE 400 LINE

SHORT PATH HIGH-VOLTAGE CONDENSERS



TOBE 400 Condensers are so named because of being designed for continuous operation on 400-volts D. C.

They are of the short-path type, cased in the characteristic silvered metal container, and of compact shape occupying minimum space on the baseboard with strong lugs for attachment.

The terminals are of the unique TOBE type, situated at the base of the can, one above the other, so that the condensers may be arranged in a bank with minimum wiring.

These condensers are made in three sizes:
No. 401 — 1 Mfd. — \$2.00 No. 402 — 2 Mfd. — \$2.75 No. 404 — 4 Mfd. \$4.50
No. 411 — 2 x 0.1 — \$2.00

TOBE 600 LINE

CONDENSERS FOR AMERTRAN AND SIMILAR HIGH VOLTAGE POWER PACKS

This extremely rugged extra-high-voltage condenser is designed for continuous operation without possibility of breakdown in the AmerTran-Power-Pack and similar high-voltage power amplifier units. It is specified by AmerTran for that use.

This condenser will operate up to 1000 volts D. C. It is made in four sizes: 0.5 Mfd., 1 Mfd., 2 Mfd., 4 Mfd. The two smaller sizes are cased in containers 4½ in. high by 2¾ in. overall, including fastening down lugs, and 13-16 in. and 1¾ inches deep, respectively. The two larger sizes are 5 in. high by 5¾ in. wide overall, and 1½ in. and 3 in. deep, respectively.



Containers are finished with the familiar TOBE silvered finish, and terminals.

No. 650 — 0.5 Mfd. — \$2.00 No. 602 — 2.0 Mfd. — \$4.50
No. 601 — 1.0 Mfd. — \$2.50 No. 604 — 4.0 Mfd. — \$7.50

TOBE 1300 LINE HI-VOLTAGE SURGPROOF CONDENSERS



A new type condenser guaranteed to operate at rated voltage and carrying an Iron-Clad Replacement Guarantee. No better condenser available for Hi-Voltage Power Pack work, especially designed for use with two UX-250 Power Tubes in Push-Pull, or the UX-245 Power Tube. The 1300 Line New SurgProof Condenser has safe working voltage of 1300 volts D. C. We recommend these condensers for any high-voltage amplifier. These condensers are not designed for Transmitting.

No. 1301 — 1 Mfd. \$3.50 No. 1302 — 2 Mfd. \$6.00
No. 1304 — 4 Mfd. \$11.00

TOBE 4000 MFD. A-CONDENSER



Within a space of but 5"x5"1½" the Tobe A-Condenser has 4000 microfarads. Its life appears to be indefinitely long when used at 12 volts or under. Its use saves cost of batteries or motor generators and their care.

Connect a Trickle Charger to Condenser and Dynamic Cone Speaker for energizing fields of the latter. Just four wires required.

This condenser retains its original capacity.

Two Tobe A-Condensers are in every Tobe A-Filter.
Tobe A-Condenser, 4000 Mfd. PRICE, \$7.00

TOBE FILTERETTE FOR DYNAMIC SPEAKER

For Low Voltage Dry Disc Rectifier (12 v)

Designed for application to dynamic speakers to suppress the hum set up in the speaker field by the field-energizing current. This annoying hum is entirely eliminated by the smoothing effect of the Filterette. TOBE FILTERETTE TYPE DA

Outside dimensions, 5"x5½"x1½"

D A - 1 2,000 Mfd. Price, \$5.00
D A - 2 4,000 Mfd. Price, \$7.00





B BLOCKS



In the construction of plate supply units and B eliminators proper filter condensers are essential. These must be of correct capacities, capable of withstanding voltages used, and must be adapted for shortest and most direct wiring connections, to avoid chance contacts.

TOBE B Blocks, combining in a single heavy silvered metal case all the filter condenser capacities required for the various types of plate supply units in demand today, fulfill the most stringent requirements of the most exacting builder. Constructed according to R. M. A. specifications, they are moreover exceedingly compact, conveniently arranged for wiring, occupy little space, and are fully guaranteed.

Type No.	Contains Mfds.	Max. Trans. Sec. Volt	Rectifier Type	Application	Price
411	.1-1	350 per anode	B H	Buffer condenser units for use in B. eliminator circuits.	\$ 2.00
611	.1-1	400 per anode	B A	Buffer condenser units for use in B. eliminator circuits.	\$ 2.75
R 171	8-2-2-1-1	300	B H 280	For use in Thordarson or other power packs using the type 171 or 171A power tube. Designed from Manufacturer's specifications, and arranged for simplest and most direct wiring connections.	\$15.00
R 210	2-2-2-4-1-1	650	281	Similar in design to the 171 but contains higher voltage condensers as recommended and specified by Thordarson for use with their R-210 power compact.	\$18.00
245	2-2-2-1-1-1-1-4	500	280 or 281	Designed for use with the new Thordarson 245 power pack or any power pack used as power supply for the new 245 power tubes.	\$20.00
250	2-2-2-4-1-1-1	650	281	For use with types of transformers specified for 250 power tubes notably the Thordarson No. 2098 or similar transformers used in high voltage B. eliminators or power packs.	\$26.00
280	2-4-4-1-1-1-1	325	280	For use with Thordarson transformer for 280 type full wave rectifier.	\$18.00
668	4-4-2-2-1-1	300	280	For Madison-Moore Int. one spot receiver.	\$15.00
760	8-2-2-1-1	300	B H or 280	Designed especially for Raytheon Tube type B H. Shape reduces floor space required on baseboard. Terminals are brought out on the bakelite binding post strip at the bottom of the block, for shortest, most direct wiring connections, and to reduce danger of chance contacts. Individually packed in decorative cartons.	\$13.00
760 G	6-2-2-1-1-1	300	280	For use with Glow tube.	\$10.50
761	8-2-2	300	280	Filter circuits of "B" Eliminators.	\$ 9.50
764	4-4-4-1-1	300	280	Filter circuits of "B" Eliminators.	\$11.00



**TOBE UNCASED SURG-PROOF CONDENSERS
FOR GENERAL REPAIR AND POWER-PACK WORK**

We are prepared to furnish immediate delivery on Surg-proof Condensers without metal casings, for general service and repair work.

These Condensers are of Surg-proof type, all unconditionally guaranteed to operate for a period of one year without breakdown, when used according to directions. These Condensers are not to be used on A. C., but for pulsating D. C. or straight D. C. work. They are self-healing, in that should a surge take place, the condenser will not be damaged.

The Condensers are constructed in 1 and 2 microfarad units with the following ratings. They **WILL NOT** break down.

Service men, set builders and general repair shops will find these Surg-proof Condensers ideal.

Type No.	Capacity	Voltage	Size	
331	1 Mfd.	300 v.	4x1½ x ¾ inches	\$.75
332	2 Mfd.	300 v.	4x2 x ½ inches	1.45
441	1 Mfd.	400 v.	4x1¾ x ½ inches	1.10
442	2 Mfd.	400 v.	4x2¼ x ¾ inches	2.15
661	1 Mfd.	600 v.	4x2 x ⅝ inches	1.45
1101	1 Mfd.	1000 v.	4x2 x ⅞ inches	1.75
1331	1 Mfd.	1300 v.	4x2 x 1⅛ inches	2.25

TOBE MAJESTIC A and B ELIMINATOR REPLACEMENT CONDENSER BLOCKS



For "A" Outside dimensions 7½"x3"x4 1-16" Price \$10.00

For "B" Outside dimensions 5¾"x2⅝"x4",

4-4-2-1-1-1-1-1 mfd. Master or super

Models, Price, \$10.00

Dry high-capacity condensers fully guaranteed for one year.



TOBE REPLACEMENT CONDENSERS

For "A-B-C" power packs using 171 and 280 tubes. Designed for use in Majestic, Mohawk, Sonora, Zenith electric sets. Outside dimensions, 4⅞"x1¾"x6¾". Mounted in heavy cardboard container suitable for insertion in standard metal container used in the above sets. Condensers are of "Surg-proof" type with the usual "Tobe" guarantee—for one year.

Each, \$12.00

High capacity Dry condensers, 4000 mfd. effective capacity for replacement in "A" Eliminator units. Outside dimensions 4¼"x5"x1¼". Two of these condensers are generally required in a standard "A" Eliminator. Each, \$5.00

TOBE VACUUM TIPON LEAKS and 2 WATT VERITAS RESISTORS



1,000, 5,000, 10,000, 20,000, 25,000, 50,000 ohms, \$.75
100,000, 250,000, 500,000 ohms, 1 to 10 Megs. each, \$.50

5 WATT (VERITAS ONLY)
FITS ALL STANDARD MOUNTS

1,000, 2,000, 2,500, 3,000, 5,000, 7,500, 10,000 ohms .. \$1.10 100,000 ohms \$.80
50,000 ohms90 ¼, ½ and 1 Meg. (Long Type) .. .80

10 WATT (VERITAS ONLY)

PRICES
500, 1,000, 2,000, 2,500, 3,000, 5,000, 7,500 .. \$1.25
10,000 ohms 1.25 250,000 ohms \$1.00
50,000 ohms 1.10 The ¼, ½ and 1 megohm 10 watt TOBE
100,000 ohms 1.10 Veritas Resistors lists for \$1.00

Non-Inductive—Short Path—Non-Capacitive



TRANSMITTING CONDENSERS

With every transmitting condenser is enclosed a Tobe guarantee which reads as follows: "This unit is guaranteed for one year if operated at voltage not in excess of that marked on the case." This Tobe replacement guarantee is unique, and one which we believe no other Condenser Manufacturer makes, placing Tobe users on their honor not to abuse this unusual privilege.

New 1000 Volt and 2000 Volt Transmitting Condensers

The entire line of Transmitting Condensers has been radically altered and highly improved in the redesigning. These condensers are now assembled with interchangeable sections, each section sealed in an individual container so as to allow ample heat radiation and complete protection from moisture. With this new construction there is absolutely no danger of breakdown occurring between the container and the condensers.



The cover of the metal container is easily removable so that if for any reason it is necessary to replace one of the sections this can be done readily.

Each transmitting condenser is tested and labelled with date of test and initials of tester. Capacities are guaranteed within 10% of ratings.

1000 volt condensers are constructed with substantial brass terminals protected with large porcelain insulators. The interchangeable sections are of one microfarad capacity each. Each condenser is encased in a heavy silvered finish metal cabinet.

It is the ideal condenser for transmitting plate-supply use.

They are made with the same care and scrupulous attention to detail as the Tobe By-pass Filter and high-voltage power-pack type condensers.

Tobe 2000 volt condensers are similar in design but of heavier construction, necessarily, than the 1000 volt line. The best material and finest workmanship go to make up each 2000 volt transmitting condenser.



Substantial brass terminals protected with large porcelain insulators are used for safe and easy connections. The interchangeable sections are of one-half microfarad capacity each.

The safety factor of each condenser is far greater than will be required by the amateur, being tested at several times its rated voltage.

Each condenser is encased in a heavy-silvered metal cabinet. The No. 2250 model now weighs 23 pounds instead of 17 lbs., as formerly. The dimensions have been increased to $5\frac{1}{2}$ "x $18\frac{3}{4}$ "x8". The dimensions of No. 2220 are $7\frac{3}{8}$ "x $6\frac{5}{8}$ "x $5\frac{5}{8}$ "; of No. 2210 are $3\frac{7}{8}$ "x $6\frac{5}{8}$ "x $5\frac{5}{8}$ ".

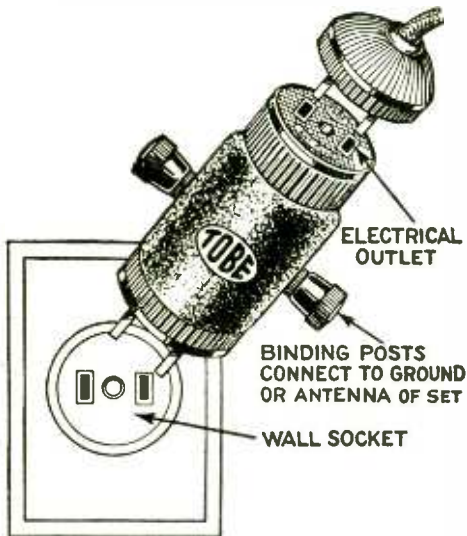
This is the ideal transmitting condenser where higher voltages are used.

Type	Capacity mfd.	Voltage	Price
1110	1.0	1,000	\$ 7.50
1120	2.0	1,000	14.00
1150	5.0	1,000	35.00
2210	1.0	2,000	10.00
2220	2.0	2,000	18.00
2250	5.0	2,000	45.00
*3310	1.0	3,000	15.00
*3320	2.0	3,000	27.00

*Made up to special order—two weeks delivery.



TOBE 4-PURPOSE LIGHT SOCKET AERIAL



COMBINES

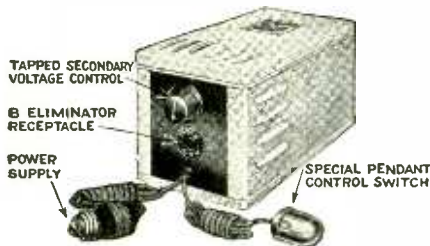
4 Radio Conveniences
in one small unit at a negligible cost

1. A perfect indoor antenna, reducing static pick-up and giving clear, pure tone reception, or—
2. A convenient and efficient ground without troublesome water pipe connections or long wires, and—
3. A power socket outlet which may be used for operating set, B eliminator, power pack, charger or any electrical apparatus, and—
4. A lightning arrester, protecting the set from all high potential atmospheric discharges.

The most convenient of all radio antenna developments. TOBE SOCKET AERIAL is sold with a free ten-day trial and a two-year guarantee.

TOBE SOCKET AERIAL PRICE \$1.50

TOBE A-SUPPLY MODEL 27



TOBE A-SUPPLY is a complete DRY A Eliminator of 2½ amperes capacity enclosed in a silvered satin finished metal case measuring 10" high and 5" wide.

This unit is designed to work on 110-120 volts and 50-60 cycles and will easily accommodate any 8 tube set with current to spare.

A contract card is furnished with each unit which when filled out and returned at time of purchase is your premium for a fully guaranteed A-SUPPLY.

Fobe A-Supply Price, \$24.75

TOBE TOBE A-FILTER



Consists of two TOBE A-Condensers over 4000 Mfd. each, with two large chokes—properly connected, so that when the proper rectifier is used on one pair of binding posts, the other pair may be connected direct to A-plus and A-minus on the set, through a 2-ohm heavy duty rheostat. Max. current-carrying capacity, 2½ amperes.

Attach a TOBE A-Filter to any good two ampere charger to make a complete A-Eliminator, or make a complete A-Supply by combining a TOBE A-Filter with a TOBE TransAformer. Just remove the cover of the TOBE A-Filter and slip a TOBE TransAformer in its place, connect two wires, plug into the house supply and you have a complete A Eliminator.

Tobe A-Filter, 2½ amperes capacity, 8,000 Mfd. Dry condensers Price, \$18.00

Tobe TransAformer, complete 2½ ampere, battery charger, Price, \$15.00

TOBE Filterette

STOPS RADIO NOISES

"Whether the device causes interference through lack of "choke" or "filter" attachments or through improper design, the cure for the interference lies in the education of the manufacturer. Many brands of devices have become specifically known as interference producers and this reputation is compelling manufacturers to improve their construction.. Already a large number of such appliances carry the guarantee of the maker that they will not produce interference with radio reception. The importance of the work along this line of trades associations has been tremendous and the time will soon arrive when this type of interference will no longer exist." From "State and Municipal Regulation of Radio Communication" by Paul M. Segal and Paul D. P. Spearman of the Legal Division Federal Radio Commission. "There is a real field for engineering effort in eliminating interference by household equipment such as electric fans, oil burners, cash registers, electric refrigerators, vacuum cleaners, and violet ray machines. All of these must be designed with elimination of radio interference in mind." From statement by Edgar H. Felix, Radio Consultant of National Electrical Manufacturers' Association.

The best equipment, the finest set is useless if it has to compete against "Man-made static." The finer the set—the worse the interference.

In Filterettes the Tobe Deutschmann Corporation offer an accurate insurance against Radio Interference. These preventive devices are accurately calculated, specifically designed and conveniently put up to do their work with a maximum of efficiency.

Tobe engineers through years of experiment devise the most efficient Filterette for specified installations. Whether it be an oil burner, a sign-flasher, a cash register, an inverted converter or a motor, the designated filterette is guaranteed absolutely to work to your satisfaction.

Filterettes are helping dealers to make sales by cleaning up entire neighborhoods formerly blanketed by needless interference. In the unnumbered instances where radio interference is the deciding factor in the sale, the installation of a Filterette will clinch the contract, as well as adding, in itself, an additional sale..

The Tobe Deutschmann Corporation has already devised individual filterettes for well-known trade-marked pieces of electrical apparatus. Why not let us build a sample filterette into your product returning the whole at no charge to you?



The Tobe Deutschmann Corporation strongly urges the cooperation, in this vital problem, of all those who have the best interests of radio at heart, whether manufacturer, jobber, dealer or listener.

To those interested we will be glad to send a copy of the eight page catalogue telling all about filterettes. We publish also, from time to time, special bulletins on the latest developments in interference elimination, as well as information on this subject, for the guidance of clubs, legal bodies, municipal authorities, etc. There is no charge for this service. Let us tell you more about this vital subject.



TOBE DEUTSCHMANN CORPORATION
FILTERETTE DIVISION, CANTON, MASS.

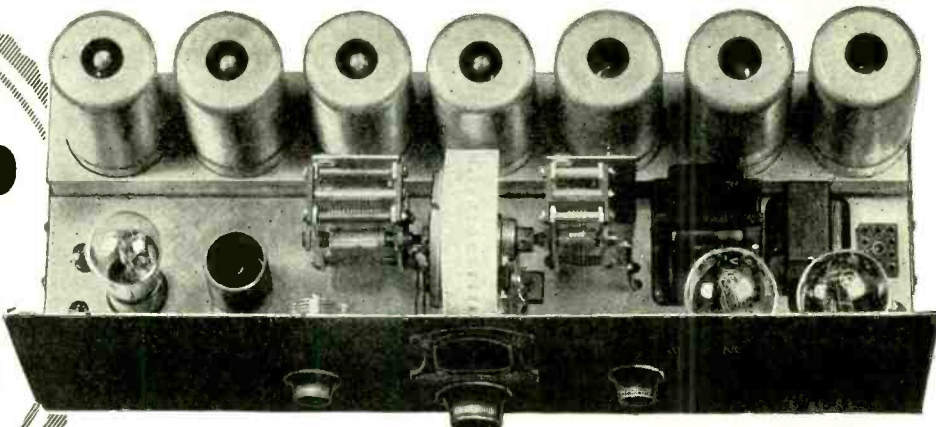
COMPLETE FILTERETTE CATALOG SENT ON REQUEST

Pioneers in Eliminating Radio Interference of Every Description

THE NEW H·F·L·MASTERTONE

11 Tubes A·C· SCREEN-GRID Receiver

Humless, Noiseless, Efficient Operation. A receiver that Incorporates Every Advanced Engineering Practice, Magnificent Tone, Tremendous Power Volume.



Completely Built, Wired and Assembled by H·F·L Engineers Shipped Ready to Operate

What Amazing Power

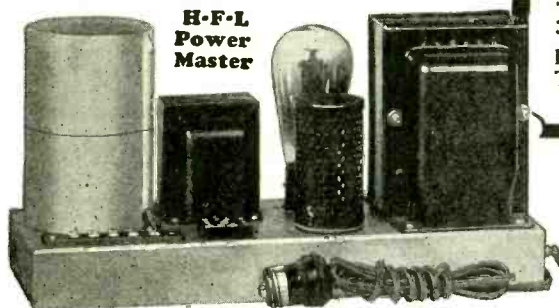
Amplification system built around the new AC Screen Grid tubes is especially adapted to intermediate frequency stages of superheterodyne receiver. No oscillation. Employs 5 screen grid tubes, the fifth being the detector, upon the plate of which is impressed 175 volts. This new system of power screen detection prevents overloading even at maximum volume.

Such Keen Sensitivity

Unlike any ever known, embracing every station, however weak or distant. Requires only wire screen or metal plate in cabinet for aerial to obtain coast to coast reception. Outside antenna may be used where louder signals or greater distances are desired.

Highly Developed Circuit

The intermediate employs four screen grid tubes with five tuned filter circuits, each one adjustable to peak of frequency to which they are tuned, assuring positive 10 kilocycle selectivity and defined clarity. The highly amplified signal is fed into the screen grid power detector, thence to the audio system. Most highly engineered receiver ever built.



H·F·L Power Master

Postal or letter brings Complete Description and Price

Write Today for Proposition

Greatest of all RECEIVERS!

11 tubes operating at peak efficiency (5-224, 3-227, 2-245, 1-280) Single Dial Positive One-Spot Tuning

Efficient, Humless AC Operation Uses 5 Screen Grid Tubes, 5 Tuned R. F. Circuits

Fits practically all models of Consoles. Panel 7x21 inches. Depth, Chassis 7½ inches

High Power Screen Grid Detector, with 175 Volts Impressed on Plate Automatic Line Voltage Control Inbuilt Holds Voltage Against Fluctuation

100-Volt FC Dynamic Field Supply Incorporated

All Metal Chassis — Completely Shielded Units

3-Stage Phonographic Amplifier

Finest Quality, Precision Made Parts: Thordarson, Carter, Mershon, etc.

The New Audio System

Uniformity of amplification over entire musical scale is an outstanding achievement of Mastertone engineers. Absolutely free from hum. The first audio stage is followed by 245 tubes in push-pull arrangement. High plate voltage for these tubes is fed thru center tap push-pull impedance, permitting use of any type speaker. No actual B voltage feeds thru speaker. Operates with same efficiency with dynamic, magnetic or horn speakers.

Phonograph Reproductions and Other Mastertone Features

Plug-in jack for instant attachment of electric phonograph pick-up. Three stages of audio system employed for this purpose. Entire receiver sturdily constructed of heavy cadmium plated steel and copper. All stages and tubes are shielded. Condensers, coils and wiring completely enclosed. Front panel is 7 x 21 inches. Depth of chassis, 7½ inches.

H·F·L Power Master

Designed to accommodate either AC or DC Dynamic. It is a specially developed unit of the Mastertone receiver built separately to simplify installation. Has large, oversized transformer. Filter system is equipped with a heavy choke and the new self healing type Mershon Condensers of 24 Microfarads capacity. Full wave type 280 rectifier tube. Automatic line ballast and regulator levels out all fluctuations in line voltage from 95 to 130 volts. Unit may be switched out if not desired.

A revolutionary achievement that sets up new standards of performance. After two years of painstaking research work and tests, the ultimate in receivers has been achieved—the H·F·L Mastertone—a receiver that awes and thrills with its great power, its sweetness of tone—each unit performing in its function with unflinching accuracy and precision.

Custom Built But Low in Price

Every Mastertone Receiver is built by hand in our own laboratories. This necessarily limits its production, yet the price is surprisingly low. Quality — not quantity — is our standard. We guarantee the Mastertone to be perfect in workmanship and materials, and to fulfill the claims we make for it. One demonstration will be proof conclusive that we have rightfully named it—MASTERTONE.

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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

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LICENSED UNDER LEKTOPHONE PATENTS

for Short Wave SUCCESS

There's no bunk about tuning in GSSW of England, P.C.J. of Holland, and other overseas stations, right in your own neighborhood, day in and day out. Many radio fans are doing it, but—
Many have tried and failed. Perhaps you have. Why? The cause may be traced to crude regeneration control. Those weak, overseas signals thrive in the threshold oscillation zone—that point in regeneration just before the detector "spills over." Unless your regeneration slides gradually into oscillation, with a soft hiss and a gentle "plop," you won't get real distance in short-wave work. Irrespective of what short-wave set you are using, it can be improved by means of the

CLAROSTAT

The micrometric resistance for every resistance requirement—micrometric regeneration, proper plate voltages, accurate grid bias, volume control, sensitivity control, and so on. WRITE for data regarding the complete CLAROSTAT line and how to apply same for better radio results.

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The Most Complete Line of
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If Screen Grid Put the Kibosh

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Set Analyzer

send it to us and we will remodel it. With your present Analyzer you are helpless to test the new screen-grid tubes or sets—and the Jewell factory advises that no adapter is made that will remedy the condition. It's a case of buying a new Set Analyzer or sending to the factory for a change-over costing you \$22.50 plus transportation—or you can

Let Us Make the
Changeover for \$13.50

including all parts, labor, accessories and complete instruction for the operation of the remodeled Set Analyzer. Your tester will be

RETURNED IN 10 DAYS

Send it in now while the season is slack and be ready for fall business.

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Usable on Screen-Grid Sets
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1500 Illustrations, 6000 articles

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Co. ships orders promptly—offers you 100% quality merchandise on a strict money-back basis.

Our catalog contains the largest assortment of completely assembled all-electric AC Receivers at amazingly low prices, and other Radio Merchandise, including such lines as Pilot—Silver—Marshall—Carter—Aero—Yaxley—Tobe—Hammarlund—Amer Tran—Cunningham—Dongan—Thorlanson—Vuter, etc., etc. The latest improvements in Radio are listed and thoroughly described in this great catalog: AC All-Electric Sets with self-contained ABC power supply—Public Address Amplifier systems—AC Set Converters—A and B eliminators—Dynamic Speakers and Units—Magnetic Speaker Chasses—250 Tube Amplifiers—Airplane Cloth Speakers—Push-Pull Power Amplifiers—Electric Phonograph Turn-Tables—Combination Radio and Electric Phonograph Consoles—Speaker Tables—Short Wave Sets and Adapters—Shield Grid Tube Kits—Television Parts—Electric Household Appliances, Vibrators, Tools, Workshops—Cameras, etc., etc. Logically, how can you afford to be without our catalog? Send for one now!

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PYREX Radio Insulators are made from a special glass embodying exceptional electrical resistance, mechanical strength and chemical stability. Initially they are a strong barrier against leakage and eddy losses, and remain so because unimpaired by exposure to rain, fog, soot, dirt and industrial fumes.

If you want the best transmission or improved reception and one thing less on the trouble list, *equip your antenna and lines with PYREX Insulators.* The insulating qualities, the mechanical strength, the super-hard smooth time-and-element-resisting surface, and the resistance to destruction originate in the molten glass and are imperishable.

Correct antenna, strain, entering, stand-off, pillar and bus bar types are easily chosen from our booklet "PYREX Radio Insulators."

Write to us for a free copy of the booklet and get PYREX Insulators from your supply house

CORNING GLASS WORKS, Dept. 65
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Special Test Equipment



for use in the service laboratory is soon to be announced. This will include an oscillator for measuring the over-all response characteristic of a receiver for the entire broadcast band.

Write for Bulletin R-1

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Radio servicing offers the biggest opportunity for the man interested in radio. About 10,000,000 receivers need service some time or other, many are naturally inefficient and can be improved on.

The Radio Doctors, Inc., is the only institution teaching exclusively radio repairs, having specialized on this phase of radio for a number of years.

\$3,000 to \$5,000 per year

The professional "Radio Doctor" receives \$2.00 or \$3.00 per visit and is welcomed in the best of homes—may I tell you more about this new, fascinating and extremely profitable business? Write now for free booklet, "Why the Radio Doctor." (Early inquiries will receive a blueprint of a recent well-known manufactured superheterodyne.)



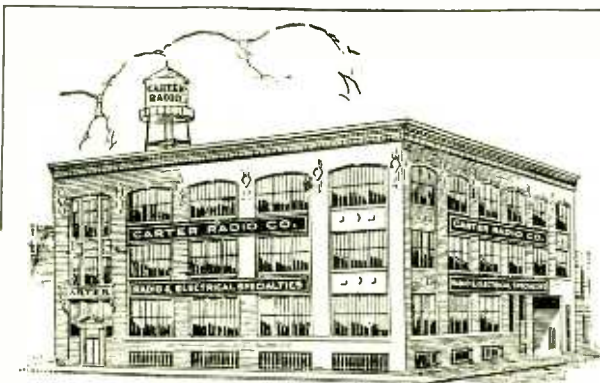
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AN invitation is extended to everyone to visit us in our new location at 407-415 South Aberdeen Street, Chicago, Illinois. Here with the largest factory in the world, devoted to the manufacturing of radio parts exclusively and the installation of the most modern labor-saving devices and production methods, we will be able to give you better service than in the past. Watch for important announcements by CARTER in the near future.

CARTER

Radio Company

Telephone MONROE 1780

Now at 407-415 South Aberdeen St., Chicago

PLATE BYPASS CONDENSER

(Continued from Page 26)

the r-f current *divides* between it and the tickler, so that it must be *decreased* to increase regeneration (Fig. 2).

We have now three condensers in parallel: C_1 , this regeneration condenser; C_2 , the "bypass" condenser; and C_3 , a fixed "stopping" condenser to prevent a short-circuit of the *B* battery through the tickler. As a matter of fact, it is probable that C_2 will not always now be needed, but it is shown to make the comparison of the two figures easier.

As we decrease the capacity of the regeneration condenser and thus favor the high notes (by decreasing the total sum capacity of the three), we are simultaneously increasing the regeneration, and thus favoring the *low* notes; and, by a suitable choice of the size of the tickler coil and its distance from the grid coil, these two effects can be made to cancel each other. Better still, the effect of the increased total capacity favoring the low notes can be made to balance the *two* effects that favor the high ones (the effect of the decreased regeneration and the effect of the increased volume on the ear).

The exact values depend entirely on the rest of the set; on the selectivity of the r-f side (cutting down the high notes), and above all on the characteristics of the a-f amplifier. But the principle holds good in every case; try to get balance, but at any rate don't have a balance that is hopelessly upset by every change of one of the commonest adjustments.

So far we have been dealing with the "standard" detector. If, however, we consider the "power" detector (anode-bend), we find an entirely new set of conditions, however similar the circuit may appear as regards our "bypass" condenser.

This condenser is now an absolutely vital part of the detector itself, and the larger it is, the better is the detection. (This is of course putting it very crudely—much work has been done on the subject lately, especially in England; there is a very curious effect involved, the reduction of the damping of the *grid* circuit of the detector. See, for example, the London "Wireless World" of May 22, 1929.)

On the other hand, if it is made too large the high notes will suffer.

It seems probable that a *total* value (i. e., the sum of C_1 , C_2 and C_3 if used) of about .0002 to .0003 microfarads is a workable compromise; .0005 is probably too large, unless we want to cut the high notes down (e.g., if our audio amplifier favors them).

The important point to notice here is that this condenser is needed here, even if there is no regeneration what-

(Continued on Page 90)

FREE RADIO GUIDE

SEND FOR IT

This book tells about newest startling developments. How to take advantage of the new wrinkles in radio, television, short wave, etc. Pictures and descriptions of thousands of new ideas. Shows new A-C Screen Grid tube and other sets, kits, parts, accessories and supplies at wholesale prices. Shows you how to save money on these and many home necessities besides. New edition now ready. Send for it today—NOW!



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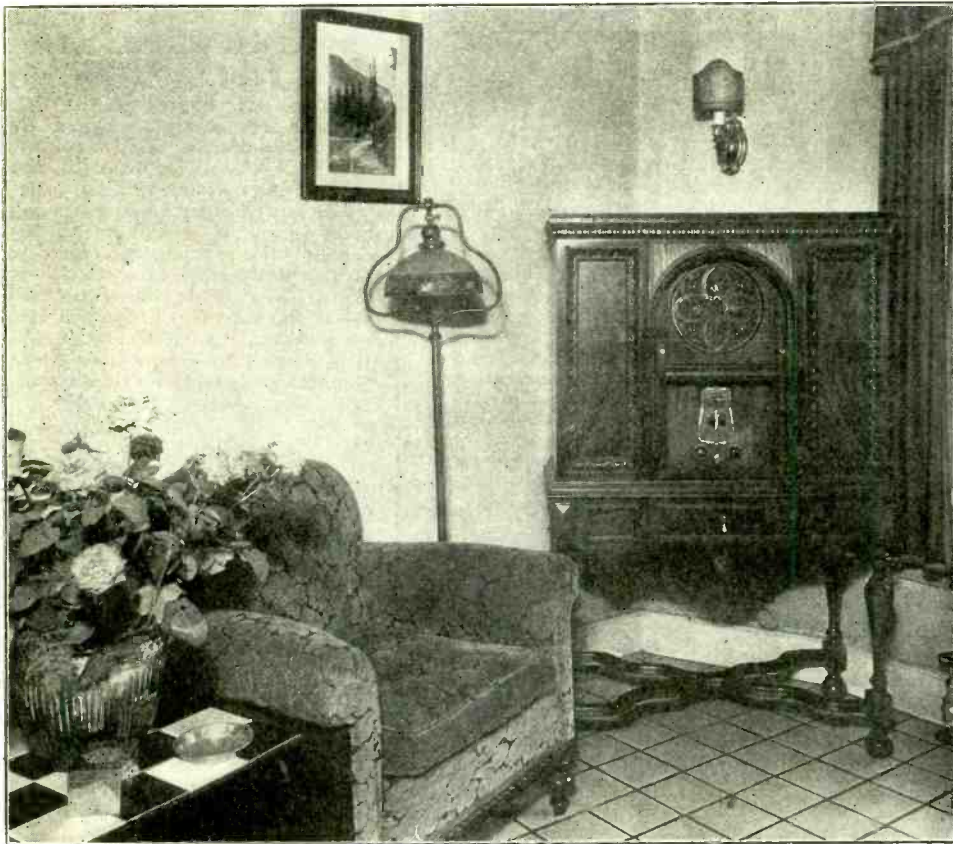
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Shows how to make new design short-wave receivers and short-wave adapters. How to use the new screen-grid tube in D. C. and A. C. circuits. How to make short waves get long distance. Latest information on all new radio developments. It's free. Send for copy today.

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ALTOONA, PA., U. S. A.

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Speaker
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Push-Pull 2-250
Tubes
Single (Split)
Dial
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All
LEUTZ
QUALITY

SEVEN SEAS

Tell them you saw it in RADIO



CONTROLS THE TRAFFIC THRU YOUR TUBES

Like the corner cop directing traffic, AMPERITE controls tube voltage. Self-adjusting, dependable, accurate. A type for every tube—A. C. or D. C. \$1.10 with mounting (in U. S. A.) at all dealers.

This symbol in a radio diagram means—

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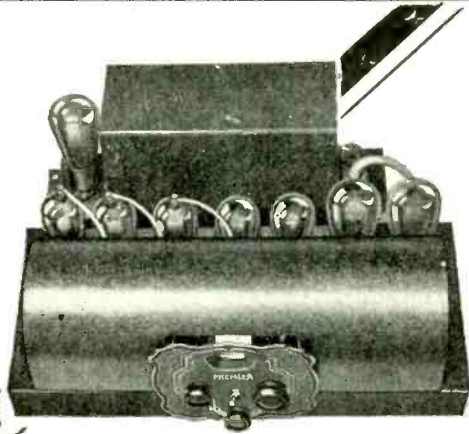
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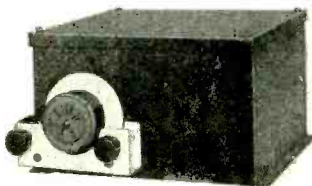
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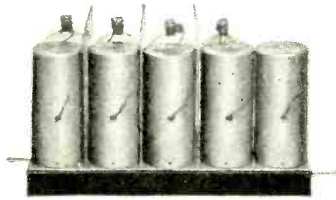
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SCREEN-GRID COMPONENTS



Exterior view of Screen-Grid Tuner Component, using five-gang condenser, three screen-grid tubes in the R-F and a screen-grid power detector. Illuminated single dial control.



Interior view of Screen-Grid Tuner Component. Total shielding. Massive construction. Beautiful workmanship. This Screen-Grid Component is the very last in 1929-1930 radio.

SPECIAL CONSOLE FOR THESE COMPONENTS

We will have a special console cabinet ready with ELECTRO-DYNAMIC SPEAKER—and these REMLER COMPONENTS—all assembled for you and ready for operation. Price for the entire job—console, components, electro-dynamic speaker, \$160.00, list (less tubes). We will be glad to give complete details by mail.

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THE ENTIRELY NEW AMPLIFIER using two tubes in parallel in first stage and push-pull '45's in second stage. TONE—lifelike—an entirely new conception of reproduction. Extra heavy duty condensers and power unit.

\$80.00
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For Both
Components

AT THIS price there is nothing on the market of equal value. The screen-grid component AND the husky push-pull '45 amplifier with parallel tubes in first audio stage. BOTH COMPONENTS for \$80.00 list.

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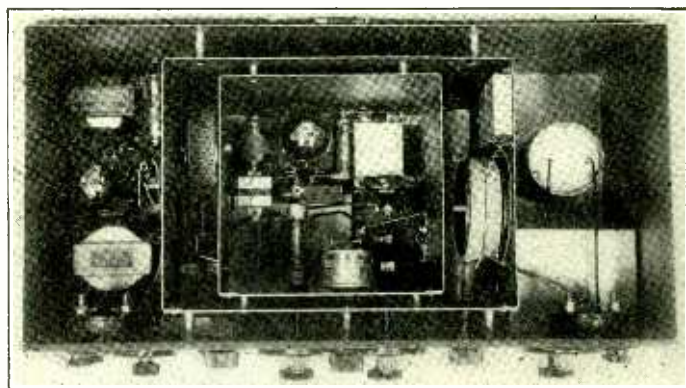
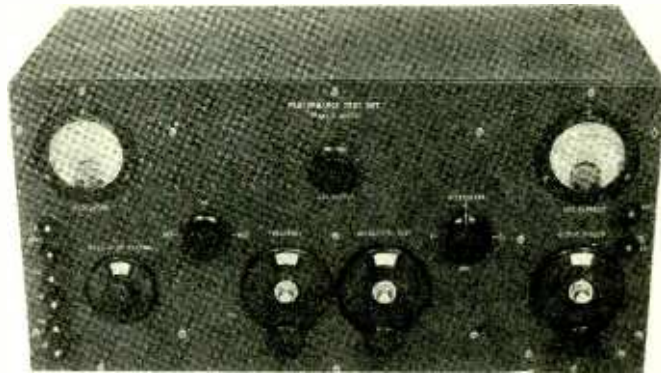
Oakland, Calif.

Supplying the Wants of Dealers and Custom Builders

How Receiver Performance Is Tested

A description of the author's equipment which is used to determine "Inside Facts About Factory-Built Receivers."

By FRANK C. JONES



Panel and Rear Views of Performance Test Set

MANY claims are made about perfect radio receiving sets, but seldom are the facts published about their actual performance. Discounting the fairy tales about perfect reproduction, many people are interested in what a new model should be capable of in the way of selectivity and sensitivity. The problem of measuring these characteristics as well as the fidelity of reproduction is indeed difficult.

The performance test set shown here-with has proven to be accurate when used properly. The equipment used in conjunction with this set consists of a variable audio frequency oscillator, terminating resistances, vacuum tube voltmeters and a microphone with associated amplifiers. A mutual conductance tube tester is also used for checking a-c tubes used in any receiver in order that tube characteristic variation would be minimized.

The sensitivity may vary from 10 to 20 per cent with ordinary "good" vacuum tubes so it is necessary to use

identical tubes in every receiver to be tested. By identical tubes is meant that the mutual conductance should always be some certain value for each type of tube used.

Special shielding is used in the performance test set since the output values of voltage are usually in terms of microvolts, while the r-f oscillator's output is in terms of volts. Triple shielding is used for the r-f oscillator and everything is carefully filtered before leaving the second shielding compartment. The whole unit is shielded and all controls brought out on insulated shafts. The r-f ground currents are confined to their local circuits, rather than allowed to pass through the heavy copper shields.

The r-f oscillator itself consists of the familiar Hartley circuit in which a small voltage is utilized for the output. This voltage is obtained by passing the LC circuit r-f current through a section of the resistance attenuator.

This circuit arrangement was chosen because an r-f oscillator normally gives

less power output as the tuning condenser is increased in value. However, the current tends to increase, the larger the capacity within limits. The two effects are such as to give somewhat uniform current through the thermocouple and resistance attenuator over the range of the oscillator.

The thermocouple was taken out of a 115-milliamper thermogalvanometer and isolated from it by means of two r-f chokes. These chokes were wound with quite heavy wire so as to have a very low d-c resistance. The thermocouple was mounted inside of the r-f oscillator can, the chokes in the next compartment, and the galvanometer in the front panel. This panel was made of heavy aluminum.

In series with the r-f tuning inductance is a variometer arrangement consisting of a few turns of wire on a rotor. This varies the inductance of the whole coil slightly for purposes of selectivity tests. A variation in inductance was chosen since it tends to

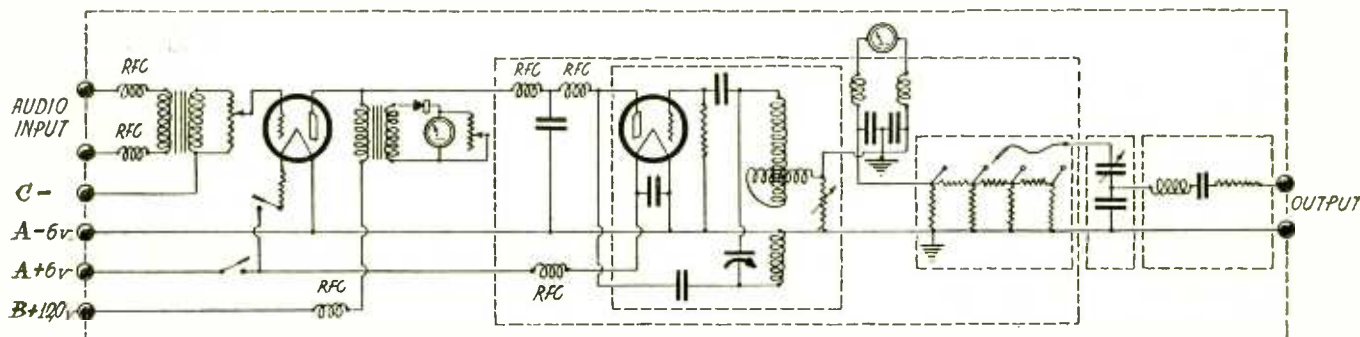


Fig. 1. Circuit Diagram of Performance Test Set

Entirely new principle . . .

The I. C. A. Electro-static shielded Lightning Arrester affords complete protection plus a definite reduction of static

\$1.00 List Price Makes It a Big Seller

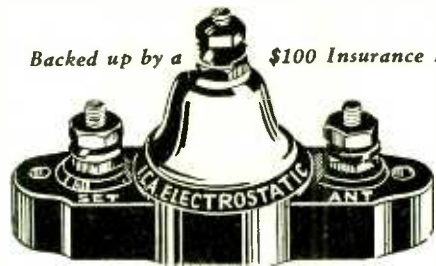
The I. C. A. Electro-static is the last word in lightning arresters for safety, static reduction and improvement of radio reception. It is a scientific instrument in every sense of the word, incorporating the silicate carbon high resistance principle, plus a special choke and condenser filter system and a bypass shield that shields the set from the usual electro-static field set-up between the aerial and ground connections.

The I. C. A. Electro-static is handsome in appearance—black porcelain with heavily nickelplated hardware. It looks like a big dollar's worth—and it is.

\$1.50
List Price



Backed up by a \$100 Insurance Bond



RESISTOVOLT STILL GOING STRONG



Resistovolt is breaking even last year's record for big sales and will be increasingly in demand during the 1929 and 1930 season.

Besides protecting regular A-C tubes from blowouts caused by line surges and overloading, Resistovolt gives equal protection to the new 224 Screen-Grid Tubes.

No installation can be considered complete without the Resistovolt to eliminate the hazard and expense of tube blowouts. List price \$1.75. Also available combined with light socket aerial—Antenna-volt. List price \$2.25.

Beauty and Efficiency Created a Quick Demand for This New Station Selector and Static Reducer

The Selectuner is a new principle station selector and static reducer that in nearly every case greatly enhances the radio reception of any type of set. It cuts out unwanted stations over the whole wave band, gets better distance, reduces static and enhances tone quality.

And from the dealer's point of view, the good looks and low price of Selectuner make it a very popular item.

Insuline Corporation of America

78-80 Cortlandt Street

New York, N. Y.

Makers of Resistovolt and Filtevolt

give nearly a straight line calibration over the whole broadcast band. A midjet variable condenser would have many times as much effect at the high end as at the low frequency end of the broadcast band; this would be unsatisfactory.

The r-f resistance attenuator is perhaps the most important piece of equip-

ment since it may give the most trouble. This attenuator was made so that the impedance at any point of connection is 5 ohms. This low value of shunt resistance allows the use of fairly low values of series elements. This minimizes the inductive and capacitive effects of the windings and of the special switch. The windings were made with

the criss-cross non-inductive type of winding, using insulated resistance wire as small as No. 40. These windings were made on a long thin strip of bakelite with taps projecting up to make contact with a special switch. This switch has four brushes spaced 90 degrees along a 7-in. shaft. The capacity effects are practically negligible and the whole assembly is mounted in a brass tube. The shaft is extended out so as to be controlled by a knob on the front panel.

The resistance attenuator was designed to give one-tenth steps. For example, if the input was 50 milliamperes, the input voltage would be 0.25 volts with outputs of .25, .025, .0025 or .00025 volts, depending on the switch setting. These voltages are impressed across a capacity type attenuator which gives a fine control of the output. To insure accuracy, this attenuator must have a reactance of many times that of the resistance attenuator. This was obtained by using a .00035 mf variable and a .001 mf fixed condenser, the series reactance never being less than 400 ohms. This value of 400 ohms capacitive reactance is high enough to have negligible effect on the 5-ohm resistive impedance of any step on the resistance attenuator.

A dummy antenna of 25 ohms resistance, 20 microhenrys inductance and 200 micro-microfarads is used as the

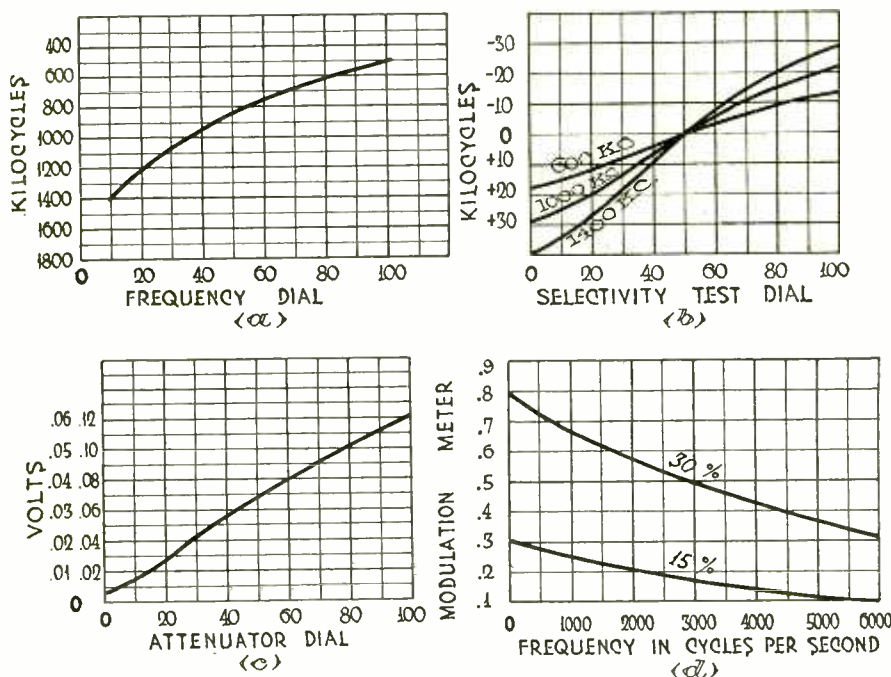


Fig. 2. Calibration Curves of Performance Test Set

input to any set under test. This dummy antenna has the .001 mf section of the condenser attenuator in series with it. Since the variable condenser is practically in parallel to the .001 mf condenser when "looking back" from the dummy antenna, the constants of the latter change slightly. This can be readily taken care of in the final calibration of the outfit and is a very small factor in most measurements.

The average dummy antenna current is read indirectly by means of the thermocouple in series with the first step of the attenuator. The percentage modulation is read by means of a carbondum crystal detector and galvanometer circuit. The latter, of course, has to be calibrated and checked occasionally. This modulation meter is quite sensitive, and satisfactory, both from a viewpoint of service and cost. Heising system of modulation was used and since most measurements are made with not over 30 per cent modulation, the modulator tube could be of the same type as the oscillator. The average modulation of any station seldom runs above 30 per cent even when using 80 per cent on peaks. Many stations run from 10 to 20 per cent modulation as an average.

The percentage modulation for any given value of output current reading is found by measurement with a vacuum tube voltmeter. The carrier peak voltage is first read, then the peak modulated carrier voltage read after the audio frequency is applied. These values give the percentage modulation as long as the average "antenna" current stays constant, which is measured by the thermocouple.

The remainder of the equipment needs little explanation. A good beat-frequency type audio oscillator is used in supplying power to the modulator tube of the performance test set. The vacuum tube voltmeters are similar to those described in various technical journals. Normally a terminating resistance, of value equivalent to the loudspeaker impedance at low frequencies, is used, since the former's impedance is constant for all audio frequencies.

A microphone and amplifier are also used for comparison of various receivers which are complete with loudspeakers. The microphone is not used for showing the actual sound output as a person would hear it, but rather as a fixed standard of comparison. The audio-frequency response of any loudspeaker is dependent upon the acoustic surroundings so actual response measurements mean very little except as a comparison with another receiver operated under exactly similar conditions.

Fig. 2 gives an idea of the calibration curves which were made on the performance test set. Selectivity, sensitivity and

audio fidelity curves of various receivers will be shown from time to time, using this equipment for that purpose.

PLATE BYPASS CONDENSER

(Continued from Page 84)

ever, and even if we had no need of filters.

Here, again, if we are going to use regeneration (which is, however, far less worth while with "power" detection than with the grid-leak and condenser type) the "reversed" control is preferable to the "direct."

After all, then, that "bypass" condenser is not such a simple or unimportant item as it looks!

THE RIGHT KIND OF AN AERIAL

(Continued from Page 33)

sion lines, which may always be determined by the size of the insulators on the cross-arms and by a sign on the cross-arms reading "High Voltage." In general, the larger the insulators on the poles, the higher the voltage.

Make the flat-top portion of the aerial and lead-in as tight as possible, because swaying of the wire may cause fading of signals.

Erect the aerial in such a manner that it will withstand the strongest wind.

Keep the aerial away from trees and separate it by at least 6 ft. from any metallic bodies such as tin or iron roofs, steel girders and stucco screens, etc.

As nearly as possible, use a one-piece aerial. Joints, even though soldered, will have a higher resistance than the wire itself and will be more susceptible to corrosion. If joints are made, always solder and tape them.

Read the local city ordinance pertaining to aerial installation, so as to become familiar with procedure in standard construction. A copy of this ordinance may be had upon application to the local City Electric Department.

UNITED STATES CIVIL SERVICE EXAMINATION

The United States Civil Service Commission announces an open competitive examination for assistant radio inspector to fill vacancies in the field service of the Department of Commerce. The entrance salary is \$2400 a year. The duties will be primarily to assist the radio inspector in the enforcement of the Radio Act; to inspect radio equipment on vessels and at land stations, which involves the carrying of 30 or 40 pounds of testing and measuring instruments; to make high frequency and field intensity measurements; to assist in the examination of radio operators, and to perform such office work as is required.

Competitors will be rated on theoretical and practical questions on radio and electrical engineering, and on their education, training and experience.

Applications must be on file with the Civil Service Commission at Washington, D. C., not later than September 10.

USE OF MAILS DENIED TO PROMOTERS OF "EARTH ANTENNA"

A POSTAL fraud order was issued on July 2, 1929, against the Modern Antenna Company; Earth Antenna; Underground Aerial Products; Underground Aerial Systems; Perfection Antenna Company; R. Charles Curtis, salesmanager and their officers and agents as such at Chicago, Ill.

The following typical claims were made in the advertising of this device:

"Reduces static—gives better tone.

"Snapping, crackling, humming interferences caused by induction from other antennae, power lines, car lines, etc., reduced.

"Radio experts endorse it.

"Latest step in radio progress.

"It is probably one of the most important improvements offered set owners, it is called the earth antenna."

The following facts developed by the Postoffice Department will be of interest:

"Under the names set forth in the caption hereof Frank Andrews and Charles Curtis are obtaining remittances of money through the mails upon representations to the effect that for such remittances they will furnish a so-called underground antenna; that when used with radio receiving sets as directed, such antenna causes a miraculous reduction in static and noisy interference and gives clear-toned reception on every station which can be found; that such device is the 'latest step' in radio progress; and that the price of the device will be refunded at once, in full, to purchasers thereof who find the same unsatisfactory and return it."

"A so-called 'Earth Antenna' together with directions for the use thereof, were obtained from the promoters of the enterprise by the postoffice inspector who investigated this case. . . . The device itself is cylindrical in shape, approximately thirteen inches in length and four inches in diameter, and is encased in cardboard at the sides and bottom. The top is sealed with a tar-like preparation, from which protrudes a wire approximately thirty-two inches long enclosed in a lead cable. Attached to the outside of the device and running its entire length is a metal bar one-half inch in width and approximately 1/64th of an inch in thickness. Inside the device is a hollow core about which are wrapped a number of windings of 1/2-in. metal tape. . . .

"The Earth Antenna and directions for the use thereof secured by the inspector were forwarded to the United States Bureau of Standards for examination and report as to the truth or falsity of the representations made with respect thereto. In pursuance of this action an exhaustive series of tests were made by an expert in the radio section. The tests were conducted over a period of three weeks in a place well removed from power stations or other agencies which might have any effect thereon and were made with the assistance of various instruments for measuring with scientific accuracy the results obtained. A report covering the results of these tests prepared by the expert was offered in evidence at the hearing and in addition he himself was present and testified. His testimony shows that the signals obtained by use of the Earth Antenna are inferior in strength to those secured from a vertical aerial in the ratio of from one to one hundred to one to several hundred. Results secured through use of the Earth Antenna were inferior in strength to those obtained by use of an ordinary two-inch pipe driven four feet into the ground in the ratio of one to fifteen. According to the statements of this expert, while it is true that a certain reduction in static is obtained by

(Continued on Page 92)

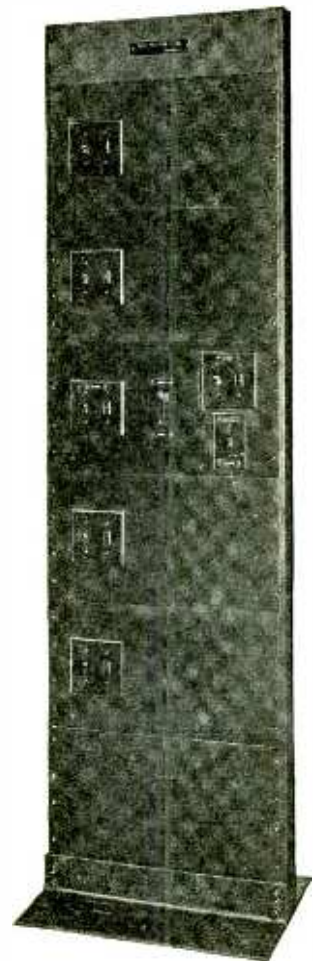
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you can get into the **BIG MONEY!**

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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!



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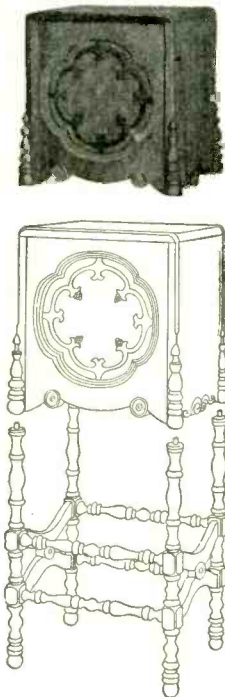
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Dealers can carry a more complete, convenient and less expensive stock by purchasing separate units.

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ST. PAUL, MINNESOTA

use of the Earth Antenna, a directly proportionate reduction in general reception is concomitant thereto. Static was in fact present during certain of the tests when no other sound was audible. He stated in effect that any results whatever obtained from use of the Earth Antenna are due to the fact that it acts in some slight degree as a grounding device.

"He further stated that while in some instances, due to improper installation of overhead aerials, lack of proper tuning of the set or similar factors, use of the Earth Antenna may seemingly cause an improvement in reception, the fundamental fact remains that in passing through the earth electromagnetic waves are greatly attenuated.

"Summarizing his testimony, the expert stated that the Earth Antenna does not cause a reduction in static and noisy interference; it does not give 'clear-toned reception' on every station which can be found or cause any kind of broadcast to be more faithfully reproduced; and it is not the latest step in radio progress.

"During the course of the hearing there were introduced in evidence a large number of complaints from persons having dealings with the concerns here involved. In many of these cases nothing whatever has been received by the complainants in response to their remittances; in other instances the Earth Antenna has been forwarded, found unsatisfactory and returned within the prescribed time without refunds being made; in still others devices already paid for have been forwarded to remitters C.O.D. Letters of inquiry addressed to the company by complainants are usually ignored.

"Despite the fact that during the course of an interview with the inspector Messrs. Andrews and Curtiss tacitly admitted that they were not in a position financially to make refunds, they have continued to accept incoming remittances.

"The only evidence offered by counsel for the respondents consisted in an unsworn written statement in favor of the Earth Antenna from Mr. William W. Harper of the Harper Research Laboratory, Chicago, Illinois, a testimonial from F. R. Steel, President of the F. R. Steel Company, and several testimonials and copies of alleged testimonials from other persons. According to the statements of Mr. Nash, the F. R. Steel Company is the concern through which the advertising of Messrs. Curtiss and Andrews is placed.

"The statement of Mr. Harper is a lengthy, opinionative dissertation based on theoretical considerations. Moreover, in concluding his discussion of the device Mr. Harper states: 'It is practically impossible to predict that certain improvements or lack of improvements would be encountered using a device such as the Earth Antenna.'

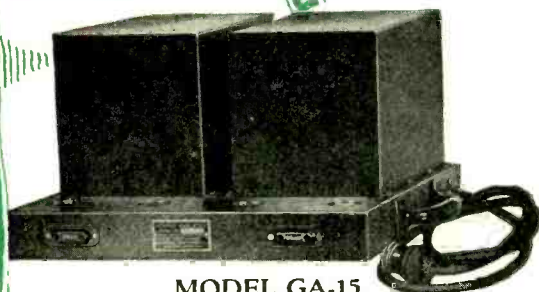
"Under date of November 27, 1928, an affidavit was executed by Messrs. Andrews and Curtiss in which, in order to obviate further consideration of the question of the issuance of a fraud order against them they stipulated to abandon the sale of a so-called 'Aerolimator,' a device closely resembling and intended for use for the same purpose as the Earth Antenna, and to refrain from conducting any similar enterprise in the future. Shortly after the filing of this affidavit Messrs. Andrews and Curtiss started the scheme involved herein.

"The evidence shows that this is a scheme for obtaining money through the mails by means of false and fraudulent pretenses, representations and promises, and I so find."

The fraud order was issued July 2, 1929, signed by Walter F. Brown, Post Master General.

TONE QUALITY

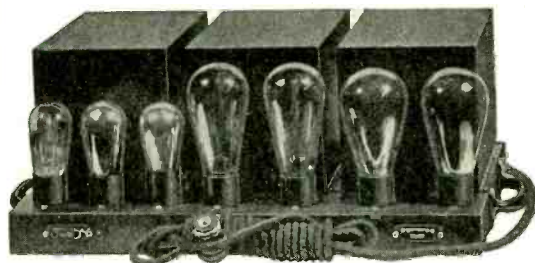
An Outstanding Feature of All General Amplifiers



MODEL GA-15

A two-stage power amplifier employing one 227, two 245 power tubes in push-pull and one 280 rectifier. Will deliver approximately 4.5 watts of undistorted energy to the reproducer. Suitable for the home or other moderate sized installations.

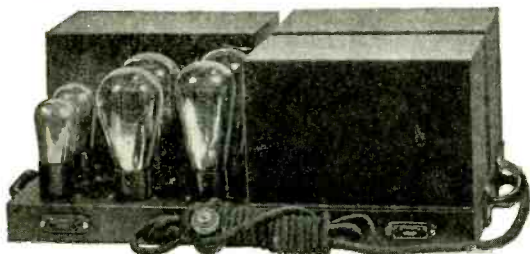
Price (less tubes)\$85.00



MODEL GA-20

A three-stage power amplifier incorporating dual push-pull. The tubes required are one 227, two 226s, two 250 power tubes and two 281 rectifiers. Will deliver approximately 14 watts of undistorted energy to the reproducers. Suitable for apartment house, theatre or other service requiring extreme volume reserve.

Price (less tubes)\$225.00



MODEL GA-30

A three-stage power amplifier employing two 227s, two 250 power tubes in push-pull and two 281 rectifiers. Will deliver approximately 12 watts of undistorted energy to the reproducers. As in all other General Amplifiers, no output device is required.

Price (less tubes)\$175.00

THE manufacturer and the purchaser of "Sound Projection" equipment realize the important relationship of the power amplifier to the satisfactory performance of the complete assembly. The rapidly increasing demand of the general public for finer tone quality necessitates improved design in all associated equipment. This demand has been successfully met in General Amplifiers.

Created by an engineering staff whose sole aim has been to give the public the best in power amplification. Built by men thoroughly experienced in their construction and operation. A product of merit is the result.

Sound engineering and inbuilt quality together with the incorporation of many distinctly unusual features have made possible this line of power amplifiers of unrivalled performance and tone quality. From the faintest whisper to tremendous volume absolute faithfulness in reproduction is maintained. Volume, tone fidelity, stability and service are assured with General Amplifiers.

Our engineering staff, specialists in the design and manufacture of power amplifiers to meet specific requirements, are always pleased to cooperate with you in your problems of audio amplification.

These and other models, not illustrated, are fully described in our Bulletin R3, which will be sent on request.

GENERAL AMPLIFIER COMPANY

27 Commercial Avenue, Cambridge, Mass.

MAKERS OF HIGH-GRADE POWER AMPLIFIERS

CONTINENTAL & MACK PRODUCTS
4 NEW PRODUCTS FOR 1930

No. 150 Mack Spring Aerial



The best Indoor Aerial money can buy.
 Price 25c

No. 100 Mack Spring Aerial



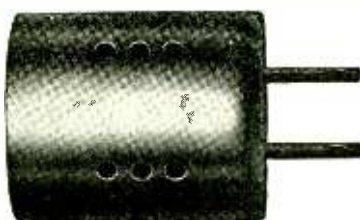
The most efficient and practical Aerial known to science. Fits any set, any roof. Can be erected in five minutes. Lasts a lifetime.
 Price \$1.75

Continental Modulator No. 3



A combination Wave Trap, Local Interference and Static Eliminator.
 Price \$2.00

Continental Voltage Control No. 2



A real ballast Voltage Control, to protect A.C. tubes. Will not burn out.
 Price \$1.50

Jobbers and Dealers Write for Prices and Literature on Our Entire Line

Gardiner & Hepburn, Inc., 2100 Washington Avenue, Philadelphia, Pa.

MOTION PICTURE MAGAZINE

For Radio Men Who Are Interested in Sound Projection

Radio and the Movies work hand in hand to create better sound pictures. Follow the new developments each month in MOTION PICTURE MAGAZINE.

Always gives you the latest news and reviews, exclusive photographs and intimate stories about the players. Twenty-five cents at all newsstands.

Send for Miniature Sample Copy

MOTION PICTURE MAGAZINE

1501 Broadway

New York City, N. Y.

MEDITERRANEAN RATES

By ATHAN COSMAS, KODV

(All rates are quoted in centimes. To convert to American money figure 20c per gold franc—1c per 5 centimes.)

GIBRALTAR—Coast Tax 60, Local Del. nil. Algeria 34, Italy 32, Malta 29, France 24, Greece 43, Greek Islands 48, Spain 15, Portugal 22, N. Y. C. 1fr50, Morocco 15, Turkey 71, Soviet Russia 64.

FRANCE—Coast Tax 40, LL 25 (10 wd. min.), Belgium 19, Gibraltar 24, Greece 34, Greek Islands 39, Italy 22, Malta 40, Portugal 27, Roumania 34, Spain 22, by radio 29, Sweden 28, N. Y. C. 1f12.

SPAIN—Coast Tax 45, (10 wd. min.) LL 5 per wd. up to 5 wds.; each additional wd. 25. Algeria 27, France 22, by radio 29, Gibraltar 15, Portugal 18, Italy 31, Malta 46, Morocco (Tangiers) 15, Tunis 27, Turkey 70, Soviet Russia 60, by radio 76, Egypt 1st region cable 1f30, by radio 1f15.

TUNIS—Coast Tax 40, LL 25, (10 wd. min.), Gibraltar 34, Greece 44, Greek Islands 49, Italy 32, Malta 40, Tangiers 32, Spain 27, Egypt 1st 1f32. QTE 6 francs.

MALTA—Coast Tax 60, No LL on Island, Gibraltar 29, Great Britain 42, Italy 21, Tangiers 62, Algeria 33, Tunis 40, France 40, Spain 45, Turkey 73, Russia 80.

PORTUGAL—Coast Tax 40, LL 15, (10 wd. min.), Algeria 37, Azores 68, Canary Islands 38, France 27, Gibraltar 22, Greece 46, Greek Islands 51, Italy 33, Malta 43, Tangiers 34, Roumania 46, Spain 18, Tunis 77, Turkey 74.

MOROCCO—Tangiers—Coast Tax 40, LL 25 (10 wd. min.)
 CNA to France 30.
 CNP to Algeria 25, (10 wd. min.)
 CNW to Tunis 25, (10 wd. min.)
 Gibraltar 15, Italy 43, Portugal 34, Greece 55, Malta 62, Spain 15.

ITALY—Coast Tax 60, LL 20, (10 wd. min.), Algeria 32, France 22, Gibraltar 32, Greece 28, Greek Islands 33, Malta 21, Morocco 43, Portugal 35, Roumania 28, Spain 31, Tunis 32, N. Y. C. 1f25.

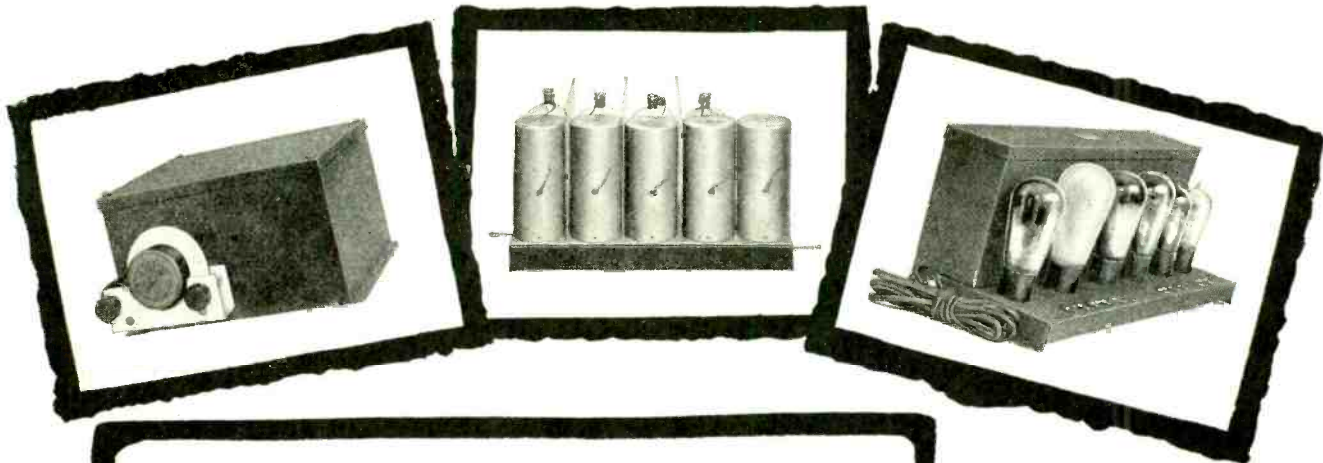
GREECE—Coast Tax 40, (10 wd. min.), LL 15, (10 wd. min.), Greek Islands 25, (No. min.), Italy 28, Roumania 25, Turkey 29, Egypt 1st region cable 25, Tunis and Algeria 44, France 34, Gibraltar 43, Malta 45, N. Y. C. 1f62.

EGYPT, 1ST ZONE—Coast Tax 60, LL 10, France radio 1f15, cable 1f32, Gibraltar radio 1f15, cable 1f25, Great Britain radio 94, cable 1f25, Greece radio 1f15, cable 1f25, Greek Islands radio 1f20, cable 1f30, Italy radio 1f15, cable 1f30, Malta 1f25, Tangiers radio 1f15, cable 1f25, Tunis radio 1f15, cable 1f32, Portugal radio 1f15, cable 1f25, Roumania radio 1f15, cable 1f49, Spain (including possessions in North Africa) radio 1f15, cable 1f30, Turkey in Europe 1f47, in Asia 1f97, Russia 1f97, N. Y. C. via Marconi 1f90, Eastern 2f20, cable 2f25, (Indicate routing.)

TURKEY—TAD, Coast Tax 60, LL 25 (10 wd. min.)

LEBANON—Coast Tax 12, Lebanon 15, Palestine 40, Syria 15, Turkey 55, Egypt 1st Zone 55.

ROUMANIA—Coast Tax 30, (10 wd. min.) LL 05, (10 wd. min.)



DEALERS ~

THE NEW REMLER
SCREEN-GRID
COMPONENTS,
AMPLIFIERS AND
OTHER COMPONENTS
ARE THE FINEST IN RADIO . . .

NEWARK ELECTRIC CO.
WILL SUPPLY YOU

DEALERS in the Mid-Western territory are supplied with Remler equipment by us. Deliveries will commence about the middle of September. In addition to the REMLER COMPONENTS there are other new REMLER items. A new 945 Power Transformer for filament supply for six heater tubes or '24 tubes and plate current for 90-110 volt D-C concert type electro-dynamic speakers. This transformer lists at \$18.00. Then there is a new REMLER 915 Push-Pull Input Transformer, listing at \$6.00 Write for full information and discounts to dealers and set builders.

DELIVERIES

Can Be Made
SEPTEMBER 15th
Get Your Order
to Us Now for
Early Delivery
Write for Literature and
Discounts

NEW REMLER 111 SCREEN-GRID COMPONENTS

THE latest development of the Remler factory. A super value in screen-grid components. Using four screen-grid tubes. Three of them in a highly efficient r-f circuit and another screen-grid tube as a Power detector. The 111 Remler Screen-Grid Component, which includes the r-f and detector unit, feeds into a push-pull audio amplifier using two tubes in parallel in the first stage and two of the new '45 type tubes in push-pull in the second stage. It is a simple matter for anyone to put these components into operation. The performance will exceed your fondest expectations. Totally shielded screen-grid component and an entirely new amplifier component, using everything that is new in radio—bandpass selector—five gang condenser—single dial control—PARALLEL FIRST AUDIO TUBES—speaker field supply—screen-grid tubes and an audio system that gives LIFELIKE TONE—all for only

LIST \$80.00

Here is \$300.00 worth of radio equipment for \$80.00, list. Here is a set of components that will enable you to assemble the finest set in radio today. There is nothing on the market at anywhere near the price that even approaches these new REMLER specifications in advance design, efficiency, compactness, tone quality and RESULTS. This REMLER 111 sells on its outstanding qualities. Bandpass selector gives selectivity without loss of quality. Tone quality is the inevitable result of the combination of '45 tubes in push-pull. Get these new COMPONENTS from Newark Electric Co.

NEWARK ELECTRIC CO.

"Nothing But Radio"

226 West Madison Street

Chicago, Ill.

Investigations of Radio Advertising by the National Better Business Bureau

1. In our last report to the industry we described our investigation of a mail order radio advertiser against whom many complaints has been received. This matter was referred to the Post Office Department who issued a fraud order against the company after substantiating our findings by an independent investigation.

2. Complaint was received from a dealer who had ordered and paid for several radio cabinets marketed by a metropolitan mail order concern. They claimed that two months after the cabinets were paid for they had not yet received them. They desired a refund as the holiday season was over and they felt they could not dispose of the merchandise. The manufacturer advised that delay was due to a shortage of cabinets. He sent a check to our complainant at once.

3. Complaints were received against two metropolitan retailers who employed switching tactics and "bait" advertising in the sale of nationally advertised "B" batteries.

With the cooperation of the New York Better Business Bureau investigation of these matters was made with the result that evidence of similar tactics in the sale of tubes, speakers and other items was collected. Negotiations were had with the advertisers, but later transgressions occurred. The local bureau plans to make the facts known to the public.

4. Advertising of a radio set which contained statements indicating an automatic tuning feature was called to our attention. Such claims as the following were made:

"It's lots of fun to tune in because it is entirely automatic."

"The Blank Automatic Meter Selector registers the wave length."

Complaint was made that the set so advertised does not contain an automatic tuning device.

Investigation showed that in operating this set it was necessary to turn the meter register until the numbers corresponding to the wave length desired appeared on the dial. The same procedure must be followed each time that particular station is desired and represents approximately the same tuning operations as are required in the average set. These points were brought to the attention of the advertiser with the suggestion that future copy be changed in accordance with the facts. After a short discussion the concern advised us that all claims giving the impression that the set was automatically tuned would be eliminated.

5. Our previous report mentioned a discussion held with a well known set manufacturer regarding claims as to the number of tubes used in his set. After this point had been adjusted satisfactorily, objection was raised as to the use of the term "Dynamic" in advertising a loudspeaker. Construction details of the speaker featured in trade paper advertising showed the speaker to be different from the usual "dynamic" or "moving coil" speaker. In view of the definitions recommended by the R. M. A. and N. E. M. A. we suggested that the advertiser omit the term dynamic from future copy. He objected to this, claiming that the accepted definitions were unscientific and should be changed. He wrote to both trade associations advising them of his objections to the definitions.

The associations upheld the accuracy of the definitions and we continued discussing the question with the advertiser. He finally agreed to revise future advertising in accordance with our recommendations and at present the speaker is being described accurately.

6. Newspaper advertising of a well known radio set featured the incorporation of a dynamic power speaker in the console model. A complaint was made that the speaker in this set was not a true dynamic speaker. Investigation by the bureau, in cooperation with the manufacturer determined that the speaker in question was accurately described.

7. An individual purchased a new type of aerial from a mail order radio concern, but was not satisfied with it when he tried it. In accordance with the advertiser's ten day trial offer he returned it within the time limit and asked for a refund. He heard nothing from the advertiser. Contact with the advertiser by the National Bureau and a local bureau brought about a refund to the customer.

8. A dealer claimed that a mail order radio supply house delivered a radio set unsorted and that he was forced to pay express charges.

The advertiser advised us that delivery of this set was made in error. The complainant was located in Akron, Ohio, and the set should have been shipped to Akron, New York. The matter was adjusted satisfactorily.

9. We were asked to obtain information regarding two mail order radio supply houses and a manufacturer.

Through contacts located in those cities we obtained complete reports regarding the concerns in question and this information was given to our inquirers.

10. A complaint was received against a local dealer to the effect that the dealer had neglected to install completely a well-known make of radio set purchased by the complainant.

Through a local Better Business Bureau contact was made with the dealer in question who claimed that he had sent a service man to the home of the complainant several times but that the purchaser of the set was not home. He agreed to send a man to install this set provided the complainant would name a time when he would be on hand to admit the service man. The complainant was advised of this assurance and the matter was satisfactorily adjusted.

11. Advertising of a mail order concern featuring a device designed to eliminate radio disturbances due to external causes reproduced copyrighted literature of a competitive organization.

The bureau recommended that the copy be changed to avoid copyright infringement. We were assured that future advertising would be changed in accordance with our suggestion.

12. A farm publication asked for information regarding a mail order radio concern who had submitted copy to them for publication. The company offered to send an all-electric radio for a 30-day free trial.

Contacts in the city where the advertiser was located informed us that the concern could not be located and that none of the local radio dealers in that vicinity had ever heard of the concern.

The publisher refused the advertising.

13. A consumer stated that he purchased a high priced A-C set and that since its installation it had given very unsatisfactory reception. The dealer's service men called at his home and stated the trouble was due to a fluctuation in the voltage of the power lines. The Public Service Commission investigated this matter and found no such fluctuation and the complainant notified the dealer to that effect. Receiving very little help from either the dealer or the local sales agents for the manufacturer, the complainant asked the bureau to look into it.

We referred the complaint to the manufacturer who advised that the matter would be handled to the satisfaction of all. The local sales agency instructed the dealer to make any necessary changes in the set. A few days later the complainant advised us that changes had been made and that the set now operated perfectly.

14. Advertising including the following statement, was questioned:

"Does it utilize the new a-c tubes (Type Nos. 226 and 227)? The a-c detector tube has five prongs instead of four. Look for these five prongs. It is a simple means of finding out whether the set is of the latest type or made over battery set."

We are informed that there are other a-c detector tubes on the market which have only four prongs and that consequently this advertising was misleading and confusing.

We wrote to the advertiser pointing this out. The company replied that their copy had already been revised. They forwarded to us corrected mat copy which is supplied to their dealers.

15. The claim "Largest exclusive radio tube manufacturers in the world" was questioned.

The manager of the local Better Business Bureau took this question up with the advertiser in a personal conference and obtained his agreement to discontinue this statement in all future copy in line with our recommendations regarding the elimination of superlative claims in advertising.

16. Philadelphia radio retailers advertised tubes for television purposes. Advertising of this product led the public to believe that purchasers could obtain television reception merely by the use of these tubes.

The manufacturer of the tubes advertised informed us that these tubes were originally intended for a night light, indicator, or test lamp, and that it uses only from one-half to one-quarter watts. It was recently found to be suitable for use in connection with television but a number of mechanical changes must be made in the ordinary radio set to do this. The manufacturer referred us to an article in Q. S. T. which described the use of such tubes, and the changes which must be made in radio sets, in order to obtain television reception. This article stated that an electric motor must be used to rotate a suitable disk containing a number of pinholes equally spaced around the circumference. It is also necessary to apply additional voltage to the radio circuit before television reception is possible.

Report to this effect was made to the Philadelphia Bureau, which took the matter up locally with their dealers.

17. A consumer purchased a radio receiver and claimed he was never able to receive any

(Continued on Page 100)



Frost-Radio Brass Tack Talk on Rheostats



Frost-Radio Air-Cooled Bakelite Rheostat

Made in a wide range of resistances, from 2 to 75 ohms, in either plain or P.C. switch type; also as Potentiometers of from 200 to 6,000 ohms.

Plain Type, \$1. With Switch, \$1.35
Potentiometers, \$1.25 to \$2.50

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

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

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

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

Use the Coupon to Send for Our Complete Catalog

We have a catalog that contains a wealth of information about our complete line of Radio Parts and Accessories. By all means you should send for a copy if you have not already done so. The coupon brings it. Fill out and mail this to us today.



Frost-Radio Gem Rheostat

The best little rheostat your money can buy. Made in plain and switch type from 3 to 30 ohms and as 200 and 400 ohm potentiometers. Diameter is but 1 1/2 inches. Utmost quality in a small rheostat.

Plain Type, 75c.
With Switch, \$1.
Potentiometers, \$1.

HERBERT H. FROST, Inc.
ELKHART, IND.
160 N. LaSalle St., Chicago, Ill.
*The World's Largest Manufacturers of
High Grade Rheostats*

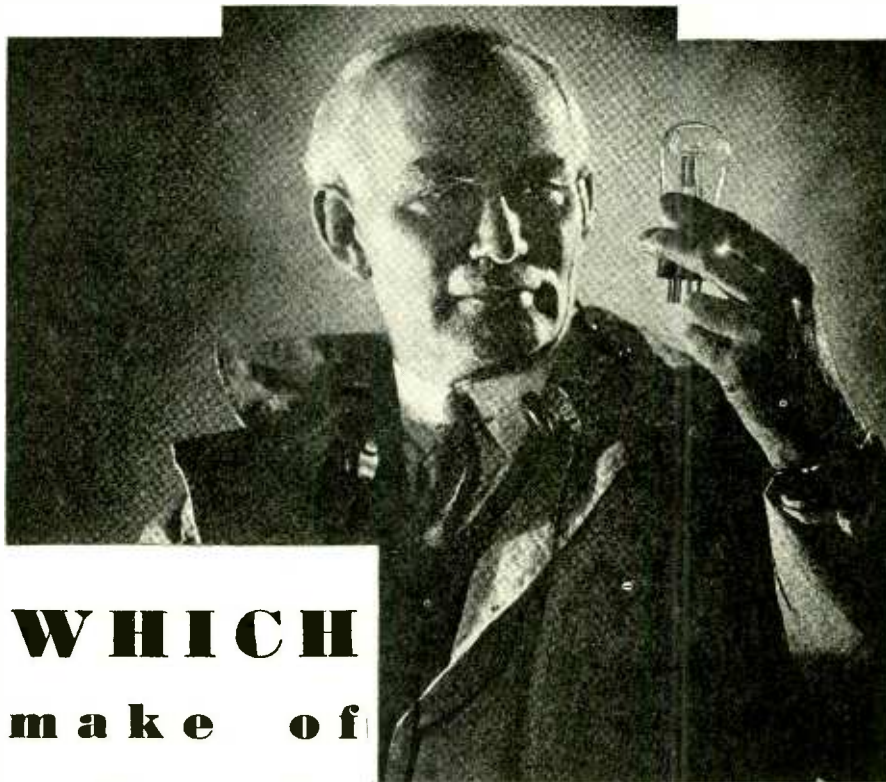
HERBERT H. FROST, Inc.
160 N. LaSalle St., Chicago

Send me a copy of your catalog of Frost-Radio Parts and Accessories, and the name of my nearest dealer.

Name

Address

City State



WHICH make of radio tube

shall I use or recommend?

DE FOREST Audions have set the world's standard for 23 years. Every other radio tube in the country, no matter what its name, is made under the inventions and basic patents of Dr. Lee De Forest.

All the recent improvements of De Forest Engineers are included in De Forest Audions. For example, consider vacuum which determines the life of a tube and its tone qualities. De Forest Audions contain less than 1-15th the air pressure of most other radio tubes.

De Forest Engineers discovered that hum common to house-current sets was caused by improperly designed tubes. By a new process of insulation De Forest Audions reduced this hum to a point where you can scarcely detect it.

Radio tubes may look alike but that is where the comparison ends. It is easy for you to convince yourself that De Forest Audions are superior. Test them in comparison with other makes of tubes.

DE FOREST RADIO COMPANY, JERSEY CITY, N. J.

de Forest AUDIONS

HOTELS FOR RADIO TRAVELERS

L. A.
Radio



Show
Visitors

Select the

HOTEL NORMANDIE

6th at Normandie Avenue

because

It is only two squares from the Ambassador where the annual Los Angeles Radio Exposition is being staged during September—because the NORMANDIE has rapidly won recognition among radio business men as the most cheerful and satisfying of residential hotels—because its dining room service is the talk of the Wilshire District and because the rates are so low that they will surprise you. A large number of your radio associates will be here during show week.

RATES

From \$3.00 single— Every room has a
\$5.00 double. private bath.
Special Weekly and Club Breakfasts from
Monthly Rates to 35c to 60c.
Permanents. Dinner, \$1.25.

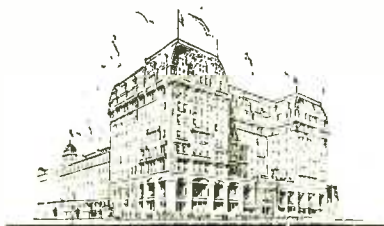
GARAGE

Unusual convenience—only hotel in Wilshire District with fine, fireproof garage at the door.

HOTEL NORMANDIE

6th at Normandie Avenue
LOS ANGELES, CALIF.

"RADIO" can arrange hotel accommodations for you. Write us for full particulars.



ON THE OCEAN FRONT

The
Breakers
ATLANTIC CITY N.J.

Preferred—

In all seasons by those who know and wish the best upon either the American or European Plan.

Sensible Rates Withal!

HILLMAN MANAGEMENT

HOTEL MONTCLAIR

Room and
Bath
Tub and Shower
\$3 to \$5
per day

For 2 persons
\$4 to \$6
per day

Suites
\$8 to \$12
per day

Special Monthly
and Yearly Rates

49th to 50th Sts.
Lexington Ave.
NEW YORK CITY

800 Rooms
Each with Tub
and Shower

Radio in Every Room

3 minutes' walk from Grand Central. Times Square, Fifth Avenue Shops important commercial centers, leading shops and theatres nearby. 10 minutes to Penn. Station.

Grand Central Palace
only 2 short blocks away



S. Gregory Taylor,
President

Oscar W. Richards
Manager

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

E. G. KILL
General Mgr.

31ST STREET

7TH AVENUE

Tell them you saw it in RADIO

Quick SUCCESS in RADIO

**Satisfaction Guaranteed
or Money Refunded**

At last! A guaranteed method of radio training... sponsored by RCA... based on the research and discoveries made in the great RCA laboratories... a method that insures quick success in all branches of radio; manufacturing, servicing, selling, ship-and-shore broadcasting, television, photoradiograms! Radio needs you... big pay... amazing opportunities... thrilling work... adventure galore. Prepare at home through this marvelous new laboratory method! Act now... mail the coupon below for thrilling free book about this guaranteed short-cut to success in America's fastest growing profession! Radio Institute of America, Dept. RA-7 326 Broadway, New York, N.Y.

**Pick the job you
want and fill it
in 9 months**

SPONSORED BY



RADIO INSTITUTE
OF AMERICA

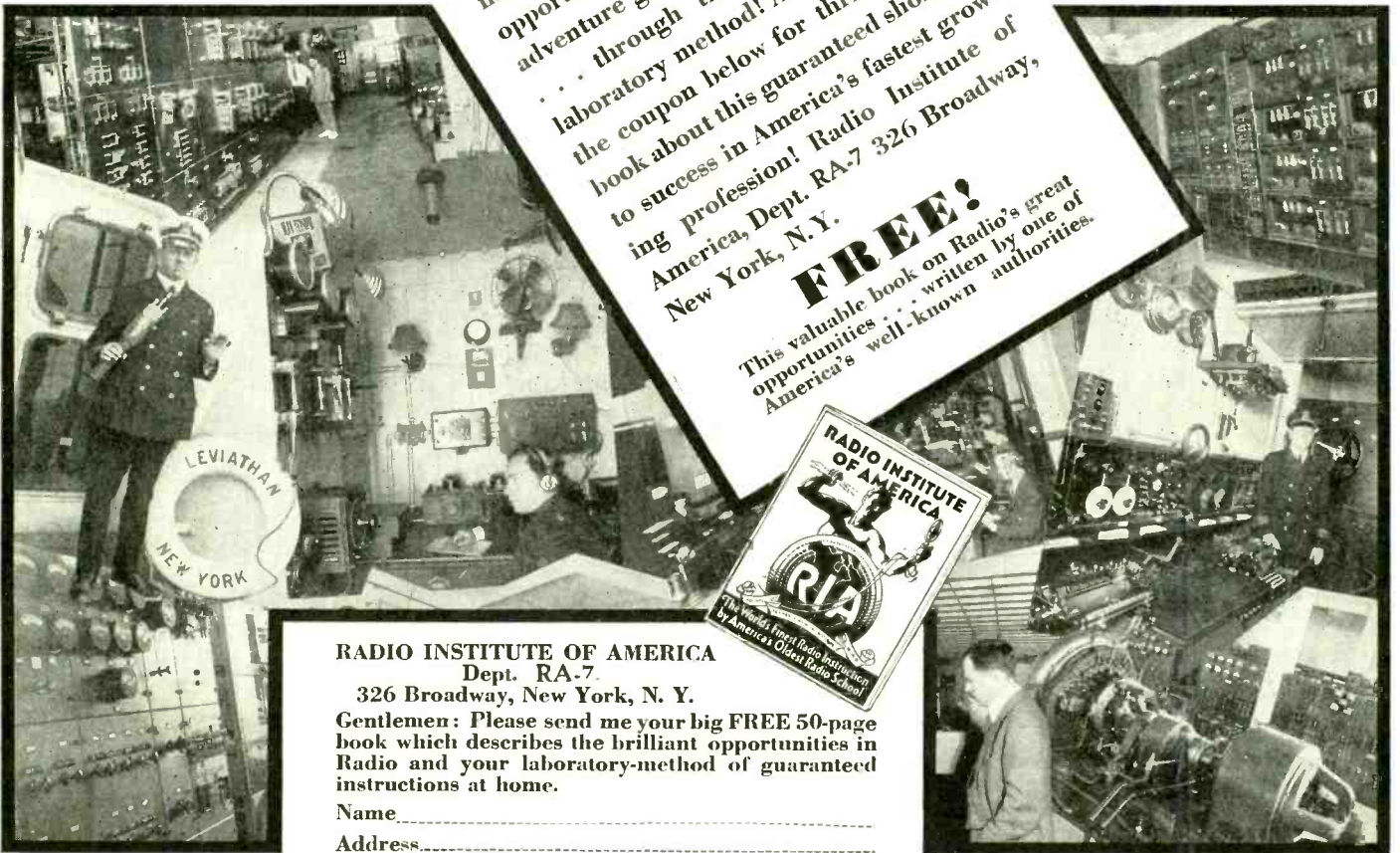
FREE!
This valuable book on Radio's great opportunities... written by one of America's well-known authorities.



RADIO INSTITUTE OF AMERICA
Dept. RA-7
326 Broadway, New York, N. Y.

Gentlemen: Please send me your big FREE 50-page book which describes the brilliant opportunities in Radio and your laboratory-method of guaranteed instructions at home.

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



Tell them you saw it in RADIO

RADIO ADVERTISING

(Continued from Page 96)

broadcast nor to obtain any satisfaction on his complaint. Later other complaints were received along the same lines.

We asked a local bureau in the city in which the manufacturer operated to investigate the firm. They reported that the proprietors of the company had signed a voluntary agreement to discontinue their business following an investigation by the Post Office Department.

18. Due to a local advertising controversy, a local bureau asked us to determine whether a certain receiver and loudspeaker had been discontinued by the manufacturer.

We were advised by the manufacturer that the receiver and the loudspeaker had been discontinued and that probably they would not appear on next year's list.

19. The western branch of a chain of radio stores advertised a number of radio sets and accessories for which exaggerated comparative value claims were made.

We communicated with the head office of this chain, pointing out the fact that several local bureaus had shopped the merchandise in the Pacific Coast stores and that in many cases the comparative value claims were inaccurate and exaggerated. We suggested that steps be taken by the head office to curb the use of unwarranted statements by their local stores and were assured that they had taken the necessary steps to have their chain stores stick to the facts in featuring their merchandise.

20. Newspaper advertising of a chain of radio stores featured radio tubes using a cut of one manufacturer while the store actually had tubes of another manufacturer for sale.

We wrote to the head office of the concern pointing out the misleading and unfair nature of this copy. The advertiser claimed that the proper cut was not available at the time but assured us that an error of this kind would not occur again.

21. A number of complaints were received by the bureau regarding the use of "bait" practices on the part of several New York radio dealers.

Shoppers from the National Bureau and the New York Better Business Bureau purchased a quantity of radio products at these stores to determine the facts. Clerks disparaged tubes particularly to Bureau shoppers. The dealers involved have been repeatedly warned against using such methods. Cooperation has been promised a number of times, but violations have continued and constant check-up is being maintained.

These conditions were called to the attention of local bureaus and investigations were requested to check the use of bait practices by radio retailers generally.

22. Advertising of a radio phonograph combination contained the statement: "15-volt tubes almost three times as powerful as those used on any other set."

A complaint was received that this statement was misleading and that it was unfair to competition.

We first communicated with contacts in the radio industry to learn something of the background of tube voltage and power as applied to the radio set. We then brought the matter to the attention of the manufacturer of the set in question asking for substantiation of the claim. He advised us that this copy was not prepared by the head office and that it was placed by one of their distributors. He informed us that he was checking up on the matter. In a later communication the manufacturer admitted that the voltage of a tube is not indicative of the power and that the statement was misleading. He assured us that steps had been taken to correct this claim advising that the distributor

was requested to discontinue using such statements in the future.

23. Our attention was called to advertising of a device claimed to eliminate line noises and interference from outside sources. Complaint was made that it was inaccurately rated and that it was not "99 3-10 per cent efficient" as the advertiser claimed.

Investigation revealed that the product contained filters, choke coils and condensers and was attached either directly to the source of interference or between the aerial and the set. The advertiser gave us the names of radio testing laboratories, engineers, dealers and users to whom we wrote for an expression as to the merits of the product. All the replies received indicated satisfactory performance and one contact stated that he was so impressed with the product that he wrote an article in the radio section of a leading New York City newspaper describing it. He claims this was the only product which he ever mentioned in print while he was the radio editor of the publication.

After a discussion with the advertiser he assured us that he was eliminating the phrase "99 3-10 per cent efficient" and was also changing the rating of the device.

24. Our attention was called to three new makes of radio tubes on the market put up in cartons simulating in color scheme and printing the containers used by several leading manufacturers. We succeeded in communicating with one manufacturer and recommended that new boxes be made up to avoid confusion on the part of the public and substitution on the part of unscrupulous dealers. The discussion is still pending.

We have been unable thus far to locate the other two manufacturers and have not succeeded in purchasing these makes of tubes in the retail market. Our investigation is being continued through trade contacts and appropriate action will be taken.

25. A well known radio manufacturer used the following claim in his advertising: "The world's largest manufacturer of high grade radio."

We wrote to the advertiser and asked for data in substantiation of the claim and he advised that his sales of high priced sets exceeded those of other concerns having national distribution. He was unable to supply us with sales figures and we advised him that in our opinion a "high grade" radio was not exclusively a "high priced" radio. The discussion is pending.

26. Advertising of a leading make of radio set contained such claims as "plug in for television!" "Performance that's five years ahead" and "—has out-performed in side-by-side comparison sets costing double its price." Question was raised as to the accuracy of these statements.

We wrote to the manufacturer asking for the facts in substantiation of the advertising and requested copies of the reports of the tests mentioned. The advertiser admitted that television is not generally practicable as yet, but maintained that the construction of his present set will make television reception available when it finally is broadcast by all stations. He informed us that tests made in the laboratory of a leading engineering institution demonstrated the set to be an outstanding performer and the finest production job known to radio up to this time. Communications have been addressed to the testing laboratory for the details and negotiations with the concern will be continued as soon as additional information is received.

27. Attention was called to the claim: "At any hour of the day or night the Blank brings in the station you want, just as you would like to have it." The investigation is pending.

28. An inquiry was received from a publisher asking for information regarding a product advertised to reduce static.

Investigation showed that the product was constructed of condensers, choke coils and filters and was designed to be attached between the aerial and the set. It was practically the same as other products placed on the market for that purpose by several large radio accessory companies. The advertiser sent us statements from users indicating the successful performance of the products and forwarded samples of advertising copy used. The claims made for the device were reasonable and conservative and full report was made to the publisher.

29. A mid-western manufacturer used a trade name for his set which was claimed to plagiarize the name used by a large eastern manufacturer for a similar product. Investigation was made through the local bureau in that city and it was claimed that the concern had used that name for eight to ten years. The matter is still under investigation.

Ferranti Sponsors Power Amplifier.



To help you build Better Power Amplifiers

EVERY man interested in building, installing or servicing Power Amplifiers needs these priceless helps. In addition to Diagrams and Components for building ten different 2 and 3-stage Power Amplifiers, capable of unequalled tone quality and maximum power, there is invaluable information on Matching Impedances, Adapting Dynamic Speakers to Power Amplifiers, How to Secure Natural Tone Balance and other important subjects.

Here is *real* help for the engineer, as well as for the practical constructor.

Send 15¢ coin, to partly cover cost of production and mailing, and a copy will be sent you postpaid.

FERRANTI, INC.

130 W. 42nd St. Desk 19 New York, N. Y.



THE Commodore Hotel

Where Radio Friends Meet

250 Outside Rooms, all with Private Bath. Rates: Single, \$2.00 up; Double, \$3.00 up.

JACK DUFF, *Manager*
MRS. HILDA FOOTE, *Owner*

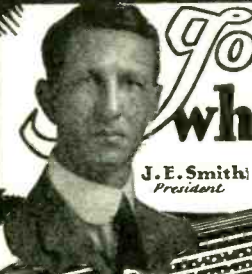
On West Seventh Street at Lucas
LOS ANGELES, CALIF.

50

SALESMEN WANTED IMMEDIATELY

AN OPPORTUNITY to make more than \$200.00 weekly is offered to fifty salesmen who are thoroughly familiar with the sale, installation and service of radio sets and accessories. Applicants for the position must be familiar with radio trade conditions in their locality. They must be willing to work on a commission basis. Salesmen who are not capable of earning commissions in excess of \$200.00 weekly need not apply. Our proposition applies to a specialty item which is needed daily by every radio dealer, salesman, service man and repair man. The article sells on sight. The commission to the salesman is 50%. The list price of the article is two dollars.

This proposition has been given a thorough try-out in some of the large cities. Out of ten calls made, eight dealers and service men bought the article. You can work this as a full or part time proposition. References must be furnished. Write today—giving full details of your sales ability, references and your home address. Send your letter by air mail to BOX 202, care of "RADIO," 428 Pacific Building, San Francisco, Calif.




70 ambitious men and young men
who are awake to the opportunities
in **RADIO**

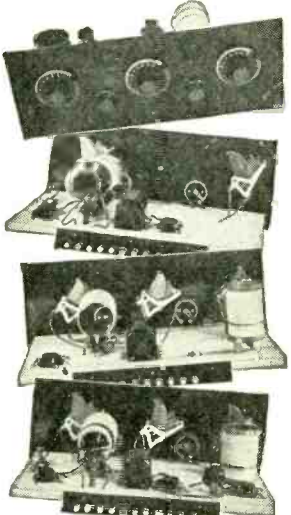
*This book tells you
where the GOOD JOBS are
what they PAY
how to GET one*

**I start many in Radio at two and three
times what they were making before.**

**The \$10,000 and \$15,000 a year men of
the future will be picked from those
who get in now.**



**I GIVE YOU THE RADIO
PARTS FOR A
HOME EXPERIMENTAL
LABORATORY**



**WITH THEM YOU
CAN BUILD 100
CIRCUITS. 4 YOU BUILD
ARE SHOWN HERE
MY BOOK EXPLAINS THIS
PRACTICAL, FASCINATING
WAY OF LEARNING
RADIO AT HOME**

**Jumped from \$35 to
\$100 a week**

"I had the pleasure of earning \$110 last week servicing and selling sets. I have made as high as \$241 in two weeks. Before I entered Radio I was making \$35 a week."

J. A. Vaughn,
4202 Arsenal St.,
St. Louis, Mo.

Ever so often a new business is started. You have seen how the men who hooked up with the automobile, motion picture and other industries at the right time are now the \$5,000, \$10,000, \$15,000 a year men— independent, satisfied. The same opportunities they had in those industries—the chances that made them rich, are now being offered you in Radio. Radio's growth has already made hundreds of men wealthy. Many more will become rich and independent in the future. Get one of these fine jobs for yourself.

**Radio's big growth making hundreds
of fine jobs every year**

I am doubling and tripling the salaries of men and young men by training them for Radio's good jobs. My training fits you for Radio factories, broadcasting stations, a spare time or full time business of your own, operating on board ship which gives you world-wide travel without expense, commercial land stations, research laboratories and many other branches. Talking Movies, Public Address Systems, Radio in Aviation, Screen-Grid Tubes, A. C. Sets and many other of the latest developments are included in my world famous training.

**Opportunities so great that many
make \$5 to \$25 a week extra
almost at once**

The day you enroll I will show you how to do ten Radio jobs easy to find in every neighborhood. Frank Golden, 329 Walnut St., Newark, N. J., says—"I made over \$900 in my spare time in about 10 months." G. W. Page, 1801 21st Ave., S. Nashville, Tenn., made \$935 in his spare time while taking his course.



\$400 a month

"I was making good money, but could see the opportunities in Radio. Believe me, I am not sorry as I have made more than ever. I have made more than \$400 each month. The Radio field is getting bigger and better every day."

J. G. Dahlstead,
1484 So. 15th St., E.,
Salt Lake City, Utah.



**Seldom under
\$100 a week**

"My earnings seldom fall under \$100 a week. My profits for the past three months were \$577, \$645, \$465. If your course cost 4 or 5 times more I would still consider it a good investment."

E. E. Winborne,
1414 W. 48th St.,
Norfolk, Va.

**I will train you at home
in your spare time**

Hold your present job. My 50-50 method of training, half from lesson books and half from practical experiments using Six Big Outfits of Radio Parts given without extra charge, makes learning at home easy, fascinating. It is unequalled. It gives you practical Radio experience while learning. You don't have to be a high school or college graduate. Many of my most successful graduates didn't finish the grades.

Your money back if not satisfied

That is the agreement I make with you. I am so sure that I can satisfy you that I will agree to return every penny you pay me for tuition if, upon completion, you are not satisfied with the lessons and instructions received. Could anything be fairer?

ACT NOW—

**Find out about Radio's opportunities
for success and bigger pay**

My book gives you the facts, what your prospects are for the future, how you can get in without delay, what you can make. It explains my practical method of training with my home experimental laboratory, how my Employment Department helps you find a job upon graduation and many other features that have made N.R.I. training unequalled. There is no obligation. Simply fill out the coupon below and mail it. Do it today.

**J. E. Smith, President
Dept. 9W75
National Radio Institute
Washington, D. C.**

**This Coupon is good for ^{Mail}
one FREE COPY of my ^{it}
Valuable Book ^{now}**

J. E. Smith, President,
National Radio Institute, Dept. 9W75
Washington, D. C.

Dear Mr. Smith: Without obligating me send your book explaining Radio's opportunities for bigger pay and your method of training at home in spare time. I understand that no agent will call on me.

Name _____
Address _____ Age _____
City _____ State _____

Projection Engineering, the new technical journal of the Sound and Light Projection Industries, occupies a prominent position in the "new industries" publication group. The editorial contents cover the engineering, industrial and technical developments in the rapidly growing fields of

Theatrical Engineering
 Home and Theatrical
 Sound and Light Projection
Television

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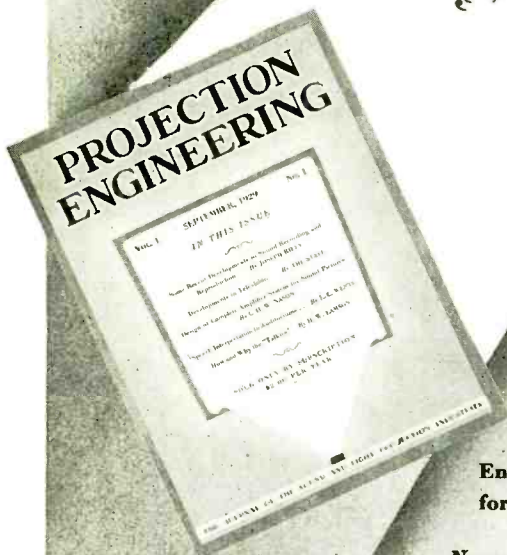
"The Journal of the Sound and Light Projection Industries"

The editorial staff of *Projection Engineering* is headed by M. L. Muhleman, for years editor of Radio Engineering with Austin C. Lescarbours, Donald McNicol and John F. Rider as associates.

The first issue (September, 1929) will carry the following material—
Recent Developments in Sound Recording and Reproduction

by Joseph Riley
 Television Developments by M. L. Muhleman
 Design of Complete Amplifier System for Sound Pictures by C. H. W. Nason
 Speech Interpretation in Auditoriums by E. C. Wente
 How and Why the "Talkies" by H. W. Lamson
 News of the Industry—New Developments (and other timely material)

**PROJECTION ENGINEERING IS NOT SOLD ON NEWSSTANDS
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- (Including executives, plant superintendents, foremen, purchasing agents, etc.)
- Engineer
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- Distributor
- Theatre
- Projectionist

Name.....

Address.....

Town and State.....



THE BEL CANTO SERIES

This NEW AMRAD Line SELLS!

THE opinion of Amrad Distributors expressed with emphatic enthusiasm in the May Convention has been corroborated by Amrad dealers in every section of the country.

Here is a radio line, out of the intensely competitive field—yet priced reasonably enough to sell readily.

It wins on appearance — for Amrad Consoles are beautiful examples of master furniture design; it wins on examination — for every detail of the chassis is engineered with painstaking exactness; it wins on demonstration for the tone is a marvel of rich, full, loveliness — the finest tone in radio!

Built-in full floating dynamic speakers; screen grid tubes in three stages; eight tubes including two powerful 245 tubes in push pull; extra heavy construction; four tuned circuits for maximum selectivity; special audio system. The most notable product of 1929.

THE AMRAD CORPORATION
MEDFORD HILLSIDE, MASS.

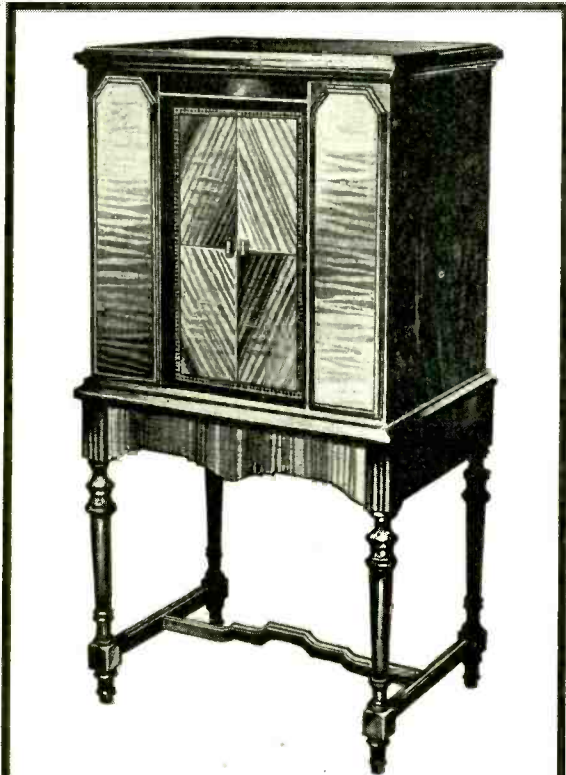
J. E. HAHN
President

POWEL CROSLY, JR.
Chairman of the Board

There are still open dealer territories for authorized Amrad dealers. Write today to Dept. UX for full details.

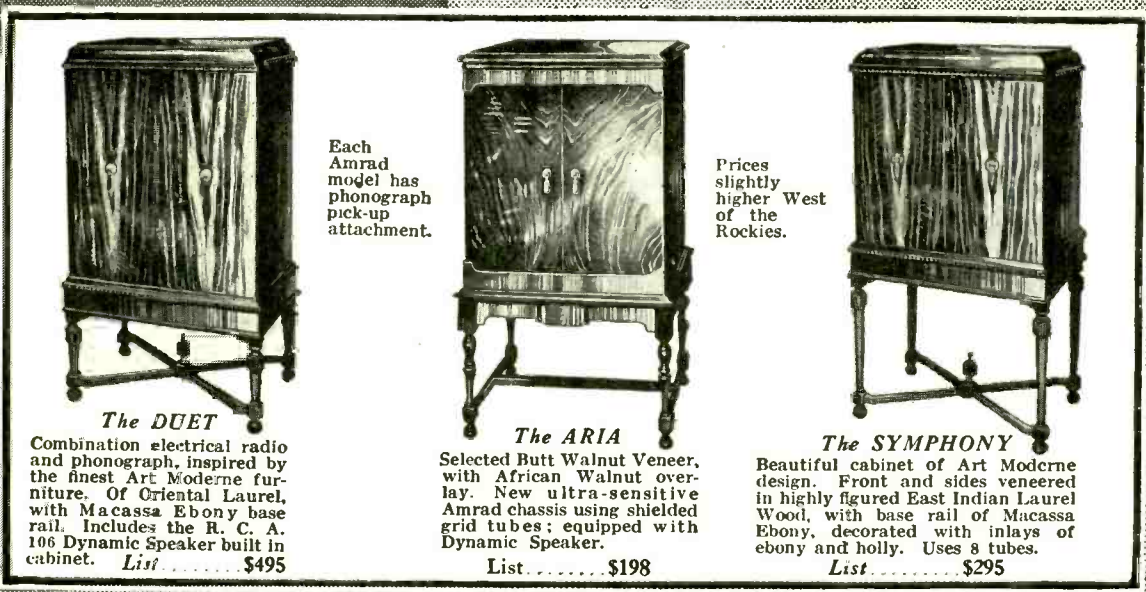


THE BEL CANTO SERIES



The SERENATA

Modern sliding door cabinet of diamond matched Oriental Walnut, and other fine woods. Uses standard Amrad shielded grid chassis with R. C. A. 106 Dynamic Speaker. List \$245



Each Amrad model has phonograph pick-up attachment.

Prices slightly higher West of the Rockies.

The DUET

Combination electrical radio and phonograph, inspired by the finest Art Moderne furniture. Of Oriental Laurel, with Macassa Ebony base rail. Includes the R. C. A. 106 Dynamic Speaker built in cabinet. List \$495

The ARIA

Selected Butt Walnut Veneer, with African Walnut overlay. New ultra-sensitive Amrad chassis using shielded grid tubes; equipped with Dynamic Speaker.

List \$198

The SYMPHONY

Beautiful cabinet of Art Moderne design. Front and sides veneered in highly figured East Indian Laurel Wood, with base rail of Macassa Ebony, decorated with inlays of ebony and holly. Uses 8 tubes.

List \$295

Feature these products as your "bargain" drawing cards and pep up sales



Model K-5
Height 42", width 25½"
depth 19"

THIS radio equipment is KOLSTER built, packed in the original Kolster cases and cartons, shipped direct to us from the Kolster factory.

Every Receiver and every Electro-Dynamic Reproducer is BRAND NEW; each bears the Kolster guarantee tag and original serial number.

These phenomenal values will prove a tonic to summer slumps.

Just notice the "extra special" prices at which the products on these two pages are "going."

You can't afford to pass up these extraordinary offerings. Let us have your order 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 burl 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 burl 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!**

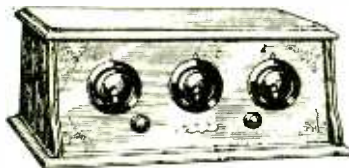
Lots of 5 or more \$44.50 ea.

AMERICAN SALES COMPANY

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

FREED-EISEMANN

SIX TUBE RECEIVER



Model No. 130

List Price \$80.00
(less tubes)

Size
18 3/4" x 10 1/2" x 9 3/4"

(For Battery Operation)

Features:

- Completely Shielded
- 3 Stages R-F, 1 Detector
- 2 Audios (1 Power Tube)
- Stippled Panel
- Genuine Mahogany Cabinet—
- Cable Attachment

An excellent summer number for customers preferring an inexpensive set for camp, bungalow or touring trip. This Freed-Eisemann Set is ideal for portable use.

Built of the finest of parts. Uses 5—UX-201A tubes and 1—UX-171A tube. Wired for "C" Battery.

Special \$9.50

Lots of 5 or more **\$9.00 each**

POWERIZER



PXY-1 MODEL R-20

Complete "A B & C" Eliminator and 210 Power Amplifier

It is a "B & C" Eliminator furnishing "B & C" current to the entire Radio Set, also a Super Power Amplifier furnishing "A, B & C" current to the 210 power amplifying tube. Simple to connect, no rewiring necessary in the set. Comes equipped with an adapter plug which is inserted in the last audio tube socket. Has filament windings which will also supply A-C current for the A-C tubes, if desired. Uses the UX-210 super power and the UX-280 full-wave rectifying tubes. Using this Powerizer with any Battery or Electric Set will bring out the finest tone reproduction and volume, comparable with the results obtained from any of the best modern receivers.

Operated direct from light socket; 110-120 V., 50-60 cycle, A-C current.

LIST PRICE \$59.00 EA.

Special \$15.00

(Complete with Harness)



Size 6"x5"x3 1/2"

AEROVOX or Dubilier

High Voltage Filter Condenser Blocks

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.

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

The New Gould Kathanode



List Price \$39.50

Unipower

GOULD PRODUCT

(With Built-in Relay)

Automatic
Radio "A" Power
From Light Socket

Model A-C—6 K (Six Volt)
Furnishes rich, smooth, unfailing "A" current, without any trace of hum. No rewiring necessary in your set. Equipped with a new noiseless Balkite Charging Unit which has four graduated charging rates and in addition one booster rate (1 1/2 amperes) for an emergency charge, which enables it to properly take care of all sizes of sets and conditions of operation. Operates on 110-120 V., 50-60 cycle A-C current. Complete with extra fuse.

Lots of three—\$8.50 ea.

Lots of six—\$7.50 ea.

Special \$9.75

KOLSTER



List Price

\$39.50

Without Tube

"B" ELIMINATORS (135 Volts)

This genuine Kolster "B" Supply Unit uses the full-wave rectifying tube UX-213 or UX-280 and is tapped and delivers 22 1/2, 67, 90 and 135 volts. Delivers clear, steady "B" voltages.

Each Eliminator is packed in original factory sealed carton.

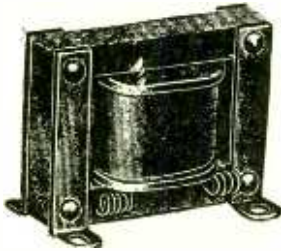
Special \$7.25 ea.

19-21 WARREN ST., NEW YORK

order.) All units offered are BRAND NEW, packed in original factory sealed carton and fully guaranteed.

EAGLE

Audio Transformers



Eagle Type U

An excellent replacement transformer, will fit into any convenient place in set. Loose leads facilitate easy wiring.

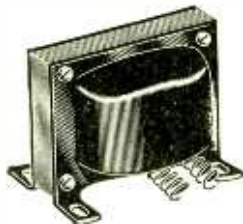
Ratio 3-1; 5-1.

NET 65c ea.

Power - Clarity - Tone Volume

EAGLE

Audio Transformers



Eagle Type L

Highly finished black japan, with loose leads. Very convenient for set builders and replacement because of its compactness and size.

Ratios 3-1; 5-1.

NET 75c ea.

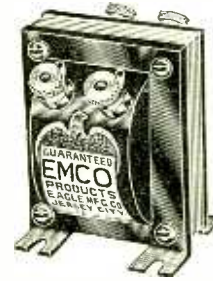


Eagle Type H.B.

Highly finished black japan — small, compact, ready to replace in any set. With binding posts.

Ratios 3-1; 5-1.

NET 85c ea.



Eagle Type V.B.

Highly finished in black japan. Ratios 3-1; 5-1.

NET 95c ea.



Push-Pull Transformers

Input and Output

Use of these two highly advanced transformers in the last stage audio amp. in conjunction with two 245 or UX171A will give maximum volume and clarity.

NET \$3.00 per pr.

The "EAGLE" transformers cover the entire audible scale of frequencies. Reproduce both the high and low notes equally and with natural fidelity. They are low priced, and you cannot obtain better transformers for more money. Stock these transformers and double your investment.

A TRANSFORMER FOR EVERY NEED



Eagle Super Audio

Clear reproduction now obtained by use of this master transformer. Scientifically designed, voice and instruments are amplified in all their true values. Two are recommended in a 2-stage audio amplifier.

Volume Without Distortion

NET \$1.10



Zenith Replacement Blocks

Flexible wire leads off each tap. Each tap is properly marked.
14 mfd. B. Block, Net \$3.00
12 mfd. B. Block, Net 2.90
8 mfd. B. Block, Net 2.75

Mayola Majestic Eliminator Replacement Condenser Block

A replacement block for Majestic eliminators, which is guaranteed by the Mayola Laboratories for a period of one year.

The condensers in this block are all composed of high voltage condensers, and you can be assured that once this block is installed it will last indefinitely.



Net \$4.50

In lots of 6, \$25.00



Eagle (Unshielded) Push-Pull Transformers

Designed for set manufacturers and set builders.

It also makes an excellent replacement Push-Pull Transformer.

NET 95c ea.

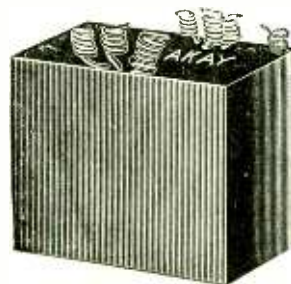


All-American Replacement B Block

(For the All-American Eliminator Model No. A-8)

This block has all colored leads identical with the original B Block. A hook-up diagram is also furnished. Fully guaranteed for 1 year.

NET \$4.50



Atwater Kent Replacement Unit

(For Atwater Kent Electric Set Model No. 37)

This unit contains the proper chokes and high voltage condensers. All flexible wire colored leads identical to the original. Fully guaranteed.

NET \$7.50

Dubilier Type 601 Fixed Mica Condensers

.001	.0001	} 25 for \$2.80
.002	.00015	
.003	.0005	
.004	.00025	
.005, .006 and .00025 with Clips		

DUBILIER FILTER CONDENSERS

	List	Net
2 mfd.	\$2.25	\$.60
4 mfd.	3.50	1.00
6 mfd.	5.00	1.50

DUBILIER BY-PASS CONDENSERS

	List	Net	Doz.	Lots
.1 mfd.	\$1.00	\$.25	\$2.64	
.25 mfd.	1.10	.28	3.00	
.5 mfd.	1.25	.30	3.36	
1. mfd.	2.00	.35	3.65	

FARADON 14 MFD. CONDENSER BLOCK

with taps—max. voltage \$3.50
Polymet Filter Condensers
1/10 mfd. 15c each.

Federated Purchaser

A National Organization Serving Over 10,000 Retail Merchants

16-22 Hudson Street, New York, N. Y.

Telephone Barclay 7583
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If you have not received our May 24th "Radio Bargain News," send for FREE copy today. It contains \$100,000 worth of radio merchandise at prices more than 75% off the regular list.

RADIO ADS

A CLASSIFIED ADVERTISING SECTION
READ BY BETTER BUYERS

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

REMITTANCE MUST
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RATES: 8 CENTS PER WORD ✓ \$6.00 PER DISPLAY INCH

RADIOADS FOR THE OCTOBER ISSUE SHOULD REACH US BY SEPTEMBER FIFTH

"RADIO THEORY AND OPERATING"—4th edition revised, by Mary Texanna Loomis, President of Loomis Radio College, member Institute of Radio Engineers. The leading radio text and reference book of the day. Used by more than 300 radio schools, universities, high schools and technical colleges, and by all the Government radio schools. The book contains 992 pages, 800 illustrations, is right up to date, and is really a whole library on radio. Among the many subjects covered are marine radio operating, radio compass work, land radio operating, television, broadcasting, radio construction, repairing and servicing, airways communications, radio accounting, message forms, junior engineering, and the 1929 radio laws. For sale by bookdealers throughout United States and many foreign countries. Price \$3.50, postage paid. Buy of your bookdealer, or send check or money order to Loomis Publishing Company, Dept. 12, Washington, D. C.

AMATEURS-EXPERIMENTERS-BUILDERS—We serve over 4000 IRE, ARRL, etc., experimenters and "nuts." Full discounts, \$50,000.00 stock approved parts—no sets. Over four pounds, catalog, circuits, data, prepaid, 50c. Weekly bulletins (new items, results of experiments, etc.) 20 weeks, \$1.00. Sample experimenters "Over the Soldering Iron" magazine, 25c. Transmitting data, price list, etc., 25c. Kladag Radio Laboratories, established 1920, Kent, Ohio.

450 REVIEW QUESTIONS—Supplement to the textbook "Radio Theory and Operating." Just off press. Designed for the home study work of persons preparing for Government examination. Valuable assistance to instructors and students. Price 25 cents in coin or postage. Loomis Publishing Company, Dept. 25, Washington, D. C.

GENERAL RADIO WAVEMETERS GIVEN FREE. The type 247-W wavemeter is yours, free of all cost, with only one subscription to "RADIO" for two years. Full price for the wavemeter and the subscription to "RADIO" is only five dollars. No further payments of any kind to make. Only a few of these wavemeters left. Get one now—act quickly. Send \$5.00 and your order to "RADIO," 428 Pacific Building, San Francisco, Calif.

LAST CHANCE! This is the last time that we can offer you a copy of Professor Hermann Schnitzel's humorous book of radio lectures—"Und Comes It Now." Only a handful of copies left. Get a copy free with a subscription to "RADIO" for 4 months. Full price for the book and the subscription to "RADIO," only one dollar. "RADIO," Pacific Bldg., San Francisco, Calif.

RADIO MEN WANTED—Positions wanted—Agencies wanted—Merchandise wanted and for sale—All of these matters can be brought to the attention of readers of "RADIO" with an advertisement in this RADIOAD Section. The rate is eight cents per word. One ad will convince you. More and more advertisers are using these columns. They pay! Mail your ad now for the next issue. "RADIO," San Francisco.

SALESMEN ATTENTION!—Chance to make extra money selling our complete radio index log to dealers. Write for sample and information. Shield Press, P. O. Box 1634, Indianapolis, Ind.

SELL Pilot "Super-Wasp" receivers, 14 to 500 meters, built and tested, \$40.00 or "Super-Wasp" kit, \$29.00. We pay postage. Gussie Groth, Hartley, Iowa.

JEWELL RADIO SERVICE SET PATTERN 117. Weston A.C. Voltmeter Model 528, Sterling R408 Tube and Set Tester, Jewell Radio Set Analyzer Pattern 199. Mello Heald eleven receiver in cabinet. G. R. Ewalt, Herington, Kansas.

SALESMEN WANTED—Screw-holding screw driver. Amazing brand new patented invention! Retail \$1.50. Factories, garages, electricians, auto, radio owners buy on sight! Exclusive state territory. Genuine opportunity, earn big money. Free trial offer. Jiffy 1027, Winthrop Bldg., Boston.

HELP WANTED

WANTED—Men to work with National Radio Service organization. No selling scheme. Radio Doctors, Inc., Dept. R, Essex St., Salem, Mass.

WANTED—Radio men to demonstrate MONARCH screen grid radio receivers. Easy work and big profits. Write for full information, also data for large buildings. The MONARCH Radio, 205 W. Wacker Drive, Chicago, Ill.

SITUATION WANTED

RADIO Broadcast Engineer, now employed, wants work in California. Plenty of experience.—Composite and Western Electric. Write care "RADIO," Pacific Building, San Francisco.

FOR SALE—MISCELLANEOUS

600-volt, 5-ampere Storage B Battery, Charger, Panel and Rack—\$25.00, or \$2.00 per 50-volt bank, Hankins, KGEF.

"As furnished
the U. S. NAVY"

reads an order for condensers
from the Byrd Expedition.

Every CARDWELL condenser meets
the rigid requirements of the Navy
and other branches of the Service—
your guarantee of quality and satisfac-
tion.



Transmitting Condensers for
powers up to 50 K. W.

Receiving Condensers in all
Standard capacities.

Send for Literature

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RADIO

Established 1917

Published Monthly

Entered as second-class matter at
 Post Office at San Francisco, Calif.

Address all communications to

"RADIO"

Pacific Building, San Francisco, California

NEW YORK - 415 Lexington Avenue
 Phone: Murray Hill 5992
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Subscription Price, \$2.50 per year in
 U. S. and Canada
 \$3.00 in Foreign Countries

VOL. XI

SEPTEMBER, 1929

No. 9

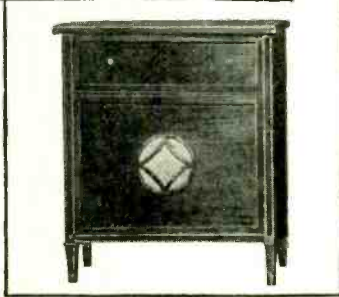
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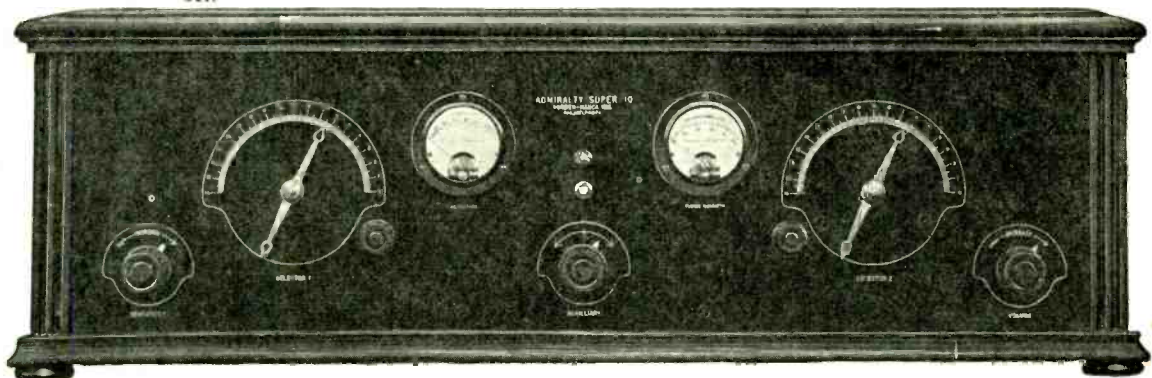
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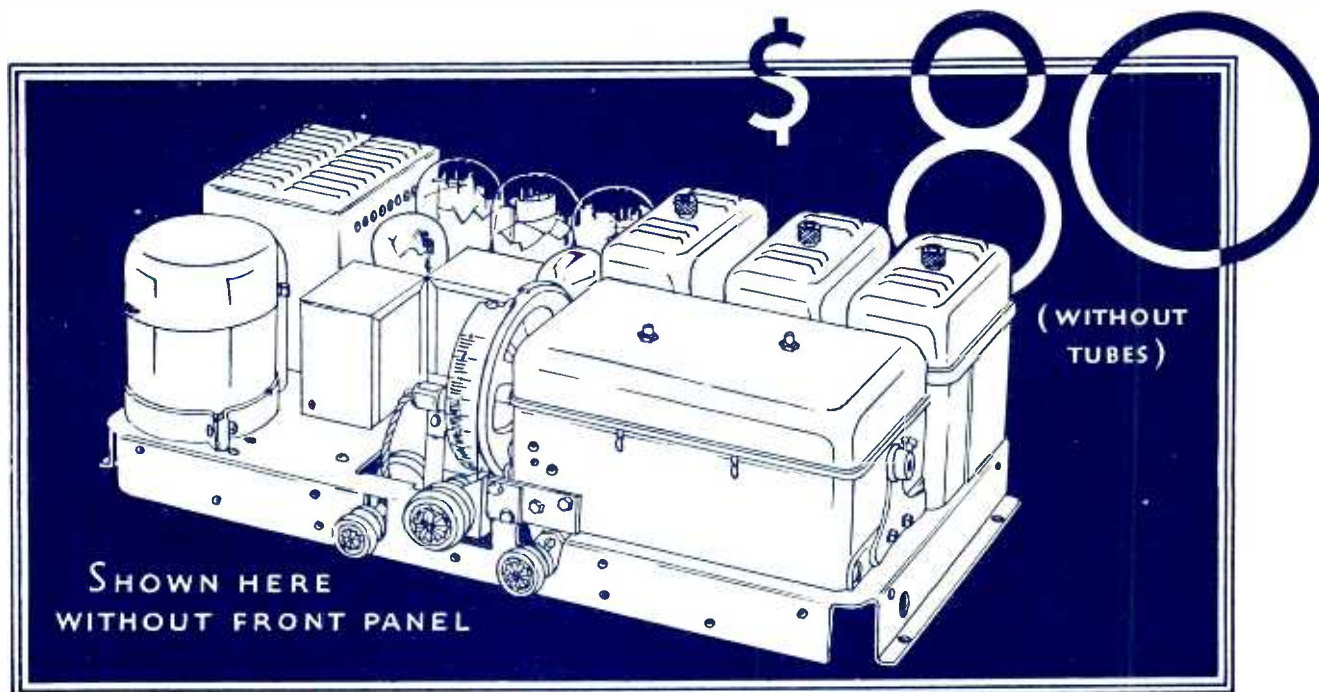
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